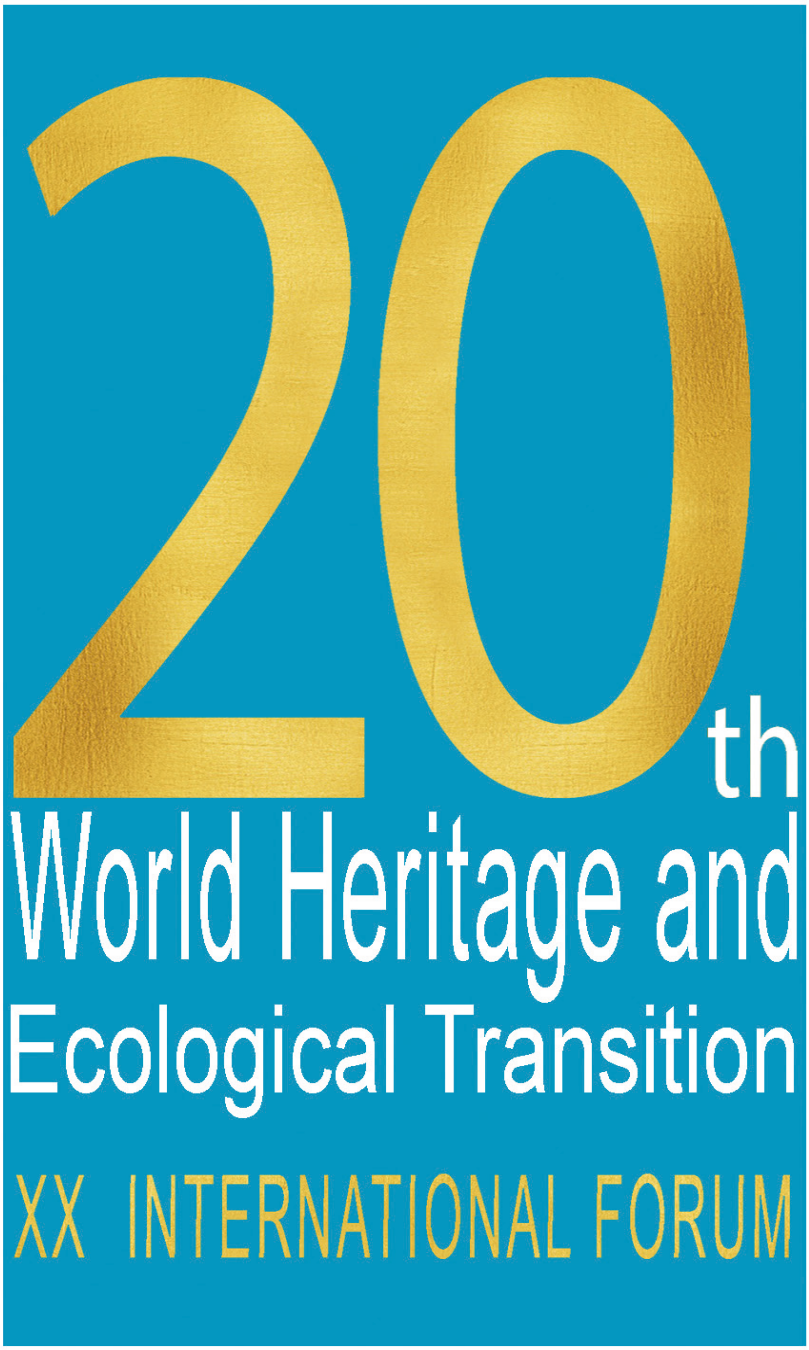
ARCHITECTURE HERITAGE and DESIGN

Carmine Gambardella

XX INTERNATIONAL FORUM

Le Vie dei Mercanti



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Carmine Gambardella
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Le Vie dei Mercanti
XX International Forum

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ARCHITECTURE HERITAGE and DESIGN | 10

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20

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Materials
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WORLD HERITAGE and ECOLOGICAL TRANSITION

Le Vie dei Mercanti

XX International Forum

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Scholars has been invited to submit researches on theoretical and methodological aspects related to Smart Design, Planning and Technologies, and show real applications and experiences carried out on this themes. Based on blind peer review, abstracts has been accepted, conditionally accepted, or rejected. Authors of accepted and conditionally accepted papers has been invited to submit full papers. These has been again peer-reviewed and selected for the oral session and publication, or only for the publication in the conference proceedings.

Conference report

300 abstracts and 550 authors from 40 countries:

Albania, Arizona, Australia, Belgium, Bosnia and Herzegovina, Brasil, Bulgaria, California, Chile, China, Cipro, Cuba, Egypt, France, Germany, Greece, India, Italy, Japan, Jordan, Lebanon, Malta, Massachusetts, Michigan, Montenegro, Montserrat, New Jersey, New York, New Zealand, Poland, Portugal, Russian Federation, Serbia, Slovakia, Spain, Switzerland, Texas, Tunisia, Turkey, United Kingdom.

From the XIX FORUM WORLD HERITAGE and DESIGN for HEALTH to the XX FORUM WORLD HERITAGE and ECOLOGICAL TRANSITION

In 2022 the Capri International Forum 'Le Vie dei Mercanti' will reach its 20th edition.

A Story of love for the Earth and its Inhabitants, Landscapes, Architecture, Cultural and Archaeological Heritage told by over 7000 Scholars and Academics from all over the World in an interdisciplinary way, by integrating skills, experiences, good practices in order to train talented people who care about the destiny of our Planet.

If the Future is an Eternal Present, the renewal of the Forum in these twenty years has produced a wealth of knowledge to guide those who govern and administer the Public Good, and citizens in their daily activities. A future that must be prepared in this era, that cannot ignore the ongoing climate change and that should not catch future generations unprepared.

A Present that transmits to the future the values that Humanity has passed on to us and that must be protected and transmitted as regenerative sources of Humanity itself.

Not coincidentally, the First International Forum assigned the topic 'From Luca Pacioli to the Ecogeometry of the Territory' to the participants.

An invitation to submit scientific contributions and good practices based on double-entry, legitimized by the measurement of tangible and intangible assets, in order to integrate knowledge and state it like entries in an income statement.

Therefore, if Luca Pacioli, tutor of the Rompiasi Venetian merchants family, suggested the method to legitimize the results of the activities undertaken, that is, through the measurement he indicated the survey activity as managing a heritage, which as such must not only be geometrically definable but must be also discretized into batches, noted in its multidimensionality, in order to produce a result whose added value can always be quantified and is given by the difference between the value of the asset, as we have received it, and the value reached for the activity of knowledge and management of the potentialities which are identified and stated as in an income statement; Eco-geometry, intended as a technological echo of reality, feasible through the use of digital and artificial intelligence to create forecasting scenarios, a model in which it is possible to measure all the components and relationships between the parts and to restore the matter, no longer as an instrumental covering to be described only in the geometric matrices generating the forms.

Once again Leonardo point us the way, conceptually anticipating the transition from analogue to digital and to the management of big data: "io vò pigliare quella licenza ch'è comune ai matematici, cioè siccome loro, dividono il tempo a gradi e di quantità continua la fanno disscontinua, ancora io farò il simile, dando col miglio o renella nella comparazione all'acqua" (Codice Atlantico, f. 126, t.a.).

Through the topic of the next XX Forum World Heritage and Ecological Transition, I want to provide some interesting food for thought, to identify a lived place, a life

environment, as an integral of forms of organization of the elements that surround us, examined through the prism of a civilization; we will deal with an innovative project of measurement and representation of the natural and built environment that is no longer an expression of the relationships between society and the natural environment but a construction of the relationships between the future as an eternal present and the legacy of the past as an economic value. A vital commitment that binds people to the environment; an educational revolution that match skills to the new way of managing what is learned and measured; the ecological transition with the use of technological innovation shall have the aim of entering the body of the territory, of the buildings and of the objects, it analyzes all its components through a multi-criteria analysis in order to establish a rating which in itinere defines the added of the results.

Just as the rulers and merchants in the mid-15th century, on the margins of international trade, in an economy contracted for mercantile life, combined research and training in new paths, taking refuge in agricultural operations, in favour of the reclamation of uncultivated lands in relation to the search for energy and its distribution and established the reasons of the earth compared to those of the sea in a perspective of systemic response.

Prof. Carmine Gambardella
General Chair XX Forum ‘World Heritage and Ecological Transition’
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UNESCO Chair on Landscape, Cultural Heritage
and Territorial Governance

Dal XIX FORUM WORLD HERITAGE and DESIGN for HEALTH
Al XX FORUM WORLD HERITAGE and ECOLOGICAL TRANSITION

Nel 2022 il Forum Internazionale di Capri, Le Vie dei Mercanti, raggiungerà la sua XX edizione. Una storia d'Amore per la Terra e i suoi Abitanti, i Paesaggi, l'Architettura, i Beni Culturali e Archeologici raccontata da oltre 7000 Studiosi e Docenti provenienti da tutto il Mondo in modo interdisciplinare, integrando competenze, esperienze, buone pratiche per formare Persone di Talento che abbiano a cuore il destino del nostro Pianeta.

Se il Futuro è un Eterno Presente, il rinnovarsi del Forum in questi venti anni ha prodotto un patrimonio di conoscenze per orientare coloro che governano e amministrano il bene pubblico e i cittadini nelle loro pratiche quotidiane. Un Futuro che va preparato in questa epoca che non può prescindere dal cambiamento climatico in atto e che non colga le generazioni future impreparate.

Un Presente che trasmetta al futuro valori che l'Umanità ci ha consegnato e che devono essere tutelati e trasmessi come fonti rigeneratrici della stessa Umanità. Non a caso, il Primo Forum Internazionale affidò ai partecipanti il Tema "Da Luca Pacioli all'Ecogeometria del Territorio". Un invito a presentare contributi scientifici e buone pratiche fondati sulla partita doppia, legittimati dalla misura dei beni materiali e immateriali per integrare conoscenze e per declinarle come partite di un conto economico.

Pertanto, se la figura di Luca Pacioli, l'Istitutore della famiglia dei Mercanti veneziani Rompiasi indicava il metodo per legittimare i risultati delle attività intraprese, e cioè attraverso la misura indicava l'attività di rilievo nel senso di gestire un patrimonio, che in quanto tale non solo deve essere geometricamente definibile ma deve essere discretizzato in partite, rilevato nella sua multidimensionalità, al fine di produrre un risultato il cui valore aggiunto sia sempre quantificabile e dato dalla differenza tra il valore del bene, cosi come ci è pervenuto, e il valore raggiunto per l'attività di conoscenza e di gestione delle potenzialità individuate e declinate come in un conto economico; l'Ecogeometria, intesa come un'eco tecnologica della realtà, attuabile con l'utilizzo del digitale, dell'intelligenza artificiale per creare scenari previsionali, un modello dove è possibile misurare tutte le componenti e le relazioni tra le parti e restituire la materia non più come strumentale involucro da descrivere nelle sole matrici geometriche generatrici delle forme. Ancora una volta Leonardo ci indica la strada, anticipando concettualmente il passaggio dall'analogico al digitale e alla gestione dei big data: "io vò pigliare quella licenza ch'è comune ai matematici, cioè siccome loro, dividono il tempo a gradi e di quantità continua la fanno discontinua, ancora io farò il simile, dando col miglio o renella nella comparazione all'acqua" (Codice Atlantico, f. 126, t.a.).

Con il Tema del prossimo XX Forum World Heritage and Ecological Transition intendo proporre spunti di riflessioni per identificare un luogo vissuto, un quadro di vita, come integrale di forme di organizzazione degli elementi che ci circondano esaminato attraverso il prisma di una civiltà; ci si dovrà confrontare con un progetto innovativo di misura e di rappresentazione dell'ambiente naturale e costruito

non più espressione delle relazioni tra la società e l'ambiente naturale ma costruzione delle relazioni tra il futuro come eterno presente e l'eredità del passato come valore economico. Un impegno imprescindibile che lega le Persone all'Ambiente; una rivoluzione formativa che omologhi le competenze al nuovo modo di gestire ciò che si apprende e si misura; la transizione ecologica con l'utilizzo dell'innovazione tecnologica deve avere il fine di entrare nel corpo del territorio, del costruito e degli oggetti, ne analizza attraverso un'analisi multicriteria tutte le componenti per stabilirne un rating che ne definisca in itinere il valore aggiunto dei risultati.

Così come i governanti e i mercanti, verso la metà del quattrocento, al margine del commercio internazionale, in un'economia contratta per la vita mercantile, saldarono ricerca e formazione in Nuove Vie, trovando rifugio in operazioni agricole, in favore delle bonifiche dei terreni incolti in rapporto alla ricerca di energia e di distribuzione della stessa e instaurarono le ragioni della terra rispetto alle ragioni del mare in una prospettiva di risposta sistemica.

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20th World Heritage and Ecological Transition
XX INTERNATIONAL FORUM
NAPLES 16 - CAPRI 17|18 JUNE 2022
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Le Vie dei Mercanti
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ESG criteria to monitor and assess women's empowerment in development processes: basic framework and proposals for a preliminary theoretical analysis

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Abstract
The acronym ESG is intended to typify, measure and certify the ability of companies to manage the impact of their activities in environmental, social and governance terms. Environmental, Social and Governance are key-parameters of the so-called sustainability rating, to assess the performance of a company in the marketplace.
In particular, parameter E focuses on operations aimed at reducing risks linked to climate change, in terms of respect for biodiversity, decisions and interventions on the food chain, agri-food safety, population growth and, in general, management of natural resources such as water, land, air and forests. This parameter is linked to the social one, including labour rights, working conditions, gender equality and the countering of all forms of discrimination. Also the governance dimension features the identity of the company, its organisation and ability to define and implement organisational forms inspired by ethical principles and rules of good functioning.
This proposal intends to focus attention and address some theoretical proposals introduced in several international intergovernmental systems, stressing the relevance of ESG parameters in fostering corporate growth in terms of gender diversity and empowerment of women - both workers and in leadership positions, advancing on methodologies to measure ESG parameters relating to gender inequalities, encouraging or limiting investments in companies of different sizes that ensure a proper gender management.

Keywords: ESG, gender equality, empowerment, environment, business

1. Preliminary overview of the ESG parameters: setting the scene

The first decade of the new Millennium represented fertile ground for the rise of a new awareness related to the demand for a more equitable and responsible economic and financial system. As a result, sustainable finance, which considers environmental, social, and governance factors in the definition of investment choices, oriented towards the long term and sustainable economic activities and projects, is gaining strength. This evolution has been driven by the investors' desire to combine the search for economic performance with a positive environmental and social impact in response to a broader global trend of higher sensitivity and better management of these issues. Finance, therefore, is an active part of implementing these ideas in investment practice [1].
In this framework, the ESG profile becomes more and more clear. Environmental, Social, Governance: keywords that describe the intention to incorporate financial and investing procedures with a higher level of responsibility, also interacting with a large spectrum of issues not usually associated with financial analysis, but that has become more and more prominent over time. Among these issues, gender equality and women's empowerment gain in importance.

The economic and social crisis caused by the Covid-19 pandemic has made increasingly evident the existence of severe and no longer acceptable gender inequalities, leading this issue to become one of the main political priorities at the international level. For this reason, it comes to notice an increasing need to adopt a gender-lens and a gender-transformative approach in all policy tools, strategies, regulatory measures that address future sustainability, with a perspective towards new paths to promote gender equality and women's empowerment. On the other hand, women are no longer perceived as the passive actors to be sustained, while a new narrative is increasingly emerging whereby female potential is presented as a changemaker. Gender equality is crucial to ensure a balanced approach to the economic, social, and environmental dimensions of sustainable development and the achievement of the Sustainable Development Goals (SDGs) of the United Nations (UN) 2030 Agenda for Sustainable Development. In such a scenario, the ESG perspective is not an exception [2].

The attempt to find an explicit definition is not easy. The terminology and practices associated with ESG investing vary considerably, primarily as ESG has evolved from various socially responsible investment philosophies. In addition, the development of ESG parameters has been stimulated by changes in the demand from across the financial ecosystem, driven by both the desire to improve the long-term financial value and the search for effective alignment with the comprehensive set of sustainability values.

Officially, the acronym ESG emerged in 2004 as part of the "Who Cares Wins" Report [3], the result of a joint initiative by financial institutions invited by UN Secretary-General Kofi Annan to develop guidelines and recommendations on how to effectively integrate environmental, social and corporate governance issues into asset management, securities services, and associated research functions, with the belief that in an increasingly globalized, interconnected and competitive world, these issues were necessary to compete successfully.

The following year, thanks again to the impulse of the UN and the Secretary-General, the six Principles for Responsible Investment took shape, involving a broad group consisting of leading institutional investors and experts in the field of investment, intergovernmental organizations, and civil society. The initiative was launched to understand the effects of ESG issues and the impact of sustainability on investors and financial markets, as these were still poorly understood and largely overlooked.

Specifically, the six Principles for Responsible Investment include: integrating ESG issues into investment analysis and decision-making processes; incorporating ESG issues into active shareholder policies and practices; requiring appropriate disclosure of ESG issues by entities in which investments are made; promoting acceptance and application of the Principles within the financial industry; working together to improve the effectiveness of the application of the Principles; and reporting on activities and progress made in applying the Principles.

A solid ethical imprint typically marks ESGs. However, they acquire a considerable concrete and practical sustainability's profile in influencing the choices and activities of companies and investors, also impacting the perception of risk and economic returns.

The "E" of the environmental dimension includes initiatives and operations aimed at reducing the risks linked to climate change, in terms of respect for biodiversity, decision-making, and actions on the food chain, agri-food safety, the growth of the population, and, in general, the management of natural resources such as water, land, air, and forests. The challenges linked to climate change necessarily require the use of ESG parameters, also including the related risks to the transition processes of companies and organizations towards new productive and organizational models, to the implementation of projects and the impact on the market, or instead to the capability of optimizing choices and investments by taking into account the demands of customers and consumers.

The "S" in the social dimension highlights the fundamental role that people have in the company's success, the functioning of the entire supply chain, and society as a whole. Furthermore, the specific way companies relate to their workforce is one of the most frequently considered factors in business management. It represents a significant element in the definition of corporate reputation, influencing it positively but also leading to potential financial losses. The Social domain, therefore, includes the guarantee of rights and respect for adequate working conditions, gender equality, health and safety, education and training, combating all forms of discrimination, the development of human capital, care for individuals and the local communities in which a company operates, and philanthropic activities.

The "G" of governance is characterized by the company's identity, its organization, and the possibility of setting and implementing organizational forms and concrete actions inspired by ethical principles and rules of good management. It is closely related to the decision-making process, in the public and private sectors, to the distribution of rights and responsibilities among the several company participants, including the board of directors, managers, shareholders, and stakeholders. It includes anti-corruption, lobbying, donation policies, and taxation strategies. In addition, diversity and gender equality constitute another important governance issue, with many institutional shareholders calling for greater female representation on boards and executive levels and mobility and growth opportunities for women in an increasingly inclusive perspective.

The factors included within the ESG framework are numerous and undoubtedly variable since sustainability priorities evolve with the arising of new challenges and needs, from the local to the global

level. Based on this assumption, it is possible to argue that the adoption of ESG parameters in the operative choices of the company and investment decisions can effectively support positive development in terms of gender equality and female empowerment. As mentioned, gender equality is associated with the social dimension. It can be intuitively declined - as examples - with equal salaries, the adoption of welfare policies to support the work-life balance, the compliance with the legislation against gender-based violence and harassment. About the environmental aspect, an active role of women can positively influence the strategic approach in terms of green transition and measures to prevent, manage and fight climate change and its related risks. Concerning governance, its practical application includes correctly implementing gender quotas in boards of directors and, therefore, valuing women's merit, knowledge, and skills in management and control positions.

2. Environmental monitoring and assessment: international features

It is true that ESG parameters are particularly useful, with specific reference to the environmental component, for monitoring and evaluating business performance and assessing the sustainability rate in the planning and implementation of interventions. From the public point of view, they have allowed institutional investors and central credit institutions to use their knowledge - especially in terms of environmental and climate risk - to introduce appropriate changes in financial systems from a green perspective [4]. The collection and analysis of useful data and information through ESG parameters has highlighted, not only from an economic point of view, how important is to adopt methodologies of investigation, measurement and evaluation that respond to an all-inclusive and multi-dimensional vision. This urgence, more broadly, has emerged within the international scenario in the compilation and adoption phase of the UN 2030 Agenda for Sustainable Development. Definition of renewed priorities and global common and interdependent goals (SDGs) has required, alongside political, economic, social and environmental commitments, tools for measuring and evaluating implementation results of the Agenda. The global indicators framework prepared by the Inter-Agency Expert Group (IAEG-SDGs) and formally operationalised by the UN Statistical Commission in March 2016, is the proper mechanism for this purpose.

Precisely because the 2030 Agenda entails an all-encompassing analytical approach, where the clustered environmental SDGs cannot call for a joint analysis with those that remind, for this study, the social and women's perspective, the progressive proposal of indicators designed to measure its achievement is based on three categories. The indicators belonging to the so-called Tier 1 are those based on an international consolidated methodology for at least 50% of UN member countries; for the so-called Tier 2, if the international methodology can be advanced, data have not been collected and analysed for a large number of UN member countries; finally, for the so-called Tier 3, the methodology or standards to outline indicators cannot be found and therefore the UN system has proceeded with the elaboration of new indicators. For the most relevant SDGs, a large number of yet available indicators can be grouped under Tiers 1 and 2, so the reference context is appreciable, although there have been difficulties in measuring some of the related targets on a regional and national basis.

If we dwell again on the environmental component, in parallel to the process of compilation and adoption of the 2030 Agenda, the creation in 2018 of a coordination mechanism for the management of environmental issues - in terms of environmental and social sustainability - has allowed the careful outlining of key-pillars of the UN Sustainability Strategy 2020-2023: it is based in a targeted manner over the principles of adaptation, environmental and social risk and the relevance of these aspects in global decision-making processes, starting within the same UN system. In close connection with the definition of indicators inherent to the environmental and social SDGs, even when reading related targets, useful indicators were proposed for monitoring, evaluating and enhancing the environmental dimension of interventions, programs and projects. They have proved essential for the elaboration of a Model Approach to Environmental and Social Standards for UN Programming [5], i.e. for the prior verification of compliance with environmental and social standards for all UN interventions and for the use of related indicators in order to assess the sustainable impact of actions on the field.

In the UN system, moreover, the environmental component is put under the specific strategic, programmatic and operational leadership of the United Nations Environment Programme (UNEP), the agency that is specifically assigned to promote the satisfactory pursuit of the 2030 Agenda environmentally clustered SDGs. The environmental dimension is substantially complex: in fact, it includes aspects such as natural resource management, climate change, water-related issues, marine issues, biodiversity and ecosystems, circular economy, environmentally sound management of chemicals and waste, and other issues. However, UNEP's mandate as custodian of the SDGs goes beyond those environmentally-sound ones such as SDGs 6, 8 and 12, up to SDG 17. UNEP has repeatedly emphasized lack of data at the global level to allow an adequate measurement of the positive results inherent in the achievement of the environmental SDGs [6]. This critical baseline does not encourage the proper use of the 23 indicators managed by UNEP, compared to the 93 inherent, in total, to the environmental cluster; moreover, overall, 38% of environmental indicators belong to the so-called

Tier 1, 37% to the so-called Tier 2, and 25% to the so-called Tier 3. For this reason, in 2019 UNEP launched an important exercise to address these methodological gaps, starting with the verification of national monitoring and evaluation mechanisms, and aligning proposed analytical measures with statistical standards already in place, as provided by the Framework for the Development of Environment Statistics (FDES) and the System of Environmental Economic Accounting (SEEA).

3. The nexus between climate and gender: proposals for a new vision along the international debate

The UN Conference on Climate Change 2021 (COP26), held in Glasgow, Scotland, has raised the issue of the urgent necessity for a global change in growth strategies and objectives, seeking a revolution in the traditional approach to economic development to ensure sustainability. The goals set by COP 26 can be summarized as follows: mitigation through the reduction of emissions; adaptation to support populations already facing the effects of climate change; finance to assist countries in achieving climate goals; collaboration, pursuing a joint cooperative effort. These points condense the priority axes on which international and national policy should concentrate on the primary measures in actions and solutions. Beyond this consideration, there is also the conviction that this process should be addressed using a gender lens, capable of actively involving women in decision-making processes and defining resilient climate strategies [7].

The Glasgow Climate Pact, in its preamble, recognizes climate change as " a common concern of humankind" and therefore, "Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights [...] as well as gender equality, empowerment of women and intergenerational equity". Moreover, the document "encourages Parties to increase the full, meaningful and equal participation of women in climate action and to ensure gender-responsive implementation and means of implementation, which are vital for raising ambition and achieving climate goals" [8]. It is evident the desire to strengthen the international political narrative about the existence of a strong interconnection between gender equality and the environment, the fight against climate change, and the search for more sustainable development.

This interconnection was further confirmed by the 66th Session of the Commission on the Status of Women (CSW), held in New York from March 14-25, 2022. The CSW represents the most relevant forum for discussion on women's empowerment and gender equality, guiding the priorities to be addressed regarding the global agenda for women's rights and empowerment. In the Secretary-General's Report [9], it is clearly stated that "Gender inequality coupled with climate and environment crises is the greatest sustainable development challenge of the present time. Climate change, environmental degradation, and disasters affect the entire planet and all peoples, although not in the same way or to the same degree, while gender inequality results in the denial of full human rights to half of humanity". The Report shows that climate change and its consequences have a disproportionate impact on women and girls, particularly those in vulnerable and marginalized conditions. This impact is exacerbated by extensive gender inequalities that make it difficult for women to access resources, from land to finance, technology, knowledge, and mobility. This implies a higher complexity of women's response to the crises caused by climate change, worsened even more in the last two years by the economic and social consequences of the coronavirus pandemic. The Secretary-General then recalls that the possibility for women to act and build a resilient future is conditioned by the removal of structural barriers and gender gaps. In addition, women's participation and leadership are more crucial than ever to make political action in response to climate and related risks more effective. In this scenario, large-scale public and private funding appears necessary to help countries transition from fossil fuel dependence to climate-resilient, low-carbon economies.

Public finance, particularly in the form of grants, should prioritize gender-sensitive climate change mitigation and adaptation actions. In addition, effective mechanisms for safeguards, accountability, and transparency are needed in both public and private funding to ensure respect for gender equality, human and labour rights, and environmental standards.

The Agreed Conclusions to the 66th CSW [10] represent the guiding document in the construction and consolidation within the United Nations, and therefore for the international community, of the substantial existing nexus between gender and climate, in terms of response and capacity for adaptation and resilience.

In the document, the Commission firstly recognizes that gender inequalities together with climate and environmental crises and disasters - including the pandemic and its socio-economic consequences - are today among the most severe challenges to sustainable development and have an impact on the entire planet and all populations, with disproportionate effects on women and girls, particularly those in situations of vulnerability and marginalization and areas of conflict. Moreover, it is a threat to the full realization of human rights, in every domain of life, from violence to health, from development to a healthy environment.

It highlights the need to provide a robust and unified foundation for governance that utilizes a gender-lens and respects the rights and needs of women and girls, also given that, although women and girls are taking action at every level on climate and environment, their participation and leadership is still failing to emerge.
The Commission emphasizes that building women's resilience should start from the transformation of unsustainable economic patterns of production and consumption and that a green transition process to be fair should take into account a transformative gender approach. By doing so, it will structure a potential to create decent jobs for women and support the elimination of discriminatory social norms and persistent gender gaps in secondary and tertiary education in science, technology, engineering, and mathematics (the so-called STEM disciplines), which foster occupational segregation and keep young women away from quality jobs in the green economy and climate sectors. With this passage, the Commission emphasizes one of the issues that is currently a priority in the normative strategies for women's empowerment in many countries: it considers that encouraging the study of STEM disciplines by girls and women, beyond all stereotypes, enables the valorisation of women's technical potential to support the processes of transformation of economic and production models in a sustainable way.
Furthermore, the Agreed Conclusions highlight the importance of involving men and boys both as agents and beneficiaries of change: they must be considered strategic partners and allies in achieving gender equality and empowerment of all women and girls. The Agreed Conclusions also contain a list of preliminary actions to embody the relationship between gender and climate and encourage the adoption of a whole gender mainstreaming approach in all activities towards the green transition and the fight against climate change. Specifically, the Commission invites all actors involved in different ways in the definition of policies and regulatory strategies - from governments to civil society, feminist and youth activism groups, and the private sector - to promote the following actions: integrating gender perspectives into policies and programs on climate change, the environment, and disaster risk reduction; expanding gender finance; building women's resilience; improving gender statistics and data collection disaggregated by sex and providing for a fair and gender-sensitive transition. Briefly dwelling on expanding gender finance, the following efforts are called for: an increased focus on meaningful policies and programs that adopt a gender lens dedicated to climate change the environment, through the mobilization of financial resources from all sources; the reuse of harmful subsidies earmarked for fossil fuels and agriculture to fund policies and programs dedicated to enhancing and increasing the resilience of women and girls; and increased public and private funding for women's organizations and businesses working on climate change and risk reduction.
Overall, the CSW is designed as a forum for discussion involving institutions, both national and international, and civil society and activist movements. If the general debate and the ministerial round tables represent the high-level moments of dialogue and confrontation, the CSW's program also includes many side events that ensure a mixed participation, both institutional and non-institutional, enabling a debate that takes into account the complexity and the many different shades of the connection between climate and gender. On the occasion of the 66th CSW, the side events represented a valuable tool to consolidate - further confirming what has been stated in official documents and processes - some key points about the role that women and girls must play in the design of a better future in terms of sustainability and environmental protection against climate change. Indeed, there is a demand for full recognition and promotion of an active leadership role and broader participation of women in decision-making processes at every level of governance. This is associated with the need for greater involvement of women in climate justice. Increased female participation in these areas helps promote policies, strategies, and programs that are responsive to climate change while adopting a complete gender perspective and supporting the elimination of social norms and stereotypes that still prevent women from fully participating in sustainable development. It is also essential to support grassroots activities, movements, NGOs, women's and youth activism groups that promote greater sensitivity towards understanding the relevance of women's role and the protection of rights undermined by climate change. Women must increase their resilience and ability to adapt to climate change, especially those who live in contexts and conditions of greater vulnerability (economic, geographical, social), including simplified access to natural resources, financing tools, knowledge. In this scenario, it is essential to collect more and more disaggregated data on the nexus gender-environment, allowing the monitoring, evaluation, and correction of policies, programs, and measures.

4. Women’s empowerment and participation to public decision-making processes: how to measure it?

As already highlighted, the material interdependence between the 2030 Agenda SDGs, if examined from a gender perspective, has favoured a reinterpretation of priority commitments enshrined in the Declaration and the Platform for Action [11], as key documents adopted at the Beijing Conference convened by the United Nations in 1995.

Two decades later, the need to ensure full and effective participation of women as well as equal opportunities for the assumption of high-level leadership positions in political and economic decision-making processes, more generally in the public sphere, has been renovated for the formulation of target 5.5 of SDG5, monitored through data collection and analysis by the Inter-Parliamentary Union. To supervise this SDG, two specific indicators have been introduced: the percentage of positions held by women in parliamentary bodies and local government bodies, and, in the private sector, the percentage of managerial positions held by women. It is clear that an increase in the quantitative and qualitative rate of women in parliamentary and governmental bodies greatly impacts for the inclusion of a gender vision in decision-making legislative and programmatic-strategic agendas. Such a vision is a core prerequisite for ensuring respect for democracy, good governance and equal opportunities.
If participation in public decision-making mechanisms is correlated to economic and environmental policies, it is essential to refer to two additional SDG5 targets and related indicators developed by the UN Food and Agriculture Organization (FAO). Target 5.a calls for the adoption of reforms that give women equal rights in access to economic resources, ownership and control of lands, financial services within national legislative frameworks. This target is monitored and measured through indicators relating to the rate of the population enjoying these rights - on the basis of data disaggregated by sex - and the resulting rate of women as right-holders, as well as the rate of countries whose legislation recognizes and guarantees the full exercise of these rights. There are two key elements that make crucial the adoption of these indicators to explore the gender dimension: underestimation of the key role of women in the agricultural sector and in contributing concretely to the production and management of agricultural products, including in the family context; the enforcement of customary legislations which often do not explicitly recognize the value and contribution of women to agricultural productivity as holders of property rights or control over land on an equal footing with men.
More generally also the target 5.c of SDG5 could be analysed in that it aims at the adoption or consolidation of legislations and policies for an effective and comprehensive promotion of gender equality and empowerment of women and girls - jointly monitored by the Organization for Economic Cooperation and Development (OECD) and the United Nations Development Programme (UNDP). To supervise this target, an indicator was developed that measures the rate of countries where a public governance mechanism is in place, especially in relation to taxation and fiscality management, for tracking available and accessible financial resources. This indicator is based on three analytical parameters: government commitment for the elaboration, adoption and implementation of political-programmatic measures that are instrumental in the allocation of financial resources; government action in defining and using programmatic and financial tools to monitor available resources within the framework of public finance; transparency ensured by governmental authorities as per the allocation of public resources for interventions on gender equality. As far as this target is concerned, there is a clear correlation with the Beijing Declaration and Platform for Action, whose paragraphs 345 and 346 introduced in 1995 the principle of adequate financing of gender equality: the evidence of a real commitment to this purpose and its impact on the proper implementation of gender-responsive legislations and policies, as well as the lack of improvement in terms of results in highly relevant economic and productive sectors, has demanded for the strengthening of monitoring and measuring the gender dimension.
If, up to now, we have focused mainly on SDG5 and we have mentioned indicators that most pertinently allow us to verify the state of the art over the participation of women and girls in public decision-making processes, a further interpretation to check if it is also relevant for environmental, social and economic aspects could be encouraged by using and adapting the above-mentioned indicators according to gender mainstreaming approach over other SDGs. For example, with reference to SDG7, the so-called energy goal, it could be essential to introduce gender indicators since energy policies are by no means 'gender-neutral'; SDG9, recalling the concept of resilience in industrial and infrastructural development processes, would also count upon a gender perspective in its local and sectoral dimensions. If we focus attention on SDG13, dedicated to climate change, it is conceivable that scarce consideration of the gender perspective is instrumental in perpetuating gender disparities that need, instead, clear and active roles and participatory decision-making procedures in favour of women and girls. To remedy this material weakness, three UN operational measures can be mentioned. In relation to the Paris Agreement on climate change [12], an initial monitoring tool is represented by the 5-years cycle submission by the States parties to the Agreements of the so-called determined national contributions (NCDs) introduced in their climate National Action Plans (NAPs), to be retained as goals and targets for the reduction of carbon emissions. In this framework - according to Art. 7§5 of the Agreement – should be included information on women's participation in decision-making processes on climate issues. Since 2016 the initial references to the inclusion of the female component have been modified in order to provide for a more articulated and systemic gender-responsive overview, in relation to priorities for adaptation and mitigation of the impact of climate change on people, communities, and also on women. Again, in the Paris Rulebook [13], States Parties are encouraged "to continue to promote the systematic integration of gender-sensitive and participatory education, training, public awareness, public

participation, public access to information, and regional and international cooperation into all mitigation and adaptation activities implemented under the Convention, as well as under the Paris Agreement".
This commitment has not only been reiterated and consolidated in the Enhanced Lima Work Programme on Gender but has also been addressed in detail in the elaboration of the information mechanism inspired by climate gender mainstreaming or rather aimed at the compilation of the Gender Action Plan (GAP), in its first edition in 2017 and in its final version in 2019 [14]. Starting from the five key areas of the document - mitigation, adaptation, technology transfer, financing, monitoring and reporting - it is evident how the female component can play a prominent role in the environmental, economic and social contexts, counting on strong and specific technological knowledge and access to financial resources (public and private) available. If we focus on the last key area, unfortunately, it is not possible to identify adequate indicators for measuring and evaluating the real participation of women in public decision-making processes, i.e. in the definition of strategic policy priorities and the resulting impact [15]. For this reason, indicators proposed in the framework of the 2030 Agenda and SDG5 could be particularly useful to specifically observe access to financial resources: this factor, indeed, could reinforce positively the implementation of gender-impacted policies. Henceforth an interesting measurement modelling has been provided by the Green Climate Fund: in the submission of projects that can count on the Fund's financial support, the gender component is preferential to ensure more effective and efficient climate impact interventions starting from the prior collection of sex-disaggregated data in relation to categories of beneficiaries of the interventions [16]. The financing of interventions that take into due consideration political, economic and social components that can produce climate inequalities and that rely on the contribution of men and women to address the challenges posed by mitigation and adaptation to climate change, relies on investigation methodologies based on specific targets and indicators: these approaches allow not only an evaluation of each intervention from a gender perspective but also a modelling of projects in such a way that they are gender-responsive.
If from climate issues we would like to refer to broader analysis over the active and participatory role of women in public decision-making processes, survey methodology of the International Union for Conservation of Nature (IUCN) on the governance of natural resources by women is worth of mentioning [17]. To monitor and assess the significance of the female component, the Union has developed a targeted analysis tool in collaboration with UN Women. In order to observe the level of participation of women in environmental decision-making processes promoted and carried out at local, national and international level, the EGI is based on nine indicators, used in a multi-sectoral perspective with reference to climate policies, climate finance, forests, energy and transport. Compared to an initial pilot phase, which suffered from a lack of information as regards sex-disaggregated data, the periodic activation of the EGI has confirmed that, especially on a national scale, countries that do not ensure the full involvement of women with respect to the six categories or areas monitored (Ecosystems, Gender Based Education, Governance, Country Reported Activities, Livelihoods, and Gender Based Rights and Participation), do not increase the overall well-being of the population and therefore the proper use of available natural resources.
The direct correlation between protection of the environment and natural resources and the encouragement of sustainable economic development processes, with a clear quantifiable impact in increasing GDP is analysed by the World Bank [18] and, above all, by the Organization for Economic Cooperation and Development (OECD), through the SIGI Index [19], which includes 27 variables, rests on 16 indicators and is developed in four main dimensions to investigate according to an integrated and multi-sectoral approach active participation of women in decision-making processes, moving from legislative and political solutions to activate really successful gender-transformative processes also according to an economic and environmental point of view.
In conclusion, alongside the theoretical contribution provided by some of the main international organizations, two further proposals for monitoring and evaluating participatory trends in decision-making processes from a gender perspective should be mentioned. The first was proposed by the Melinda & Bill Gates Foundation in the framework of the Gender Integration and Innovation Initiative starting in 2016, to monitor women's participation in projects funded and implemented as promoters of autonomous decisions or deliberations shared with men that have an impact on personal, private or even social and public life [20]. The second was formulated by the McKinsey Global Institute and is articulated in the monitoring, through 15 indicators, of gender inequality in 95 countries to measure their Gender Parity Score (GPS) in four areas: equality in work, essential services and enablers of economic opportunities, legal protection and political voice, and physical security and autonomy [21].
On the basis of modelling and preliminary results between existing monitoring and evaluation tools, the importance of the approach for real decision-making empowerment in the public sector strongly emerges, with clear impact on environmental, economic and social dynamics. Maybe multiple solutions of investigation could be conflicting and fragmented: the complex gender reality, however, needs to preserve these methodologies and possibly to make them more systemic so that the quantitative analysis is instrumental for an even more incisive role of women in the dynamics of public decision-making, albeit in a perspective of post-pandemic reconstruction.

5. Female leadership and inclusion into business: investigation for a proper assessment to boost women's role and action into companies decision-making

Promoting women's leadership and participation becomes critical in the private sector. Therefore, the promotion of higher empowerment of women in the business sector, mainly in decision-making positions, appears to be crucial.

In 2010, the UN Global Compact and UN Women promoted the definition of the Women's Empowerment Principles (WEPs), seven principles inspired by business practices and designed to promote gender equality in business. The adoption of the WEPs is a key instrument for companies to implement the 2030 Agenda and the Sustainable Development Goals associated with gender equality. Providing women with full participation in economic life in all sectors and at all levels makes it possible to build strong economies, to build a more stable and fair society, to reach faster the international goals in terms of development, sustainability, and human rights, to improve the quality of life of all people and communities and to promote business activities and goals [22].

Companies increasingly realize the business case for women's economic empowerment - supporting and enabling them to achieve their full potential across all value chain stages - as leaders, employees, suppliers, distributors, customers, and community members. This awareness is reinforced within the company by addressing explicit and implicit discrimination in recruitment and promotions; ensuring robust and formal equal pay procedures with opportunity for appeal; and by providing training and mentoring for women to develop their capabilities [23].

The composition of Boards of Directors is perceived to strongly influence corporate social responsibility performance [24]. Women seem to have a different perception of the leadership role than men, as they are more likely to adopt an approach that is guided by a greater sense of community. Therefore, women are more likely to implement growth strategies for companies that integrate a comprehensive vision of sustainability in all its variations. Although the literature on the topic appears still limited, it is plausible to argue that the more significant female representation on Boards and in corporate leadership positions leads to a positively influenced decision-making processes and ESG disclosure [25]. Gender diversity in Boards can improve the quality of decision-making processes, thanks to greater creativity and disposition to innovation encouraged by the presence of different points of view and perspectives. It is also considered that women are likely to have more ethical attitudes, which can be effective, for example, in reducing the chance of economic and financial fraud [26].

The International Labour Organization also confirms that the last decade has observed an increase in the share of women on corporate boards: among the drivers that have mainly contributed to this shift is the growing evidence that a better gender balance results in higher profitability, better governance, and the potential to develop the diversity of thought [27].

It is worth focusing on some of the outcomes generated within the G20 context, the most important international strategic forum dedicated to global economic growth. Women's empowerment in the private sector has been an issue that has also gained growing prominence in that forum, which gathers the world's leading developed and emerging economies.

In 2021, the B20 Engagement Group -dedicated to the dialogue of the global business community - promoted a Special Initiative for Women's Empowerment, identifying three main recommendations for companies in G20 member countries: include by bringing more women back into the workforce and into the center of economic activity to rebuild the future; reinvent, by building an inclusive society and workplace culture that dismantles pervasive gender stereotypes; and grow, by smoothing the path to leadership and business ownership for women. Specifically, for this last recommendation, two policy actions have been identified, namely: aiming for gender parity in high-level decision-making positions by promoting and removing barriers that limit women from reaching high-level decision-making positions, with a focus on a comprehensive collection of sex-disaggregated data; boosting female entrepreneurial potential by supporting the aspirations and capabilities of women entrepreneurs and actively supporting the start-up, financing, scalability and sustainability of women-owned businesses. Overall, this recommendation primarily impacts the achievement of SDG5, and in particular the aforementioned sub-goal 5.5 on public, political and economic leadership, sub-goal 5.c on adopting and strengthening solid policies and effective legislation to promote gender equality and empower all women and girls at all levels, and sub-goal 5.1 on eliminating all forms of discrimination. Furthermore, adopting the recommendation would also have positive repercussions on SDG4, concerning education, particularly sub-goals 4.4 on increasing the number of young people and adults with high-level skills and 4.5 on ensuring equal access to all levels of education vocational training. In addition, of particular interest is the impact of SDG9 on promoting inclusive and sustainable industrialization and innovation, recognizing that women's leadership can direct business choices towards more sustainable, ethical, and responsible growth paths [28].

More impactful still appears to be the work of the G20 Empower Alliance, a temporary, public-private hybrid group (comprised of both business and government representatives) that was established in 2019

with Japan's G20 presidency and has now grown in importance, extending its duration to 2025. The Alliance focuses its work specifically on promoting women's corporate leadership, talent development, and educational investment in future skills. In the final G20 Empower Communiqué for 2021, the relevance of appropriate measurement of progress is emphasized and - to accelerate change within G20 countries - companies are encouraged to adopt a set of indicators (KPIs) to monitor the female share of the workforce (at each career level); the female share of promotions; the gender pay gap; the share of women on company boards of directors (also detailing managerial roles) and the share of women in technical roles (also detailing managerial positions). Even more valuable is the mention of the recognition that there is broad evidence that companies that are more diverse and inclusive - thus relying on the presence of women among executive-level managers and a high level of gender parity throughout the organization - are more likely to be more oriented toward environmental, social, and governance (ESG) priorities, make better, more effective, and sustainable decisions, and innovate, thereby gaining a competitive advantage and increasing their profitability and performance [29].
In 2014, with the Australian presidency of the G20, it was established the so-called Brisbane Goal, with the commitment to reduce the existing gender gap in the workforce by 25% by 2025. This goal was expanded in quantitative and qualitative terms under the Italian G20 Presidency in 2021, with the establishment of the "G20 Roadmap Towards and Beyond the Brisbane Target: more, better and equally paid jobs for women" [30] adopted at the end of the G20 Meeting of the Ministers for Employment and Social Policies. The Roadmap, a broad and ambitious document addressing women's empowerment in the workplace, also deals with the promotion of women's leadership, indicating - among others - various actions to be taken: supporting measures to increase women's participation and representation in decision-making bodies in private and public companies, relevant decision-making bodies, and workers' and employers' organizations; pursuing equal opportunities in educational and professional paths; and increasing women's participation in sectors characterized by high wages and growth, including by strengthening educational, professional, labour market, and career counselling; supporting women's entrepreneurship by removing legal, policy, procedural, and regulatory barriers and practices that inhibit female entrepreneurs' access to financial and digital services, venture capital resources, and promoting transparency measures to help identify gender bias in investments; implementation of policy measures to achieve fair and transparent career progression processes, including selection criteria for executives and other senior positions, such as regular and voluntary reporting by companies on gender gaps in promotions, hiring, and management positions.
The practices reported here are one relevant example of the growing prominence of female leadership empowerment in the private sector coinciding with the resilience and recovery phase in the aftermath of the pandemic crisis. They are a confirmation of the value and importance of the role that women can assume in boosting economic growth, refocusing development priorities in terms of broader sustainability in all its manifestations.

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The recovery of Miseno and its untold architectures

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Abstract
The Covid emergency highlighted the need to offer new cultural proposals, measured on the current needs of fruition and sustainability, the result of collaboration with the reality of the territory through the Recovery Plan.
The proposed challenge is to make the goals set nationally for the rebirth of Miseno and its hidden architectures feasible.
Among the opportunities for digitization, innovation, earning opportunities and culture, better management of social networks will be prepared for the inclusion of new content for young people, the ability to multiply the knowledge and experience. Through the predisposition of QR Code it will in fact be possible to deepen in detail topics of interest directly on site, without visually abusing the spaces dedicated to the purity of vision and experience.
In line with the indications that convey towards the ecological transition and in conjunction with the already prepared projects of the territory, the "Ciclayak" project aims to create a sporting-cultural path of an environmental nature, including some sites in the path.
Connections will be improved, the criticalities of the place will be analyzed and collective and / or “green” mobility will be exploited to the fullest.
This will make it possible to locate territorial focuses capable of reviving a still hidden part of this territory but which must not be forgotten given the historical and cultural importance that characterizes our civilization.

Keywords: Miseno, Architectures, Recovery Plan, Connections

1. Objective: Miseno and its territory



Fig. 1: Inlet of Schiacchetiello (photo by the author).

Since the first months of the SARS-CoV-2 pandemic, economists have advanced various hypotheses on probable scenarios regarding clearly unavoidable economic problems, albeit commonly, not leaving aside political arguments. Much has been said about the crisis that specifically plagued Italy by depriving it of the full enjoyment of its artistic heritage. The emergency experienced thus highlighted the need to offer new cultural proposals, measured on the current needs of use and sustainability, developed in collaboration with the realities of the area.
Hope finds its way through the Recovery Plan or National Recovery and Resilience Plan.
With the Recovery Plan, approximately 192 billion euros have been allocated, divided into the 6 missions that make up this plan:

- 60 billion will be allocated to the green revolution and ecological transition, seeking to obtain "greener" behavior from companies, public bodies and citizens;
- 40 billion will be allocated to the digitization, innovation, competitiveness, culture and tourism of territories, works and realities that characterize our territory;
- 31 billion will be allocated to education and research;
- 25 billion will be allocated to sustainable mobility;
- 20 billion will be earmarked for inclusion and cohesion with companies and organizations for the recruitment of men, women and boys, the latter two categories being the most affected, at work level, during the epidemic;
- 16 billion will be allocated to research for health.

The proposed challenge is to make the nationally established objectives for the rebirth of Miseno and its hidden architectures feasible through concrete functions. Now a relic among those Roman wonders of the priceless Campania region but which stands out for its interest and uniqueness in many popular articles and multimedia platforms.
Starting from the assumption that the enhancement of cultural heritage concerns "activities aimed at promoting knowledge of cultural heritage and ensuring the best conditions for public use and enjoyment of the heritage itself, in order to promote the development of culture" (Legislative Decree . 42/2004 and subsequent amendments)
A net loss of quality reduces the attractiveness of the work, leading it to be discontinued. This is also stated and demonstrated in the graphs by Prof. Xavier Greffe.
To try to solve these problems, which often plague our cultural heritage, there are various ways of acting. These do not have to manifest themselves individually, at the most the implementation of a plurality of actions tends to improve not only the state of the heritage, but also increases participation and awareness on the part of citizens.
As an opportunity to implement a first digitization of the territory, QR Codes could be prepared along the territory, in order to deepen in detail topics of interest directly on site, without visually abusing the spaces dedicated to the purity of vision and experience.
Another fundamental element, in the age we live in, is the improvement of the management of social networks, including new content for young people.
One could opt for a privatization of part of the public assets. This would tend to increase public financial resources, reducing management costs and increasing cohesion with companies, organizations, citizens and the territory.
These interventions, accompanied by an improvement of the transport network system, would lead to an increase in tourist attraction (public / private) and would improve the quality of the context and the life of citizens, underlining and strengthening the relations between cultural heritage and the territory.
Another mode of action would be the training of citizens in building maintenance of the architectural heritage for the protection of territorial identity.
In this regard, in 2001 the principle of subsidiarity was introduced in the Italian constitution, which states that: "State, regions, metropolitan cities, provinces and municipalities favor the autonomous initiative of citizens, individuals and associates, to carry out activities of interest general on the basis of the principle of subsidiarity "(Title V Art. 118) allowing social groups or individual active citizens to act independently and with a spirit of solidarity for the common good.
As a first step to address these changes, there is certainly an analysis of the territory and its criticalities.



Fig. 2: View of Miseno from Monte di Procida (photo by the author).

1.1 Network reconnection

From some analyzes carried out on the territory, the time and distance traveled to reach Miseno by car from some specific locations have been calculated:

- Aversa (University of Campania “Luigi Vanvitelli” - Department of Architecture) - 39.2 Km in 44 min;
- Naples (Piazza Garibaldi) - 28.9 Km in 41 min;
- Pozzuoli - 9.7 km in 21 min;
- Cuma - 8.8 Km in 19 min;

To reach Miseno from the corresponding locations specified above through public mobility, an increase in time equal to three times the time compared to private mobility has been calculated.
This has brought out the need to "reconnect" Miseno and the neighboring areas to public mobility.
The ecological transition is the basis of the new Italian development model, as indicated in the UN 2030 Agenda.
Taking action to reduce polluting emissions, prevent and mitigate soil degradation and minimize the impact of production activities on the environment is necessary to improve the quality of life and environmental safety, creating greener environments and a more sustainable economy. , capable of reducing waste and emissions.
Sustainable mobility primarily understood as cycle mobility is one of the tools we can implement to improve urban traffic and improve open spaces, not to mention the benefits it would bring to people's health and well-being.
This will generate a decarbonisation and also improve the management of those infrastructures equipped for mass transport, moreover it could be connected to the European network of cycle paths started by the European Federation of Cyclists (ECF), generating new tourist-attractive itineraries.
The symbol of the walk between public spaces, and therefore, the fruition and environmental improvement of urban environments lies not only in the quality of the individual open spaces but also in the fact that these can be connected in networks, generating connections and improving the reading of the territory with all its riches and all its historicities.
A reconnection that starts from the built to activate mechanisms of renaturalization by creating performing micro spaces that become pieces of a larger urban mosaic.
The goal is to reformulate the way we see the different open spaces and how they integrate and connect with green areas / collective spaces and facilitate movement within the system.
Encourage flexibility and experimentation, both from a design point of view and in terms of how to involve the community. Generating micro interventions that will allow the promotion of widespread interventions with different dynamics.

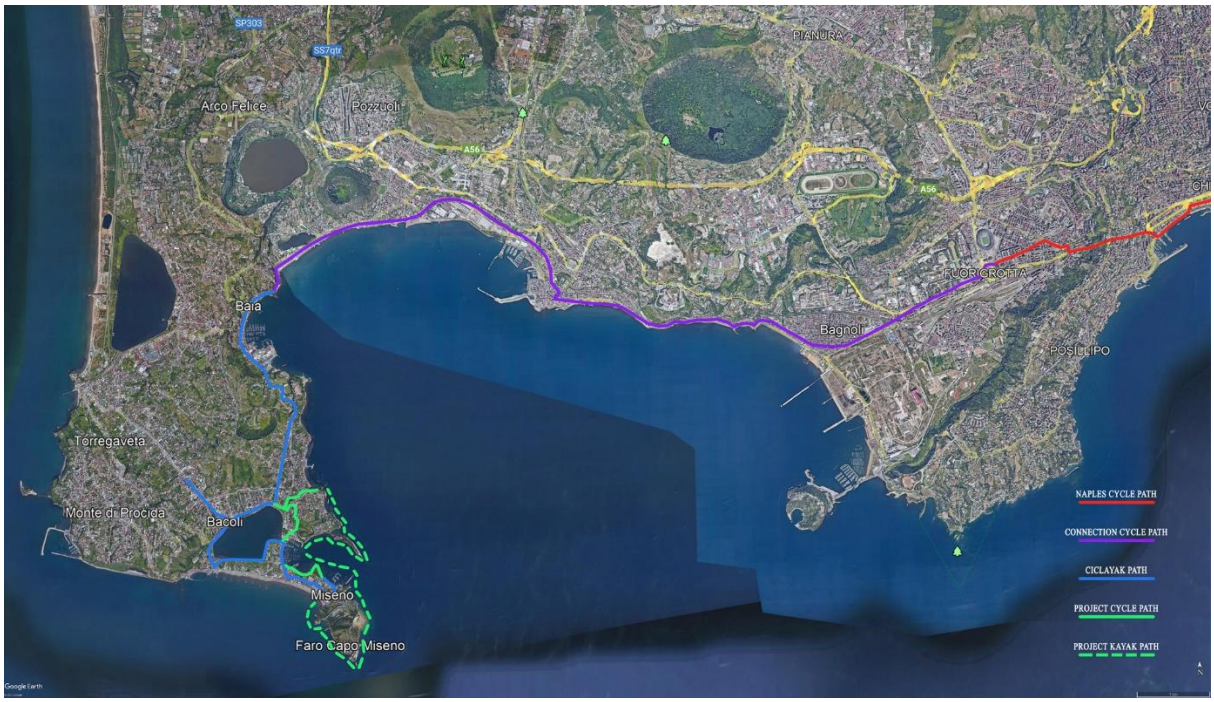


Fig. 3: Connection between cycle path and tourist route (image from Google Earth).

1.2 New cultural routes

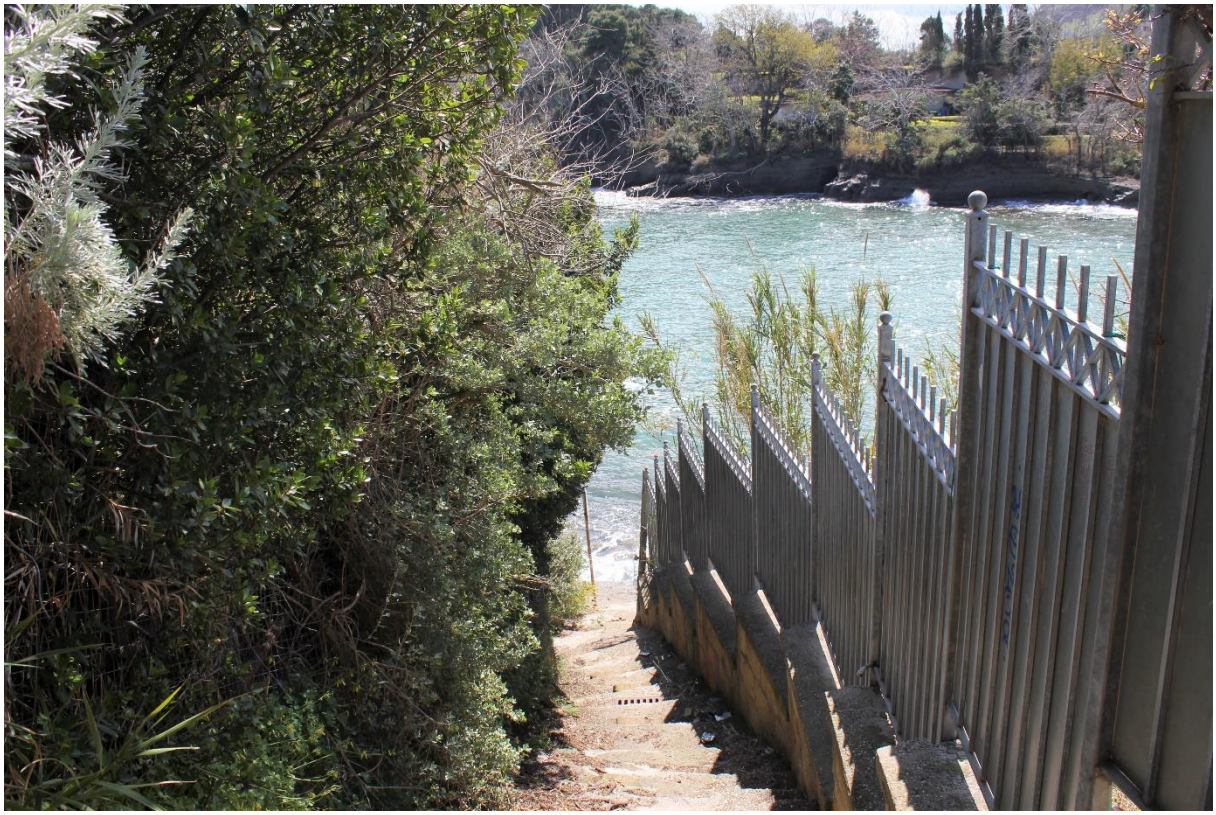


Fig. 4: Descent of the Schiacchetiello (photo by the author).

In line with the indications that convey towards the ecological transition and in conjunction with some projects prepared in the area, such as the "Ciclayak" project, supported by the AMP Baia Supply Chain Association, an environmental sports-cultural path could be created, including some sites in the path.
By identifying potential itineraries, both cycle-pedestrian and marine (by kayak), it would be possible to recreate the historical territory, managing to recount the old pre-existences from a new point of view, not only historical and cultural, but also sensorial.
These cycle-pedestrian and marine connections aim at territorial requalification involving many of the territorial competences, generating new economic opportunities.
The first step would focus on improving connections and analyzing the criticalities of the place, making the most of collective and / or "green" mobility.
The second step would involve identifying the paths and territorial focuses capable of reviving a still hidden part of this territory but which should not be forgotten given the historical and cultural importance that characterizes our civilization.
The third step would consist in the creation of storytelling capable of keeping tourists active and participatory during the journey.
The fourth and last step would identify marketing strategies linked to the territory, not only historical ones but also food and cultural ones.
All this would serve to make the tourist offer innovative, more stratified and differentiated by age and subject.
The relationship between the built-historian and the visitor, according to a new, more efficient and attractive point of view, would generate a tourism that is not quantitative but qualitative, offered to the mass but with greater awareness. Able to improve the way we think and act towards the environment around us.
All this has been designed to improve the ability to read the works and make them accessible in all their parts, even in a different way according to the canonical methods, in order to preserve them and hand them over to future generations, triggering innovative perspectives for a more conscious tourism.



Fig. 5: Internal view of the Piscina Mirabilis.

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Via Popilia in Calabria. Potential of a tourist-cultural itinerary

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Abstract
Via Popilia was one of the most important road infrastructures built by the Romans on the Italian territory. It connected the cities of Capua in Campania and Rhegium on the shores of Messina Strait, with a route of about 550 km largely away from the coast.
After some historical references relating to the primary network linking Rome and the peripheral regions and the old road construction techniques, the attention is focused on the southern part of the Via Popilia, within the territory of the Calabria region, to represent its potential from a tourist-cultural point of view.
The results of a research aimed at highlighting the most significant emergencies of the old road, in particular the elements of greater historical-monumental value, are presented, following the logic of an ideal tourist path largely still to be exploited. Some specific insights are proposed relating to some of these emergencies; the historical research concerns also architectural and engineering aspects.
The paper intends to offer a cultural background in relation to a valuable ancient heritage, rich in singular components of great interest, and to draw attention to a touristic latent potential in the perspective of a Way (route to be practiced walking or by bicycle), or a sequence of places to visit in stages, with direct positive impacts on the economy of the crossed territory.

Keywords: Via Popilia, old roman route, Calabria, tourism, cultural heritage

1. THE VIA POPILIA, HISTORICAL INFRASTRUCTURE CHARACTERISTICS

Via Popilia was one of the main communication routes built by the Romans. Also known as Via Annia, it connected the ancient city of Capua to the city of Rhegium (Via ab Regio ad Capuam).
The Romans created, during their territorial expansion, a large road system, to easily reach the numerous regions of the Empire. "*Omnes viae Romam ducunt*", or "All roads lead to Rome" is a famous expression that summarizes the idea of a road network structured so that all regions were connected to the center of the Empire, ideally assumed in the Roman Forum. The built network represents an extraordinary civil engineering work that had a significant role for exchanges, land control, military and commercial logistics [1,2].
Starting from the end of the 4th century BC the streets were named with the name of the consul who built them (hence the name of consular roads). Limiting attention to the Italian territory, the most important are 7. The first four were routes crossing the Apennines to reach strategic cities on the Adriatic coast:

- Via Appia Way (Appio Claudio Cieco), one of the oldest, towards Brindisi, passing through Capua and Taranto;
- Via Tiburtina Valeria (Marco Valerio Massimo), an extension of Via Tiburtina (from Rome to Tivoli), which reached Aternum (today Pescara);
- Via Salaria (ancient Sabines), from Rome to San Benedetto del Tronto (Castrum Truentinum);
- Via Flaminia (Gaio Flaminio), which connected Rome to Rimini (Ariminum).

Three others developed on the Tyrrhenian side:

- Via Cassia (Caio Cassio Longino) crossed the whole of Etruria and reached Pisa;
- Via Aurelia (Caio Aurelio Cotta), along the west coast up to Pisa;
- Via Popilia (Popilio Lenate), from Capua (north of Caserta) to Reggio Calabria.

mention should also:

- Via Clodia (gens Claudia), a shorter alternative to the Via Aurelia up to Roselle (a few km north of Grosseto);
- Via Latina, an alternative to the Appia between Rome and Capua;
- Via Aurelia (Caio Aurelio Cotta), along the west coast towards Genoa;
- Via Traiana (Marco Ulpio Nerva Traiano), alternatives to the Via Appia, from Capua, towards Bari and Brindisi;
- Via Emilia (Marco Emilio Lepido), from Rimini to Piacenza;
- Via Julia Augusta (Gaio Giulio Cesare Augustus), from Pisa to Genoa and along the Ligurian coast;
- Via Postumia (Postumio Albino) from Genoa to Piacenza and Venice through the Po valley;
- Via Valeria (Marco Valerio Levino) along the northern coast of Sicily, from Messina to Marsala (Lilybaeum), passing through Palermo;
- Via Pompeia (gens Pompeia), along the Sicilian Ionian coast, from Messina to Syracuse.

Fig.1 illustrates the layout of the Roman consular roads network of in the third century BC.



Fig.1 Network of Roman consular roads in the 3rd century BC

2. STRUCTURAL CHARACTERISTICS OF THE ANCIENT ROADS

The roads built by the Romans were public, open to all, without exclusions or privileges, and free from tolls unlike those built in previous eras, which were for the exclusive use of the kings for their travels, to move armies or for commercial purposes.

The Romans built a real road system, capillary and organic, ensuring the connection throughout the Mediterranean basin with every part of the vast empire, with a network of over 100,000 km of paved roads and dirt roads. In the construction of the primary road network the Romans favored linear routes; to overcome more easily hilly and mountainous reliefs, irregularities of the territory, cross rivers, many bridges were built [3].

2.1 Classification of Roman roads

Some historical sources have highlighted a hierarchical organization of the streets; the most classic distinguished the viability in relation to the property (public and private roads). But in the field literature there are also classifications of Roman roads in relation to different characteristics of usability, function, land use

[4, 5]. It is possible therefore distinguish the following three forms of classification, with related detailed specifications:

A. Type of road network
- **angiportu** (paths);
- **itinera** (pedestrian accessibility only);
- **actus** (possible accessibility for one cart at a time);
- **viae** (wider roads, on which two carts could cross or overtake each other).

B. Methods of use and behavior rules
- **viae Militares**, of prevailing military strategic interest;
- **viae Publicae** (also called *Praetoriae* or *Consulares* because they were built by a praetor or a consul), roads of great communication, suitable for the passage of chariots; the width of this type of road was about 5 m, to allow the passage of several vehicles side by side;
- **viae Vicinales** (local), roads for public use used by the inhabitants of the same territorial area, roads of local interest or connecting roads between *Viae publicae*; at least 3.75 m wide, with one or two traffic directions;
- ***viae Privatae*** *(also called viae Rusticae or* Agrarie), adopted mainly for access to fields or privately owned land, built by private individuals and often blind; sometimes also open to the public if they allowed access to consular roads or *viae Vicinales*.

C. Land use
- flat and straight path, with direct connections between the main cities, with right-angled access from the side or connecting roads;
- embankment path, with raised pavement with respect to the ground, to allow a wider view and therefore greater control of the territory;
- development at high altitude, keeping the route at the same level and overcoming irregularities due to the land morphology more easily, with frequent use of bridges and viaducts. Sometimes tunnels were also built, entirely dug by hand. The aim was to guarantee linear continuity to the roads, without hitches or interruptions.

In Fig. 2 a synoptic framework relating to the infrastructural components of Roman roads is proposed.

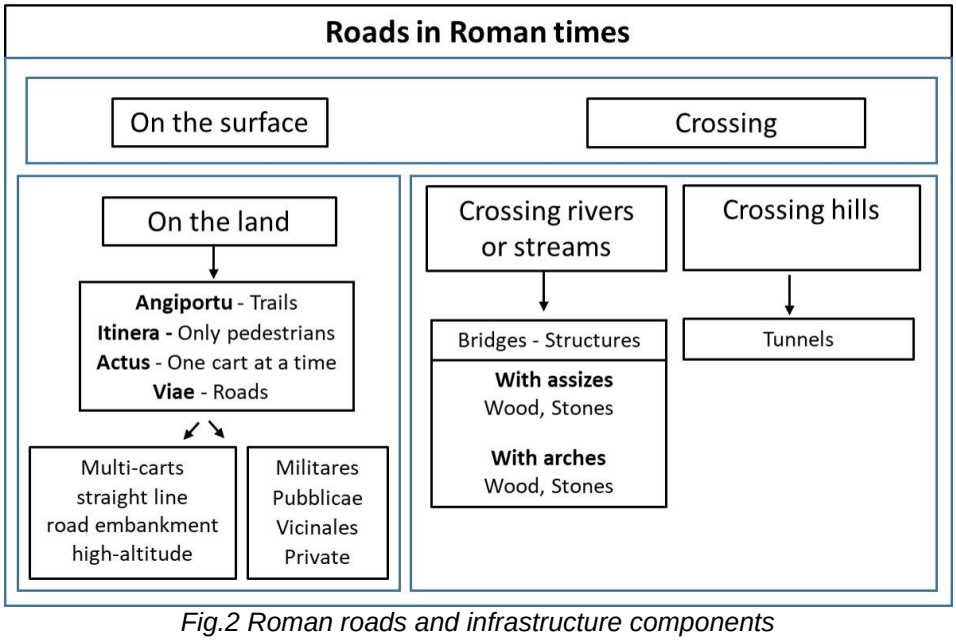


Fig.2 Roman roads and infrastructure components

2.2 Typical road paving structure

The Roman roads were built in such a way as to ensure solidity and comfort; not infrequently signs and even monumental works were placed along the route. The nature of the materials used to make the flooring depended on the local natural resources [6].

The standard dimensions in width ranged from 3 to 7 m; the larger infrastructures, which allowed the simultaneous passage of two carts, also reached 10-14 m. In urban contexts the streets were often flanked by dirt or paved sidewalks; they were between 3 and 10 m wide.
The construction work required preliminary identification of the edges of the carriageway; an excavation of the soil was then carried out, to a depth of about 50-60 cm. Four layers of different materials were then arranged from bottom to top (Fig.3). The first, the *statumen*, consisted of a massive base made of stone blocks. The second, the rudus, was made up of a mixture of rounded stones and lime. The third, the nucleus, was a layer of gravel leveled with beating and passing heavy rollers. Finally, the fourth, or the pavimentum (covering), was made using polygonal boulders of smooth hard basalt stone, a practically indestructible material. The boulders were well connected and joined using smaller stones that filled the cracks. The "humpback" section was adopted to facilitate the outflow of rainwater which was then conveyed into gutters suitable for disposal [7, 8].

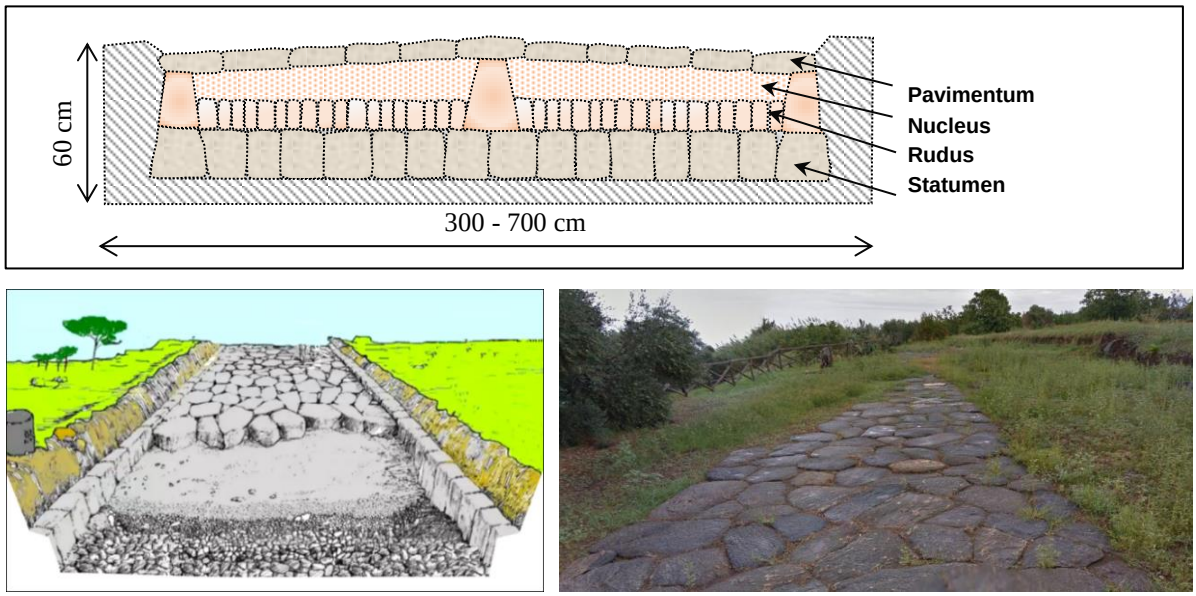


Fig.3 Typical section of a consular road and final result

2.3 Staging points and milestones
Along the consular roads, stopping points (**stationes**) were created which were configured as post stations (for a sort of postal service, the *cursus publicus*) and rest stations. The stationes were generally divided into two types: **mutationes** and **mansiones**. The former were distributed irregularly along the route and were equipped with taverns; they were used for short stops, to change horses and were mainly dedicated to public employees with the exception of people with special licences. The latter were placed at the distance of about a day's travel and were intended for a prolonged stop also for the night's rest; they were used by postmen (called *tabellari* because they carried letters on tablets) and by state officials; the distance between two mansiones included from 6 to 8 mutationes and was of about 75 km. The best equipped mansiones allowed for supplies and assistance for people, animals and vehicles; there were buildings along the roadside, sometimes protected by surrounding walls; sometimes the mansiones corresponded to villages with an economic-commercial function, confirmed by the presence of workshops and warehouses. Not infrequently, permanent army camps or even cities arose around the mansiones [9].
On the roadside, milestones were placed, stone columns that signaled the distance in miles from the *Golden Miliary* located inside the Roman Forum; the *Golden Miliary* consisted of a marble column covered with gilded bronze, erected in 20 BC by Cesare Augusto, which represented the zero kilometer. One mile corresponded to 1000 "steps" or approximately 1480 m.

3. THE VIA POPILIA IN CALABRIA
Via Popilia represented one of the most important historical Roman roads; it branched off from the Via Appia at Capua and made it possible to reach Reggio Calabria (Rhegium), crossing three regions, Campania, Basilicata and Calabria (*Via ab Regio ad Capuam*) [10,11].
In Calabria the Via Popilia was the unique main Roman road (Fig. 4), also known as Via Annia (from the name of the Consul Tito Annio Rufo). Some historians argue that the road was started by Publius Popilio Lenate, in 132 BC as evidenced by the Lapis Pollae (or Elogium Pollae), a plaque in Latin found in S.Pietro

di Polla (Salerno) and completed by Tito Annio Rufo due to a milestone inscription found in the Vibonese area which mentions it and reports the distance from Vibo to Capua (255 miles). This would explain the dual denomination of the Popilia-Annia road [12].



Fig.4 Via Popilia in Calabria and the milestones of Polla and Vibo Valentia (S.Onofrio cippus)

In the *Tabula Peutingeriana* (Fig.5), an ancient paper road map (about 375 AD) contains a graphic representation of the then known world, in which the roads were represented as links between the individual stages of the routes. In the map, kept at the Vienna Library and dating from the 4th or 5th century AD the stations and their distances are identified. The distance between Capua and Reggio is equivalent to approximately 475 km, a measure that roughly coincides with the current one; according to Lapis Pollae the distance would be equal to 321 miles, while according to Peutinger's Table it would be 329 miles, quite close to the previous one [13].

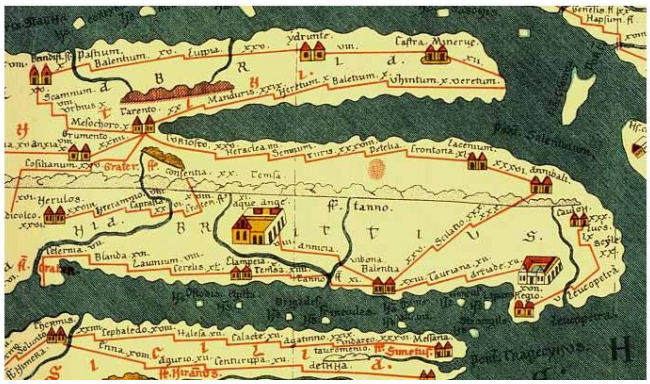


Fig.5 The Tabula Peutingeriana

Via Popilia was connected to another important and even more ancient road, the Ionian coast road that from Metaponto connected the cities of Magna Graecia (Sybaris, Petelia, Kroton, Scolacium, Kaulon, Locri Epizephiri, Rhegium) through some transverse minors roads. The Ionian route, sometimes referred to by the term *Dromo*, however, did not have solid structural characteristics like the Roman ones and therefore even more scanty evidence can be found today [14, 15].
Via Popilia is an important itinerary around which the culture of Romanization in Calabria has developed, which has left a considerable heritage that could be better exploited. This awareness has led to the development of a study aimed at highlighting how it relates to the Calabrian territory and its connections with the sites and cultural heritage found along its path.

The Calabrian stretch of the Via Popilia crosses 52 municipalities; among the most important locations along the road there are:

- Muranum, now Morano Calabro;
- Castrum Villarum, now Castrovillari;
- Castrum Laurentum, now S.Lorenzo del Vallo;
- Thorus, current Torano;
- Aufugum, today Montalto Uffugo;
- Consentia, currently Cosenza;
- Mangone;
- Vibona Balentia, today Vibo Valentia;
- Taurianum, today's Taureana di Palmi;
- Rhegium, now Reggio Calabria.

4. DESCRIPTION OF SIGNIFICANT SITES AND MONUMENTS

In order to enhance the ancient Via Popilia, it seemed appropriate to identify the most significant archaeological sites and highlight their characteristics, according to an ideal tourist-cultural route. Six have been identified in particular: the Roman Villa of Larderia in the municipality of Roggiano Gravina, the aqueduct of Cosenza, the Hannibal Bridge over the Savuto river, the Roman thermae of Curinga, the remains of Taurianum (Palmi), the Roman thermal baths of Reggio Calabria.

4.1 The Roman Villa of Larderia (Roggiano Gravina)

The Roman Villa of Larderia and its park constitute one of the most important extra-urban residential sites in Calabria from the end of the 3rd century BC to the early Middle Ages, both in terms of plan development and for the mosaic apparatus. The site has a continuity of attendance that goes from the end of the third century.
The Villa located in the municipality of Roggiano Gravina, stood out from the others for its luxurious appearance, given by the presence of rooms with important and elegant mosaic floors and an area used as a thermal complex.
The still existing masonry structures were discovered in 1973, during the construction of the Esaro river dam and the subsequent construction of the reservoir. The analysis of the structures, during several excavation campaigns, and the particular subdivision of the rooms have allowed to recognize the typical type of construction of the the Roman era "*villas*". In particular a more ancient structure has been identified, consisting of walls in uncertain work that is traced back to the second half of the first century BC and a more recent structure characterized by walls that present in some places, as in the corners, brick elements, built between the end of the first century and the end of the second century AD. Currently only the thermal area is visible, since the residential area has been entirely covered by land [16,17, 18].



Fig.6 Roman Villa of Larderia. Overview and floor with mosaics

4.2 The Roman aqueduct of Cosenza

The ancient Roman aqueduct, of which a structure with various arches is still visible (Fig.7), allowed water to be brought to Cosenza. It was fed by a spring located on the mountainous reliefs near the city (Bagno locality). Along its route, the aqueduct crossed the Rovito valley. For a stretch it was flanked by a paved road with large greyish paving stones, as evidenced by some findings, which went up towards Dipignano, passing to the east of the Tessano hamlet. These could be segments of the Via Popilia.



Fig.7 Tratto di acquedotto romano di Cosenza con vista aerea

4.3 Hannibal Bridge (Altilia/Scigliano)

The "*Hannibal Bridge*" (Fig.8) is a bridge over the Savuto stream and is located between the municipalities of Altilia and Scigliano, in the province of Cosenza. Its current name is Ponte S.Angelo. It dates back to the 2nd century BC and is considered among the oldest in the world, certainly the oldest in Italy, and it is a national historical monument. The name of the builder is unknown, but it is plausible that, as was the case with the Roman bridges that were generally built by legionaries, it was also the same for the Hannibal Bridge [18, 19, 20]. It can be accessed from one side through a typical Roman ramp that rests on the rocky hill; on the other side, the access ramp is supported by a shoe buttress (Fig.9).

The bridge has an arch with a double concentric ferrule; the lower one is made up of squared blocks mounted dry; the second, also made with square blocks, acts as a reinforcement and counterweight to the first supporting arch. The blocks are of red limestone tuff, coming from the quarry of an adjacent hill. The floor was built in masonry with river stones and pozzolan stone [21, 22].

The structure is in a fairly good state of conservation, the degradation phenomena are found above all on the surfaces where there is a widespread biological matter (weed vegetation and colonization of lichens) with different chromatic attributes, which over time have formed the typical biofilm that is found on the surfaces of the limestone rocks of ancient monuments. The bridge was restored in 1961, by the Superintendence for Archaeological Heritage of Calabria.



Fig.8 Hannibal Bridge over the Savuto river



Fig.9 Access ramps to the Hannibal Bridge

4.4 The Roman thermal baths of Curinga

In the municipality of Curinga, in the province of Catanzaro, in 1966 the remains of the Roman baths of S.Aloe were found, better known as the "*Temple of Castor and Pollux*" (Fig.10). The wall structures allow the monument to be dated between the 3rd and 4th century AD, as confirmed by the only significant monetary discovery consisting of a Diocletian nominal. They most likely belonged to the much larger structure of a Roman villa.

The area where the remains of the thermal building were found is located near the Turrino stream, and is today mainly used for grazing and cultivation; unfortunately, around the 1960s, it was used to find materials for the construction of the Mediterranean motorway; during the works, the careless action of a mechanical means resulted in damage to the south-east corner of the building (*calidarium* area) [22, 23, 24]

The thermal building, consisting of five main rooms, was accessed from the East through a portal over two meters high which led to a vast atrium of 70 square meters, the *frigidarium*, a rectangular room, covered in the centre with a cross vault and bordered on the short sides by large apses with niches containing the basins. In southern position there was an access to the heated rooms identified as *laconicum* and *calidarium* (typically intended for hot water baths and steam baths); finally there was a third service room with the *praefurnia*.



Fig.10 Ruins of Roman thermal baths in Curinga

4.5 The remains of Taurianum (Palmi)

On a plateau overlooking the Tyrrhenian coast, near the small city of Palmi (Reggio Calabria Province), there was an ancient Brettian settlement. In a subsequent period, between the 2nd and 1st century BC, the plateau was occupied by the Romans. New buildings were built on the ruins of the original settlement; among others there is an important sacred area, consisting of a cult building on a podium that some scholars have defined typologically similar to the Etruscan-Italic one. Its position was very interesting, given that the monument stood out clearly and above all it was visible to those who were passing through the stretch of sea below. From the constructive point of view, the podium (Fig.11A) had a quadrangular shape, developed for a length of 21 m and a width of 8 m, and was made in *opus coementicium* while the elevated one was partially covered with bricks. The monument was accessed via an alleged staircase unfortunately not preserved; on three sides there was a structure as a porch, typical of the buildings of that period, even if the divinity to whom the temple was dedicated is unknown. Another element of interest is a mosaic pavement (Fig.11B) unfortunately today very deteriorated.

Recent excavations have brought to light on the northern edge of the plateau, a part of the walls, in isodomic limestone blocks, dating back to the 1st century BC. In the eastern part of the plateau, a stretch of paved road made of hard local stones (Fig.3) was unearthed which probably connected to Via Popilia and overlooked by some rooms of uncertain function.

Adjacent to the road was a large arched building with steps (Fig.11C). Even if the excavation has not been completed, it can be said that the building consisted of a cavea set on a north-south axis about 60 m long on the slope existing between the paved road and the sacred area. It is a singular architecture in the Italian panorama which, originally was perhaps an amphitheater for playful events or gladiator fights. Occasionally the structure could be used for theatrical performances. Its capacity is estimated at around 3,000 spectators.

From the end of the XIX century the area became a site of historical and archaeological interest for the discovery of finds and structures linked to the ancient Tauriana.



Fig.11 Roman remains of Taurianum. A) Podium, B) Mosaic, C) Cavea structure

4.6 The thermal baths of Reggio Calabria

The thermae of Reggio Calabria are located in the southern part of the current Marina Street. They were found during the reconstruction works following the 1908 earthquake and are considered one of the most important monuments of the city. Given its modest size (Fig.12), the bath probably belonged to a private villa, like other in Calabria. They were located a short distance from the city's public baths, about 300 m further North, under the current prefecture building.

From the whole original system it is possible now recognize an elliptical tub for hot baths (anticipated by a sequence of heated rooms, *tepidarium* and *calidarium*), a square bathtub for cold baths and a small semi-circular dressing room characterized by a black and white mosaic floor. The bathtub was surrounded by a low wall reserved for the bathrooms guests.

The extraordinary technique used for the construction deserves attention. It was able to distribute the steam generated by combustion to heat the rooms; in fact it was channeled through the raised floor and led into the cavities of the walls. The confirmation of the design capacity is found in the distribution of the rooms; to take advantage of the sun exposure, the cold diving pool was located to the North, the one for hot diving to the West.

The archaeological site of the Marina Street, which also included an area reserved for gymnastic exercises, was embellished with a colonnade that is now only partially legible [24, 25].



Fig.12 The thermal baths of Reggio Calabria with mosaic flooring

5. THE TOURIST-CULTURAL POTENTIAL OF THE VIA POPILIA IN CALABRIA

The southernmost part of the ancient Via Popilia, which falls within the territory of Calabria, has very interesting potential from a tourist-cultural point of view. It is one of the 4 itineraries that cross the region from North to South and which are proposed and managed by local associations with the aim of promoting tourism in the form of Ways and Trails. The other paths are the Sentiero Italia (*Italian Trail*) that develops along the Apennine mountains from Pollino to Aspromonte, the *Basilian W*ay that extends on the Ionian hillside, touching numerous villages with historical-monumental references from the Byzantine era, the Cammino della Magna Grecia (*way of Magna Graecia*) along the Ionian coast that connects archaeological sites of the Hellenistic period. This article presents the results of a research aimed at highlighting the most significant emergencies of the old road, dating back to the Roman era, following the logic of an ideal tourist route largely still to be exploited. Some specific insights are proposed relating to these emergencies; in particular, historical research also concerns aspects of an architectural and engineering nature. The paper intends to offer a cultural contribution relative to an ancient cultural heritage of great value, rich in singular components of great interest, and to draw attention to the latent potential of a tourist route that could acquire new dignity in terms of a way to be practiced on foot. or by bicycle, a sequence of sites to visit in stages, with direct positive impacts on the area crossed economy [28, 29, 30].

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Research notes on safeguarding architectural heritage: a proposed mode of operation for defining territorial buffer zones

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Abstract
What the gaze can embrace in an anthropized space is a sinuous carpet, dark and rough and with well-defined surfaces. The alternation of these elements marks the territory, it animates it with perspectives and life, and intensifies it in the balance of shadows and light, transforming it into a landscape.
This case study's field of research is therefore the landscape and the aim is to identify a way of scientifically defining territorial buffer zones for Man's activity in order to avoid incongruences that sometimes arise when applying the present legislation.
The research was based on the territory of Molise. An area with little tourism characterised by the presence of Samnite remains, was chosen as the study area, in part to indulge the wish to make the region's more remote places known. The quantity of work fed by alternative logic made it possible to correlate the resulting data and create a possible operational method.
The conclusions showed that the establishment *a priori* of parameters for buffer zones is not the right approach to obtaining the best results in that each site where history has left its mark is unique and visual capacity, orography and volume of vegetation play an important role. On the contrary, working in coordination with these entities produces an acceptable outcome both for the conservation of cultural resources and for improving what can be offered to tourists, without blocking them in a static context that represents neither the past nor the present and, above all, denies the future.

Keywords: Landscape; buffer zone; safeguarding; enhancement; survey; archaeological site

1. Introduction
What the gaze embraces when observing the territory is a series of sinuous, dark, textured forms and well-defined surfaces. The alternation of these elements marks the terrain, animates it with perspectives and life, intensifying it below the balance of shadows and light and transforming it into the landscape.
The territorial space in which manmade structures and nature maintain a relationship of figure-background is the cultural context in which the considerations of this paper are formulated. It is a complex theme providing much food for thought as every visual experience "is a formative process, is a creative act" [1], where the perceived reality is not the sum of the stimuli that produce the image, but the totality of the component processes; a concept that the Gestalt, the psychology of perception, has synthesised thus: "the whole is more than the sum of its singular parts" [2].
The particular theme examined in this paper is the safeguarding of the man-made component within the historical landscape and the proposal of a methodology for defining territorial buffer zones, which avoids the incongruities that sometimes occur when the present laws are applied without qualification. The actuality of this topic has recently become manifest during our research in areas of the Molise Region placed under tutelage due to the presence of Samnite structures. Obviously, we intend to propose a methodology applicable to all structures of historic-architectural value, not just to archaeological sites.

2. Archaeological sites in the law
An attempt to clarify the concept of the archaeological site is not without surprises, suffice to say that the scientific publications we consulted never gave the same definition. One of the more comprehensive

definitions of this concept is the following: “the archaeological site is a three-dimensional portion of space that bears the signs of time, that is the fourth dimension, which modelled it either by the addition, or by the removal of material. Places that can be analysed by retracing in reverse the phases marked by the succession of events” [3].
This clarification shows that the study of archaeological areas regards not only the great diversity of their forms as these places are created, transformed, preserved, but also the meaning of these traces, the sense they had at the moment in which they were created, that they subsequently acquired and that we believe we can continue to attribute them [3]. Therefore, analysing the places where history has left its mark means putting to use the notions from diverse disciplines. In fact, an archaeological site is both a cultural asset and a landscape asset, which would be extremely favourable if, as a logical consequence, it was afforded dual protection. Paradoxically, on the contrary in our country the archaeological site is not adequately protected; indeed, often once the excavation and recording of the walled remains is completed the latter are abandoned to their fate, especially if peripheral to the urban context or surrounded by vegetation.
In addition to being a question of economics it is also a question of law, in the sense that an analysis of the evolution of legislation regarding cultural and landscape heritage reveals that the archaeological site has never been defined as such, in its typology and substance, therefore, no specific safeguarding action has ever been foreseen.
The Code for Cultural and Landscape Heritage [5] – Urban Codes – does not take the archaeological site into consideration. In the first part, relating to general definitions, article 2 circumscribes the cultural heritage to two large categories: “cultural heritage assets”, “landscape heritage assets”. The legislative definition indicates the archaeological site as simultaneously belonging to two different categories; in other words, to none.
In Part Two, relating to cultural heritage, article 101 defines cultural institutions and places and here for the first time a term compatible as a synonym for the archaeological site appears, that is “archaeological area”, a zone characterised by the presence of “ancient remains”. The site remains within the exclusive domain of methodologies for access and instruments for enhancement, but is not considered among the actual objects under tutelage.
Although the debate on this question has, according to our memory, been going on since at least the 6th century B.C. [5] – the time of the Babylonian king Nabonidus – and although the Convention for the Protection of the Architectural Heritage of Europe was signed in October 1985, in which Article 1 defines the archaeological site as “the combined works of man and nature, being areas which are partially built upon and sufficiently distinctive and homogeneous to be topographically definable and are of conspicuous historical, archaeological, artistic, scientific, social or technical interest”, it seems that the Italian legislature still today remains unaware that the concept of the archaeological site includes both the walled remains of an architectural structure and the orographic-naturalistic context in which they are inserted.
Contrary to what occurs in Italy, in the Iberian Peninsula, for example, the law has already taken on board the proposals for an integrated vision of the monument and its context. In 2007, the region of Andalucía passed Law no. 14 denominated: *Patrimonio Histórico de Andalucía*. An important innovation in Spanish law relating to visual contamination is written in Article 19, which specifies that the surroundings of a cultural heritage site are also protected [6]. Thus, the principle of the integral conservation of the monument is fully activated. The Spanish law asks the municipalities with examples of cultural heritage within their territory to integrate their own urban planning regulations with a study on the “contaminación visual o perceptiva” with the aim of preventing interventions of territorial transformation that disturb contemplation of the monument.
This example could be a source of inspiration for us and help us to understand that the protection of an archaeological site means protecting the walls of a structure and the surrounding territory, but also the visual perception of the latter, therefore the glimpses of perspective that are permitted by the orography of the construction site, by the roads and the vegetation in which the historical remains are embedded.
As mentioned above, the archaeological site is a place defined by the dual characteristics of cultural heritage and landscape heritage and this particularity must make us reflect and understand that, in addition to appearing as a fascinating enigma, and, like art being an invitation to experience the passing of time, this historical place is a unique and inseparable ensemble, where the perceptive component has the same value as the historical, artistic and architectural ones in the process of evaluating the measures for its protection.

3. The buffer zones

One of the problems deriving from the application of the principle of safeguarding to cultural heritage is that of defining buffer zones, both in areas in which the presence of archaeological remains is attested but their exact nature has yet to be determined, and in those territorial realities that have to maintain certain characteristics so as not to alter the public’s enjoyment of the heritage site in question. In the first case, maps indicating archaeological risk have been drawn up, which define the zones with known

archaeological remains and the zones presumed to be at risk. However, in the second case the problem is more complex and has yet to be clarified.
In the Urban Codes, the term restriction present in preceding laws has been replaced by a definition that places the accent on the importance of the object for the entire community. This is a certification that the Ministry of Culture (MiC) adopts based on a proposal by the Superintendency by which the object under examination becomes a cultural asset and therefore protected under Italian law, according to the obligations for conservation established in article 30 of the Urban Code. This is the law relating to the object itself, which therefore identifies it and places it under protection, whether it be movable or immovable.
In Part Two, Section III, relating to Other Forms of Protection, the legislator has returned to the concept of the indirect restriction, that is the limitations placed on buildings adjacent to the object under protection, with the aim of not compromising the conservation of the area around the principal cultural asset. The law is very generalised and limited to providing approximate indications on aspects that the provisions could take into account, for example distances, article 45.
The content of the provisions can cover restrictions on permitted uses of an area, vehicle circulation and parking, production activity installations or polluting activities, it could even restrict the property by reducing or eliminating the right to build. The legislation is intended to preserve the “integrity”, “the perspective” as well as “the state of the environment and décor”.
With regard to the first point, the legislation implicates the evaluation of all possible anticipated damage deriving from inappropriate use of adjacent areas; while for the remaining points the evaluation must be made from the point of view the static and dynamic perception of the heritage asset under protection. However, in day-to-day reality it is difficult to put into practice a provision for safeguarding that is codified in this manner. The regulation in article 45 is of particular importance as the legislator intends to make the provision for indirect tutelage a restricting force that is without precedent in the legislation regarding the protection of cultural heritage. The term “preceptive” used in the text of the legislation, means that for such provisions there is no need for further regulations for the application of such legislation. In substance, the provisions for indirect safeguarding take effect immediately and their adoption by the urban planning and construction tools is compulsory.
The definition of the indirect restriction remains the responsibility of the superintendent, who therefore must necessarily find the criteria to use for defining all the safeguarding measures aimed at conserving the cultural/heritage asset. It is easy to see that this procedure leads to heterogeneous provisions for similar situations placed under the control of different Superintendencies. Distance, for example, is one of the main restrictions foreseen, but in the legislative text there are no indications regarding the criteria to adopt in order to deal with this directive.

4. A working hypothesis for defining buffer zones

The legislators decision to write the section of the Urban Code dealing with buffer zones for cultural heritage sites in generalised terms means, as a logical consequence, that in putting into practice the safeguarding procedure the superintendents in this sector prefer to assume a precautionary position and take metric values contained in the Civil Code, the Urban Planning Legislation or Building Legislation as their model for safeguarding, rather than expose themselves by taking an original line that would enable them to reach a result through the analysis of the landscape where history has deposited itself.
An analysis of cultural assets where a buffer zone has been imposed by using indications based on the norms contained in other legislation shows that the structures do not always have coverings that are suitable for maintaining visual integrity as required by Italian legislation; the reduced size of the area under restriction, the limited set of provisions and their influence on an area that is out of keeping with the particularities of the landscape, are just some of the problems highlighting the limitations of this operative approach.
With the aim of putting an end to such situations we have concentrated our attention on what we hold to be the principal question, that is: the visual perception of a monument, that which one acquires when at the site. Consequently, we will bring into the discussion the peculiarity of human binocular vision and the environmental characteristics of the landscape. In order to test the methodology will use Colle Rimontato, in the municipality of San Giovanni in Galdo, as a pilot area as it presents not only the remains of a Samnite sanctuary [7], but also the detrimental effects that we aim to reverse (Fig. 1).

4.1 Human binocular vision

Generally, we can consider infinity as the limit to human vision, that is: a healthy adult eye can see an object positioned at an infinite distance. However, this affirmation is not universally accepted. Indeed, interdisciplinary studies on this function show that visual capacity is influenced by several physical and environmental factors that reduce the scale of this range, such as the curvature of the earth, the terrain’s orography, the luminosity of the object, its size and not least the contrast with the background. Thus, it

seems obvious that it is of primary importance to understand at up to what distance the human eye can see and clearly recognise things.
In this regard, a number of practical experiments have reached the conclusion that for medium height individuals, with healthy eyes, observing the sea from the shoreline on a clear day, the limit of the horizon is situated at 4.5 km. Naturally, this is data that we take on board with prudence, although it is the result of scientific research, as outside of this optic model the distance is drastically reduced.
Taking a closer look at this question, we turn our attention to the visual organs. Observing the human face, the eyeballs are positioned frontally with a distance between them of circa 6.2 cm [8] and this position allows each eye to have the same field of vision.

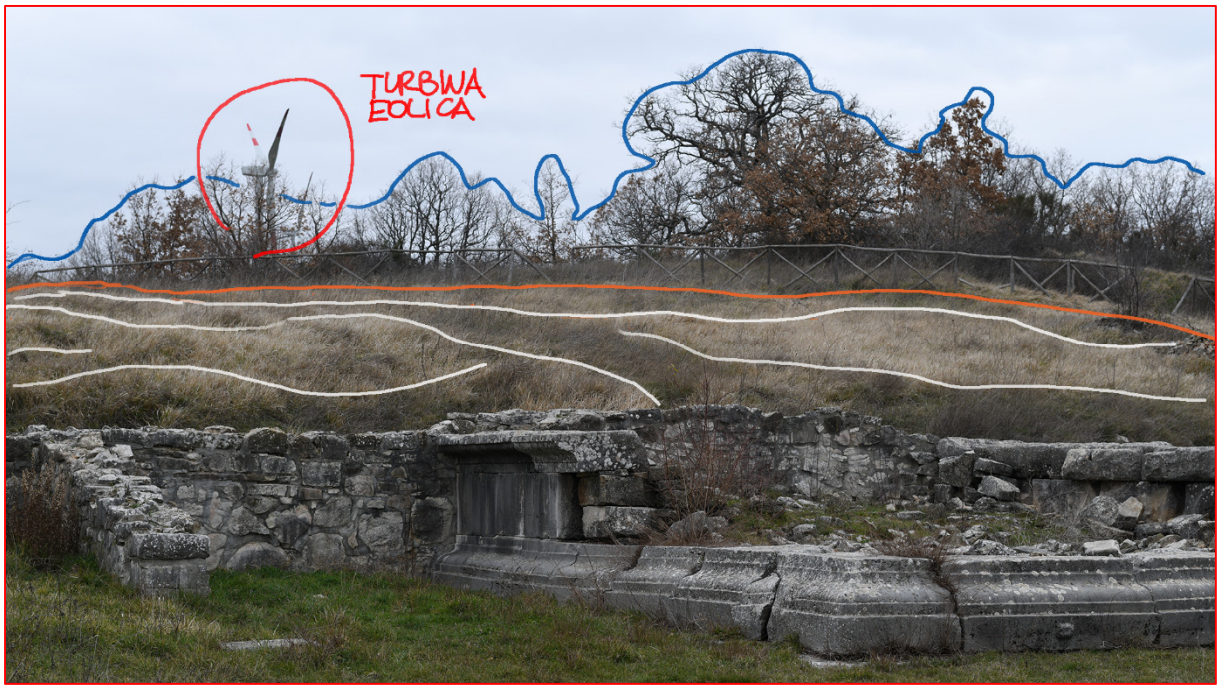


Fig. 1: The remains of the Samnite temple at San Giovanni in Galdo.

It follows from this data on human physiology that in binocular vision, the mechanism of collimation will form a triangle in space that has a base equal to the distance between the eyeballs, in which the angle at the vertex of the fixation point, the angle of convergence of the optic axes, will be smaller for distant objects and greater for those that are closer. This mechanism suggests that a point in infinity will nullify the convergence of the optic axes, that is, it will create the parallax effect (Fig. 2). Furthermore, given that the natural lack of correspondence between the two retinal images is produced by the different positions of the two centres of ocular projection, it can be understood that a three-dimensional object placed at an infinite distance generates two identical retinal images, while, on the contrary, they will become increasingly different as the subject gets closer to the centres of projection. This ocular phenomenon makes it possible to understand the spatial form, as the difference in position and aspect of the various geometric elements comprising it make it possible to perceive depth. However, the cerebral image is only one and three-dimensional, and this particularity is directly proportional to the difference in the retinal position [9].

4.2 The limits of human vision

Optometric science has shown how the ability to see things clearly is based on the relationship between the distance between the pupils and the parallax. Because the distance between pupils can be considered as fixed, the parallax is the only parameter that allows the evaluation of the shape of things. There is also an area in the eye called the fovea, positioned opposite the pupil. Here visual acuity is very high and there is an exact perception of spatial depth. It is a depression in the inner retinal surface about 1.5 µm in diameter, corresponding with circa 24” degrees [8].
Analytical models have been set up using these physiological parameters, which have revealed the entire mechanism of human vision, from which it can be deduced that two equally luminous points of light in space, one placed at an infinite distance in the direction of the ocular axis and the other in a different position, are perceived as separate entities if their images are formed on non-contiguous photoreceptors in the fovea. Considering then that from the instrumental examination of the inner eyeball it was possible to quantify in 4 µm the distance between two non-contiguous retinal cells and in 16.67 mm the distance between the projection centre and the back of the eyeball, a right-angled triangle can

be constructed and using trigonometry the smallest angular distance at which the two identical light sources can be perceived as separate be calculated, the result being 49" degrees (Fig. 3). Once this angle is known it is possible to finally define the limit of human vision, that is: the maximum distance at which man can perceive two identical points of light as separate entities. For this calculation a binocular vision diagram is used and by exploiting the trigonometric properties of the angles the desired value is obtained, that is: 130 m, while the angle of convergence for the optical axes is 0°01'37" (Fig. 3).

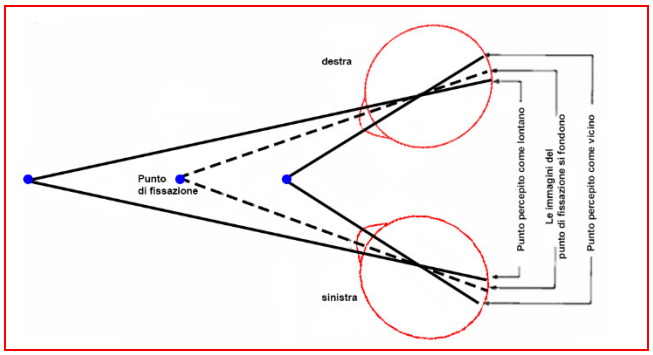


Fig. 2: The remains of the Samnite temple at San Giovanni in Galdo.

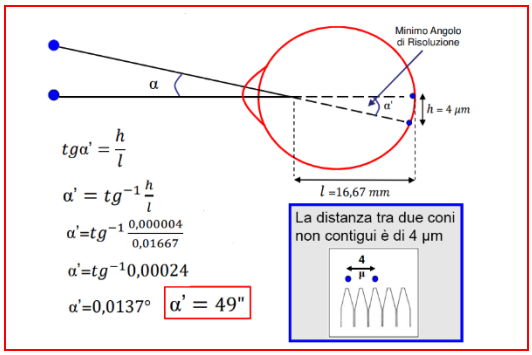


Fig. 3: Diagram of visual acuity.

4.3 Environmental characteristics

Having established the limits of human vision the other aspect taken into consideration in this study is the nature of the environment, for which we have studied archival sources and made subjective evaluations originating from our reactions to being on site, the intention being to constitute an exhaustive documentary base that narrates the history of the place.

In such analyses, direct perception of the overall complex is of great importance as it makes it possible to verify one's mental image of the study site formed on the basis of information obtained from reading the documentation, and in addition it allows us to update and therefore complete the collection of information. It is an activity for which drawing from life, *en plein air*, and photographic and metric recording are also particularly effective. Although the latter is not mentioned in the Urban Code, it has long been considered the building site of knowledge of architectural forms because not only is it a product but also a sequence of procedures and evaluations; the words used by Giorgio Vasari to describe the work of Filippo Brunelleschi bear eminent witness to such [10]. Moreover, we must not forget that drawing, by definition, is the appropriate too for delineating the signs of the culture left by those who inhabited the place at the centre of our interest, that is: it highlights the semiotic value of the architectural structure. Therefore, this type of investigation of a structure may be characterised as indispensable in all realities where the aim is to delimit a visual buffer zone given that the historical places discussed here measure themselves through architecture, and having all relevant documentation regarding the walled remains and their surroundings simplifies the task of those who observe in order to understand and assess.

The graphic-geometric analyses of visibility provide further in-depth study in the exploration of the environmental characteristics. This is an objective graphic reading of the territory aimed at highlighting changes in altitude and documenting the presence of rough terrain that could have a negative influence on the perception of the heritage site, and is fundamental for establishing the positioning of preferential viewpoints which, as will be seen below, is carried out digitally, using the potential of systems such as the Geographic Information System (GIS) for the implementation of specific territorial analyses.

4.4 Determination of the area of direct or indirect restriction

When we posed the problem of finding a new way to define a buffer zone around a cultural heritage site/structure it was clear that we should not reach a result that would cause an ample area of territory to be restricted, as this would mean blocking it in a static picture that represented neither the past nor the present, and above all denied the future. In order to avoid finding ourselves in this situation, the idea gradually matured of maintaining both the direct and indirect restrictions and concentrating our efforts in defining their sphere of influence and recording the essential contents of the regulations for one and the other domain.

Consequently, the distance between the projection centres which make it possible to distinguish two points of light as separate entities is the value that is assigned to the radius of the circumference of the area covered by the direct restriction, whose centre is to be calculated as the heart of the architectural structure. Clearly, in other situations that are larger and formed by more components than our subject one can imagine using several circumferences positioned on the perimeter of the overall architectural complex (Fig. 4).

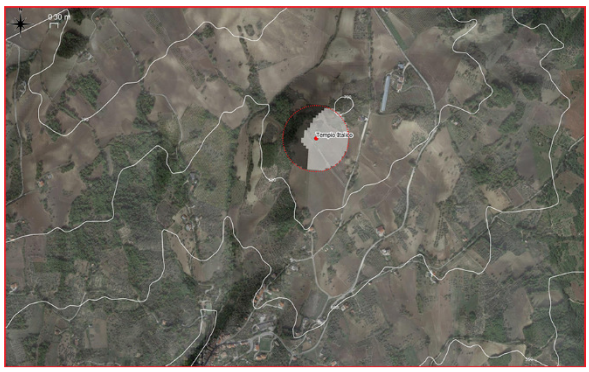


Fig. 4: Area covered by direct restriction.



Fig. 5: Area covered by indirect restriction.

While we believe that the indirect restriction can be extended as far as the theoretical limit of human vision, as mentioned above, and as the area involved is extensive, it is suggested that the safeguarding is commensurate with the distance from the heritage site. Furthermore, we believe that is important for the model for the secondary restriction level should be based on the orography, so that zones hidden from sight by depressions in the landscape or hills, are not included among the elements subject to legal obligations. The latter indication is of the utmost importance given that it meets the desire not to restrict a vast area of the territory and at the same time the desire to only restrict the areas within the field of perception, which at this point would assume a legal value (Fig. 5).
As regards human activities permitted in this area, naturally farming is consented while all other activities should be subject to a check on their visual perception. In particular, a critical analysis should be made of the visual impact made on the historical landscape by the size of buildings and their conformation, the colours of the building materials and pigments for exterior paint, the reflection of light waves from materials used in innovative construction, and roads of all types.

5. Geographic information systems and visibility analysis

Nowadays, Geographic information systems (GIS) play a fundamental role in all disciplines linked to the territory. GIS are special information systems that allow to associate spatial analyzes to the typical databases features and to visualize the geographical data and the results of the performed analysis.
The data, although they come from separate archives belonging to the most varied sectors, such as environment, society, economy, etc., are suitably correlated, in order to be composed and displayed. Their structure allow to manage and analyze all the information related to the territory.
The QGIS software was used and, in particular, it was necessary to use specific functions for the three-dimensional analyzes that these systems are able to provide. Therefore we worked with the digital terrain model (DTM, Digital Terrain Model). The data files contain the elevation data of the terrain in a digital format which relates to a rectangular grid. It describes the earth's surface through a finite number of points whose coordinates (x, y, z) are known. The x and y coordinates identify a specific point in the reference system, the z coordinate defines the elevation of the terrain. The simplest model is made up of raster GRID, that is a regular matrix of elevation values with variable resolution. Figure 6 shows a DTM model with a resolution of 10 meters displayed in QGIS in a 3D map with the single gray band. The color gradient shows the information relating to the elevation data.

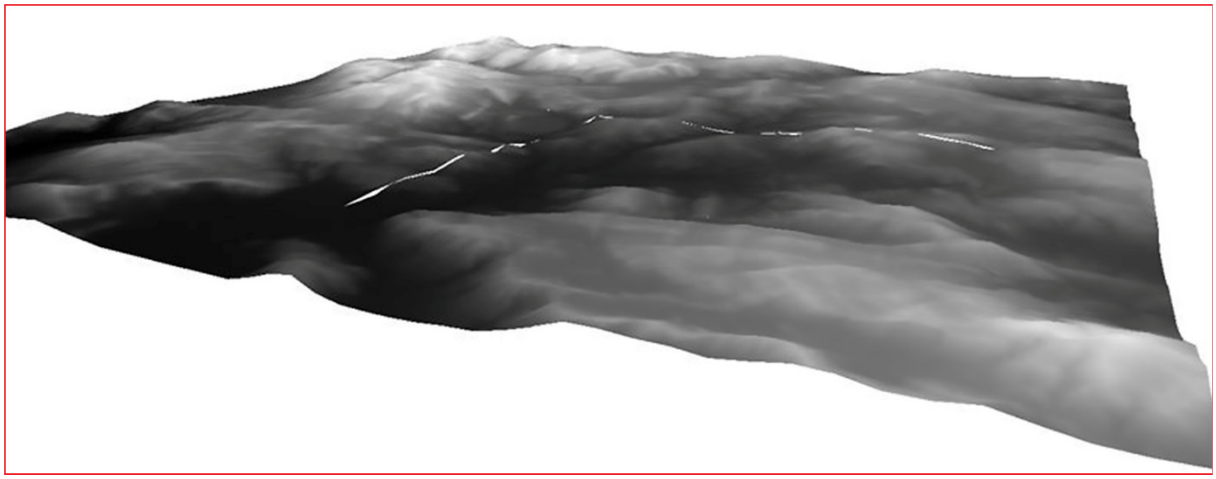


Fig. 6: Digital Terrain Model (DTM) visualisation in QGIS in a 3D map.

Several 3D analysis can be performed. The most common are:

- Contours line
- Slope
- Hillshade
- Aspect
- Visibility analysis

The 3D analyses can be performed in QGIS with suitable plugin that implement appropriate algortm.
It is possible to obtain Contours line (Fig. 7).

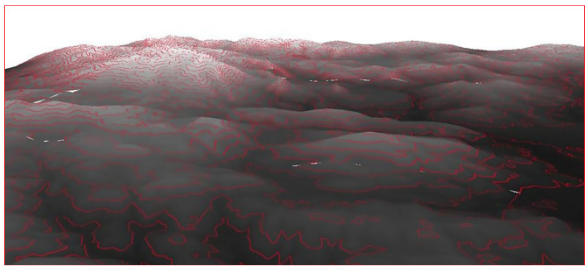


Fig. 7: Vector file of a 100 m contour line.

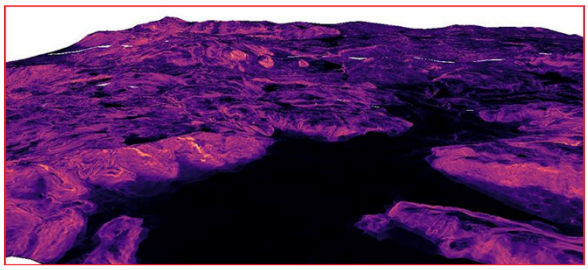


Fig. 8: Raster data of slope.

In several studies it is necessary work with slope. Thanks to DTM it is possible to obtain the terrain's slope (Fig.8) that is the angle of inclination to the horizontal.
The QGIS software offer also the aspect algoritm wich calculate the compass direction that a slope faces. The pixel value (from 0-360°) is measured in degress from north indicating the azimuth.

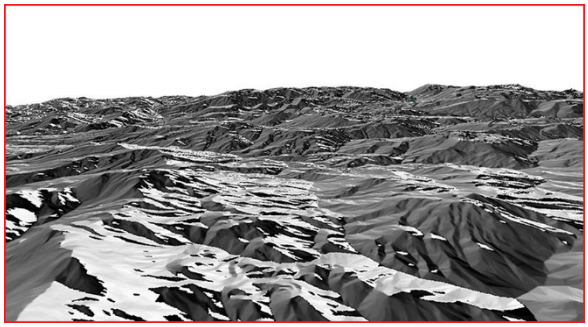


Fig. 9: Raster data of Aspect results.

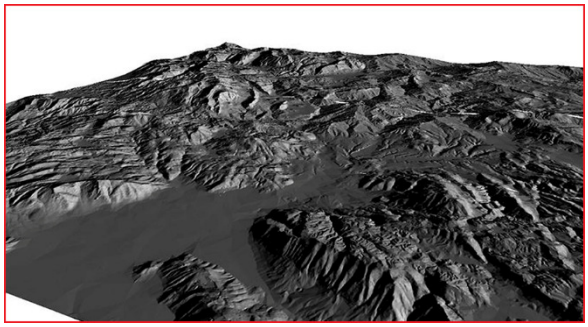


Fig. 10: Example of hillshade (azimuth= 90°, Elevation=15°).

With height data of a DTM it is possible to represent a nice shaded relief effect. It's very useful for visualizing the terrain. It is necessary to set the azimuth and altitude of the light source. The gray scale to which the information is displayed varies between black (0), for completely shaded areas and white (255), for completely illuminated areas. The result dipnds on the values of azimuth and elevation of the sun (Fig. 10).
Very intersing tools are offered by the Visibility Analyses plugin. With this function it is possible to establish which portions of the landscape are visible to an observer placed in a certain place and at a certain altitude. This is an analysis that has vast fields of application.
The first step of this analysis is to create the observation points using the Create viewpoints algorithm. As input data it is necessary to provide a vector file (shapefile format) of point geometries, which constitute the spatial reference, and a digital elevation model.
The Viewshed algorithm that deals with the analysis of visibility requires, the position of the observer (Observer location) and produces a raster where the pixels have value 1 (white) if visible or 0 if not visible (black).
It is possible to produce a map of the visible areas from one or more observation points (visual field) or a map of the areas from which the point or points of interest are visible (visual display).
The following figures show some results of our analyses.

6. Preferential viewpoints

Viewpoints are physical places qualifiable as geomorphological and anthropological elements from which a cultural asset can be observed without being "damaged by the perspective, or the light or the conditions of the environment and décor being altered", as required by article 45 of the Urban Code.

The legal norms described above indicate that these positions for the observation of cultural heritage are linked to perspective vision and to the limits of the human eye, given that in the legislative text there is no mention of fixed optical instruments for the observation of distant objects. To be honest, neither do we consider the placing of sight-enhancing instruments at these places a priority, with the exception of those where the fauna and historical landscape offer unique sights.
So, this project's direction suggests circumscribing the area in which to search for observation points to just the visual buffer zone. Furthermore, in order to meet the needs of all people interested in the history of the territory, these places must also be recognisable and easily accessible, as well as being provided with information panels about the landscape.
In practice, in order to provide a solution to the solicitations within the legislation, firstly the perimeter within which the visual safeguarding of the cultural heritage asset is in force has to be put onto the digital model of the territory. Next, the zone where the asset is visible is chosen from the correlated database. Finally, as a further step it is necessary to identify the stretches of public road lying within these areas and here, where visibility of the asset is ensured by mathematical calculation, concentrate attention on identifying the positions from which to bring to life this didactic-sensorial experience (Figg. 11-12).

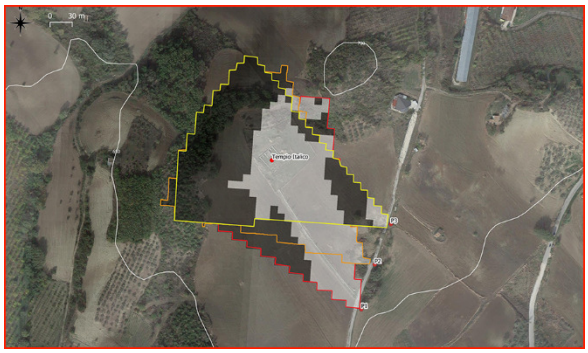


Fig. 11: Dynamic preferential viewpoints.

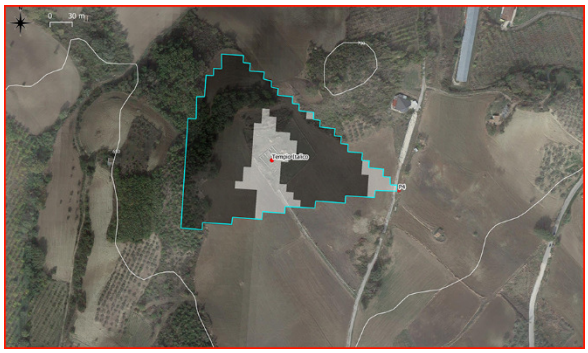


Fig. 12: Static preferential viewpoints.

In any case, even if the selection of the positions is made on the basis of a process of digital evaluation, as long as the conscious perception of the place can aspire to objectivity, the choice of preferential viewpoints is transferred to the impressions one has when experiencing these places and to the sensations coming from the observation of photographs taken during this experience.
These are photographs for the study of perspective and therefore the subject is positioned at the centre of the visual axis, and they are single takes given that beyond 50 m the images perceived by the eyes present a minimal difference and can be considered the same, thus the vision results as practically monocular [8]. Images that good sense suggested be taken during days with maximum visibility, in the hours during which shadows are ill-defined and with the camera positioned on a tripod.
Lastly, it is useful to make a brief mention of the photographic equipment to use in the field. In order to deal with the verification of perspective when not actually on site would require photographs identical to the images produced by our eyes. This is difficult to achieve using normal cameras. It is a complex problem and had been widely discussed in published works [11]. Here it suffices to say that what is required is a professional Digital Single Lens Reflex (DSLR) with a full-frame image sensor, that is 24 x 36 mm, and a 50 mm fixed-focus lens, as this combination makes it possible to get very close to the extension of the human field of perception.

7. Conclusions

The methodology adopted in this simulation made it possible to establish a visual buffer zone for the cultural heritage site offering a value close to the true threshold.
The decision to focus on a simplified path of research may seem risky to many, but we preferred this option in order to acquiesce to the desire to try an analytical path that could easily and rigorously be applied in any situation. The decision to use diverse base maps available on internet also follows the same logic. Moreover, our aim was also associated with the desire to give space to computer programmes such as GIS for the inter-visibility graphic analyses, which have also demonstrated their ductility and versatility in this type of spatial analysis, clearly showing us in real time the answers to our interrogations in graphic form on the reference map.
As regards the perception of the Samnite temple we can only hope that the competent authorities for this territory, responsible for the installation of a wind farm, will remedy what they have sanctioned and promote an intervention to improve the view aimed at limiting the dominance of contaminating elements by, if not actually removing them, at least undertaking interventions on the landscape such as increasing

the primary and secondary autochthonous vegetation so as to restore the visual integrity of the Samnite remains, at least from the viewpoints we have identified in this study.
Furthermore, given that every abstract space becomes a place if inhabited by history and every visual experience is a formative process, it would also be useful for the development of tourism in the Molise region for the same authorities to promote a cultural project placing this Samnite sanctuary within a system with the other signs of history scattered across the territory in order to create a circuit in which the scholar and tourist can find the opportunity to consciously perceive the landscape, which these ancient structures help to characterise, giving them the opportunity to formulate an opinion, a description, possibly graphic as suggested by Paul Valéry [12] and Le Corbusier [13], given that we do not think, do not live in what others have seen, but we think and live for what we see: the eye is our primary sensory organ, it creates the world in which we live.

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1. Se entiende por contaminación visual o perceptiva, a los efectos de esta Ley, aquella intervención, uso o acción en el bien o su entorno de protección que degrade los valores de un bien inmueble integrante del Patrimonio Histórico y toda interferencia que impida o distorsione su contemplación.

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The oldest ecological Law and the "Ecological Transition" in Athens

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Abstract
In 430 B.C.E. a decree (*IG* I^3 257) in Athens forbade certain serious forms of pollution. Some significant peculiarities make this document, the first known in the field of territorial protection, an *unicum*. The resolution taken by the *boulé* was aware of the kind of environmental degradation in question; it was equally aware of the causal connection between environmental degradation and certain routine economic activities; it acknowledged that practices more respectful of the environment were consequently called for; it believed that activities that were disrespectful of the environment could no longer be left to individual discretion; it is issued during the severe plague epidemic that broke out during the Peloponnesian War. The decree clearly treats degradation of the environment as an illegal activity, and it, already known to epigraphic scholars, has been studied for its topographical implications. Today instead it must also be analyzed in relation to the current ecological problem and the current health emergencies, also to highlight the aspects of an unprecedented ecological transition and in order to deduce some constants of the human reaction to certain events.
During a serious health crisis, the text introduces a concatenation –unprecedented for the times- between pollution and damage to health, all the more significant as it clashed with the economic interests of a particular sector (the leather tanners industry).
Although motivated by religious scruples, the rule documents the awareness of the Athenian community, which seeks to introduce behavior that is more respectful of the natural environment, without neglecting the economic aspect.

Keywords: environmental legislation; ecological transition, Athens; Ilyssus.

1. The oldest known ecological Law in Context

The first legislative text aimed at regulating the impact of man on the environment dates back to 430 BC (*IG* I^3 257). It is significant that the problem of pollution was already felt in ancient times and that the link between the environment and the economy was noted.
The decree is known to scholars, but so far it has been studied above all for its topographical implications.
The stone with the inscription was found in the 1920s at the foot of the eastern slope of the acropolis and is now preserved in the Epigraphic Museum of Athens (EM 12553). It is a fragment of a Pentelic marble stele, broken at the top and bottom, but intact on the sides (h. 34,5 cm.; l. 44 cm.; sp. 15, 7 cm.).
Despite the shortcomings, the text can be translated as follows: "(the present decree) be inscribed on a stone and let it be placed on both sides. (It is not allowed) to put skins (in the river), and thus to pollute the Illyssus by the mounth of Heracles' temple, or to practice tannery and dispose of the waste in the river".
The inscription expressly refers to the river Ilissus and the temple of Heracles by the city gates. Hence we can locate with some precision the location of the environmental problem.



Fig. 1: Ancient Athens with the Illyssus River.

The decree is explicitly intended to protect a holy site, yet its effects are also economic, and the protection of public health also appears to be a primary concern. The removal of hazardous and noxious materials from the vicinity of the temple will achieve two related results: public attendance at the religious site will increase, and so will donations.
In the inscription, seriously incomplete, it speaks of the sum to be allocated in order to prepare two equal *stelai* and the archon *basilèus* is given a mandate to see to their realization. On the other hand, it is not clear who is responsible for actually observing the prohibition.

2 The Athenian decree and modern interpretations

The geographic data is significant: the Ilisso river originates from the northwestern slope of the Hymectus, flows west to south of Athens, outside the walls of Themistocles. After the urban center, it joins the Eridano and flows into the Cefiso, which flows into the Gulf of Falero.
The area crossed by the river was known in ancient times for the richness and freshness of the waters and, in Roman times, it was the site of prestigious villas, such as that of Atticus, a friend and correspondent of Cicero.
Many theories have been advanced so far regarding the decree: according to some, it is a rule that delimits the area to be protected; according to others, it is a “sacred” law since reference is made to the archon *basilèus*, while the publisher of the decree (Lind 1987: 15-17; Lind 1990: 157-159) highlighted that it was issued not by a minor territorial body, but by the *boulé*.
The long-held hypothesis that the pollution was caused by those who went to the sanctuary of Heracles and washed the skins of animals sacrificed to the god in the river does not seem valid: the verb βυρσοδεψέω does not refer to an impromptu activity, but to an long and complex professional activity, which requires organization and equipment. Only recently (Panessa 1983: 379-380; Rossetti 2002) has the decree been interpreted as the first ecological standard: the city would have taken measures against private entrepreneurs, to impose behaviors that are more respectful of the natural environment.
By carefully considering the text, it appears that it contains three prohibitions:
it is forbidden to immerse animal skins near the temple of Heracles;
it is forbidden to manipulate the hides and, in essence, the works on the coast are prohibited;
it is forbidden to throw waste products into the river.
The three prohibitions essentially concern the involvement of river waters in the tanning and processing of hides
Considering that the problem of pollution, by moving the activities, would have re-proposed elsewhere and that the decision entailed evident economic damage, we must assume a serious motive for it. Some critics have identified this motive in the plague described by Thucydides. However, the

uncertainty about the chronology of the epigraphic document, which is also dated to the 5th century due to its characteristics, makes it difficult to express a sure opinion.
The only fixed points remain the prohibition of the tanning activity in a specific area and the link with a religious site.

3 The decree: Industry and religion

However, it must be considered that the transfer of an entire industrial area is not required because it harms the residents nor is it possible to hypothesize that a similar prohibition was applied to please the priests of a temple of little importance in the civic religious context.

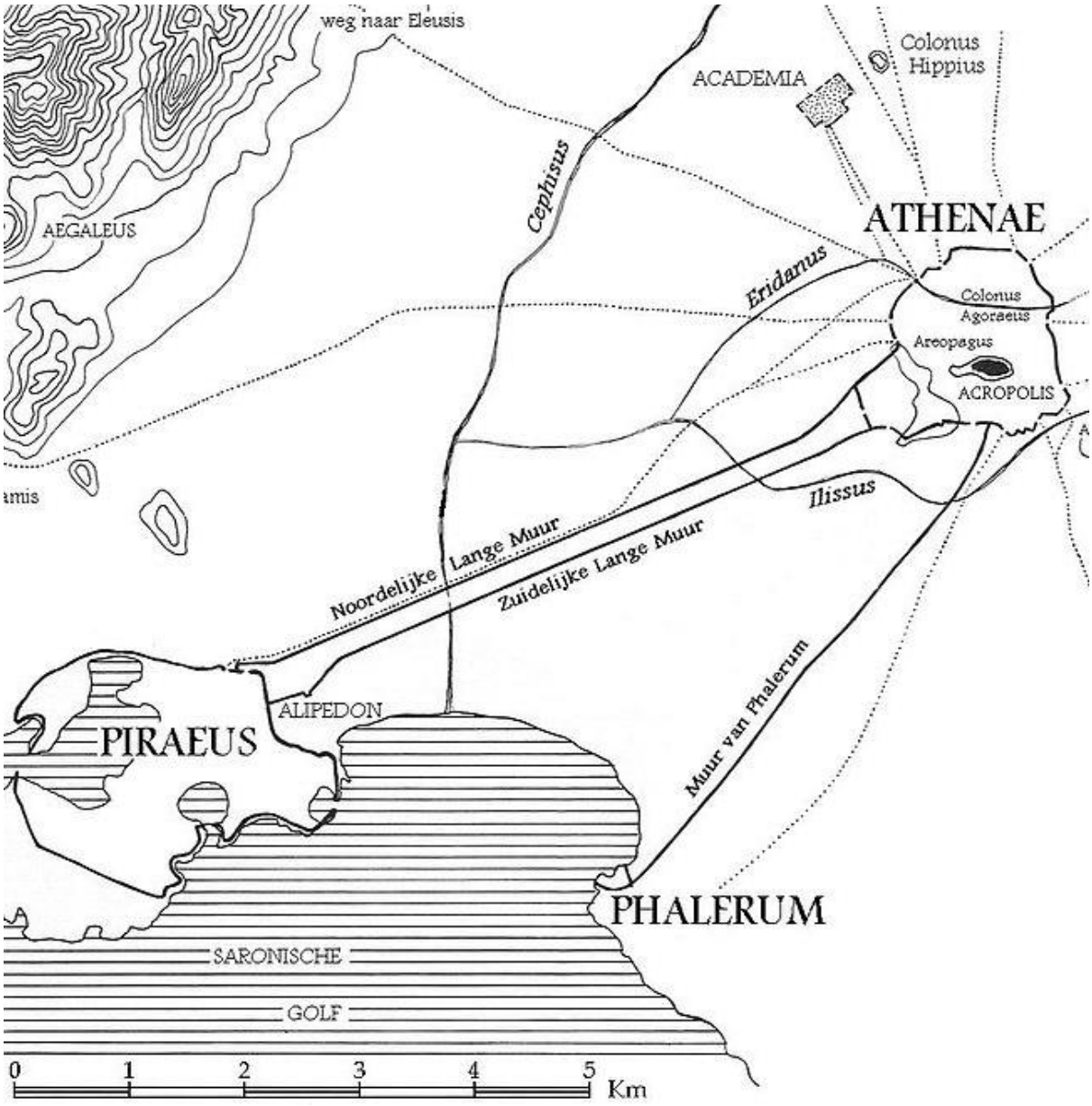


Fig. 2: Athens in the 5th century. In evidence, the Eridano river, the Illyssus, the port of Piraeus and the Falero.

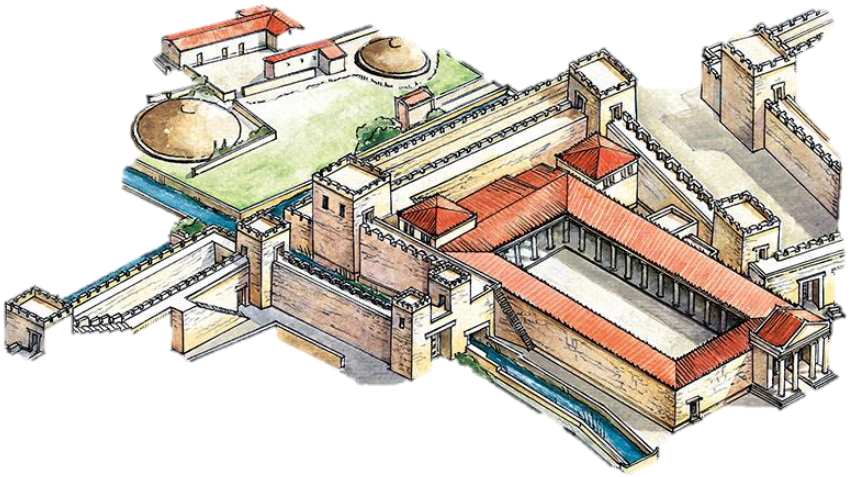


Fig. 3: The course of the Illyssus River along the southwestern stretch of the ancient walls of Athens. Graphic reworking (Campone 2022).

Vice versa, a health emergency such as the plague of 429 BC. it may have forced the authorities to issue this provision with a determination motivated by the dramatic proportions of the contagion. If so, the transitory and local character of the benefits for the environment and people might have been acknowledged, even if it caused economic damage.
The decision could therefore have been made due to the plague and the consequent desire to curb any possible worsening of the infection.
In this sense, religious and health motivations converge. In fact, both the bad smell and the pollution of the water produced by the tanning industry have a double value, both health and cultic. Examining the epigraph, we note that the first prohibition is "μηδέ δέρματα σήπειν" in the Illyssus river. In reference to our registration and proposing a translation *ad hoc*, the *Greek-English Lexicon* edited by Liddel-Scott-Jones translates the verb σήπω "to soak hides" especially in reference to corpses. The prohibition to immerse skins was therefore expressed with a strongly connoted verb that contains a clear reference to the operations of riviera with their immersions and rinses and the stench produced.

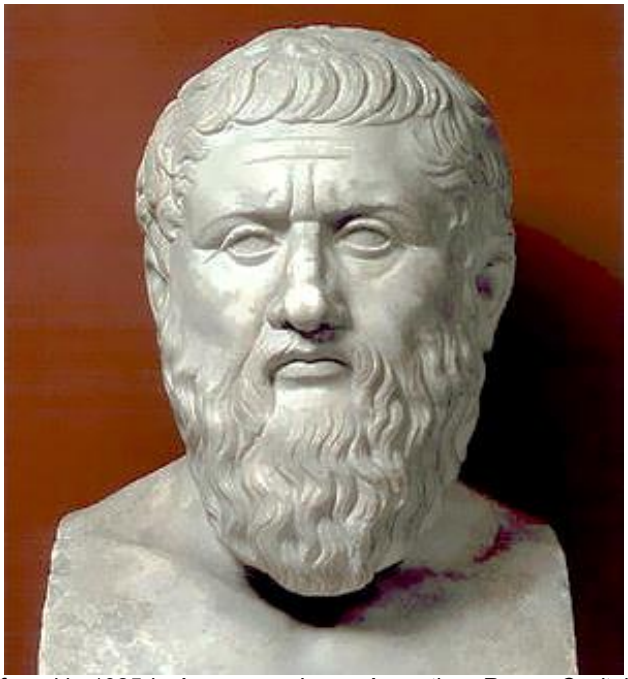


Fig. 4: Plato's Portrait, found in 1925 in Area sacra Largo Argentina. Rome, Capitoline Museums. Graphic reworking (Campone 2022).

In Greece, where the activity of the tanner was metaphorically associated with bad smell, as evidenced by the references of Aristophanes, such a profession involved social marginalization.
All this had a twofold implication. In fact, perfume was connected to divinity just as its opposite was its antithesis. Bad smell was *mìasm*a, physical and moral evil, in a society which, as Greek tragedy proves, connected the two spheres. The same double value had the pollution of the waters, also because some rivers, including the Illyssus, were deified and also the Illyssus to which a place of worship was dedicated (Fabiani 2018: 393). Ilisos was also considered a demi-god, the son of Poseidon and Demetra, and was worshipped in a sanctuary on the Ardittos Hill, next to the current Panathinaiko. This area was named Cynosarges in antiquity and the spring of *Kallirrhóē* was located there.
Thucydides (II, 15, 5) lists the *Kallirhoe* (the sacred source of Illyssus) as one of the sacred places in the area and remembers that water was drawn from it for *loutrophoria*, the sacred rites.
Here there is also the Shrine of the God Pan. This rocky outcrop with a small natural cave and two perpendicular faces was found to have a relief of the god Pan. This deity of wild nature was worshiped regularly in caves and rocky terrain. Pan is depicted striding to the right with the "pipes of Pan" in his right hand and a stick for hunting hares on the left.
However, the religious motivation does not exclude the hygienic-sanitary one: for the Greeks, as for other ancient peoples, medicine and religion were closely connected, as evidenced by some cults such as that of Apollo.

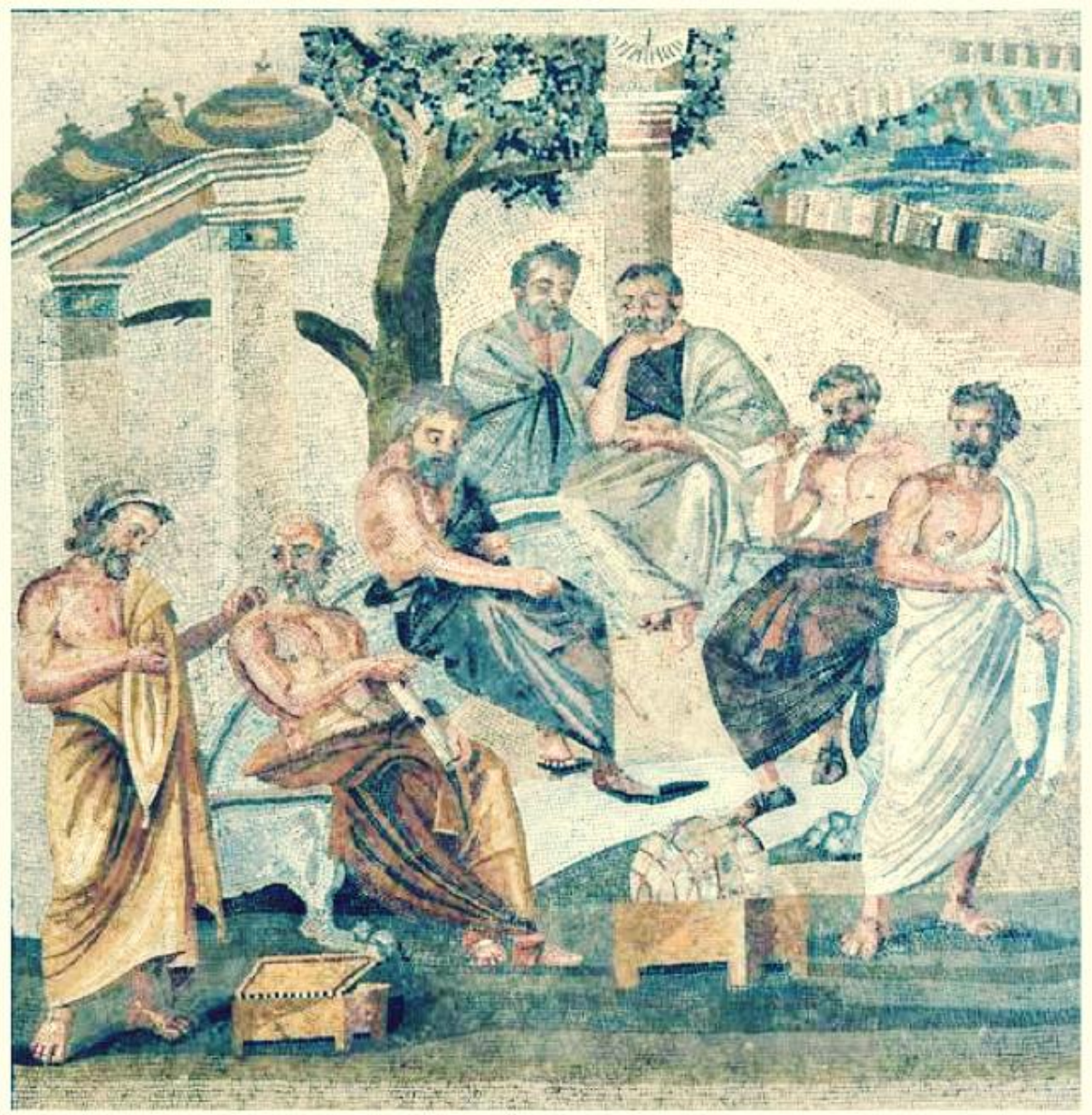


Fig. 5: Plato's Academy mosaic from the Villa of T. Siminius Stephanus in Pompeii. Graphic reworking (Campone 2022).

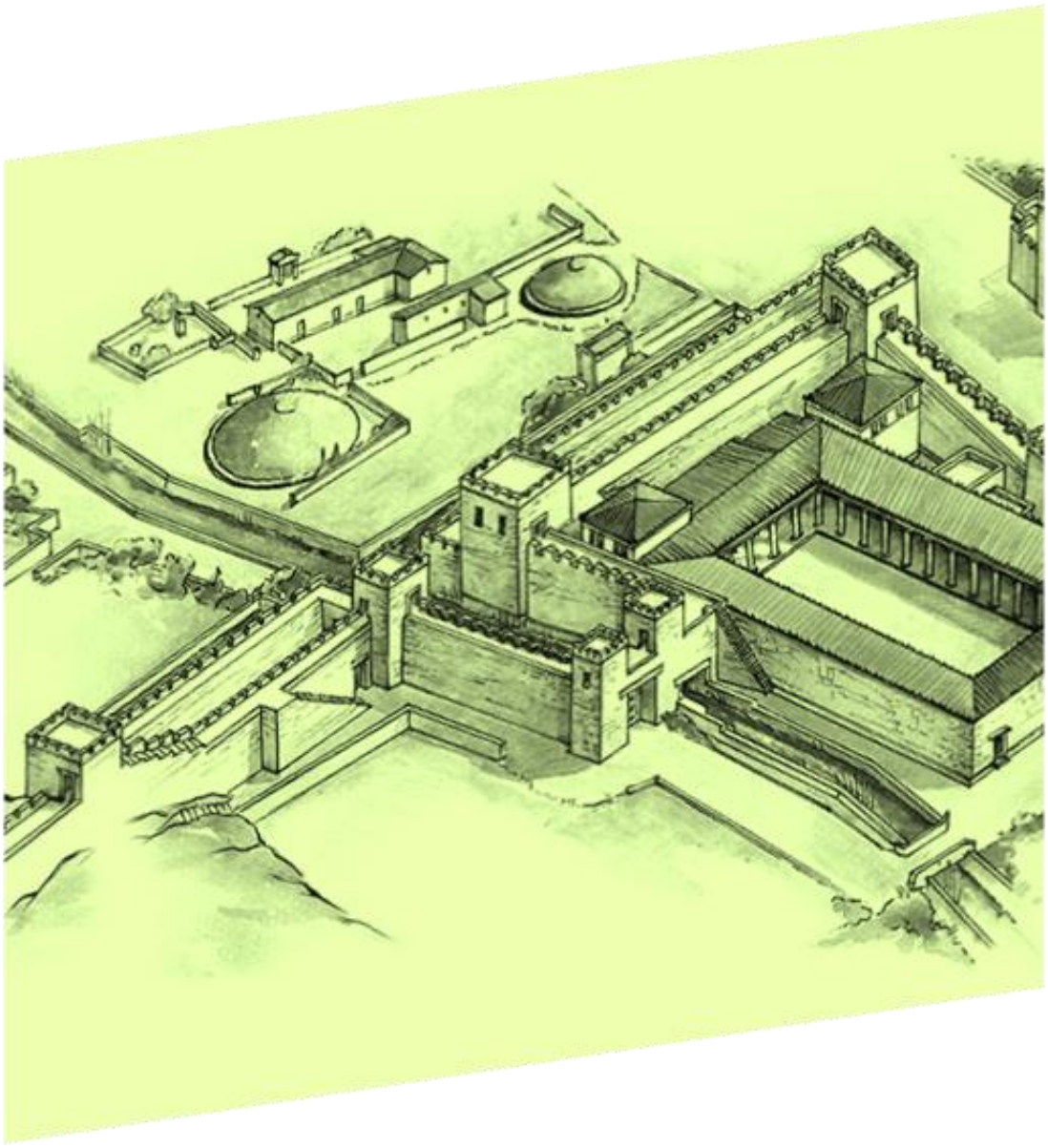


Fig. 6: The course of the Illyssus River along the southwestern stretch of the ancient walls of Athens. Graphic reworking (Campone 2022).

The historical conditions at the time indicate some of the reasons for the decree. These conditions include an unexpected concentration of commercial enterprises in the affected areas, with health consequences hazardous enough to convince political leaders and legislators in Athens to put at risk the entire leather production industry, an important craft at the time.

4 The evidence of Plato's *Phaedrus*

In 1987, Hermann Lind discovered some unexpected evidence: as early as 370 B.C.E. Plato had noted the incompatibility between pollution and the respect and admiration all felt for pure water and the beauty of nature. The *incipit* of the *Phaedrus* is set at the Ilisso: the path of the walk of Socrates and Phaedrus cannot be reconstructed with certainty, but the mention of the sanctuary of Acheloo and Pan and of the Nymphs takes us back upstream to the Herakleion of Cinosarge. The environment is idyllic and uncontaminated and the water is crystal clear, so it must be believed that the resolution in question was effectively applied and the environment was restored.

Hence, if the incompatibility was already perceived at that time, it is plausible that legislators would have initiated regulations for the protection of those values, even if it would take decades to effect a restoration of the natural environment i.e. a restoration attested by the *Phaedrus*.

In effect, for the interpretation of IG^3 257 it is, as always, necessary to recall a context more general, namely the set of regulations produced in Athens on the subject of pollution, environmental

degradation and health protection. Here it seems to me appropriate to point out some evidence concerning Solon and, above all, Plato and Aristotle.
Plutarch (*Sol*. 23) reports that Solon dictated rules regarding the minimum distance between water wells, we do not know if also taking into account the possibility of pollution.
Plato dedicates two entire sections of his *Nomoi* (*Laws*) to the theme of protecting water from pollution. These precious micro-treatments appear in the context of the rules concerning agriculture and find their place in the course of Book VI and towards the end of Book VIII.
In the *Nomoi* (VI, 760b-761a) Plato dwells, to begin with, on the need to establish a body of *agronomoi* (agronomists) and on how to organize these groups of public officials; in 761a-c he speaks with a certain breadth of the need to keep the flow of water under control with embankments, small streams and springs, also dwelling on the opportunity to embellish the springs with meadows and walls, to make sufficient flow quantity of water in the sacred groves and gymnasiums. The speech continues with considerations on agronomists, the canteens reserved for them, the possibility that they sometimes behave unfairly, the need for them to live together, roughly like a military unit, and other problems related to the proper functioning of their business (761d-763c).



Fig. 7: Raphael. The School of Athens. Apostolic Palace in Vatican. 1509-1511.



Fig. 8: Raphael. The School of Athens. Apostolic Palace in Vatican. 1509-1511. An elder Plato walks alongside a younger Aristotle. Graphic reworking (Campone 2022).

Then, in the course of Book VIII, Plato again tackles issues related to agriculture, he first of all introduces an embryo of legislation concerning the construction of wells and canalizations, the right for those who cannot find water in his field to draw water. certain water conditions and other cases of conflict in the management of water intended for some form of irrigation of the fields (844a-d).
Significantly, in carrying out this second micro-treatment he explicitly refers to the *palaioi kai kaloi nomoi* relating to the waters of the fields and specifies that it is superfluous to repeat the same rules in detail.
The comparison with the little that we know about the norms dictated by Solon gives us the virtual certainty that Plato intends to refer precisely to those ancient norms.
A little further on (VIII, 845de) the author finally focuses on the precariousness of water, which can be easily polluted, and which "therefore needs legal protection".
Sanctions follow for those who pollute the water of others. Thus, something like a real “ecological crime” can take shape consisting of διαφθέρειν ύδωρ (“diaphthèrein hydor”).
Also in this regard it is very unlikely that Plato could have devised a specific norm from scratch. More likely he will have learned of specific rules aimed at managing disputes relating to water pollution and will have limited himself to reformulating them without too much modification.
Even Aristotle has the opportunity to mention the subject in the course of Book VIII of the *Politics* (1330b, 4-18). He begins with a consideration even banal, namely that cities must be located where there is an abundance of water. He then goes on to state that we need to think about the health of the inhabitants and this depends not only on the position and exposure of the area but also on the availability of healthy, that is, clean waters, and adds that "we need to think about this and not lightly".
Precisely for this reason, Aristotle continues, "in all wise cities, if the sources are not all equally pure and there is no abundance of them, one must keep drinking water separate from that used for other

uses ". This last sentence is manifestly ill-conceived, but its meaning is transparent. Aristotle intends to affirm that the city is not wise if it does not prepare suitable measures for this purpose to protect drinking water resources and prevent their pollution. Public health is an important asset, those who govern the city must take care to guarantee it and therefore, among other things, must take care to ensure that the sources of drinking water are adequately monitored and protected.
Even Aristotle therefore limits himself to recalling, albeit in a more nuanced way, the norms that Plato spoke to us in more detail and which, at least in part, should even go back to Solon.

5 Pollution in Athens and the diaphtorà hydatos

This convergence of the three authors is significant, because it informs us in the most convincing way on the account of a well-established attention of the state authorities (therefore also of the legislator) for the protection of water and the prevention or repression of specific forms of pollution. The legal sources do not also speak to us of the crime of *diaphtorà hudatos*, but it is significant that Plato used the technical expression “an tis diaphtheirei hudor allotrion” (if the water of others is polluted). This is a good indication of what has happened definition, in fact, of a crime that perhaps was called *diaphtorà hydatos.*
Moreover, it is a question of rules which, not surprisingly, we find in comparable forms also in the Gortina code and in Roman jurisprudence. Well, if the Attic law has known since the time of Solon, or in any case since very ancient times, the crime of *diaphtorà hydatos*, then we understand better the meaning of the decree concerning the processing of hides on the banks of the Ilyssus river.
There is an intuitive connection between the general rule and this particular rule since, at least in theory, the inhabitants of the place could have argued that the processing of hides precisely involved a severe form of *diaphtorà hydatos*. But since it is an economic activity concentrated in that area from time immemorial, a very profitable activity and, moreover, an activity that produced everyday goods considered indispensable by the entire population, in order to be able to effectively affect the pollution of that particular area could not be sufficient to appeal to a single rule which, moreover, referred to the relationships between individual farmers. There was therefore a need for more specific legislative action and of very special reasons: even this circumstance leads us to think that to impose exceptionally drastic measures - the forced cessation of an entire industrial production in the area and its forced transfer to other areas - was a real emergency, the plague that raged in Athens at the beginning of the Peloponnesian war. On these premises, it is likely that the reference to the temple of Heracles served more to indicate the area with precision and to strengthen the rule than to introduce unnecessary and non-determining religious reasons.
A comparison with a different situation in the same geographical context is illuminating. Callimachus, in a passage quoted by Strabo (IX, 1, 19) from the lost work Συναγωγή τῶν ποταμῶν, made fun of those who wrote that Athenian girls "draw pure joy from the Eridanus". The waters of the Eridano were not spared from pollution: on its banks there were in fact workshops of tanners, potters and dyers and it had a different fate from the Illyssum.

6 Final remarks

Plato’s testimony suggests that the decree was applied and the environmental consequences were positive.
The epigraph is proof of how, even in ancient times, the link between health and the environment was recognized, especially during an epidemic and how, in the face of a catastrophic event, private interests were subordinated to public ones. Not only that, but the city obliges private individuals to transfer their laboratories at their own expense
Further evidence in Solon, Plato (*Nomoi*) and Aristotle (*Politeia*) also suggests a strong commitment on the part of all three of them to the importance of clean water for a healthy city. Which leads us to think that it is to Greek civilization that we must look for the origin of views of surprising modernity in the matter of dealing with what may well be one of most dangerous of all forms of pollution.
The epigraph allows us to understand that classical Athens not only knew how to set standards for environmental protection, but did much more: it became aware of the type of environmental damage, of the danger it represented, of a precise cause-effect link between some behavior and environmental degradation, became aware of being able to impose behaviors that are more respectful of the natural environment.
The Athenian decree therefore testifies to the will to effectively combat environmental degradation and to declare it outlawed and therefore anticipates an attitude considered, wrongly, modern.
It therefore seems entirely acceptable that «Dire che noi “occidentali” siamo greci da molti fondamentali punti di vista è quasi un luogo comune. Notiamo con una certa sorpresa – e con un senso di gratitudine– che ai greci va ascritto anche il merito di aver elaborato una “cultura” della tutela della potabilità dell’acqua che non ha solo preparato il terreno per l’*aquaeductus* romano ma tuttora marca, a distanza di millenni, la differenza fra i popoli che hanno elementi ellenici nel loro DNA e i popoli che non hanno avuto un simile privilegio» (Rossetti 2002: 10-11).

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From rural design ideas for the ecological transition. Conservation as a technology transfer

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ricordando Riccardo Dalisi (9/4/2022)

Abstract
Only in October 2020 in Italy was the National Government ratified the Council of Europe Framework Convention on the value of cultural heritage for the Society [Faro, 2005] which, in paragraph c of Article 7, is it undertakes "to develop knowledge of cultural heritage as a resource to facilitate peaceful coexistence, promoting mutual trust and understanding, with a view to resolving and preventing conflicts". Many objects of Italian tradition and cultural customs tell of the conspicuous value of conviviality, especially when connected to some intangible assets recognized as heritage of humanity, such as, for example, the Mediterranean diet and the art of the Neapolitan pizza maker. The annual community rite of tomato grinding, during the last week of August, was for the inhabitants of condominium houses, a perspicuous opportunity to strengthen relational ties and, at the same time, they worked on a product that, at zero kilometer, guaranteed quality for the foods with a particular identity character. Some of the objects used for the realization of the food product are Design d'Argot objects of undoubted value that should be known and preserved, also in view of the creation of places of memory strongly characterized by the community dimension and the associated management of the shared spaces of the architecture. The proposed contribution intends to report on some of them.

Keywords: Framework Convention [Faro, 2005], Design d'Argot, Conservation, Tradizional Know-how, Tecnology transfer

1. Intangible assets and tradition

Only in October 2020 in Italy was the National Government ratified the Council of Europe Framework Convention on the value of cultural heritage for the Society [Faro, 2005] which, in paragraph c of Article 7, is it undertakes "to develop knowledge of cultural heritage as a resource to facilitate peaceful coexistence, promoting mutual trust and understanding, with a view to resolving and preventing conflicts". Many objects of Italian tradition and cultural customs tell of the conspicuous value of conviviality, especially when connected to some intangible assets recognized as heritage of humanity, such as, for example, *the Mediterranean diet* and the art of *the Neapolitan pizza maker*. The annual community rite of tomato grinding, during the last week of August, was an important occasion for the inhabitants of traditional courtyard houses and condominiums to strengthen relational ties and, together, they worked on a great food product of best quality, using the vegetables grown in the area and which characterized the identity of the territory.. Some of the objects used to make the food product are of the Design d'Argot, objects of important value that deserve to be better known and preserved, also in view of the creation of places of memory that can motivate a community dimension. Widening attention to the issues of sharing and associated management of architectural spaces for common life should represent a solidarity commitment that is also capable of opening up horizons towards the culture of hospitality. However, often not only the spaces for sharing are necessary but also the tools

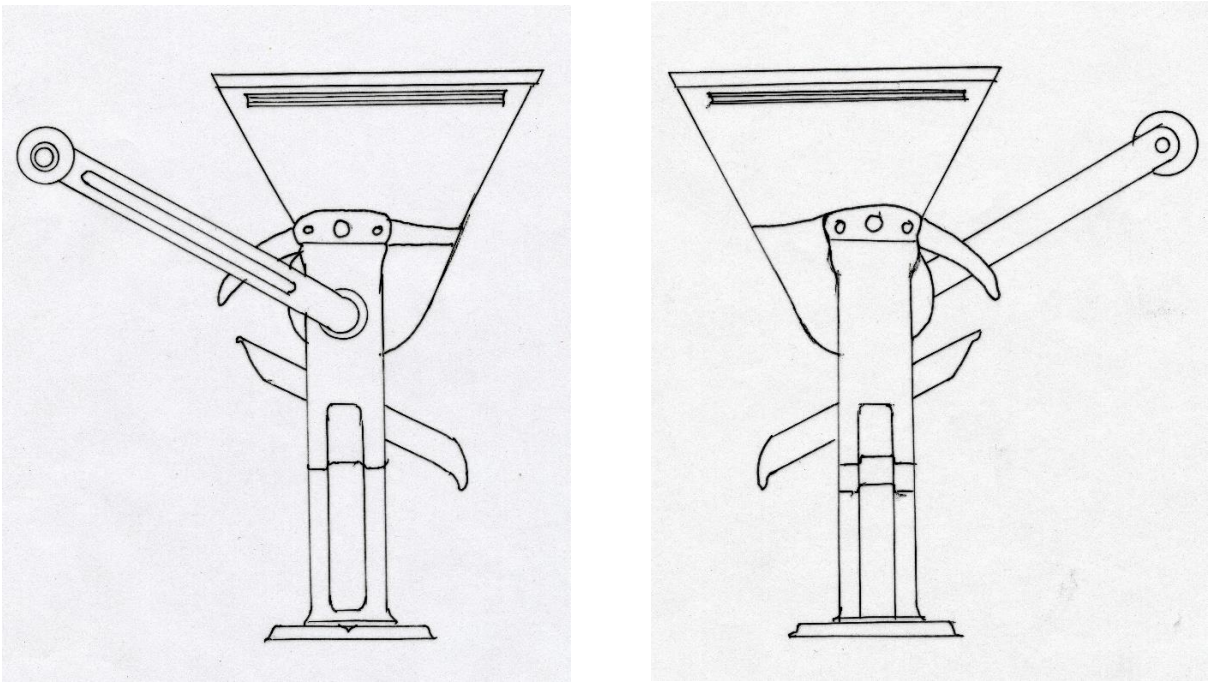


Figg. 1-2: The tomato sauce machine. Private collection of the Author.

of collaboration between neighbors who contribute, in solidarity, to the support of harmonious relationships between men. Very significant, from this point of view, a design object appears that we have used as an object representative of a culture of solidarity and collaboration between neighbors. Traditional culture, once upon a time, in the Neapolitan territory used friendships as opportunities for collaboration in order to produce goods of common utility. Together, at one time, preserves were prepared which consisted in the transformation of agricultural products of immediate consumption into food that could be used even after a long time span of the calendar year that was outlined in the immediate future. One of these objects was the tomato sauce machine.

2.1 The tomato sauce machine

The machine for crushing tomatoes to extract their juice consists of a hopper which, in the shape of a truncated pyramid, collects tomatoes that have been roughly opened to free them from the internal liquid and seeds. The hopper has a semi-cylindrical closure in the lower part which bears a homogeneous distribution of holes against which the tomato will be pushed to extract the juice. The terminal portion of the half cylinder also has a slit through which the non-hydrated parts of the tomato will be expelled. In order to be able to crush the tomato in the semi-cylindrical portion, a hollow cylinder is housed which is held in place by the presence of a pin which, by means of an external crank,
.



Figg. 3-4: Graphic rendering of the facades of the manual machine for extracting juice from tomatoes (Carillo 2021)

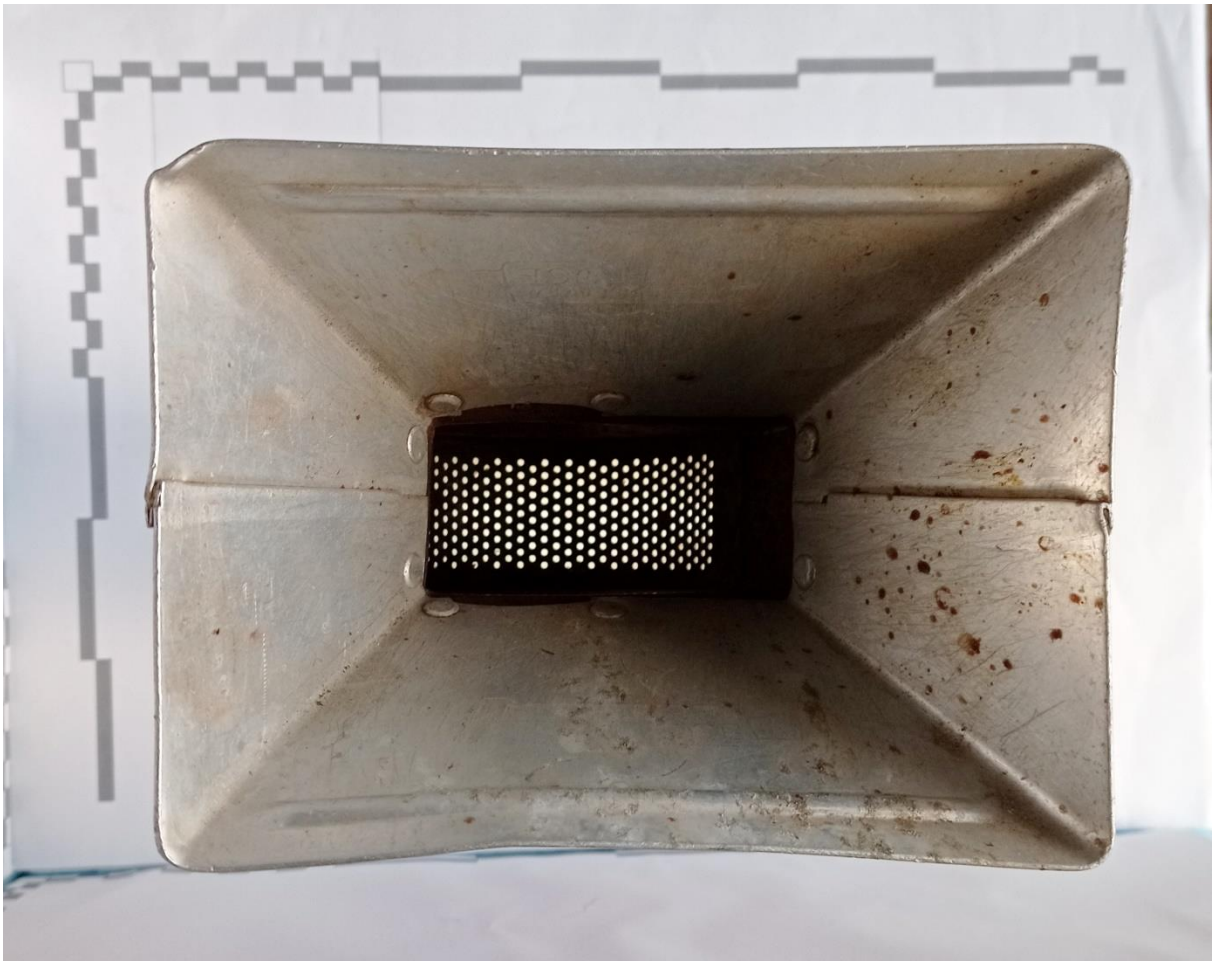


Fig. 5: The tomato sauce machine. View of the hopper and the tomato crushing half cylinder

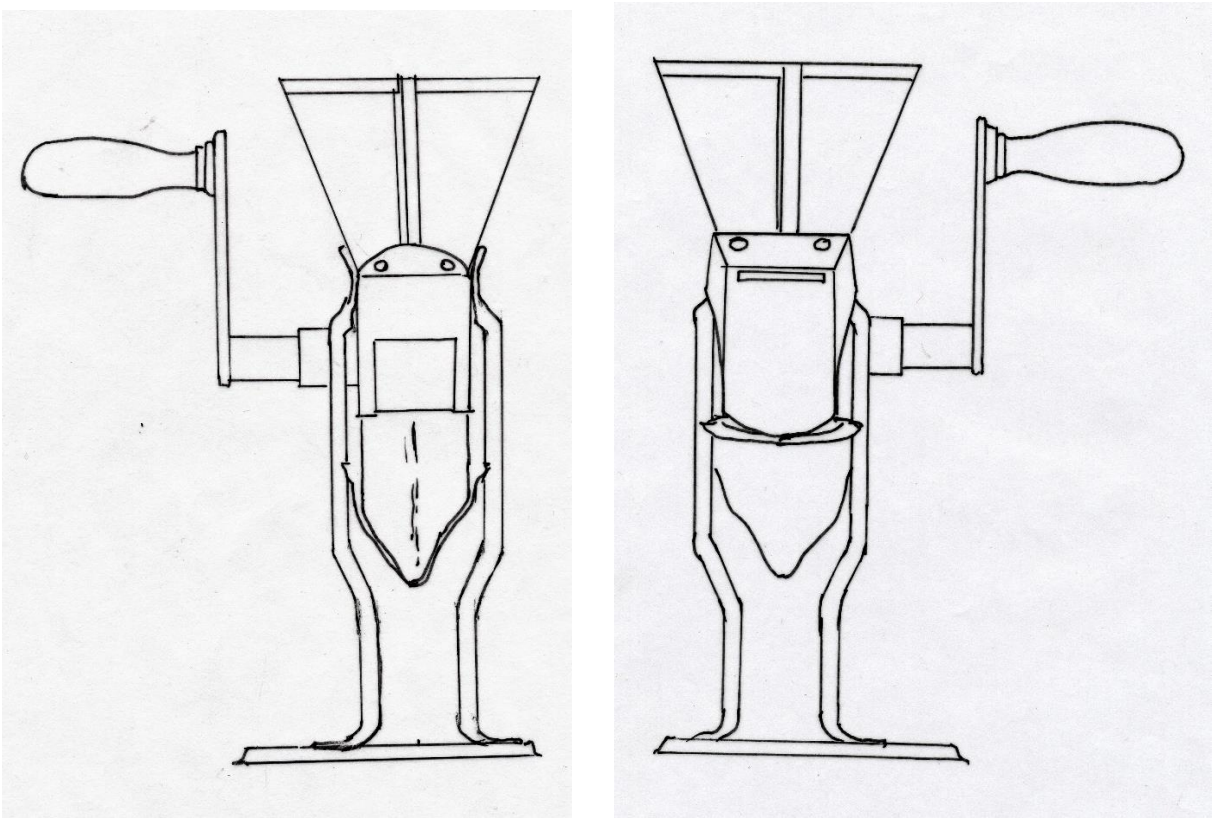


Fig. 6: The tomato sauce machine. Cylinder for crushing tomatoes



Fig. 7: The tomato sauce machine. Operation of the connection between the crank and the tomato crushing cylinder.

will allow the hollow cylinder to rotate in the housing where, due to the presence of the screen, the tomatoes will be crushed.
Inside the hollow cylinder there are also two blades embedded in the metal of the cylinder and held under pressure by a spring that allows them to push the tomato against the perforated surface. The hopper is suspended about twenty-five centimeters from the support surface by two arms welded to the feet on a plate which is anchored, by means of a vice, to the corner of a table. The rotary action of the cylinder, which rotates inside the semicircular housing with perforated surface, allows the juice to escape, while the two fins under mechanical pressure expel the peel of the tomato coating, which, not being hydrated, remains in its filmic consistency, and is ejected at the end of the half turn against the screened curved part of the lower housing of the hopper.



Figg. 8-9: Graphic rendering of the pricipal facades of the manual machine for extracting juice from tomatoes (Carillo 2021)

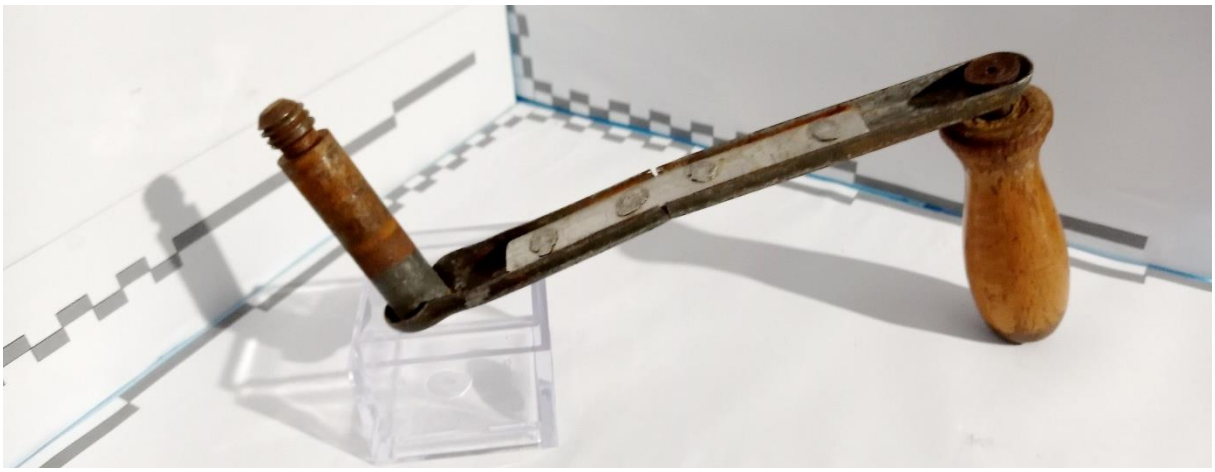


Fig. 10: The tomato sauce machine. Crank to operate the tomato crushing cylinder.

2.2 “Le bottiglie”. The ritual of preparing tomato juice

The organization of the production of preserves such as tomato juice and other types of products to be bottled referred to the responsibility of the individual family who, for their food needs, provided for the purchase of tomatoes. In the spirit of solidarity and proximity, the neighbors of the residence helped each other both in making available, for use, the necessary tools which, from time to time, were used by one family rather than another. In general, machines were fixed to the four corners of a table with clamps which, when grinding the tomatoes, let the dense red fluid fall onto a tab and was collected in underlying basins. On the other side of the machine, on the table, a bowl collected the waste of the tomatoes ejected from the machine. Once a large quantity of sauce was collected, it was bottled with jugs that they fished from the basins and filled bottles with use the funnels. Different were the techniques for closing the bottles, all carefully reused, through a careful cleaning, the same that had involved the tomatoes before being opened for grinding.



Fig. 11: small sheet metal with some hole to bottl's collar for azioning to mechanism for 'a capsula' capping of tomato bottles. Private collection of the Author.

Some bottles were corked with corks and with further binding with strings to prevent them from opening during the boiling operation for sterilization. Another way of recovering to old bottles was to cork them with ‘a capsule’ closure represented by a sheet metal sreet with some holes that was wrapped around the neck of the bottle and the hermetic snap closure was attached to the band, which included an ring rubber for ceramic cap perforated in the upper body and two short segments of small iron rods which, hooked between them and the neck of the bottle, allowed the hermetic closure of the bottle itself. In this way the same bottles could be used multiple times without having to go to landfill as it happens every day today. The ergonomic use of resources, the zero kilometer culture, constant education in recycling were consolidated practices in the daily experience of community life and proximity. Once the bottles were sealed, they were deposited in bins with rags or paper placed between them to avoid direct contact which during boiling could have caused bursts and, therefore, loss of products and creation of scraps. Boiling for a few hours over a wood-fueled flame ensured the perfect sterilization of the product and therefore its more extensive conservation for use for the entire duration of the year in the making.



Fig. 12: Corked bottle with 'a capsula' mechanism. Private collection of the Author.

3. The story from literature

These products, as is known, formed the basis for the foods of the Mediterranean Diet. A notable Italian novelist recounted: «Masto Fafele era il re della pizza sugna e formaggio e del calzone imbottito di erbette crude con pepe. Non sarebbe stata alba, aurora e mattino se masto Fafele non fosse apparso dal cancello del mercato. Senza il suo banchetto, che il vecchio portava in spalla, e la sua mercanzia la gente avrebbe dovuto cambiare abitudini centenarie. Avrebbe dovuto mangiare prima di uscire, quasi notte. Ma né latte né caffè né orzo né zuppa né anice o un bicchiere di vino avrebbero potuto infondere lo stato di forza di una pizza sugna e formaggio o di un calzone alle erbette mangiato all'impiedi o seduti su una balla o su un marciapiede di quel babilonico traffico. Fafele estraeva la pizza dal contenitore, una sorta di tozzo cilindro di zinco molato e splendido con coperchio a cupola ageminato di disegni di paladini di Francia, la passava a Miluzza, che vi aggiungeva un altro pizzico di formaggio, piegandola in due o quattro parti come un libretto. La pizza di Fafele era leggendaria. Lo avevano chiamato a Cava e a Salerno, ma il vecchio non ne aveva mai voluto sapere. Cava o Salerno gli sembravano lontane come la Francia. E non aveva accolto nemmeno la richiesta della clientela nofinese perché le sue cinquanta pizze giornaliere diventassero centinaia. Si difendeva, dicendo che fare una pizza non era come fare un piatto di spaghetti. La pizza non è che una disforme polpetta di 200 grammi di farina lasciata lievitare. Bisogna intuire il momento propizio per cominciare a distenderla sul marmo incipriato di farina, batterla e rivoltarla e poi aggiustarla fino a farne una sfoglia circolare come il golfo di Napoli, sottile e quasi trasparente al centro, frastagliata come una costiera sul bordo. A dirlo sembra facile, a farlo è come addomesticare una creatura selvaggia e renderla adatta a ricevere i pezzetti di mozzarella, che sono le vele bianche, quelli del pomodoro, che sono le vele turche, e le foglie di basilico simili a spume sorridenti del mare. Un lavoro enorme in tempi stretti. A ogni pizza il nonno ne rifaceva la storia che Miluzza ormai sapeva a memoria»[1].



Fig. 13: Salty biscuit seller -taralli- (da Scognamiglio [1])

[1] Domenico Rea, *Ninfa plebea*, IX ed. Leonardo Editore, Milano 1994, [ISBN 88-355-0252-7], pp. 59-60.



Figg. 14-15: Sellers of earthenware crockery and boiled corn on the cob –pullanchelle-(da Scognamiglio [1])

These The Campania capital, in the urban scenario, was told by Rea through the eyes of the young protagonist: «Non si aspettava quei palazzi così alti, il triplo, il quadruplo di quelli di Nofi; quella piazza, quelle strade chilometriche in cui non si capiva niente. Tram che incrociavamo carrette, autobus che tagliavano la strada alla gente, tanto che, per scansare continuamente i veicoli, sembrava che ballasse, ma senza paura, anzi levando grida festose e risate, saltando da una parte all'altra. Non avrebbe saputo dire se fosse puzzo o perfumo, ma la città aveva sentore di briosce e odor di pane. Sul marciapiede opposto alla stazione, dove c'era il posteggio dei taxi, c'erano dei pescivendoli e degli erbivendoli con banchi lunghi metri e metri con tanta gente intorno, ma tanta gente. Andò a vedere anche lei e, quando vide che uno stranissimo, mostruoso serpente con una testa marrò-rossa grossa così e con tante zampe si mise a correre lungo le gambe di uno dei pescivendoli, si fece indietro per ribrezzo e paura. Che gente laida. Quasi tutti gli uomini andavano scalzi con una camicia aperta sul petto. Anche i pescivendoli stavan così. Ma questi avevano un turbante in testa accanto a donne che avevano solo la faccia di donne, per il resto erano peggio degli uomini, altrettanto sfidanti e poco cerimoniose. Una città terribile, non per persone minute come lei. Meglio far presto. Meglio ritornare quanto prima possibile a casa. Fu sfiorata da un prete con una pancia grossa come un tamburo, che però camminava con passettini rapidi sotto l'ombrello rosso dell'estrema unzione preceduto da ragazzini in tonaca bianca che sonavano un campanello per farsi largo. Soldati sciamanti su camion e carrettoni. Funerali che uscivano da un vicolo con la banda musicale dietro. Non si contavano le bancarelle piccole e grandi debordanti oltre i marciapiedi. Gridi di venditori e voci spiegate e con la mano a megafono vicino alla bocca. E chi incantava serpenti, chi cani ammaestrati, chi faceva giochi con le carte su un tavolinetto pieghevole, chi s'incatenava come un forzato. Gente che parlava da sola o si fermava di botto e poi procedeva»[2].

[2] Domenico Rea, *Ninfa plebea*, IX ed. Leonardo Editore, Milano 1994, [ISBN 88-355-0252-7], pp. 94-95.

The work and creative activity of Domenico Rea who in his early days did not give up also the introduction of linguistic variations drawn from the expressive tradition and from the popular lexicon and, at the same time, in the most detailed aspect, derived from the expressive modalities of the phonetic formulas recovered from ancient crafts. Cultural heritage, today it would not be difficult to consider them as such if, already more than half a century ago, the vernacular sounds of Neapolitan crafts did not go unnoticed. The representation of the Neapolitan sound landscape, through the voices and the sonority of the lived experience, constitutes a further form of reading and decoding the plurality of landscape that Neapolitanism realizes and that should be imagined, together with the numerous production of design d'Argot objects connected to crafts and to the relational dynamics of the territory: as a real Heritage of the highest profile and value.

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Architecture and territory. The former convent of the Maddalena in Castel di Sangro

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Abstract
The former convent of the Maddalena expresses, for its history, a strong link with the place where it arose, representing a territorial architectural asset. Built on the outskirts of the town of Castel di Sangro as a hospice intended to collect pilgrims who "crossed the Via dell'Abruzzo in both directions", it still maintains a position detached from the center of the town, beyond the river Sangro, testifying a part of the history of the territory.
The ancient structure was then occupied in the fifteenth century by a community of Minori Osservanti, who used to live in makeshift shelters outside the urban agglomerations. Only when Pope Gregory IX ordered the transfer of the homes of the beggars within the inhabited areas, thanks to public and private charity, buildings to be restored were granted to the Friars Minor. The first convents of the Order of the Friars Minor, including the former convent of La Maddalena, began to rise, which became not only a centre of religious activity, but also a place of social activity. The contribution aims to investigate, through the tools of representation, the territorial principle that underlies this type of religious architecture as an added value to project the life of the former convent of the Maddalena in a sustainable future. It is hoped, in fact, to encourage greater communication between the resources of the territory and the economic and social needs of those who live there, avoiding waste for the environment and protecting the cultural heritage.

Keywords: Territorial asset, the former convent of the Maddalena in Castel di Sangro, territorialisation process, Franciscan convent of the Observance, digital survey.

1. Introduction
After an initial period of eremitic isolation and escape from the town, the Franciscan movement, founded by St. Francis of Assisi in 1209, directed its spiritual and social mission increasingly towards the urban environment, based on a radical choice of poverty, characterized by the refusal to own churches or private seats and to be "with and like" the poor of society. For this reason, they were called Minors. The Franciscans, together with the Friars Preachers, namely the Dominicans, and the lay friars or “conversi”, belonged to the religious order of beggars; they were used, in fact, to live in makeshift shelters on the edge of urban agglomerations, in which they retired after days of walking and preaching. The itinerant evangelization of the Franciscans did not require, therefore, stable dwellings and this precarious housing lasted until 1240 when Pope Gregory IX ordered the transfer of the mendicant seats within the inhabited places [1].
So it was that, thanks to public and private charity, the friars were granted building land or buildings to be restored. The first convents of the order of Friars Minor began to rise, also becoming a place of social activities, as well as a center of religious action.
The Franciscan order spread rapidly in Italy, Europe, and many other areas of the world, carrying out an action of territorialisation.
In addition to the pastoral action, the friars also carried out social welfare activities, establishing structures to combat famine or opening to the community the pharmacies and infirmaries present in the convents. Over the centuries, therefore, a model of settlement has been consolidated on the territory that has characterized the order of the Franciscans and the places where they worked.

In the first half of the thirteenth century, the order of the Minor Friars began to spread also in the land of Abruzzo. Due to its geographical position, since more remote times, the territory of Abruzzo has always been an obligatory passage zone for the cultural currents of both the North and the South. This function of connection was strengthened with the coming of the Angioini and especially with the move of the capital of the Regno di Sicilia from Palermo to Naples [2].
The contribution aims to highlight, through the tools of the representation and the relief [3], the territorialisation process to which every single Franciscan conventual unit refers. The aim is to read the architectural and cultural asset on the territory in a unified manner, throught the former convent of the Maddalena in Castel di Sangro as an expression of the history of a community (Fig. 1).



Fig. 1: The former convent of the Maddalena in Castel di Sangro, now home to the Museo Civico Aufidenate, the International Museum of Fishing and the Pegaso Telematic University in a current photo by the author.

2. The territorialisation process

To understand the territorial organization of the order of the Minor Friars, reference was made mainly to the text and the cartographic apparatus of the volume "Il Provinciale Ordinis Fratrum Minorum S. Francisci Conventualium" of the Franciscan father Antonio Francesco Righini, published in Rome in 1771 [4].
The Franciscans realized a specific territorial organization in Italy and other areas according to the internal subdivisions of which the order was characterized, as can also be seen from the tables and maps reported in the volume of Righini, and comparison with other texts mentioned in the bibliography. The maps have represented for the religious order a real tool to spread its image, for a territorial control and to affirm and celebrate its history, tradition and organization handed down over time. Once again, therefore, the cartographic apparatus represents a fundamental means to read the history of a territory. The maps, attached to the text, have no legend and graphic scale; however, a georeferencing of the map of the province S. Bernardino and the centers of Abruzzo where the Franciscan order spread, through the Qgis Geographic Information System.
Later in 1773 other maps, drawn up with greater precision, were collected in another text, again by Righini: “The Tabulae Topographicae Omnium Provinciarum Regularium Ord. Min. S. F. Conventualium, in Quibus Quaecumque Loca Seu Conventus Ab Eiusdem Ordinis Prima Institutione Ad Haec Usque Tempora Demonstrantur”.
The basic cell of the Franciscan organizational system was represented by the convent and several convents, distributed in a homogeneous territory, formed the Custody. The set of several Custodies formed a Province that, directed by the Provincial Minister, was governed, together with other Provinces, by the Minister General of the Order. In almost all the provinces there was a close coincidence between the religious settlements and the most consistent demic centers and this phenomenon remained unchanged until the first decades of about the fifteenth century.
At the beginning, the settlements of Abruzzo became part of the Campania Province of Terra di Lavoro and, only later, they merged into an autonomous province, which was first called Pennese and, later, San Bernardino. Already at the end of the 13th century the Province of Abruzzo was divided into six Custodies: Aprutina, Atriana, Pennese, Teatina, Aquilana and Marsicana, as can be seen from the map of Righini (Fig. 2), in which the first four Custodies included the coastal and hilly belt, while the last two the mountain area of Abruzzo inland.



Fig. 2: Map of the Province S. Bernardino, from the volume Righini of 1771 [4], georeferenced in the GIS software, in which the boundaries of the six Custodies were highlighted by the author.

At the beginning of the 14th century, the six Abruzzesi Custodies were composed as follows:
Aprutina (with Santa Giusta in Montorio al Vomano, Teramo, Campli, Civitella del Tronto, Controguerra, Sant'Omero, Giulianova and Morro d'Oro), Atriana (with Atri, Pelino, corresponding to Cellino Attanasio, Valle, Castiglione della Valle or Valle San Giovanni, Civita Sant'Angelo, Silvi and Montesilvano), Pennese (with Penne, Loreto Aprutino, Catignano, Pontaria, ancient name of the locality of Alanno, Tocco Casauria and Manoppello), Tina (with the settlements of Chieti, Pescara, Francavilla, Ortona, Lanciano, Palena, Guardiagrele and Bucchianico), Aquilana (with L'Aquila, Fontecchio, Castelvecchio, Ofena, Popoli, Sulmona and Gagliano Aterno), Marsicana (with Pescina, Celano, Avezzano, Corvaro, Tagliacozzo, Albe, Balsorano and Morrea) [5].
However, certain areas of the territory of historic Abruzzo, namely Abruzzo Ulteriore I and II and Citra, were excluded, belonging to other administrative districts of the Order, as reported below.
The *Custodia Regni* of the Umbrian Province of San Francesco included the settlements of Amatrice, Accumoli (aggregated in 1769 to the Abruzzese Province of San Bernardino), Cittareale, Leonessa, Posta, Borbona and Scai. The *Custodies Reatina and Tiburtina* of the Roman Province included numerous settlements in Abruzzo: Cittaducale, Borghetto, Antrodoco, Cicoli, Radicaro, Petrella Salto, Borgo San Pietro, Carsoli and Pereto. *The Civitatis Custodia* of the Apulian-Molise Province of Sant'Angelo contained numerous settlements located between the rivers Sangro and Trigno: Vasto, Monteodorisio, Gissi, San Buono, Castiglione Messer Marino, Carunchio, Palmoli, Celenza sul Trigno and Paglieta. Finally, *the Custodia of Santi Benedecti* of the Province of Campania-Molise of Terra di Lavoro included in Abruzzo the convents of Castel di Sangro (the subject of this contribution) and Barrea [6].
The maps published in the volume of the Franciscan Father Righini represent the settlement organization of the Franciscans who with their socio-religious activity have reshaped the sites territorializing and characterizing the spaces over the centuries.
The Franciscans, in fact, especially after the twenties of the thirteenth century, in carrying out their religious action of spreading the word and principles of the Holy founder, also expressed a particular way of life that entailed a reify the places, materially transforming the spaces with the construction of convents, residences, hospices and colleges. In taking care of the religious and civil life of the housing communities, they structured the territories of their relevance according to the rules of the order giving an added value to the pre-existing space.
The contribution proposes a reinterpretation of the territorial project of the order of the Franciscans through the GIS methodology to be able to represent the historical data of the eighteenth-century cartography of Righini in the current geographical context, using the open-source geographic information system: *Qgis.*

Based on these premises was therefore georeferenced the tabula of the province of S. Bernardino, on the territory corresponding to the current extension of Abruzzo, through the recognition of the site represented on the historical map with the current, starting from homologous points. This has allowed the identification of the pre-existences not always easy to interpret, through which the successive territorial transformations have also been evaluated (Fig. 3).

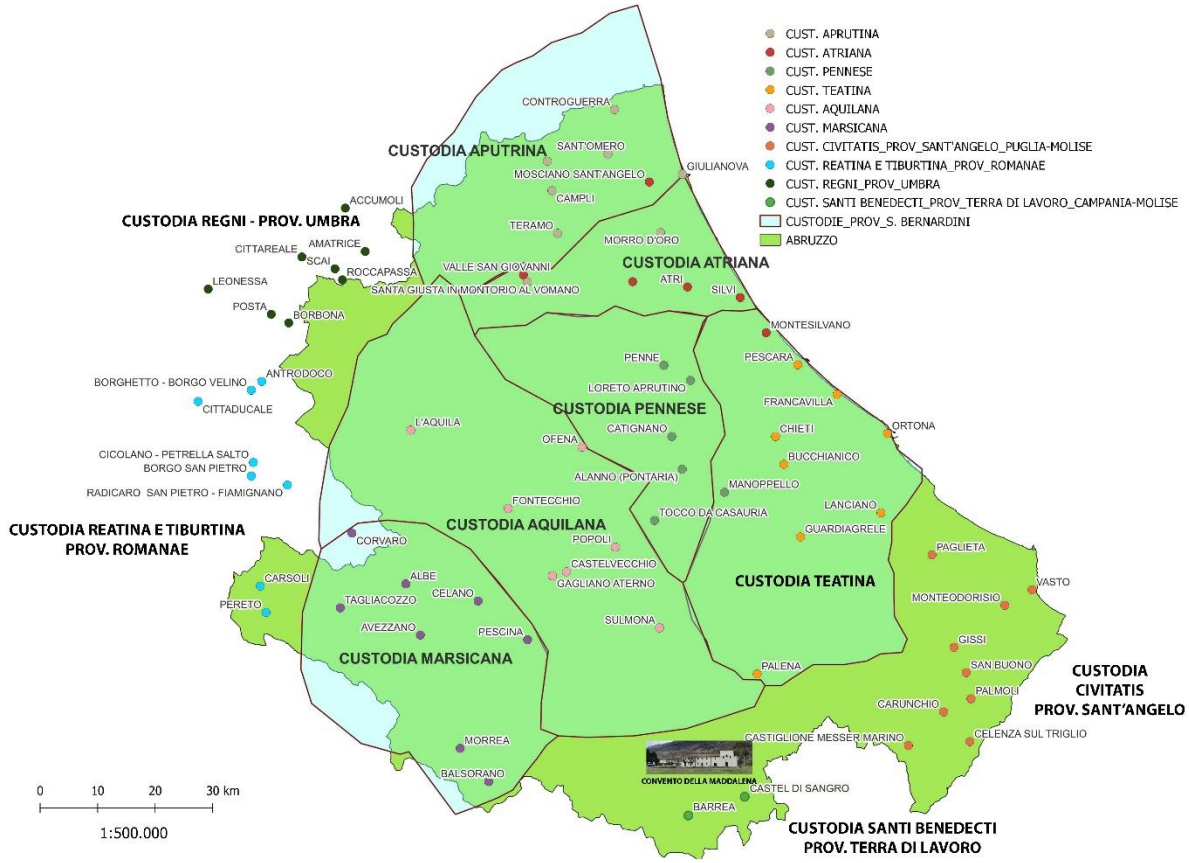


Fig. 3: Subdivision into Custodies of the Province of San Bernardino with indication of the Custodies of the neighboring Provinces, including the convents of historic Abruzzo performed by the author in a GIS software with the geolocation of the map of Righini on the current territory of the Abruzzo region. In evidence the former convent of the Maddalena.

The contribution proposes a reading of the convent of the Maddalena in Castel di Sangro, in which one can recognize the territorialisation process of the Franciscan Order [7]. The data were acquired through a critical reading of documentary and iconographic sources and through the digital survey of facades and applications in the GIS software.
Despite the various vicissitudes suffered during the centuries with continuous changes of use and the loss of the interior of the church after the bombings of the Second World War, the convent of the Maddalena has maintained its original configuration with the spaces attached to it for religious and social activities open to the urban community of Castel di Sangro [8].
The monumental complex has preserved the typological scheme of the Franciscan convents of the Observance that arose in Abruzzo between the fifteenth and sixteenth centuries. It should, in fact, be remembered that within the Franciscan Order, two currents took place: the Observants and the Conventuals, as specified in the next paragraph.

3. The Observants and Conventuals

Between the end of the fourteenth and the beginning of the sixteenth century, following internal ferments born based on the need to interpret more faithfully the original Rule and to live the community experience according to the true spirit of Saint Francis, a reforming movement was born called "of the spiritual", who longed for a greater observance of the Rule.

The movement, which was called Observance, spread to Abruzzo in the first twenty years of the fifteenth century. Increasing the differences between the friars who supported the Observance and those who belonged to the Franciscan communities of the oldest foundation, the order was divided into two families, the Observants and the Conventuals. The Observants lived in convents located generally on the margins or even outside urban settlements, while the Conventuals were so named in reference to the fact that they lived in urban convents. The spread of the observant movement in Abruzzo was rapid and in the mid-fifteenth century, in the region, there were many new settlements [6].
The official act of birth of the Observance in Abruzzo is represented by the foundation, in 1415, of the convent of San Giuliano in L'Aquila. Importance was given to the Convent of the Minor Friars dedicated to San Bernardino from Siena, located in the centre of the city of L'Aquila, built in the 15th century next to the Basilica of the same name. The church of San Bernardino from Siena was built in the 15th century. Subsequently were founded other Franciscan convents of the Observance in Lanciano, Atessa, Chieti and among these we remember the foundation probably occurred in 1487 of the small convents of the Friars Minor of the observance of the Maddalena in Castel di Sangro, object of this contribution.
The Observants based their activity on the apostolate and preaching living in penance, in poverty and in recollection, but above all their pastoral action was characterized by the will to heal discords between neighboring countries, to mediate between political factions or families. The activity of the entire Franciscan order had become, in fact, on several occasions decisive for the maintenance of peace in the communities and represented a factor of both economic and social stability. The Friars Minor thus won the support of notable families by encouraging the construction of new convents.
The convent was considered as a structure open to the territory and to the community; it also carried out social welfare activities such as, for example, remedy usury and periods of famine.
Other important structures find space inside convents such as the infirmaries (convents of San Bernardino in Agnone, and Sant'Andrea in Chieti) and the pharmacies (convent of Sant'Onofrio in Vasto). Linked to these two activities, botanical gardens arose in the lands adjacent to the convents, where medical plants and particular herbs were also cultivated for the preparation of medicinal products (convent of the Maddalena in Castel di Sangro and S. Angelo in Ocre in Fossa).

3.1 Friars Minor convents in urban and suburban centres.

The settlements of Friars Minor can be divided into two categories: those inserted in urban centers, even if at the time of their foundation they were in a peripheral position, characterized by environments linked to an adaptation to the spaces granted and to the reuse of pre-existing structures, and those located in suburban environments, whose foundation should be placed mostly, in the fifteenth century, with a conformation of its own. Both in the first and in the second case it is possible to find the urban developments of the urban and suburban neighbourhoods around these settlements, thanks to the discovery of ancient road artifacts serving travellers, such as fountains, road crosses and arcades.
In some cases, it is also possible to find remains of architectural structures linked to agro-craft activities, close to rivers and streams, as in the convent of the Friars Minor of the Observance of the Maddalena in Castel di Sangro.
The first type includes the convents and monasteries of the Friars Minor Conventual and Clarisse with churches with a single nave, such as the convent of the Clarisse in L'Aquila while the second includes those of the families of the Observants, of the Reformed and the Capuchins with churches almost always preceded by arcades and with a single side nave, such as the convent of San Francesco in Casanova di Carinola (CE) in Terra di Lavoro and the convent of the Maddalena in Castel di Sangro (AQ).

4. The former convent of La Maddalena in Castel di Sangro

The former convent of La Maddalena, a Franciscan example of the Observance, is in the province of L'Aquila at the confluence of the rivers Sangro and Zittola, retaining its original position on the edge of the town of Castel di Sangro. The landscape characteristic of the monumental complex of the Maddalena has consolidated over time [9] as can be seen from the comparison between a representation elaborated within a Geographic Information System based on the Open Data published on the site of the Abruzzo region [8] and an iconography of 1853 [10] (Fig. 4). The town of Castel di Sangro has always been an important road center, called Porta d'Abruzzo as a necessary passage to cross the territories of Abruzzo and Molise, from the Adriatic to the Tyrrhenian.
In fact, already in the fifteenth century, the town was crossed by the tratturo Lucera-Castel di Sangro, one of the oldest of the Foggia Customs as well as by other tratturi such as that of Pescasseroli - Candela and several tratturelli, for this importance had been established in Castel di Sangro right at the Convent of La Maddalena, a public Customs for the control of animals interested in transhumance and the control of goods [11].



Fig. 4: Partial topographical representation of the municipal territory of Castel di Sangro (Aq) performed in Gis software on DTM (Digital Terrain Model) [12] and based on the Open Data of the Abruzzo Region [13], original graphic scale 1:5000; 19th century iconographic representation of Castel di Sangro [10]. In evidence the convent and the crossing bridges of the river Zittola present in both representations by the author.

The complex of the Maddalena was built in the fifteenth century as a hospice intended to gather pilgrims who "walked in both directions the way of Abruzzo"; it was then occupied by a small community of Friars Minor Observant who built the convent and the church with the name of the Maddalena [9].
The date of 1487 is written on the lintel of the door that once put in communication the convent with the church. Some scholars identify this date with the year of foundation of the convent others of its completion.
The monumental complex has preserved the typological scheme of the Franciscan convents of the Observance that arose in Abruzzo between the fifteenth and sixteenth centuries, despite the restoration and restoration interventions that have occurred from the early twentieth century to today and, despite the possible recovery of the church façade alone [14] (Fig. 5).
The main nucleus of the complex is a quadrangular cloister built tangentially to the church with a well in local stone (Fig. 6), around which it the refectory, the kitchen, the guest quarters, and warehouses, were arranged, while upstairs there were dormitories.
During restorations of the late twentieth century, the portico has been freed from the surface, remaining closed to the ground floor only on one side, to the east. Large arches resting on cylindrical columns delimit the space of the cloister.

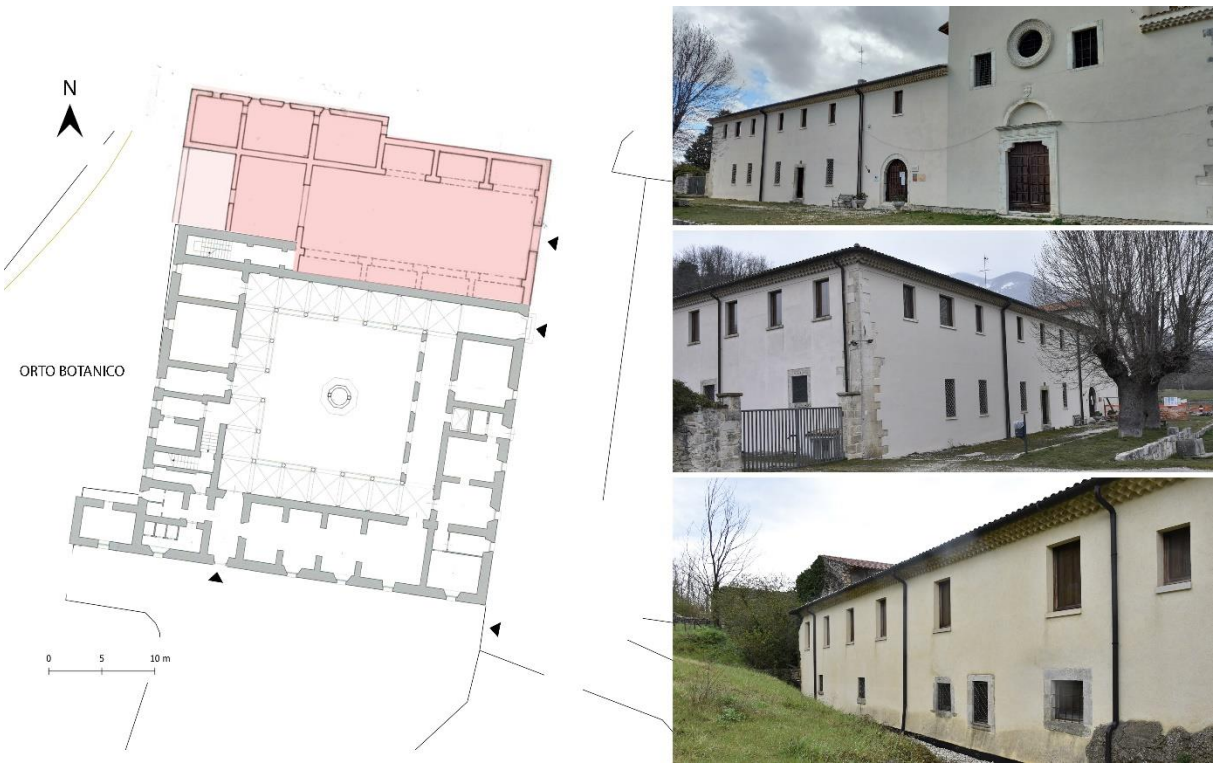


Fig. 5: Plan of the convent-church complex drawn on documentary sources taken from the text of Mattiocco [8]. In evidence the church of the Maddalena. Photos of the convent on the east, south-east and west sides towards the botanical garden by the author.

Upstairs on two sides (east and north) runs a loggia that remains closed on the other two sides, allowing the recovery of the interior exhibition spaces. Wall paintings with stories of San Francesco and Sant'Antonio decorate the lunettes on the ground floor of the ambulatory of the cloister, after a partial recovery together with the architectural structures.
During the nineteenth century, following the laws relating to the suppression of monasteries, the convent was used in different ways such as school, prison, barracks, accommodation of nomads until a phase of degradation and complete abandonment.
At the end of the twentieth century there was a restoration with the structural and functional recovery of the premises that currently house the Museo Civico Aufidenate, the International Museum of Fishing and the Pegaso Telematic University.



Fig. 6: The cloister of the convent of the Maddalena. Photograph of the ground floor: north-east and south-west corner; on the first floor: ambulatory on the north side of the cloister. Photo by the author.

The church did not have a dominant role in relation to the convent complex, but appears perfectly integrated in it, as in the convents of the Friars Minor of the Observance.
It was destroyed following the bombings of the Second World War and has suffered a long period of neglect and neglect.

The plan of the church has been reconstructed based on historical sources and documents preserved in the municipal archive of Castel di Sangro and on ruins preserved on site. The church had a central nave with a side aisle to the left of the entrance and a series of small non-communicating chapels located to the right of the entrance [8].
The facade of the church and the perimeter walls were recovered, and the roof was rebuilt. The rose window on the facade above the entrance to the church is well preserved; it is finely decorated with moldings consisting of teeth, ovules, and other floral and geometric motifs. In addition, the underlying wooden structures rotted in the weather following the dismantling of the roof to repair the roof of the church S. M. Assunta from the same type of embrici, until they finally collapsed causing serious damage to the rooms and furnishings below.
Serious was the loss of a beautiful chest of drawers of the late sixteenth century with large panels and rose windows with gold reliefs in gold. Abandoned to itself, the building went into ruin and the bell tower followed the same fate; the only surviving elements were the facade, the perimeter walls and some arches of the side chapels. Some remains and some furnishings were saved by private individuals and kept in the nearby churches and chapels of the village.
Above the church portal there is the coat of arms of the d'Avalos-d'Aquino, from the first half of the fourth decade of the 16th century. Alfonso d'Avalos d'Aquino, niece of Constance Princess of Francavilla, spent the last years of his life in Castel di Sangro, which ended in 1546.
The Friars Minor Osservant of the Maddalena also cultivated a parcel of land, as was the monastic custom. Behind and beside the convent they built a garden and a small botanical garden, used as "experimental land for the improvement of agriculture".
Many of those plants have disappeared, but with the recovery of the structures has also been provided for the protection of this small plot in memory of the ancient Franciscan place.
In the garden and in the botanical garden is accessible from the cloister. At the bottom of the garden there is a second well and currently there are stone materials from both archaeological excavations carried out in neighboring urban areas, both from the church of the Maddalena.
Above the convent there is a small hill called in the ancient land registry “peschio longo” in which is preserved a limestone boulder: the table of the friars characterizing a place of prayer and meditation.
The convent outside is in perfect continuity with the church façade. The convent was connected to the church by a side door placed on one of the sides of the cloister, today walled.
The convent is accessed by a door adjacent to the church characterized by a round stone arch, which leads to a corner of the ambulatory of the cloister.

4.1 Some applications of digital survey

A digital survey of the main façade of the convent was carried out for a better knowledge of the architectural asset in its forms and decorations.
Through digital photogrammetry and the use of *struction from motion* software it was possible to create a numerical model from which, for subsequent phases, orthophotos have been developed highlighting the architectural and geometric composition of the facade.
The result obtained was then compared also with the photographic documentation of the time (Fig. 7).
Since this is a research in progress, for the cloister has been realized a partial cloud dense of points relative to the north side through which it was possible a first visualization and formal understanding of the architectural artifact, with the hope of being able to deepen later also the study of the facades of the cloister and the ambulatories and implement the digital archive of the memory of the sites.
During some inspections, photographs were taken with a reflex camera in manual mode with a focal length of 18 mm, maintaining a constant distance between the shooting and the object.
The frames of the convent’s facade and those of the cloister were processed in two different projects with the 3D Flow 3D Zephyr Aerial structure from motion software.

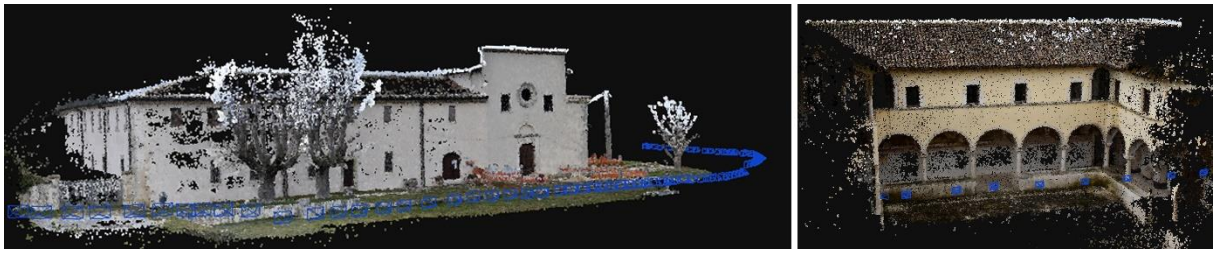


Fig. 7: Clouds of dense points of the main facade of the convent and the north side of the cloister by the author.

In both cases, after calibration of the internal parameters of the camera, the process of alignment of the images was carried out, so as to obtain a sparse cloud that allowed a first verification of the geometry of the two sides.
The dense cloud of points was then generated, and the disturbing elements eliminated, to proceed to scale the model on the basis of known points deriving from direct relief.
The next step involved the elaboration of the mesh for the reconstruction of the surfaces; a textured mesh was then performed for the digital recomposition of the material configuration of the investigated facade of the convent.
The photographic texture, applied to the mesh, then allowed to generate two orthophotos at high resolution, one of the entire façade and another of the church alone, after selecting the appropriate plane of reference.
The results obtained were compared with some vintage photos exhibited in the rooms of the Museo Civico Aufidenate (Figg. 8, 9). This comparison confirmed that the restoration was necessary to give continuity to the environmental and cultural value of the monumental complex of the Maddalena that it is hoped can be extended to the church with its next recovery.



Fig. 8: Ortofoto of the main façade of the former convent of the Maddalena by the author, compared with a vintage photo before the restoration (Museo Aufidenate).



Fig. 9: Church of the Maddalena. Ortofoto from cloud of dense points and textured mesh by the author; vintage photos before restoration (Museo Aufidenate) in which you notice the interior of the nave.

5. Conclusions

The research presented in this contribution has been an opportunity to develop a methodology of investigation to identify through a critical documentation of an architecture a lived site, a piece of life, an expression of a civil community. The former convent of the Maddalena has been studied as an expression of the history of a community as a testimony to the territorialisation process to which every single Franciscan conventual unit has referred.
The territorial principle underlying this type of religious architecture has been highlighted as an added value to project the life of the former Convent of La Maddalena in an eco-sustainable future.
It is hoped, in fact, to encourage greater communication between the resources of the territory and the economic and social needs of those who live there, avoiding waste for the environment and protecting the cultural heritage. The methodology adopted dealt with multi-scale aspects with the use of different techniques and tools that validated the choices made. The representation of the territorial project of the Franciscan order in the Province of S. Bernardino was realized with the Geographic Information System (GIS), through the comparison of various cartographic documents. The critical documentation of the convent of La Maddalena in Castel di Sangro, an emblematic example of the religious and social life of the Franciscan order in the Abruzzo area, has been realized through applications of digital survey of architectural photogrammetry, helping to foster awareness and memory of sites.
The legacy of the past becomes, therefore, an economic resource to project into an environmentally sustainable future a present that must be managed through the activity of knowledge to encourage actions to protect and safeguard the cultural heritage of each territory.

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Analysis of an ancient fresco expression of mediation and transition between action and contemplation

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Abstract
The safeguarding and enhancement of cultural heritage is the fundamental theme of this paper and the subject matter of our academic research.
In recent years we have turned our attention to exploring the art history of central Italy, turning a critical eye to some little-known works of art. The aim is to ensure they are provided with suitable and updated documentation attesting their existence and state of conservation, in order to contribute to the enhancement and promotion of Italian cultural heritage, and through this stimulate tourism.
This study examines a painting in a rock-cut church situated near Isernia and makes use of information gathered in the archives present in Molise and directly by us during several study visits to the site. The sets of photographs, which complete the survey of the structure housing the painting, were taken between spring 2015 and autumn 2021. This time span made it possible to undertake an examination of the painting's state of preservation in addition to making an in-depth analysis of its figurative programme.
The collected material has been digitized, so that it constitutes a source of information as well as being the product of the final iconographic narration, expressed through the photographic images and a series of drawings documenting the characteristics, including the hidden structure with which the artist organised the representation taken from the Gospels, which being the fruit of meditation and the transition between action and contemplation is of significant theological value.

Keywords: fresco, Isernia, photographic survey, drawings, safeguarding, enhancement

1. Introduction
The safeguarding and enhancement of cultural heritage is the main focus of this paper. Within the sphere of our academic research, this theme is amongst those to which we pay the greatest attention, a commitment that has been strengthened since we turned our attention to the works lying within the Molise region. This area of central Italy is still largely unexplored from this point of view although potentially of great interest given that it has been inhabited since the Palaeolithic period, as attested by the archaeological park on the site of "La Pineta" at Isernia, and in antiquity was inhabited by Italic populations proud of their status as free and independent organised communities, mainly dedicated to agriculture and pastoralism, but also prepared to become hardened warriors in defence of their boundaries, traditions and culture.
It is difficult to identify a precise reason why Molise has only received sporadic interest from academics. There are probably several factors behind this, for example the fact that the area has never been the theatre of important events in Italian history, with the exception of the conflict between the ancient Romans and the Samnites in the 3rd and 4th centuries B.C. [1] and the Saracen invasions in the 9th century [2]. Another factor could be that this territory has always been scarcely populated and thus relegated to the margins of social, economic, political, and military activity in southern Italy.

All things considered, a state of substantial isolation whose artistic patrimony is limited to a small number of works the majority of which resulting from the creativity of local craftsmen, which here is synonymous with essential design that sometimes has more historical value than artistic-innovative worth.
These are distinctive characteristics, which in other Italian territories would probably be of marginal interest compared to the cultural realities of greater artistic calibre. A fate that could also be assigned to our case study, if it were observed with detachment and arrogance in quick succession with other examples of cultural heritage in central Italy. The reference is to a pictorial work of the 14th century inside an ancient church in the territory of Isernia. An artistic study forgotten by the peripheral institutions of the Italian state for a long period and only recently brought to the public's attention by the Superintendency for Archaeology, Fine Arts and Landscape of the Molise having ascertained the rapid and progressive deterioration of the building in which it is housed.

2. Genesis of the study

The site of the church housing the fresco and the building's state of abandonment, have fuelled the debate among the population on whether or not it is worth spending time and money on the restoration and protection of this cultural complex.
Our approach to this work of art essentially departed from two interdependent considerations: the first being that having learnt to appreciate the Molise region and understand the rarity of existing examples of its artistic patrimony means that quite simply the thought of losing one would be culturally criminal. The second, more directly dependent of the specific socio-cultural aspects of the territory, is that we have come to believe in the idea of perceiving works of art handed down to us through history as cultural fragments of life that has been lived, in other words investing them with a status that leads us to consider them to being undeniable proof of the evolutionary journey of western society, consequently rendering their conservation and divulgation worthwhile regardless of their physical state.
During the course of several meetings with the local community, we were able to understand how the fresco we are about to discuss contributes to giving substance to the Molisan community and to stimulating the sense of belonging to the territory, evidence of a precious past, both regarding the collective, which expects research to provide a precise and scientific reconstruction of the historical events, and the individual, as part of the development of a mental image of the place inhabited by history. Thus, it can be said that an interdependence has developed between the observer and the frescoed work of art for which, "every link in the chain of historical development" [3], as Alois Riegel wrote, is an essential handhold that must survive and preserve its own characteristics given that the disappearance or variation of a constructive moment in the cultural itinerary leads to the interruption of the sequence and therefore the loss of that which makes it possible [4].

3. The building housing the fresco

The work of art that is the subject of this case study is situated in a deconsecrated rock-cut church, which stands in a position difficult to reach outside the ancient fortified city walls of Isernia, on the eastern side of the town. The building, now privately owned, can be reached by following the ancient footpath linking the town to the valley of the river Carpino, which flows at the base of the hill on which the town is built, and from here leads to the actual sanctuary of Saints Cosma and Damiano, on the opposite hill (Fig. 1).

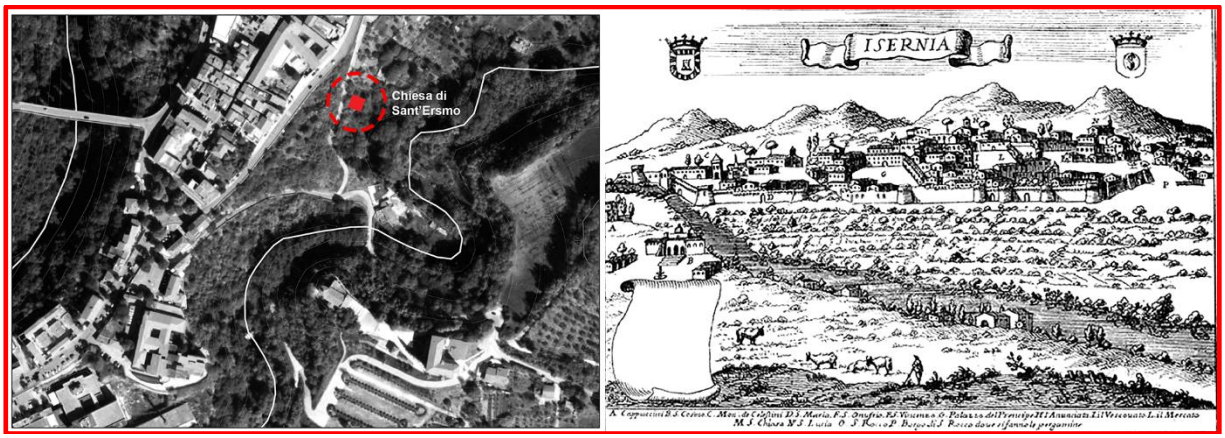


Fig. 1: Aerial photograph of the eastern side of the town of Isernia showing the position of the church of St. Erasmus.
Fig. 2: View of the town of Isernia by Giovanni Battista Pacichelli.

From the documentary sources found in the regional archives we know that the religious building housing the fresco was a small independent monastery, which at a later date was dedicated to St.

Erasmus, but the same sources are laconic and discontinuous regarding its foundation. However, the building's appearance, the natural conformation of the hall – probably the silent witness to some event that had determined its sacred origins – as well as several masonry elements suggest that it was built sometime around the year 1000, even though there are elements suggesting it could date back to an earlier period when rock-cut dwellings were widely inhabited by hermits in southern Italy [5].
The lack of documentation also makes it difficult to precisely establish the reasons why the religious structure ceased to function as a place of worship and when this occurred. The state of the documentation is such that it provides no useful clue to the first question, it is possible to speculate that it may have been due to erosion caused by the river Carpino or an earthquake, considering that the area is periodically subject to such traumatic phenomena. Regarding the second question, some archival evidence suggests that the building was abandoned before the end of the 17th century, given that the church of St. Erasmus is not shown in views of Isernia by Giovanni Battista Pacichelli made in the early 18th century [6], where the cult buildings of that period are scrupulously documented (Fig. 2), neither is it cited by Pietro Sella in his literary work 'Rationes Decimarum del XIII e XIV secolo' [7].
From the outside, the architecture of St. Erasmus does not reveal its original function, as the building has none of the morphological and iconographical characteristics typical of a Christian church. Its present conformation is probably a reduced version compared to few centuries ago, at least the level area obtained by modelling the rock to the right of the main entrance and a number of masonry toothings visible on this face of the building suggest this possibility. As the structure stands, it is formed by a single volume (Fig. 3), divided internally into four rooms on two levels. The lower part is formed by the avant-corps of the church and the liturgical hall, the original nucleus of the building entirely cut into the natural cavity of the rock. The upper level presents two small connecting spaces used by the clergy, orientated on different axes, and rendered independent by the existence of a small doorway in the building's left side wall (Fig. 4). The arrangement of the spaces on this level divided by a small doorway suggests they were not contemporary. The inner room, excavated from the rock and covered by a barrel vault, is the earlier of the two and at the same time the most precious given that it appears as a small casket protecting the fresco in question.



Fig. 3: An old photograph of the eastern side of Isernia showing the position of the church of St. Erasmus.
Fig. 4: Plan of the upper level of the church of St. Erasmus with the position of the fresco and photograph of the entrance on this level.

4. The fresco

The wall painting in the church of St. Erasmus is a cultural work with a religious theme probably dating to the 14th century, painted by an unknown artist. The fresco covers the entire back wall of the inner room on the upper level and at present constitutes the only painted evidence on which to base studies and propose ideas relating to the techniques used and the expressive language with which stories from the Old and New Testament have been narrated on the walls of this cult building, just as was promoted by the evangelists of the period who, it is no mystery, used images to aid the illiterate population in understanding the word of God.
The fresco measures c. 3 m2 and is outlined by a polychrome frame, also drawn on the wall, which follows the line of the arched rear wall.
The scene represents a version of the Passion of Christ and is an evocative figurative intuition that immediately arouses emotion. The sensations that accompany the visitor in the contemplation of this work of art are stimulated by the realism with which the religious scene is depicted, seen for example in the folds of the clothing and its embroidered decoration, and in part also by the artist's decision to paint the individuals who, helpless, watch the martyrdom, at almost life-size in a relatively small space. Today,

this decision makes the figures appear closer and more intelligible. In addition, although the colours are overlapping and never blended, and the folds of the clothing are obtained by multiple lines of different colours, the painting of the anatomy appears delicate and sfumato even when looked at closely. There are a limited number of tonalities, which are mostly warm and as in similar medieval works are heavily applied in order to provide the necessary power of expression to highlight the symbolic meaning, as well as manifest the principles of truth [8] (Fig. 5). Ultimately however, we can say that the fresco's value lies in its being a work of art of extraordinary importance if seen within the specific sphere of cultural anthropology, that is the assemblage of traditions and models that qualify the identity of a social group, and as such is therefore a work which merits attention and should be conserved for study and to be handed down to future generations.

The fresco's state of conservation, as mentioned above, is the cause of worry for the Superintendency of Molise. Although overall the painting is legible, it is however subject to frequent infiltrations of rainwater, it presents several cracks caused by the building's static instability, and, unfortunately it has also been damaged by individuals who live their life completely ignoring the fact that art is the key opening the doors of time, to travelling in all directions, to accessing the universe of the possible.

These repeated and combined actions, incompatible with the conservation of the work of art, have caused a variety of damage to the frescoed surface, in particular the missing parts where the plaster has come away from the wall facing. Also notable is the absence in the background of landscape references that provided plasticity to the two-dimensional nature of the fresco, rendered invisible by humidity and the microorganisms that proliferate in such an environment. The original existence of landscape references is indicated by the horizontal line situated on the lower left-hand side of the fresco, which separates the geometric plane from the background and also corresponds with a variation in tonality of the pigment that is still visible. The damage caused by vandalism is also clearly visible.

Of the alterations suffered by the fresco, that which penalises the critical reading of the work the most, apart obviously from the missing fragments, is the loss of the background landscape references. Their absence flattens the painted image into an anonymous background, which mortifies the painting and hampers those who try to understand it. It is a situation that we believe could be partially resolved by an intervention of restoration and conservation but which today places us in the position of being without information regarding the scene's setting. Thus, the questions that emerged from the analyses made in the field, which precisely in the study of the perspective depth could have found a logical response, remain unanswered. In fact, the frescoed space we can observe is made up of light and shadow and planes on which the figures forming the scene stand, as well as colour, but on the background plane all that is visible now is a dark pictorial treatment, which from dark blue tends towards black.

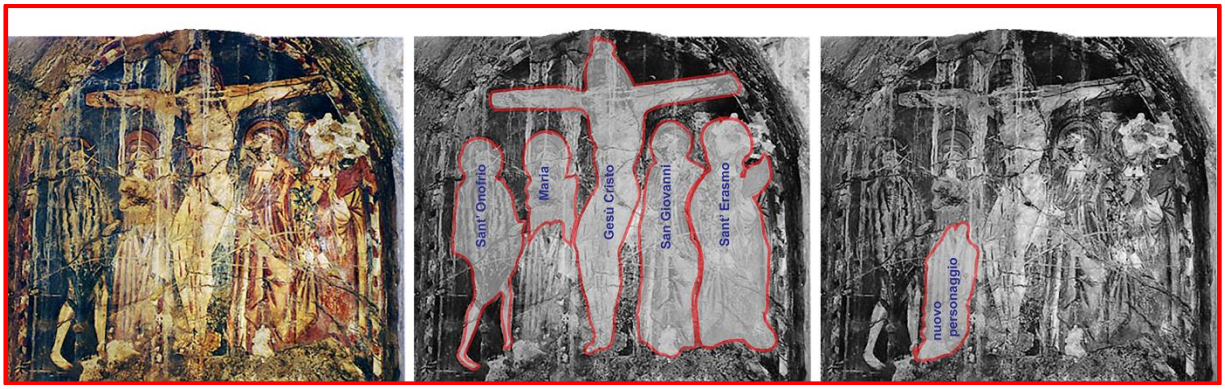


Fig. 5: Image of the fresco.
Fig. 6: Image of the fresco indicating the individuals who populated the scene of the Crucifixion.
Fig. 7: Image of the fresco indicating the new figure identified in the scene of the martyrdom.

4.1 The figurative programme

The fresco's figurative programme follows a narrative scheme that can be defined classical: at the centre is the image of Christ on the cross and at his sides are four standing human figures, two on each side, all shown with a halo around their heads indicating their holiness. The traditional iconography of this scene is taken from the Gospels and the characteristics of the clothes worn by the onlookers helps us to recognise at the foot of the cross the Virgin Mary and St. John, the only one of Christ's disciples that the scriptures tell us was present at the crucifixion. Alongside them are two figures associated with local religious traditions: St. Onuphrius and St. Erasmus, to whom the church is dedicated (Fig. 6).

The Christ figure is beardless with long thick hair, the body is slender and blood pours from the wounds inflicted by his executioners. He is naked apart from the cloth draped around his hips. Jesus' head hangs to one side, sign that his martyrdom is completed and the face is illuminated by a ray of light, which enters the painting from the right; its intensity alters the natural colour of the skin, making it almost ivory-

white in the most illuminated parts. This descriptive solution was probably adopted in order to represent the 'True Light of the Word', that is: the words spoken by God the Father as he observed his only Son in the final moment of his earthly existence.
The cross, the principal symbol of Christianity, is shown as made from roughly-worked timbers, an unusual artistic choice used by the painter to represent the contempt felt by the authorities during the trial undergone by the Son of God before the Crucifixion, a feeling of such condemnation felt for the man who proclaimed himself 'King of the Jews' [9] that in their opinion he did not deserve any respect, not even that of dying on a cross like those reserved for other condemned men, a detail that can be perceived as a strong metaphor for describing Jesus as the last among men.
A careful examination of the fresco also reveals another symbolic detail in the painting of the cross, which can be seen in the way in which the final part of the right arm is represented. In this area of the fresco the painting of the cross overlaps the frame created to delimit the painting and, at the same time, emphasize its aesthetic-artistic value. This is a new pictorial expedient used in order to increase the spatiality of the scene and to add a notable plasticity to the two-dimensional nature of the fresco. However, the more we reflect on this detail the more we are convinced that in using this figurative invention the artist wished to assign to the Cross the task of projecting the story of the Crucifixion from the past to the contemporaneity of the worshiper observing the work of art. Thus, the individual looking at the scene in the present, which represents a moment in the past, must consider and understand a temporal tryptic constituted by a before, a now and an after; man lives in sin (the past), Jesus dies on the cross (the present), man is free from sin (the future).
The Virgin Mary is shown to the left of Jesus (as we look at the painting), and is a diminutive figure standing erect and facing the front on a scenic plane that is behind that of Jesus on the Cross. Unfortunately, Mary's face is damaged, only the forehead and long dark hair surrounded by a halo are visible. She appears to be wearing a long red robe (red is the predominant tone in the fresco), at least this is what can be perceived by observing a part of the robe near the cross. The uncertainty about the Virgin Mary's clothing is due to the fact that most of her image appears to be hidden by the drapes of clothing that is not hers, an affirmation of some importance that we feel authorised to make having seen that the folds of this presumed robe to not form part of a single harmonic drawing with Mary's robe, a dissonance which on close examination of the image appears clear and leads us to suggest that there is a sixth figure in front of the Virgin Mary (Fig. 7).
St. John, stands to the right of Jesus and on the same figurative plane. A compositional choice, underlining the nearness of the head of the Christian community to his disciple. The figure of John the Apostle is in profile and as in many coeval works, he is shown with the face of a beardless young man, his expression sad and stunned by what has happened to Jesus. He stands erect, his arms are bent and his hands joined as if in prayer across his stomach.
In this Molisan version of the sacrifice of the Son of God, St. John wears a long draped red tunic, the folds emphasised by yellow ochre highlights generated by the intense light illuminating Jesus on the cross. It is a plain tunic without embellishment to manifest his status as a poor man who is free of the slavery of earthly riches. Furthermore, St. John is the only one of the figures around the cross who turns his gaze towards the face of Jesus, an artistic choice that aims to reinforce the communion of ideas between Christ and his apostle.
To this triad of holy figures, omnipresent in depictions of the martyrdom of Christ, the Isernian artist has added St. Onuphrius, a saint who during his lifetime was dedicated to asceticism, prayer and contemplation, whose cult was widespread in the central Italian territory, which today constitutes part of the Molise region.
The hermit, easily recognisable by the aesthetic characteristics conferred on him by official Catholic iconography, is visible on the left side of the fresco and is shown standing facing the front on an intermediate scenic plane between that of the crucifixion and that of the Virgin Mary. To aid recognition of the figure of St. Onuphrius, the artist has accentuated his particular aesthetics and shown him as a slight figure completely covered by long course hair and a thick beard that hangs down to his knees. The saint is also shown shoeless in sign of obedience and fidelity to the word of God.
We believe that the presence of St. Onuphrius in this fresco is not due to an extemporary decision taken by the artist, but to the desire to leave a trace referring to the origins of this cult site. To be honest, none of what we found in the Diocesan archives of Isernia and Venafro confirms our hypothesis, but it strengthens in our minds every time we think about the hall of this church, excavated out of a natural cavity, and the two small rooms that complete the complex, both morphologically and spatially comparable to a hermit's cell.
The fifth figure in the fresco is difficult to interpret. Some of the characteristics such as the figurative plane in front of the crucifixion, the spatial position at the far right of the painting, the sumptuous clothes, the frontal static pose and composed attitude, suggest the figure of a narrator, a saint assigned the function of revealing the mystery of the Son of God on the cross to the illiterate worshippers. This interpretation leads us to identify the fifth individual as St. Erasmus, the evangelizer to whose cult the church was dedicated. A man of faith who according to the Martyrologium Hieronymianum, the oldest

catalogue of Christian martyrs of the Catholic church, in order to escape persecution hid in a cave for seven years. It is probably for this reason that this ancient cult place was dedicated to him.
The face of the auxiliary saint Erasmus is rounded and damaged like that of the Virgin Mary, but its state does not prevent us from seeing that it is shown with reddish hair and beard. The saint's body is dressed in an ample long embroidered red tunic, partly covered by an embroidered yellow cloak, closed at the chest with a fibula/brooch, which hangs down along the body. The saint's left arm hangs downwards and the hand holds onto the tunic, the other arm, on the contrary, is raised and a leaf is held in the hand. The motif is flattened and ovate in shape with a pointed apex and we suggest it represents a palm leaf, a Christian symbol of peace and forgiveness, exhibited in these circumstances probably in order to indicate to worshippers the path to take in response to what is happening, or has already happened, behind him. After all, St. Erasmus was an evangelizer and is attributed with many conversions before his martyrdom, and as a disseminator of the word of God he would certainly have explained the significance associated with the palm branch in the Christian faith to his converts.
As mentioned above, a careful look at the central part of the fresco reveals, at the foot of the cross, the drapery that partially hides the image of the Virgin Mary.
A detailed analysis of the photograms led to the plausible hypothesis hinted at above, namely that in this part of the fresco there is a sixth individual and the drapery overlying the image of Mary is all that remains of the figure, given that the head and the lower limbs are now irreparably lost. This hypothesis finds confirmation in the soft lines of the garment, which as mentioned, do not match those of the robe worn by Mary, and in the triangular shape present at the centre of the drapery which, with a minimum mnemonic effort, it is easy to associate with the hood worn by several religious orders and by the pilgrims who in the past undertook the spiritual journey to the Holy Land, travelling the via Appia, the '*Regina viarum'*, which ran not far from this cult site [10].
If the proposed key to the interpretation is correct, the latter detail of the fresco assumes a crucial importance as it leaves little room for interpretation to the imagination of those who observe it with an eye to understanding the posture of the sixth figure given that in order for the hood to be visible, we are looking at a back view. Furthermore, the absence of a halo around the space that would presumably be occupied by the head suggests that this is not a saintly figure but rather a lay person, a common God-fearing man, probably shown on his knees in prayer. It appears to us that this individual was probably inserted into the fresco in order to complete the figurative system, given that he is the protagonist of this historic moment, as are the others marked by sanctity, and is there to represent each of us, to represent a popular and lay religiosity. Therefore, based on our suggestion it does not require much to understand that this sixth individual constitutes metaphorically a warning to God's people to remind them of the sacrifice of his son Jesus and the meaning of this harrowing gesture.

4.2 The hidden structure

There is a design/drawing within paintings whose study reveals possible meanings beyond those clearly illustrated by the painting itself. By referring to a contemporary concept we can understand this design as a sort of hypertext that allows us to read information, relationships and other meanings.
This is the hidden structure, a graphic framework with which the artist organises the painting's space in an attempt to find harmony among the elements of his mental vision; a "preparatory" drawing that is never casual, almost always generated by the rules of geometry applied according to the artist's creativity and ability to interpret reality and myth, mystery and faith. In any case, it is a design that is almost always covered by the overall structure of the scene in relation to the event represented.
For better understand this, we focused our efforts about the graphic analysis of the painting. Graphic analysis, as is well known, was introduced in the 1950s by Vincenzo Fasolo, remains pertinent in this type of investigation as it clearly explains that the study is made through marks and not words. It is not a 'reading' of the pictorial image but of the graphic operations of redrawing and re-proposal of the geometric and figurative logic of its visible conformation. The graphic operations do not substitute the critical processes, made with the use of verbal language, but intend to contribute to the understanding of the forms that are analysed using the same language – the drawing – which serves to communicate the forms. [11] As regards our case study, before sharing the results of the graphic analysis, the process of reading used to analyse the work in search of the hidden structure, or framework of lines, it is useful to mention that due to the present conditions of the church it is not possible to view the fresco from close up and that the fresco itself shows clear signs of the effects of years of neglect. Consequently, to avoid ambiguity, we specify that the study was carried out on the set of photographs taken during repeated visits aimed at documenting the fresco's state of conservation. The photographs were taken using a Nikon D850 camera (CMOS 45,7 Megapixel full-frame sensor) ed Nikkor AF-S 58-millimetre optics, f/1.4 G, Manfrotto #058 tripod and Manfrotto 410 3-way Junior Geared Head, with micrometric correction and built-in bubble level. An optimum combination of instruments as it allowed us to work with tranquillity and precision even in low light conditions and at the same time, to register each photogram in Nef format (Raw-Nikon, Nikon Eletronic Format) and Jpg, size 8.256x5.504 pixels and 300 pixel/inch resolution.

The analysis of the photographs made it possible to identify a graphic structure that takes the form of a series of ordinates, which are also relatable to the conformation of the space in which is contained.
Observing the wall of the fresco it can be seen that the painting is geometrically inscribable within a square with sides equal to the length of the hall and that its centre line is close to that of the geometric matrix. The deviations in position from the geometric framework that we identified, although not numerous or excessive in value, we believe can be attributed to the fact that the small chamber was excavated from the living rock and the excavation was carried out by hand by someone who we can imagine was not very expert, while the preparatory drawing was made on a carefully prepared surface.
Continuing with the description, the axes of symmetry of the figures in the fresco are equally distanced and divide the frescoed wall into two tripartitions of equal width, one to the left of the painting's axis of symmetry and the other to the right of it. Furthermore, the first and last preparatory axis also define the spatial limits within which the arms of the cross extend. While we have not identified significant relationships, as regards the vertical development of the figurative plan, between the drawing and the conformation of the frescoed wall, the only proportional data that we intercepted relates to the spring-line of the arch of the vault covering the small chamber, which is positioned at halfway up the square containing the fresco. Therefore, in the first axis on the left we find St. Onuphrius, in the second the Virgin Mary and the sixth figure we identified, in the next, which defines the mid-point of the chamber and the fresco, Jesus on the cross, then St. John and lastly on the right St. Erasmus (Fig. 8).

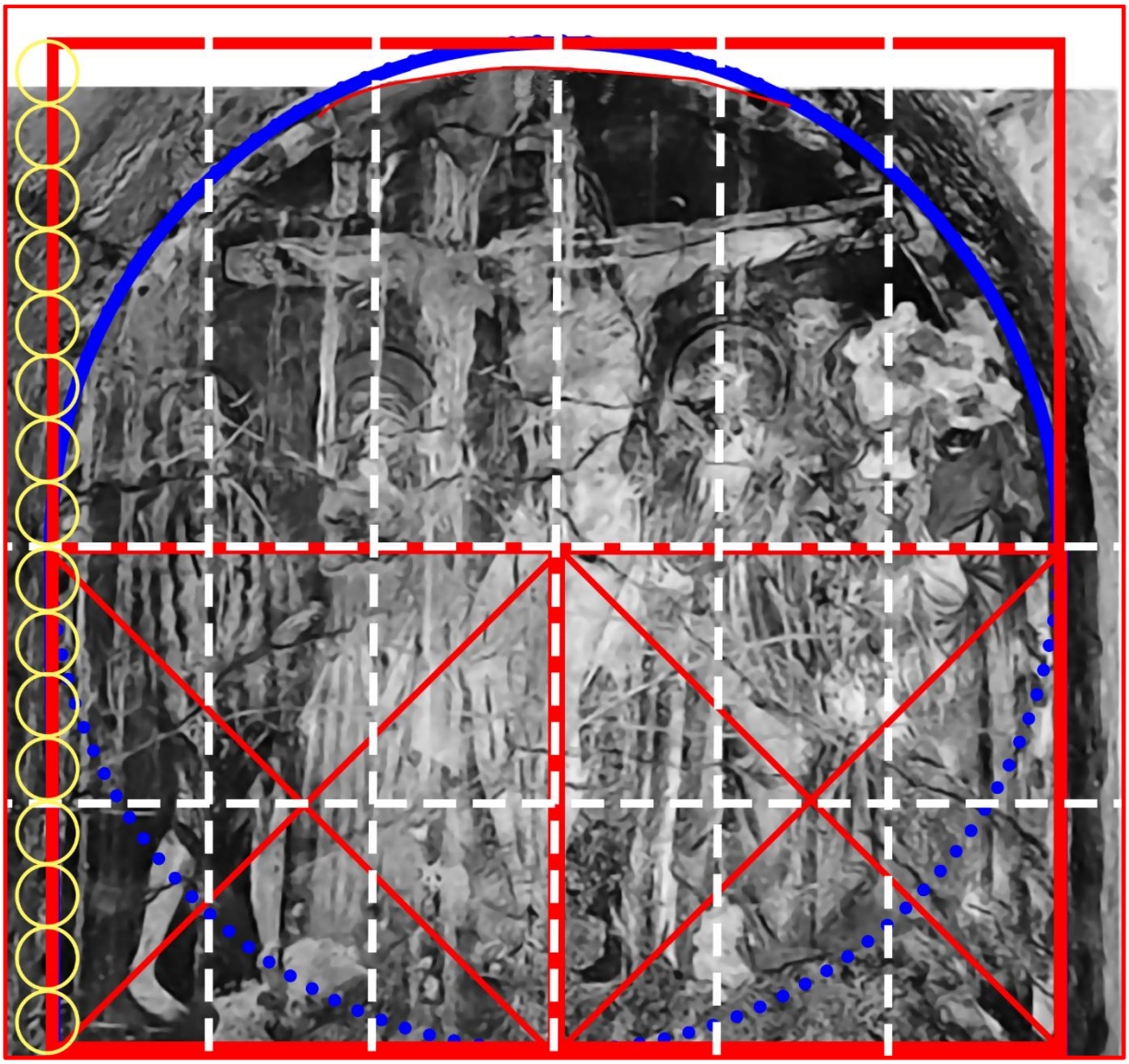


Fig. 8: Image of the fresco showing the graphic ordinates of the composition, the hidden structure.

5. Conclusion

Works of art are objects that have the power of suggestion, transmitting emotions and information, and the fresco in the church of St. Erasmus is no different.

When standing in front of this work, one has the clear sensation of finding oneself faced with a figurative structure that engages the observer for a period that is much longer than required to read it, despite the expressive formalism with which the scene is portrayed. Indeed, one has the idea that the viewer, finding himself unwittingly implicated within the scene where the event takes place, in fact becomes the seventh figure of this pictorial sequence taken from the Gospel.
What filters from the analysis of the expressive content is the conviction of finding oneself in front of a spatial, figurative and symbolic apparatus, where the figures taken from the sacred text and those from local religious tradition metaphorically converse among themselves about concepts and meanings of the Christian doctrine. Moreover, when furthering this research, we became aware that in this painting, organised around a narrative framework constructed ad hoc, there is a representation where the incarnate figures are suspended between the requirements of the narration and the tangibility of a representative moment and this state of fluctuation has led the artist to operate a mediation between the dynamism of the action represented, which occurs in a certain time period, and the static nature of a moment during the event, seized and taken up as a symbol of Christianity.
Between this before and after, between the drawing of the event and that of the space in which it occurs, a third drawing is hidden, represented through a subliminal framework that overlies the base layout. A drawing which contains, represents and reveals the other meaning of this work by the artist from Isernia: that is the meaning of the mediation and transition between action and contemplation, which attempts to overcome the classic dichotomy between acting for the good and contemplating that good itself, to become an *unicum* between the action of good over evil and the contemplation of the light and truth of good. According to this, in his fresco the artist brings together and integrates each human physical dimension in a spiritual and sacred dimension and consigns to us observers a pictorial representation of great theological value, which is, at the same time, a representation of the mystery and miracle of the Faith, therefore something much greater than a prayer.

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Kaleidoscopic ecologies.
New scenarios, from ecological utopia to probiotic architecture.

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Abstract
Pandemic, climate change, population growth and ecology are today issues of global interest that require, on the one hand, immediate action, and on the other, long-medium term policies, strategies and projects that foreshadow a gradual and continuous change as in the case of the ecological transition. The ecological transition is a multiple challenge that must be faced on different levels: technological, political, economic, cultural and which needs to respond to both global and pointly emergencies. More than objectives it is in fact necessary to define methods that are constantly updated and adaptive projects. The paper intends to propose a series of experiments and projects that, between past and present, are committed to giving innovative visions to the ecological transition, in its various forms such as: Richard Weller's Ecological Utopias, Philippe Rham's Sensory Microclimatic Habitat and Neri Oxman's Probiotic Architecture.
The different experiences highlight an essential need to respond to the ecological transition through interdisciplinary skills. Thus, while the role of archistars fades a new figure is affirmed: the "ecological maker", a hybrid professional capable of including issues related to ecology in his field and capable of proposing a new culture of design that innovates and protect our planet.

Keywords: ecological experimentations, utopian, weather-based, nature-inspired, ecologicalmaker

1. Introduction

Mankind's curiosity towards what it does not know, towards the unknown, has always pushed it in the exploration of new horizons. Over time, Mankind has colonized new places and established itself all over the globe by modifying territories, building villages, cities and metropolises, until it reached space. Human curiosity, however, demonstrates a twofold aspect: on one hand the revolutionary and extraordinary ability to innovate, to improve, on the other an inclination to unconscious transformation, unconcerned about the repercussions on our planet Earth. Already in 1924, Vladimir Vernadsky *writes "The balance of the migrations of elements that had been established in the course of geological time is being broken by the reason and activities of Man "* introducing a first definition of what we now call the Anthropocene: the geological era in which Mankind incisively modifies the territories and climate of our planet.
In the general view, the Anthropocene data are seen separately: the loss of biodiversity that is leading us towards a sixth mass extinction, the first due to anthropogenic causes (according to the study of the Pacific Biosciences Research Center of Hawaii); the global pandemic, caused by Covid-19; the effects of climate change, increasingly evident in our cities, cause of erosion, floods, alluvial events and problems related to heat islands. To these conditions is added the data, not negligible, of the demographic increase in the last 100 years, with a percentage of 400%, from 2 billion in 1922 to 8 billion today. The Anthropocene is therefore characterized by a series of problems, and consequent risks, closely related to each other and able to mutually influence themselves.
It is therefore time to undertake a change of course in our consciences and embrace a more sustainable and ecological mindset, as Alessio Malcevschi points out *"Given the urgency to act, perhaps the answer lies not so much in inventing something new as in using what we have in a better way, which is much simpler and more feasible if we are willing to change the prototype of development from a linear economic model to a circular, regenerative and sustainable one* ". [1]

The term “ecology” was introduced for the first time in 1866 by the German scientist Ernst Haeckel, as a relationship between organisms (plants, animals, mankind) and the environment.
Since the birth of the term, different disciplines have borrowed the word creating a series of new specializations: urban ecology, landscape ecology, social ecology etc ... up to define an economic ecology, the so-called *"green economy".* The importance of ecology becomes a central theme at a global level, as demonstrated by the G20, in which the leaders of the main developed Countries gathered to define a downward agreement on climate, or as the 26th Conference of the Parties (COP26) which was attended by Heads of State, together with climate experts, activists and entrepreneurs, who have committed to agreeing a concrete action against global warming.
However, political commitment is not enough. The ecological transition is today a multiple challenge that must be faced at different levels: political, technological, economic and cultural and that must be able to respond to both global and local emergencies.
In this context, the arts and the macro-world of architecture are also increasingly projecting towards issues related to ecology while experiences, experiments and projects are multiplying, committed to giving visions and responses to the ecological transition in its different meanings.
Considerations on the relationships between the natural and anthropized world, however, have also been addressed in the past, when the term ecology had just been coined and did not yet have the resonance it has today. The Farnsworth House, one of the projects that made Mies van der Rohe famous, in 1945, already showed an "ecological sensitivity" through the choice to keep the house raised from the ground according to a principle of ***non-invasiveness***. The idea was born from the need to create an equilibrium with the surrounding environment where the Fox River, in case of flooding, would have invaded the house. As Mies did, Le Corbusier also raised the house on pilotis, making the built entity respectful of the context.
These are just some of the projects that we could define as *"intrinsically ecological",* since they are guided by an ecological sensitivity of the project - not expressly declared but which turned out to be avant-garde in relation to the issues of ecological transition over time.

2. From design sensivity to global emergency

More recently, the Australian architect Glenn Murcutt speaks of *ecological functionalism* as an approach to an architecture that respects the environment, attentive to ecology, in harmony with the climate and the landscape of the place through the use of "simple materials". Ecology becomes part of the language of architecture.
In today's scenario, however, the issues related to ecology no longer refer to a sensitive and avant-garde approach but arise from the necessity to respond to contemporary needs through the definition of new paradigms. For this to be possible, it is essential to undermine the methods crystallized over time and leave room for an experimental phase in which the project is able to guarantee high levels of performance and functionality while respecting the planet.
Among the many, three experiments can be considered as a reference of project’s new ways to respond, in different scales, to the needs dictated by this specific moment of ecological transition namely: the World Park Project by Richard Weller, the Jade Eco Park by Philippe Rahm and Aguahoja by Neri Oxman.

2.1 The World Park Project - Richard Weller (2017)

Richard Weller, Australian landscape architect and professor of Landscape Architecture at the University of Pennsylvania in Philadelphia imagines, through "The World Park" project, to restore the fragmented ecosystem pathways in which the most precious and threatened biodiversity of the planet is enclosed. The intent is to safeguard endangered endemic animal and plant species on a planetary scale with the aim of protecting 17% of the earth's surface (*700.000 times the Central Park area*), a target set by the Convention on Biological Diversity (CBD). [2]
The global park project develops through the definition of 3 trails that connect: the Andreanof Islands in Alaska to the Alberto de Agostini National Park in Chile *(The PAT-ASKA trail);* the city of Tarfaya in Morocco to the city of Hobart in Tasmania *(the AUS-ROC trail);* the city of Luderitz in Namibia to the city of Dörtyol in Turkey *(the TUR-IBIA trail).* (Fig. 1)
An ecological utopia capable of restoring the health of planet Earth for over 160,000 km2, able to connect not only the most important biodiversity hotspots in the world, but also to create an infrastructure that supports ecotourism through a global pilgrimage route capable of creating new relationships with nature. [3]

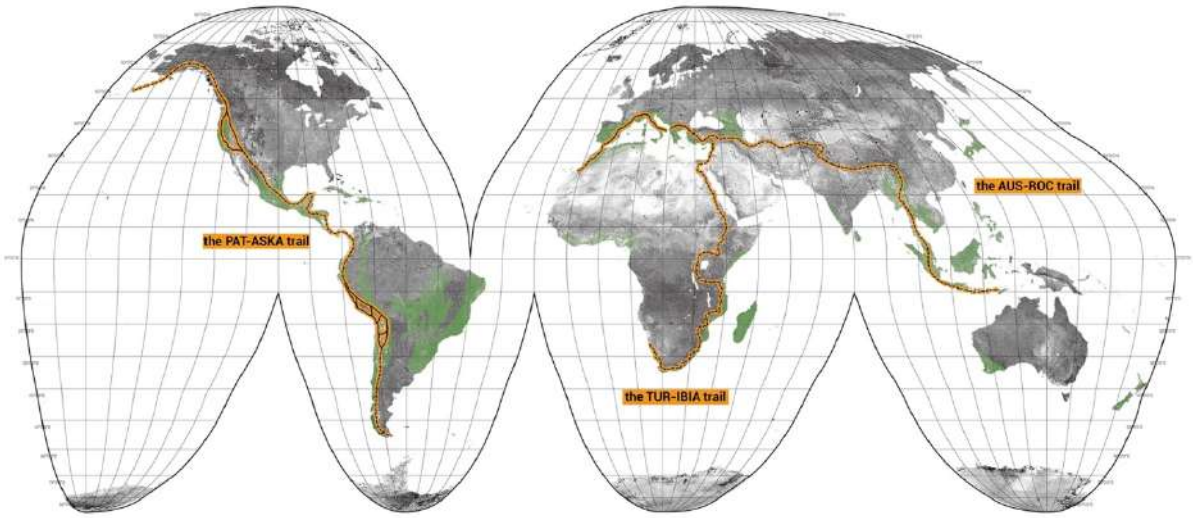


Fig. 1 Graphic reworking "The World Park Project" by A. Di Cinzio and S. Gruosso

2.2 Jade Eco Park - Philippe Rahm (2013-2018)

Philippe Rahm, architect, is the head of the Parisian "Philippe Rahm architects" studio, whose works have drawn international attention for their ability to create synergies between architecture, psychology and meteorology. In particular, the Jade Eco Park project in Taichung, Taiwan, stands out for its desire to restore the fruition of the landscape despite the extreme climatic conditions, such as too hot or too humid (Philippe Rahm 2017) [4]. The park, which occupies an area of 700.000 m2, is located on the site of the old Taichung airport. All the work is based on a mapping of existing climatic conditions thanks to which it is possible to understand which are the hottest, the most humid and the most polluted areas and which are the coldest. (Fig. 2)

The superimposition of the three maps defines a diversity of microclimates and sensory experiences located within the park, highlighting the different levels of livability. The reinforcement of comfort within the areas is possible thanks to the use of a series of devices, both natural and artificial, divided into three different categories: cooling, drying or dehumidifying, depolluting. Thousands of sensors have been placed every 15 meters to collect real-time data on temperature and humidity so that the devices can be automatically activated only when necessary. The Jade Eco Park represents a visionary spatiality in which skills on architecture, landscape, climate, meteorology and technology come together to create qualitatively more comfortable microenvironments for visitors, following a process that Rahm himself defines as "Architecture météorologique", an architecture inspired by meteorology. (Fig. 3) [5]

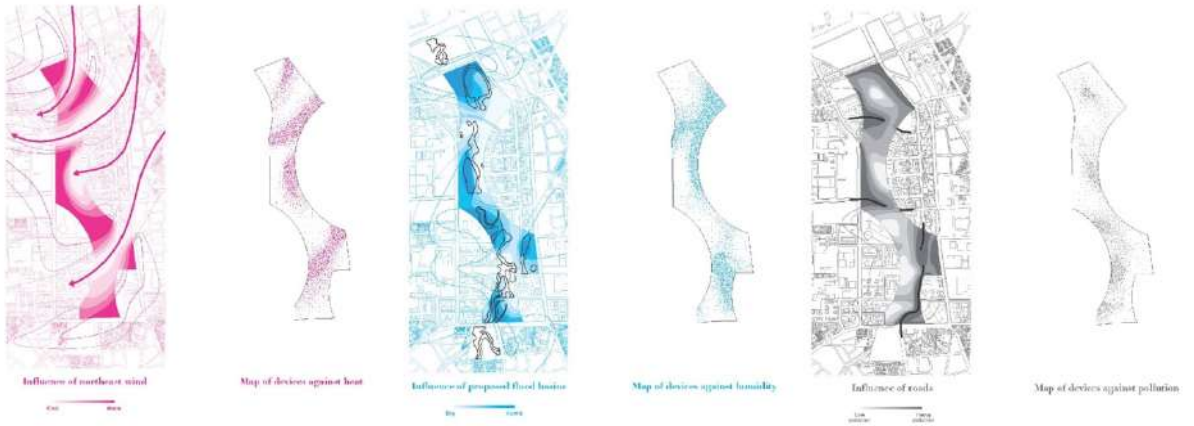


Fig. 2 Climate maps - Influences on the park © Philippe Rahm Architects



Fig. 3 View of the Jade Eco Park © Philippe Rahm Architects

2.3 Aguahoja - Neri Oxman (2019)

Neri Oxman is an Israeli architect and designer but also a professor at MIT, the Massachusetts Institute of Technology where, with his research group, he has started a real revolution regarding the possibility of using their Material Ecology for the study and design of a new biocompatible material that, at the end of its life cycle, turns into water. Studies and experimentations on materials took shape in 2019, in Aguahoja, a small pavilion, which was immediately purchased by San Francisco's MoMA, whose structure is made from shrimp shells, insects' exoskeletons and dead leaves, all 3D printed by a robot, shaped by water and colored with natural pigments. (Fig. 4)

The realization of the pavilion demonstrates how, even working with natural materials, it is possible to create extraordinary shapes and structures. At the base of this new material there are cellulose, chitin and pectin, three of the most abundant materials in nature – this means that it would be possible to produce them in large quantities saving us from the excessive use of plastic.

Oxman's is a small probiotic architecture experiment that could open the doors to important future alternatives and that highlights the importance of a relationship between architecture and nature, a seemingly elementary intuition but it is not so. Aguahoja is the expression of the ferment of contemporary architecture and design and also of a new reality in which, thanks to the use of new technologies, it is possible to realize a real methodological rethinking of the way of doing architecture and design.



Fig. 4 Aguahoja Pavillion - West elevation © Neri Oxman and The Mediated Matter Group

3. Conclusions

These three different experiences are the expression of a multi-level and multidisciplinary approach to the theme of ecology and how this can move at different project scales: global, urban, and design. The ferment and interest around ecology topic, however, have led to a sort of oversaturation of the term, which today seems to have become a common prefix to promote policies and strategies – as if the "*echo"* suffix could be a guarantee of success. What is happening is an abuse, instead, as well as an improper use of the term that leads to even describe as ecological all those actions and strategies that are completely insensitive to the future of the planet: a real *"ecomania".*

The most striking example is certainly the **city of Telosa**, a newly established city that is going to rise in the Great American Desert, in the western United States, designed by the Danish architect Bjarke Ingels together with his BIG studio and commissioned by the multimillionaire Marc Lore. Telosa is presented as the city of the future, capable of being the "synthesis of the best of current cities" (Marc Lore 2021) but its premises are very far from the concept of sustainability, if we think that the masterplan establishes to occupy an area of over 600 square km which could reach a maximum number of five million inhabitants in 2060. A new Dubai showing up from nowhere, but much larger than the Emirates capital and which claims *to "set a new global standard for urban life, expand human potential and create a project for future generations"* (Marc Lore 2021). What is proposed as a city role model, in reality is unsustainable not only at an environmental, but also at an economic level, due to the fact that includes an investment of 400 million dollars. (Fig. 5) [6]



Fig. 5 Image of the Telosa city © 2022 Junto Group LLC

Today, as in the past, human curiosity continues to show its duality: on one hand to innovate respecting the Planet and future generations, on the other to intensify the transformation for change, unconcerned about its repercussions.

The previously described projects show mutually different experimentations and outcomes, which however contribute to create a first taxonomy of what may be the declinations of the project in the ecological transition era, namely:

- **utopian** as The World Park Project with which Richard Weller imagines an ecological infrastructure able to protect planetary biodiversity and to bring mankind closer to nature, through the exploration of its trails;
- **weather-based** as Philippe Rahm's Jade Eco Park, whose project is based on the analysis of existing climatic conditions mapped via computational simulation that follows fluid dynamics (CFD) creating a new atmospheric landscape;
- **nature-inspired** as Aguahoja by Neri Oxman that is inspired by natural cycles through the use of a new material that comes from nature and returns to it when the pavilion completes its life cycle.

Despite the different nature and ambition of these experimentations, a common factor comes to life: the responsibility and the key role of the author. It is also clear that the results achieved owe their success to multiple and specific skills of the individual designer – or the team of professionals that revolve around the project.
What is certain is that the reformulation of the way of designing and the pursuit of objectives such as ecology and sustainability, have put in play professional figures with an original and innovative nature, the ones that Elena Granata defines as *"placemakers",* new protagonists who deal with “real *processes of de-materialization of the world, giving birth to new economies, new possibilities of living and new forms of sociality".* [7]
The ecological transition project brings out new professional figures that we could define as "*ecologicalmakers",* hybrid professionals capable of translating, through the project, a democracy made of: nature, animals and microorganisms. Referring for example to the previously presented case studies: Richard Weller is an architect–landscape designer, Philippe Rahm is an architect–meteorologist while Neri Oxman is an architect–designer–biologist.
In conclusion, we can say that the complexity and the responsibilities of contemporary design towards the ecological transition has decreed the beginning of a new generation of protagonists, declaring the end of the archistars era.

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THE DRAWING OF THE NATURAL LANDSCAPE IN THE HOUSING. JACQUES-FRANÇOIS BLONDEL'S 18TH CENTURY RECOMMENDATIONS.

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Abstract
Understanding Ecology as a science that focuses on the relationship between beings and their environment, when we transport it to the concept of human landscape, some relationships between architectural design and nature assume great relevance. Architectural treatises since the Illuminismo have been reaffirming how fundamental is the relationship between the built object and the outside, both from the point of view of comfort, as well as its reading and aesthetic experience - nature actively participating in these experiences of inhabiting led by the gaze.
It is difficult to imagine projects that ignore the symbiosis with the environment or the atmosphere that surrounds them, and this is perceived from the Roman domus, with their internal courtyards, to the present day, with gardens, walks and external areas, where sustainability increasingly governs housing proposals.
Living today in this suspended world implies asking what is the role of the house in the individual's relationship with the community, and with himself, with the role of architectural and urban voids becoming increasingly current, in a desired balance with the gaze and feel it.
Thus, this article demonstrates, through the study of several examples, the design relationship between the dwellings and their external spaces, focusing on the 18th century recommendations of Jacques-François Blondel, with reflections on the architecture of today in the city of Recife, Brazil,

Keywords: housing, exterior, nature, gardens, landscape

1. The indoor and outdoor landscape
The relationship between man and nature, from the perspective of architecture, has a significance in contemporary times centered on a kind of ecological commitment that is increasingly emerging. The understanding of the concept of landscape, as a part of the ecosystem, including all the complexity of human life, implies a much more comprehensive relationship than the one previously attributed by architects, centered on the dimension of gardens and outdoor areas in ancient cities..

Liz Abad Maximiano states that “in practically all civilizations, the most elaborate concept of landscape, both in the arts and in its application in gardens, was, until almost the 20th century, a

subject for few" [1], and throughout its development, other possibilities of consideration and analysis of the landscape were presented, in addition to aesthetics, as economic and social.

The aesthetic delight arise from a cut of nature. It comes from the environment shaped under the gaze, and this is one of the nowadays attitude of landscape consideration, as a result of the action of man on nature, and which configures the concept of cultural landscape, "modeled from of a natural landscape by a cultural group. Culture is the agent, the natural area is the environment, the cultural landscape is the result"[2], that is, the men's action with a purpose, taking place in the natural environment.

The internal and external gardens spaces of antiquity were configured as the action of man on his environment. In addition to the contributions of environmental comfort and the benefits of living outdoors, they had first of all, a purpose of rest and contemplation. The Roman *domuns*, adressed to the wealthiest strata of the population favored the central courtyard, a place for particular delight, a oasis inside a large urbanized area of the city. A proposal to integrate the external space into the housing.

In France, since the Renaissance period, his castles show us the concept of the paysage aimed to the purpose of aesthetic delight, where the nature surrounding the building is considered an extension of it. The keynote here is the look, and a look that can shape nature according to classical compositional principles such as order, proportion, symmetry and character of the building, with a certain expressive purpose in mind. The nature shaped by man, in view of an artistic intention.

In 1971, Gordon Cullen (1914 -1994) wrote *Urban Landscape*, an approach to landscape centered on visual delight, where he explains the concepts of "Interior Landscape" and "Outer Compartment". Both concepts focus on the visual effect that certain spaces give us from their composition and situation in the city, leading Cullen to state that, from the point of view of the look: "[...] it is very small the difference between "inside" and "outside." [3].

The image below illustrates how the city's buildings, in this case the Houses of Parliament in London, are functioning as a backdrop, and visually forming an "outdoor compartment" for people who stroll and have fun on the esplanade on the other side of the river. river.

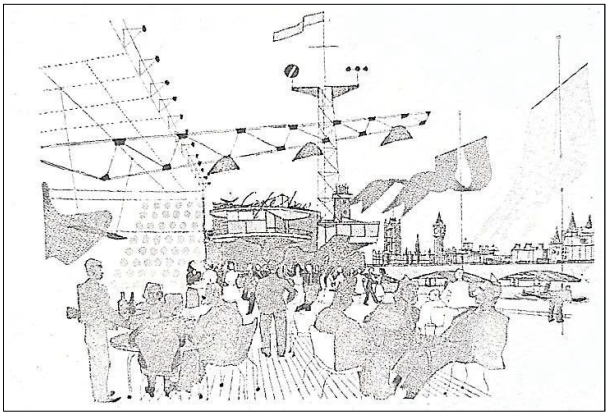


Fig. 1: Outer Compartment by CULLEN. [3].

In the century of enlightenment, Jacques François Blondel (1705 - 1774) reflected about the architectural space as a totality between the exterior and the interior, and the design as an unit, the exterior actively participating in the design of living spaces. His recommendations could contribute to the consideration of the importance of the exterior area in the project of the building, with repercussions in the protagonists of *Art Nouveau* and also in the modern movement of the beginning of the 20th century, when the project was thought in an integral way between the outside and the inside of the house.

2. The relations of the building with its outdoor in Blondel

Jacques-François Blondel, in his work *Cours d'architecture, ou Traité de la décoration, distribution et construction des bâtiments*, written between the years 1771-1777, presents contributions over the

centuries to the housing project and its relations with the surrounding nature. His contributions stem from the value attributed to certain positions considered classic, given that, for French academic treatises of the period, the concept of classicism was linked to nature, the greatest master of the relations of proportion and harmony.

Right at the beginning of the *Tome 4* of this *Cours*, Blondel, praising the buildings erected by the good French architects, states that they were conceived from the most famous examples of Greece, and that the good architects considered these peoples as the creators of the beautiful architecture by producing so many models of perfection in this genre, that we could see them as the "inventors of art" [4]. In this statement, it is demonstrated to us his evaluative consideration of classicism and its principles, as well as his conservative position, for whom the beautiful proportions were extracted from nature.

> *L'homme à talent en Architecture , comme nous l'entendons, est celui qui.... par la science des combinaisons, sçait observer des rapports exacts, entre les masses & les principales parties de son Edifice: celui qui, épris des regles de l'Art & des lois de la symétrie, sçait tréunir dans son projet, la distribution des dehors avec celle des dedans, la décoration extérieure avec l'intérieur, enfin, la solidité avec l'économie qui doit être observée dans tous les divers genres d'entreprises.*[4].

Further on, Blondel reaffirms the importance of the architect to jointly design both the building itself and its gardens and internal spaces: "*Voilá pourquoi, il est essentiel, ainsi que nous l'avons remarqué plus d'une fois, que « l'Architecte qui donne les dessins du Bâtiment, donne aussi celui des Jardins & des leurs dépendances.* »[4]. It is worth mentioning that Blondel was a professor at the Royal Academy of Architecture, founded by King Louis XIV, and makes his comments considering architecture as an art, based on artistic principles inherited from the Italians, where the reference to the general laws of nature, to metrics, and to the Classical compositional principles are inherent to academic architecture. Here, the aesthetic dimension of the building is decisive, and therefore, its placements always highlight the aspects that relate to these criteria. Figure 2 below illustrates the plan of a sixty-six *toises* palace, and how it forms a unique conceptual weave with its gardens, which are a true extension of the building:

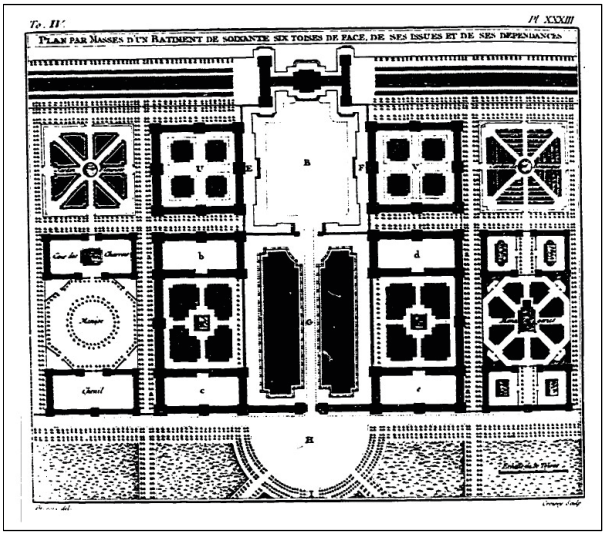


Fig. 2: Blondel's plan of a sixty-six toises palace with its gardens. [5].

For Blondel, the appearance of the facades must compose the building in a way that harmonizes with its interiors and also with its gardens. To this end, he elaborates in Chapter II of his work the concept of *Distribution*, which goes beyond the simple arrangement of rooms according to the owner's needs, since it is not enough to design the appropriate place for the *pièces de parade, de société & de commodité*, regarding its dimensions and formats. It is necessary that these environments emanate from the outside, from the building bodies that determine the order of the facades, with a correspondence between the exterior of the building and its interiors. The beauty on the outside must announce the beauty on the inside. There must be agreement between the elements of the exterior, such as character, genre, and expression, with those of the interior, such as the style of carvings,

gilding, and painting, so that both convey to strangers the dignity of the owner, and the Architect's experience and ability [4].

Thus, the Blondel *Distribution* concept concerns the set of exteriors, gardens and interiors of a dwelling, characterizing with the *Convenience*, the second major concern that the architect must have in their projects.

For him, the origin of the distribution of buildings lies in the need to protect themselves from the weather and to seek amenities related to civil life. We see his traditional reference to nature and its laws, when he alludes to bees, which gave men the first notions of the art of dividing and sharing the interior of their homes.

He continues that the cultivation of land gave men the idea of property, when they were forced to demarcate their limits, and where they erected their first huts, which later would develop further so that they could establish their residences. The first divisions were related to the organization of areas destined to agriculture and animals. The number of dwellings increased as the number of families increased, becoming villages, towns and cities. Later, with the facilities and amusements that came, men began with concerns about making their domestic environment healthier and more comfortable, as a result of the exchange of ideas provided by trade with other cities.

Thus, concerns about decency begin to be introduced into their customs, and start dividing the spaces of the house into several rooms, divided by sex, as well as the concerns about old age and infirmities make them opt for more accessible and affordable places and more durable materials.

These advances, according to Blondel, have made housing more comfortable and pleasant. For him, if men had less ambitions, they would have been content with simpler houses, since many at that time still preferred life in the countryside. It was life in the capitals that caused needs to accumulate, through the examples given by the splendor of nations, the ambition of the people, the external cult of religion, the great ceremonies. [4].

Further on, he discusses the Distribution and Decoration of Private Gardens, in chapter I of his work, called *Traité de la Distribution Extérieure et Intérieure des Batiments*, where he mentions the importance of thinking about the housing design as a whole, as already mentioned, including the gardens:

> [...]*nous persistons à désirer, que le jeune Architecte s'occupe, lorsqu'il compose le projet de son Edifice, à concevoir en même temps, les Jardins, les dépendances, & les diverses issues, avec autant de soin que toutes les parties qui regardent la distribution de son principal corps-de-logi.*[4]

Regarding the arrangement of elements for the design of a *Jardin de Propreté*, Blondel indicates the use of delicate, sweet and naïve shapes, since contrasting shapes that cause efforts of perception, confuse the delight that we must experience in a place destined to the fun and pleasure. [4]

Discussing the terraces, that is, the large flat areas between the gardens and the building, Blondel writes that they are the parts that best represent the magnificence of the owner, especially when they are arranged in such a way as to form several amphitheater-shaped gardens, embellished by large stairs and walls, treated in the same genre as the garden, and composing with the importance of the building to which they refer.

Blondel divides these areas into three types, the first being supported by sumptuous walls that contain architectural elements such as moldings, partitions and carved pieces, finished with balustrades and stairs in stone or marble. The second type are those that, instead of walls, are supported by grass terraces, between which floors are developed to facilitate the route, decorated with trees in the shape of a ball, and statues. Finally, the third type are those that do not have walls or grass terraces, and have smooth and continuous ramps, where platforms, platforms and blocks of plants are arranged, in a symmetrical composition. [4]. Figure 3 below is an illustration of his work, which illustrates a model of terrace with access stairs and walls with decorative sculptures:

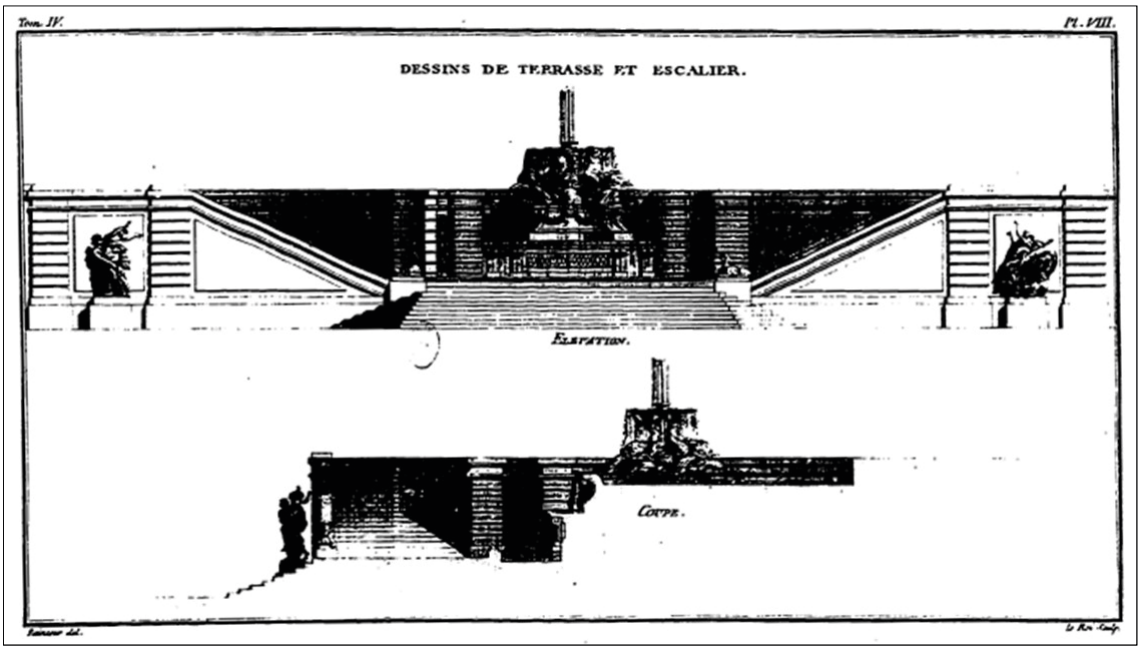


Fig. 3: Blondel's terrace with access stairs and walls with decorative sculptures. [5]

And complementing this example, we have in Figure 4 below the Maisons-Laffitte castle, a project by François Mansart, cited as one of the great architects by Blondel, where we can see the gardens and terraces, still in the 17th century. Let us observe that these terraces and gardens are foreshadowing the arrival at the building, a true promenade, inserting the visitor into the dimension of the property in a totalizing way: *"*[...]*& que le dehors doivent annoncer, plus qu'on ne s'imagine, la beauté & la dignité du principal corps-de-logis*." [4].



Fig. 4: The Maisons-Laffitte Castle, a project by François Mansart. [6]

Finally, we highlight another design concern of Blondel, which concerns the look, the visual effect that the architectural work will cause to the observer, the aesthetic delight that presupposes an erudition in dealing with the angle of view, with a predominantly classical bias. There is, at all times, a concern

with the perspective view, with the effect that the planned set of work will cause on the observer, where symmetry is a constant search.

This refers to the design practice of the rows of rooms, the so-called *enfilades,* according to him one of the most important aspects to be observed in interior design, because, from the moment that the rooms, as well as their doors , are aligned with each other, will provide visual integration between the spaces of the dwelling, so that not only the entire extension of the interior space of the building can be enjoyed, but also its exteriors, defining its limits for the observer, and communicating the grandeur and power of its owner by visualizing the extent of its property. [4].

Here, the *enfilade* provides this visual integration between the building and its external space, making the external space part of the internal space in a visual way, thus punctuating its concerns with the aesthetic delight that the design of the natural landscape causes to the internal observer.

3. The building and its outdoor in the housing projects of Recife, Brazil

The recommendations found in the work of Jacques François Blondel had subsequent repercussions, considering his academic performance, and echoes of his teachings also in Brazil, from the 19th century. Among them, we emphasize the interior and exterior integration of the building and the appreciation of nature, not only from the point of view of from the point of view of comfort, but also of its aesthetic attributes, with the use of classical compositional principles to value the viewing angles and the aesthetic delight that comes from it.

The modern architectural movement of the following century only consolidated the contributions of the natural environment to the project. That is, how to take advantage of the external environment to enhance the spatial quality of the project. A correct orientation of the houses, favoring good sunlight and ventilation, healthiness, thermal comfort and the benefits of an outdoor life, which can be enjoyed from the spaces, began to be part of modern houses, such as terraces, porches, balconies and recreation areas, to name a few.

In current design practice in Recife, architects have in mind the need to study the surroundings of the building within the site, which is locally called *agenciamento*. It is the *agenciamento* that defines the distribution of accesses, exits, gardens, planters, corners, walls and everything that can be part of this space, with a view to visual delight and harmony with the building.

In this *agenciamento*, we observe that the front part of the building, which gives access to the visitors, is always more valued, and therefore more emphasized in its constituent elements. Certainly, the buildings to which Blondel was directed, in the recommendations of his *Cours*, were those destined for the upper strata of French society. However, as a design procedure and proposition of elements that can symbolize the importance and pomp of the owners, we have that in nowadays, the monumental entrances of the houses of wealthy families in Recife maintain this reference of frontal treatment to the building.

We observe that people arrive at the entrance of the house in a solemn way, after going through levels, stops interspersed between the border of the patio and the entrance hall. On this route, little by little, the treatment of the gardens, the types of plants, the lighting, the coatings can be observed. Arriving at the entrance hall is the culmination of the journey. The photos below exemplify this treatment that was applied to the accesses of a house in the Metropolitan Region of Recife, where we observe a similarity with Blondel's propositions discussed above.

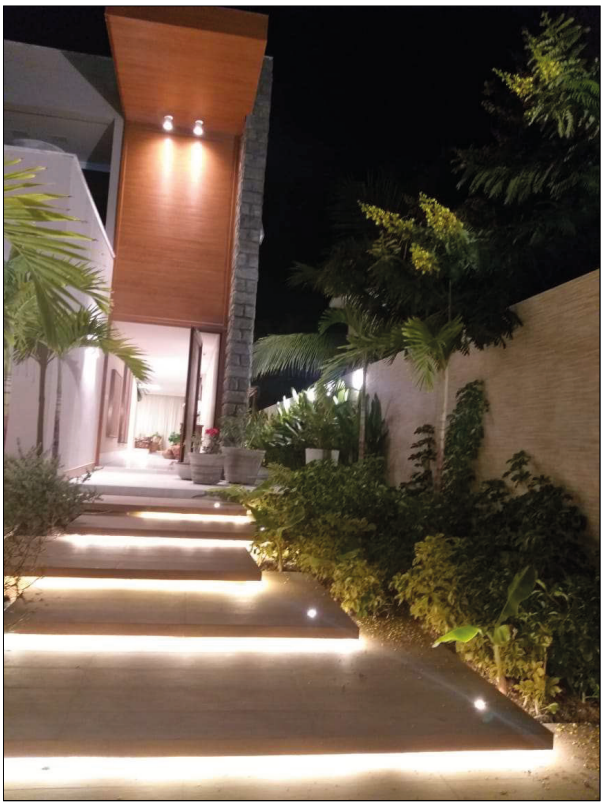


Fig. 5: Examples of blondelian levels in the accesses of house located in the Metropolitan Region of Recife. [7]

Continuing, the blondelian resource of the exterior landscape that enters the interiors of the dwellings is also identified in the projects of the wealthiest classes in Recife. The surrounding nature acts as a complementary element in the composition of the internal scenarios. In this houses, it is observed that the focused vision is valued and conditioned, from a project conception that used the classical composition principles such as ordering, proportion, symmetry. and character. In the examples below, [Figure 6 and Figure 7] we see how these principles are the composition guidelines of the project, and how the exterior is visualized from the interior, in a way that it interconnects with it in a way that makes difficult to separate the “outside ” and the “inside”, as Gordon Cullen mentions.



Fig. 6: Nature as a internal scenarios of house located in the Metropolitan Region of Recife. [8]



Fig. 7: Nature as a internal scenarios of house located in the Metropolitan Region of Recife. [8]

3. Final considerations

The concept of landscape, understood nowadays in a more complex way, was once directed to the art of gardens, which emphasized the spaces of nature shaped by man for his delight and pleasure, always conditioned by the built spaces of cities, whether public, whether private. The landscape was

taken in the reflection of this work as a cut of the environment defined by the look, and this cut, in the case of architecture and urbanism, presupposes a constructive circumstance. Thus it is relevant to observe the relationship between the environment and the project, where the importance of nature for everyday life is increasingly assumed.

Jacques François Blondel, through his *Cours d'Architecture* from the last quarter of the 18th century, will contribute with recommendations regarding the landscape, which in this case includes the dwellings, their exteriors and interiors, and the existing relations between these two environments, the natural and the built, shaped by the gaze, and aiming at the aesthetic delight.

The first recommendation concerns the consideration that must exist, on the part of the designer, of the indissolubility of the external and internal areas in the project, since the building, its interiors and its gardens are a unison whole. The design of the natural landscape in the house also assumes the leading role, the look from within to be directed outwards, and vice versa. This is achieved through artifices arising from the compositional principles of ordering, proportion, symmetry and character, propitiating a classical composition and conforming its concept of Distribution.

From Distribution, Blondel defines the second point, which concerns the character of the building, which must be communicated to the eye from the entrance of the property, passing through the gardens, and arriving at the interiors, with their related decoration. Everything should denote the importance and prominence of the owner, when it is the intention. Thus, Blondel discusses models of terraces and gardens that can serve as design inspiration. Finally, from the concept of Enfilade, which unifies the property as a whole in a single view of the observer, paying attention to the importance of the look, of the significance that the aesthetic delight causes to the observer.

Examples that are directly linked to Blondel's recommendations were found in contemporary projects in the city of Recife, where we could observe design practices that emphasize the power and wealth character of the owners, with sumptuous entrances composed of blondelian levels, in composition with gardens and lighting of Spotlight. Other examples confirm the permanence of classical composition principles, arising from the ordering, proportion and symmetry of spaces, programmed with a view to a focused vision, centered on the natural landscape, which enters the interiors and are inseparably part of them.

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[7] Photo by the Authors.

[8] Photo courtesy of Lucia Helena Andrade Lima's Office.

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Digitalisation and ecological transition through digital twins. An added value for society.

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Abstract
Digitalisation and ecological transition are two great areas that in recent years are transforming the way of life of our society.
The questions are different: how can digitalisation foster the ecological transition? How can the current heritage constitute an added value for the challenges of the future?
The study of digital twins determines a conscious situation of the reality we live in, encouraging methods of intervention.
The contribution focuses on the analysis of digital twins, differentiating them into five levels with a progressive development of automations and artificial intelligence, up to make the model independent from a decision-making point of view, that is, able to evaluate and decide independently on the basis of the data collection.
The digital twin, therefore, has the task of entering into the essence of the territory and the buildings, analyzing how man relates to it, with the aim of presenting itself as an added value to planning and sustainable management.
The goal is to clarify the overview of digital twins at present and to determine how they can become a tool to improve the quality of life of our societies, generating social and economic value.

Keywords: Digital twin, ecological transition, big data, smart city, sustainability.

1. Introduction
It is an objective fact that large flows of people are moving from small and medium-sized inhabited centers to metropolitan cities, several studies confirm that large cities (from 1.5 million inhabitants upwards) are experiencing a period of growth in terms of population and are destined to be so in the next few years, vice versa the smaller towns are suffering from depopulation. From these migratory flows a series of problems arise, for the smaller towns there are problems of abandonment and what follows, from the lack of work, to the deterioration of the building fabric to the low prospects of the future for those who remain. For large inhabited centers, new challenges are created linked to various fields: housing, infrastructure, transport, energy and health. However, providing these services to a rapidly growing population will be difficult. John Wilmoth, director of the population division of the United Nations DESA, says: "Managing urban areas has become one of the most important development challenges of the twenty-first century. Our success or failure in building sustainable cities will be an important factor in the success of the United Nations development agenda "[1].
In parallel to these aspects, climate change and the conscious decisions taken by scholars, politicians and experts are changing the way of life of people, the way in which they relate to the context, creating and encouraging new development opportunities. sustainable. Another aspect that has influenced and increasingly influenced human life for about twenty years is digitization. The latter takes possession of every aspect of the human being and its context in a transversal way. We will analyze how digitalization relates to people and environments, the interconnections between humans, buildings, infrastructures and cities. The digitization of the built environment, made possible by increased computing power, cheaper sensors, the Internet of Things (IoT), advanced analytics and greater

sophistication of three-dimensional visualization and immersive environments, has the potential to actively contribute to making cities smart and fostering the ecological transition.
Starting from the concept of a smart city, dating back to 2000 [2], the basic idea is that digital technology and data are used effectively to address urban and environmental challenges. This is no longer such a radical idea as it was in 2000, when digital technology was still in its infancy, the iPhone had just launched and digital platforms like Uber and Airbnb were still seen as the wave of the future. Since then, we have witnessed the digitization of city infrastructures that provide real-time transport data, energy data from smart grids and smart metering, data from mobile phones that track the movements of entire urban populations and that monitor energy consumption through apps. of our homes. This proliferation of data creates the ability to use it to address the challenges of our city through more informed decision making, better performance and optimized resources [3]. In this digital age, we are surrounded by huge amounts of data. One question is how can we organize and leverage the most relevant data, to plan and develop solutions that will improve the way we live in our city?
The construction industry is evolving rapidly, with unprecedented investments in technology set to transform the way buildings and infrastructure are built, used and maintained. The inexorable push towards a use of digitization in favor of ecological transition means that in the near future buildings will no longer be based only on pre-programmed responses, but will instead have to be able to program themselves by monitoring the environment, the different states of the system, occupancy and behavior patterns, using these data to predict future building states and decrease consumption. This goes far beyond what is possible with current building controls, based on lone sensor readings. To enable sustainable change, a new set of tools is therefore needed, which enriches sensor data with much more in-depth information: a digital twin. The digital twin concept is a revolutionary tool for the industry to bring about this transformation. Digital twins are a mature area for research. The Cambridge Center for Smart Infrastructure and Construction, supported by the Ove Arup Foundation, has initiated a project entitled "Digital Cities for Change", with additional funding from the Center for Digital Built Britain [4]. The research team is currently developing a digital twin pilot project for the Cambridge subregion in collaboration with local authorities. The Cambridge Digital Twin pilot project will test how policies isolated from transport, housing, environment and energy can be bridged using the digital twin and will quantify some of the interdependencies between transport and residences for air quality and energy infrastructure in relation to changes and uncertainties. [5]. Importantly, the work will test how the Cambridge Digital Twin can be combined in local authority workflows and used with other models, or whether it should remain a standalone tool. This will help us understand how to best design digital twins and associated processes so that they can be used on an ongoing basis by city governments.
However, although digital twins are clearly in vogue, we have yet to define the extent to which they can generate value, have the potential to transform existing heritage into an economic and social resource. The industry is currently burdened with conflicting definitions, misunderstandings and confusion about what a digital twin is and what it can do. In the next paragraphs we will define what is meant by digital twin, classifying it into five levels and analyzing case study the Virtual Singapore.

2. Digital Twin

In 2003, Michael Grieves (chief scientist for advanced manufacturing at the Florida institute of technology) coined the term "digital twin" as part of his research on product lifecycle management [6]. During a Product Lifecycle Management (PLM) course at the University of Michigan, Dr. Grieves described the digital twin as the virtual and digital equivalent of a physical product. However, the concept had become a reality long before modern terminology. The concept of digital twins dates back to the 1960s; in particular it was applied to NASA's Apollo 13 spacecraft [7]. The spacecraft was designed and planned using simulations. The models became vital to save the three-man crew, more than 320,000 km from Earth. General Electric, Siemens and Rolls Royce also designed rotors, turbines and motors with the aid of simulations decades before the term was coined. Likewise, the oil and gas industries have been working with fuel tank simulations since the 1980s. Prior to Grieves' "digital twin" minting, the industry used different terms such as "digital shadows", "digital avatars" and "digital models". We need to make an important distinction between a digital model, a simulation and a digital twin. A digital twin is not a static model but rather, a reactive system connected between the physical and digital systems, a virtual representation of a real twin interconnected by a continuous exchange of data.
Even today there is still confusion about the definition of digital twin, here are some definitions: For NASA a digital twin integrates ultra-high fidelity simulation with vehicle health integrated on board through the management system, maintenance history and all historical fleet data available to reflect the life of its twin flight and enable unprecedented levels of

safety and reliability. For IBM, a digital twin is a virtual representation of a physical object or system during
its life cycle, using real-time data to enable understanding, learning and reasoning. Siemens, a digital twin is a virtual representation of a physical product or process, used to understand and predict the performance characteristics of the physical counterpart.
For Microsoft, the digital twin is a virtual model of a process, product, manufacturing asset or service. Connected to sensors and the Internet of Things (IoT), combined with machine learning and advanced analytics, can be used to view device status in real time. When combined with 2D and 3D design information, a digital twin can visualize the physical world and provide a method to simulate results from the virtual model directly to the real one.
Michael Grieves defines it as a set of virtual information constructs that fully describe the potential of a real physical product of a building, from the micro (atomic level) to the macro (geometric level). Characterized by three parts, physical element, real element, virtual element and the set of data and information that provide the connections between the physical and virtual system.
Although the characteristics of the aforementioned definitions are relatively consistent, the stated purposes of digital twins can vary widely. What is perceived as the main purpose is likely to vary according to the interests of the researcher or company involved, from increasing the return on investment, to ensuring safety, to energy efficiency, rather than ensuring high standards of maintenance.
We can make the broad consensus on the definition of a digital twin more precise by stating what it is not. Neither a Building Information Modeling (BIM), for example, nor a simulation that operates in isolation from a physical asset can be defined as a digital twin. Rather, there must be a connection between the physical and digital systems. This requires the exchange of data, as well as the inclusion of the human being, who plays a central role in the triple role, designer, occupant and user. Overall, the missing idea in the definitions is that the twin controls and optimizes the physical asset. In other words, existing definitions avoid recognizing the key role of humans and artificial intelligence.
A digital twin is the combination of a computational model and a real world system, designed to monitor, control and optimize its functionality. Through data and feedback, both simulated and real, targeting an artificial intelligence capable of learning, reasoning and making decisions independently.

3. Digital twin levels

Digital twins can be differentiated into five levels with a progressive development of automation and artificial intelligence.
The first level consists of a digital twin very similar to a conceptual model, it is connected to the real world system but lacking intelligence and learning ability. It describes a model of a resource that has engineering details incorporated and coordinated within it and which allows construction companies to carry out design, coordination and maintenance activities more easily and effectively while optimizing costs and time. This is a simple and basic interpretation of a digital twin that considers only the static data of a single process, area or structure. The task of controlling and managing aspects of the digital twin lies with the user.
By moving to a second level digital twin you gain feedback and control skills. The twin collects data of the artifact, how it is used and monitors how it reacts, providing data to create scenarios that could make improvements to the physical resource or predict what will happen, so that risks, problems and waste can be mitigated in advance. This would allow the figure in charge of managing the model to build a well-detailed forecasting and prevention scenario, designing solutions to actual needs rather than perceived needs, potentially extending the life of the asset. Also in this case, the figure of the user is called upon to decide on the basis of the data provided by the twin as it has no functions that allow it to acquire previous experiences and learn from them.
A level three model can add data and design assumptions based on the priority requirements programmed by the user, this in real time, passing from a state of fact to a project state, highlighting the changes, positive or negative. The aim is to insert design solutions within the virtual twin in order to examine and analyze how they integrate in a given context, such as the usufructuaries, and therefore the human beings who live in certain spaces and territories

relate to it, in in order to evaluate the degree of feasibility by considering the greatest number of aspects before embarking on design processes that are difficult to reverse.
These three levels are the basis for starting to build a more complex and realistic model, starting to add data sets connected with public bodies, companies and associations that in some way influence and condition the projects of a building or territory.
By studying a level four digital model, taking for granted the characteristics seen in the previous levels, a learning ability from the built environment is implemented, thanks to the contribution of multiple data sets from different sources. The model is able to use this learning for the purpose of an autonomous decision-making process within a given domain, capable of changing its own decisions based on the data collected. To be clearer, let's take a trivial example of a malfunction of a heating system, the digital twin not only notifies the failure, but also gives precise instructions on how and how to intervene, memorizing this process and adapting it to future interventions. In other words, the twin learns from feedback and experiences to acquire his or her decision-making capacity.
From level four to level five there is a complete absence of the user. The twin develops decision-making autonomy dictated by the ability to think independently, takes responsibility for the tasks that would be incumbent on a human operator, management, maintenance, safety, sustainability and improvement of the resources of a building or territory. The hallmark that more than others characterizes level five is the incorporation of lower-level twins, for example, thinking on an urban scale, in a smart city where we have numerous independent systems that work in parallel to process data and feedback, they can be interconnected to a single level five digital twin.
This twin therefore has the ability to receive more data from alternative sources, which place it in a wider context, starting to consider it as a real-time system. This could also include people and their behavior, how they relate to the territory, the interactions they create with buildings and infrastructures, developing continuous exchanges of information with those directly involved.
The true power of the digital twin, however, comes from its machine learning capabilities and the ability to move a building or operational asset into a connected set of assets and then combine planning, safety, construction and maintenance datasets to provide a rich virtual representation of the physical environment. This is where a city-level model could really begin to offer added value for understanding the nuanced interactions between parts of a city and be used to offer optimized design solutions.
The concept of digital twin places man at the center, analyzing and collecting data on how he experiences spaces, enters the essence of the territory, provides in real time a clear situation of man, building, infrastructure and territory, anticipating to a certain extent future decisions.

4. Virtual Singapore

Singapore has been a technologically advanced city-state for years now. One of the goals it has managed to achieve is to use technology to transform the way people, companies and government bodies live and work, increasing the quality of life of citizens, offering everyone a fair chance of success. despite differences or circumstances. Regardless of age, whether a tech savvy or not, the goal is for every Singaporean citizen to benefit from the digitization process as part of a digital society. This process favors in parallel what we call "ecological transition", planning initiatives, activities and projects aimed at reducing the environmental impact.
The state with the support of various government agencies and in particular the National Research Foundation of Singapore in collaboration with the French software multinational Dassault Systèmes has set itself the goal of creating "Virtual Singapore". A dynamic three-dimensional city model, a collaborative data platform, including 3D Maps of Singapore. It is the authoritative three-dimensional digital platform intended for use by the public and private sectors, people and research. It allows users from different sectors to develop sophisticated tools, applications and projects and connect them to a single platform that replicates reality in real time, with the aim of optimizing and facilitating planning and decision-making, encouraging research on technologies for solve emerging and increasingly complex challenges. This specific project, in addition to being supported by the National Research Foundation (NRF), is supported by the Prime Minister's Office, the Singapore Land Authority

(SLA) and the Government Technology Agency of Singapore (GovTech). NRF is leading the development of the project, while the Singapore Land Authority contributes its data to the three-dimensional topographic mapping and will be the operator of Virtual Singapore. GovTech provides expertise in information and communication technology and its management. It is the basis of a research and development program initiated by the aforementioned National Research Foundation at a cost of 73 million dollars for the development of the platform, as well as research on the latest technologies and most innovative instruments. The platform collaborates with government agencies, companies, universities and partners of various kinds, from public transport managers, to waste managers to app creators, to make the most of the potential of Virtual Singapore. The model includes three-dimensional semantic modeling, includes information such as texture, material representation of geometric objects; terrain attributes, e.g. water bodies, vegetation, transport infrastructure, etc. Building models encode the geometry and components of a structure, such as walls, floors and ceilings, down to the smallest detail, as in the composition of granite, sand and stone in a building material. 2D data and information coordinated through existing geospatial and non-geospatial platforms such as OneMap, People Hub, Business Hub, enrich the three-dimensional model allowing such precision to make objects measurable.

Virtual Singapore is based on the following main functions: that of experimentation, can be used for test-bed or virtual experimentation activities. It supports a semi-automatic planning process where planners can quickly filter buildings of interest based on pre-set parameters. For example, it is possible to filter buildings based on location, exposure, number of floors, amount of sunlight, roof surface and its characteristics, to allow designers to analyze which buildings have the greatest production potential of solar energy and therefore more suitable for the installation of solar panels.

It can be used as a virtual test bed, to approve or disapprove certain projects and services, or to refine them and make them more productive. For example, the Building Information Modeling (BIM) model of a new stadium with semantic information within Virtual Singapore could be used to model and simulate crowd dispersion to establish evacuation procedures during an emergency.

Another main feature concerns planning and decision making. With a rich data environment, Virtual Singapore is a holistic and integrated platform for developing analytical applications (e.g. apps). It could be developed to analyze transport flows and pedestrian movement patterns, with data flows found daily by integrating and perfecting the apps within the digital twin. Virtual Singapore allows, opening no small debates on privacy, to public agencies, academia, research communities, the private sector and even citizens to use the information and capabilities of the system often for the purpose of political and business analysis by impacting in the decision-making process. Supporting and facilitating governance is a key aspect of this project. The goal is to provide tools and information to citizens, creating a more aware and active community in political and social decisions. It takes "smart" citizens for a "smart city".

By making the best use of the big data environment and aggregating information from the public and private sectors, the potential uses of Virtual Singapore in addressing increasingly complex issues are manifold.

It integrates various data sources, including government agency data, information from the Internet and dynamic real-time data from Internet of Things (IoT) devices. The platform allows various agencies to share and review plans and projects of the various stakeholders who in various ways contribute to the interventions and management of buildings and city infrastructures. For example, it allows you to visualize the existing landscape with respect to ongoing / future renovation or renovation projects, which will allow agencies to collaborate to harmonize and regulate their respective projects. At the same time, giving designers the opportunity to consciously integrate the project at 360 ° within the territorial reality, reducing the gap between design and implementation.

Identifying systemic risks and allowing city infrastructures such as public transport, ports, airports, residential and industrial construction to work together more effectively, are the main reasons that push governments and clients to invest in the digital twin, put technology at the service of man to face the challenges of the future.

From this enthusiasm, we must not forget that it is always human beings who use it. We need to design human-centered digital twins that can fit into our existing organizations, helping to change them.

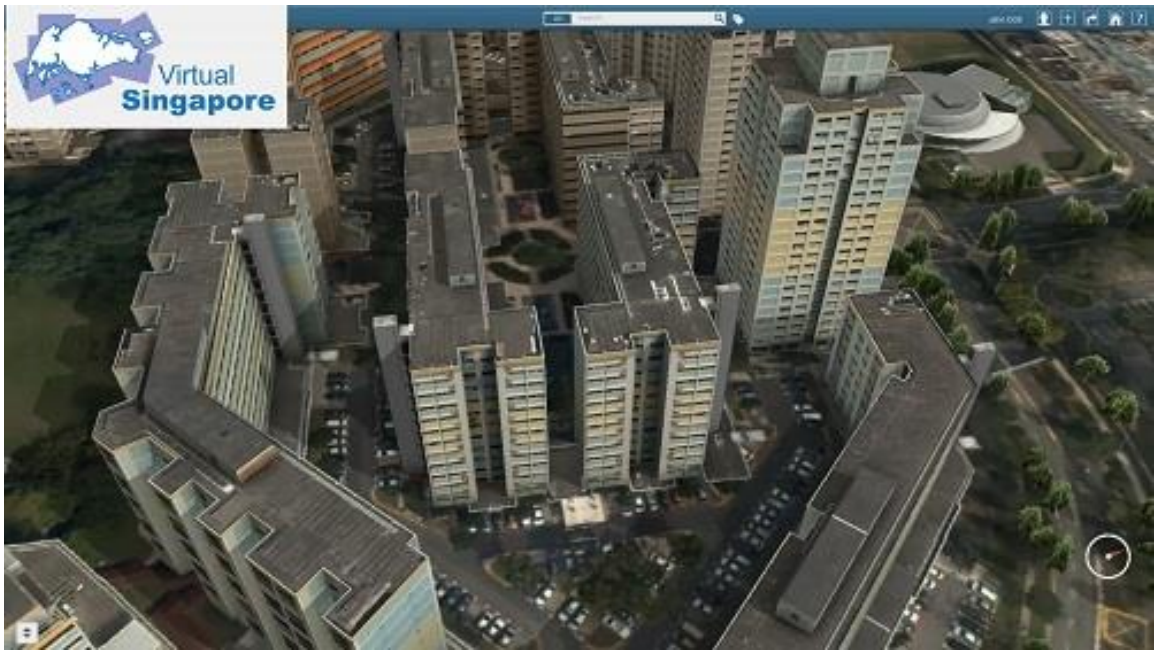


Fig. 1: Image of the Singapore virtual platform buildings © National Research Foundation

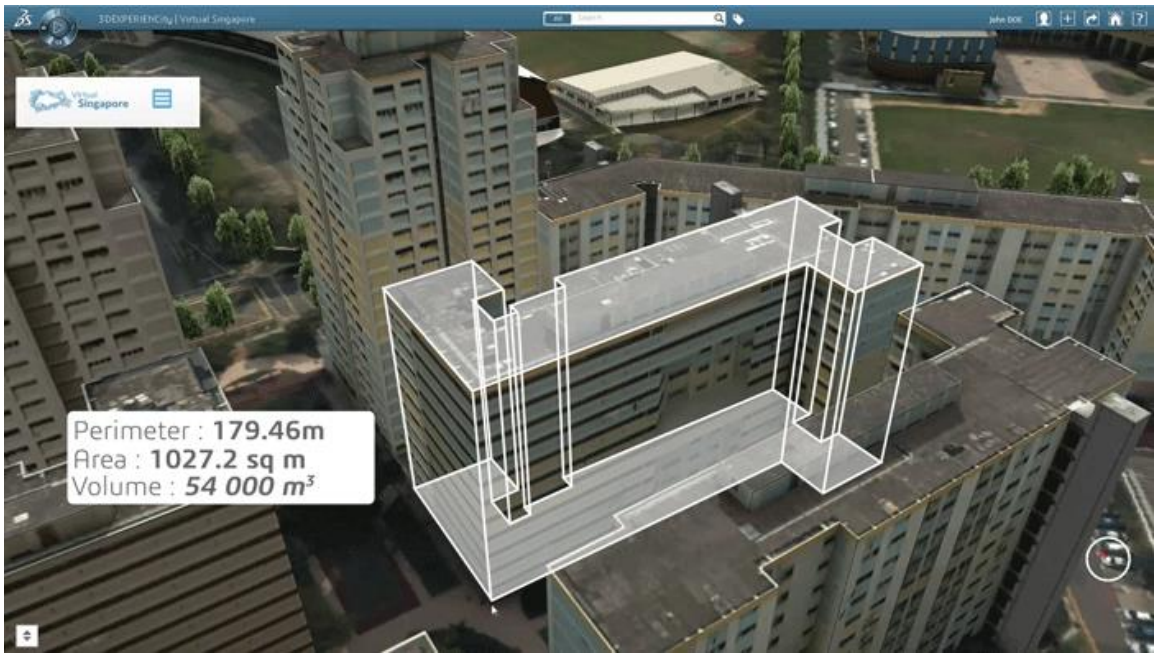


Fig. 2: Building showing a series of data within virtual Singapore © AEC

5. Conclusion

We have analyzed some aspects of the digital twin through Virtual Singapore, we have given a definition of the term digital twin by differentiating it into five levels. We conclude by stating that we are far from levels four and five, the themes and problems to be addressed, analyzed and overcome are different. It is clear that digital twins must be user-centered, inclusive of society - the ultimate beneficiary of a landscape of digital twins - but also inclusive of those who explicitly interface with digital twins, the decision makers.

Any major change in an industry requires overcoming technical, legal and cultural obstacles. This is especially true with emerging technologies such as the digital twin. It is necessary to introduce new skills and talents, create new training infrastructures and change cultures. The main risks in the current scenario will also have to be considered; these include big data, privacy, security, and

economic returns. Furthermore, this must be done in the face of uncertainty about the long-term return on investment, where consultants and professionals will play crucial roles. Even if the protection of the environment does not hold an economic discourse and for this reason local governments and policies play a main role in favoring the development of digital twins.
There are a number of technologies and trends that we need to consider when thinking about the evolution and future of digital twins. These include connected devices, cloud and edge computing, 5G and autonomous vehicles which can influence how we deliver new products and services. Connected devices are bringing great benefits to the built environment, rapidly changing the way humans relate to it and, consequently, the way we design and offer services.
We now live in a world where data affects every aspect of our life, which raises the urgent question of what kind of data and how much we need to collect to get the desired results. Although data-driven decisions are only as good as the data collected, the answer to this question isn't always clear up front. Data ethics is an area that needs further discussion. Privacy, trust and surveillance are key issues, particularly with a more widespread implementation of IoT technologies. Sharing data has a high cost and a great deal of tension, as digital knowledge, practices and culture are not yet converging in the built environment and there are inconsistent ideas on how to proceed. There will be a need for further social and political debates and discussions about the benefits and trade-offs of data ownership and privacy before we see a consensus in this area.
To achieve digital twins of great value, we need to develop partnerships through deep understanding and greater collaboration around a meaningful approach: a shared vision supported by clear action. The Center for Digital Built Britain has published The Gemini Principles, providing a first guideline for the development of digital twins [8].
The research focuses on bringing out the advantages of a tool still in its infancy, with considerable potential to improve the quality of life of our society, starting with man, the environment and the existing building stock. Doubts and uncertainties are not lacking, how is the privacy of users protected? Is it right to rely on data alone to make decisions? And again, do we have “smart” citizens to establish smart cities and buildings? Conscious and diligent decision makers to use this great opportunity productively?
There is still a long way to go to a level five shared digital twin, but we have good reason to be optimistic about digital twins creating a social, economic, ecological and cultural revolution.

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Fengshui theories for a harmonious and sustainable environment

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Abstract
In the international scenario, China has taken a leading role in the challenge of ecological transition. In this regard, the concept of 'ecological civilisation' (*shengtai wenming* 生态文明), based on the harmonious relationship between man and nature has gained particular relevance in Chinese political discourse. As a result of China's unstoppable economic and social development in recent decades and of the several critical environmental problems, sustainable development has become the ultimate goal pursued by contemporary architects and designers. The lack of natural resources and the deterioration of environmental conditions have led to a focus on the environment, and thus to a rediscovery of the doctrines of *fengshui* (风水). The present paper aims to analyze these theories from a philosophical, environmental and ecological perspective and to examine their application in the modern area, as a means of safeguarding the harmony of the relationship between man and nature through the creation of a more eco-sustainable architectural environment.

Keywords: *fengshui*, ecological, environment, design, architecture

1. Introduction
In today's world, facing serious environmental issues, there is an increasingly pressing need to adopt sustainable development that deploys measures to protect ecosystems, reduce emissions and improve technological efficiency without sacrificing countries' growth and development, and to initiate the process of ecological transition.
In the international scenario, China has taken a leading role in the challenge of ecological transition. In this regard, the concept of 'ecological civilisation' (*shengtai wenming* 生态文明), based on the harmonious relationship between man and nature has gained particular relevance in Chinese political discourse. This concept first appeared in 2000 during the Fifth Plenary Session of the XV Central Committee of the Chinese Communist Party (CCP), reconnecting to Daoist thought which claimed the supremacy of nature, and emphasizing the need of harmonious relationship between humans and the surrounding environments. Since 2007, thanks to then-president Hu Jintao 胡锦涛 (1942), this concept has been promoted as a long-term goal of the CCP and it was even included in the CCP statute. Then it was revived and extended by Xi Jinping 习近平 (1953) becoming a constituent element of the 'Xi Jinping Thought' (习近平思想, *Xi Jinping sixiang*). Xi Jinping, general secretary of the CCP since 2012 and president of the People's Republic of China since 2013, has indeed made the concept of *shengtai wenming* a key element of the Chinese Dream (中国梦, *zhongguo meng*) and the new era (新时代, xin shidai) for the rebirth of the Chinese nation, including it in the overall development strategy based on the 'five constructions' of economy, politics, culture, society and ecology. In 2017, in the opening speech of the 19th National Congress of the Communist Party of China, a five-yearly assembly attended by delegations from all over the country and one of the most important meetings for the CCP, Xi Jinping again emphasized the importance of building an ecological civilisation in order to guarantee Chinese development and realise the Chinese dream of national revitalisation. Thus, as it can be seen, *shengtai wenming* has become a key slogan encapsulating the Chinese government's

often-used perspective on environmental action. It can be defined as an economic model based on energy saving and environmental protection.
In fact, as a result of China's unstoppable economic and social development in recent decades and various critical environmental problems, sustainable development has become the ultimate goal pursued by expert of every area, and thus also by contemporary architects and designers. Lack of natural resources, climate change and increasing pollution have led them to focus on the environment, and thus to a rediscovery of the doctrines of *fengshui* (风水) whose main aim is the realisation of man's harmony with nature and the surrounding environment, condensed into the formula *tian ren he yi* 天人合一, i.e. 'sky and man form a single entity'.

2. The origins of *fengshui*

The theoretical corpus of Feng Shui has developed continuously over the centuries, but always remaining in the field of interpretation, art, and the search for relationships between events. F*engshui* has gradually become part of modernity and has produced a unique, rich, systematic and integrated theoretical system by combining traditional elements and contemporary aspects. Although it has only gained widespread attention recently, its origins are very ancient. Despite the fact that there is not an official date for its birth, from an archaeological point of view, influences of its principles can be traced back to the Neolithic period (C 8500 – C 2070 BC). According to tradition, its roots go back to the time of the mythological rulers Fu Xi (伏羲) and Huang Di (黄帝).

The term *fengshui* appears for the first time in the Book of Burials (葬书 Zang Shu), attributed to Guo Pu 郭璞 (276-324), a legendary scholar, soothsayer and astrologer who lived during the reign of the Jin Dynasty 晋朝(265-420). Here we find the first definition of *fengshui*:

> *气乘风则散，界水则止。古人聚之使不散，行之使有止，故谓之风水。*[1]
> *Qi* rides the wind, then it scatters, it encounters water, then it stops. The ancient collected it to prevent is dissipation and directed it to assure its preservation. Thus it was called fengshui.

The term *fengshui* (literally 'wind and water') is used here to refer to the activity of identifying the channels of *qi*, which stops where water is found. [2]
Although it is first mentioned in a text from the III century AD, its origins are much older. In fact, it should be pointed out that *fengshui* is the most widespread and common name used to designate these doctrines and practices, but it is not the only one. These doctrines are also referred with other names such as *kanyu* 堪舆 (heaven and earth), *buzhai* 卜宅 (divination for a house), *dixue* 地学 (science of the earth) or *dili* 地理 (lines, models of the earth, or, in modern times 'geography'). The latter term, in particular, reveals how Chinese did not consider *fengshui* a superstitious practice but an integral part of the study of the Earth and its natural and man-made patterns.
Probably the oldest term used to refer to *fengshui* is *kanyu*. Etymologically *kan* indicates a sort of cover, and later became synonymous of 'sky' while *yu* refers to the bottom of a chariot and therefore the Earth. The aim of *kanyu* was indeed to observe and examine the signs of Heaven and those of Earth. This definition encompasses the old resonance theories of traditional Daoist philosophy, according to which actions performed on Earth are reflected in Heaven, and the movements of Heaven are reflected on the surface of the Earth.
The term *fengshui* is often mistranslated in Western languages as 'geomancy', which refers to the divinatory practices of throwing clods of earth. This translation is misleading since it relegates these theories to superstition practices. Actually, as we can see by the use of the ancient terms *dili* and *dixue*, the traditional theories of *fengshui* were considered scientifically valid and were strictly related to ancient techniques of city construction and architectural design. They used to represent a set of ancient city planning and design theories that combined and integrated different scientific disciplines, i.e. psychology, geography, landscape design, ecology and aesthetics. In order to choose an ideal building site, several different factors had to be taken into account, such as the shape and quality of the land, climatic factors, landscape, ecology and any element related the environment. The aim was indeed to select and create a habitat suitable for man's needs, an environment which would make man one with the landscape, the ecosystem and the natural environment. This ultimate goal properly fit contemporary times. In particular, the concept of *tianren heyi*, which has represented the basis of traditional *fengshui*, has been used to apply these theories to contemporary architectural projects. In the contemporary world, specifically, unite man with nature means integrating man's actions, including his architectural products with environmental models, in order to achieve harmony between human and environment. Thus, landscape projects and designs must follow and take advantage of the natural rhythm and ecological principles of a particular location.

2.1. Fundaments of *fengshui*

The aim of *fengshui* is to seek harmony between the flow of *qi* and the elements in the environment, establishing a balance of energy interactions. The origin of the term *qi* remains mysterious. Its etymology is linked to the traditional version of the character *qi* (氣), which represents the steam (*qi* 气) that rises above the rice (*mi* 米) during cooking. This symbolises the ability of energy to transform matter and the ability of matter to produce energy. The traditional character *qi* basically appears as the breath and the source of life, which operates and circulates according to a binary rhythm. However, this definition is limited as well as its translations such as 'breath', 'matter-energy', 'vital energy' etc. *Qi* is more than the breath that animates living beings. It is rather the sole reality principle that gives form to everything and every being in the universe.
Qi is related to the emblems of Chinese cosmology such as the *yinyang* pair, the five phases, the eight trigrams, which are all different manifestations of the primordial *qi*. [3]
Yin and *yang* represent the fundamental cosmic dualities, which never opposite to each other, but that always alternate rhythmically. The *yang*, which includes the Sun element, symbolises the light, the side of the mountain exposed to the Sun or the Sun coming out of the clouds. On the other hand, the *yin,* as we can see by observing its traditional character (陰) where there is the element cloud, symbolise the shadow, the cold and wet side of the mountain or the Sun hiding in the clouds. In cosmological theory, *yin* and *yang* are interpreted as the two primordial breaths, the cosmic principles that interact and alternate to give life to the universe and preside over its evolution. Therefore, they are not two opposing, antithetical forces but two phases of the same *qi* that constantly circulate, expanding and contracting. Despite being opposite in nature, they are complementary. Even if *yang* holds a dominant position, it cannot exist without *yin*. In every cosmic event, both elements are fundamental: no one cannot act without the other. It is their alternation and interaction that generates every phenomenon in the world.

Closely related to *yin* and *yang* are the five phases or five agents (五行 *wuxing*). Also for this term, there have been several wrong translations in the West, such as "five elements". They are rather 'the five phases', which represent certain qualities that cyclically follow one another at fixed points of reference in space. They are wood (木 *mu*), fire (火 *huo*), earth (土 *tu*), metal (金 *jin*) and water (水 *shui*) and correspond to five cyclical phases, each of which periodically exert a predominant influence on all spheres of life. They govern all natural phenomena, historical events, social changes and the movements of celestial bodies, basically everything that occurs in the universe. Every phase corresponds to one of the five directions (that is the cardinal points plus the centre), five colours, five emperors, etc. All the events are therefore explained by the cyclical and harmonious progression of these phases.

Another fundamental concept in the *fengshui* theories is represented by the eight trigrams (八卦 *bagua*), which are cosmic symbols in combinations of three lines that constitute the foundation of the search for the primordial energy order. Each trigram has its own designation and form. They are: 乾 *qian* 'heaven', 巽 *xun* 'wind', 坎 *kan* 'water', 艮 *gen* 'mountain', 坤 *kun* 'earth', 震 *zhen* 'thunder', 離 *li* 'fire' and 兌 *dui* 'lake'. The *bagua* are able to explain the truth of matter and indicate how to create a harmonious relationship between man and the environment.

3. *Fengshui* in contemporary architecture

The relentless economic and social development, the considerable increase in population in cities, the worsening of environmental conditions and the gradual decrease in natural resources have prompted more and more people to focus their attention on sustainability and ecology.
The unstoppable process of urbanisation and industrialisation has led to numerous environmental problems, which have destabilised the harmony between man and nature. It has therefore become necessary to move towards the creation of a harmonious and ecological development, a liveable urban environment with low pollution. In this context, the theories of *fengshui* have taken on a key role, emphasising the importance of *tianren heyi*, proving indispensable for realising the idea of developing a harmony between urban architectural space and the surrounding environment and for understanding how to make the best use of limited resources. Insisting on the concept of harmony between man and nature is fundamental to the development and improvement of modern architecture and to the creation of a more eco-sustainable and suitable environment.

In concrete terms, using *fengshui* means understanding nature, protecting natural ecosystems, correctly placing buildings in harmony with the surrounding environment and with people that is combining the environment with the physical, biological and spiritual needs of its inhabitants. In contemporary urban planning, increasingly attentive to respect for nature, strong influences of *fengshui* can be found in the so-called 'shan-shui city'. Shan-shui-city is a unique spatial planning concept, dating back to ancient times, which combines the urban construction and the natural environment, mainly composed of the mountains (*shan* 山) and the water (*shui* 水). [4] This concept was revived in 1993 by Qian Xuesen 钱学森 (1911-2009) who advocated that a *shan-shui* city shows respect to nature, adopts state-of-the-art science and technology in order to address the impacts of human activities on the natural environment. [5] Example of *shan-shui* cities are Hangzhou, Jinan, Nanjing, Suzhou, Wenzhou, Changshu and Fuzhou. These are modern cities with a unique style characterised by respect for the environment and the landscape, showing perfect integration of architectural space with the natural world. In these cities, a large part of the urban buildings is created by blending with the surrounding landscape.

Fengshui doctrines is also really close to the modern notion of ecologically sustainable development (ESD). Indeed, *fengshui* encourages a mode of production that aims at self-sufficiency and moderate consumption so as to achieve a balance between production, consumption and the exploitation of nature. The aim is to use the *qi* of the Earth in ways that will allow to achieve harmony between man and nature and its consequent sustainable prosperity.

The concept of the union between man and nature in *fengshui* also share similarities with the principles envisaged for energy efficient design. In order to build an energy-efficient building, during the planning, design and processing phases it is essential to pay attention to the use of the site and the surrounding environment, while trying simultaneously to minimise the impact by adapting to the natural environment. In particular, as Li and Xia point out, it is necessary to focus on moderate development in line with local conditions and rational use of local resources. *Fengshui* emphasises the appropriate use of natural resources, the sensitive use of energy, the recycling and reuse of materials and the consistent protection of the natural environment.[6] In fact, a living environment must have the proper balance between human *qi* and the *qi* of all kinds of substances and materials present in the surroundings. In this sense the use and re-use of local materials for buildings and constructions is encouraged. The use of locally available materials not only creates the ideal harmony between the natural and architectural environment, but also considerably reduces the energy consumption required to transport the materials. By rationally using these natural resources and striving to preserve the vegetation, waterways and rock systems present on site, it is possible to reduce energy consumption during the construction phase, and to moderate climatic conditions and influence on the thermal environment. [7]

Several principles of *fengshui* are aimed at making good use of natural light and wind in order to reduce energy consumption from air conditioners in summer and convectors in winter. The Sun generates energy and, therefore, heat and light. Thus, paying greater attention to the location and orientation of buildings and taking into much consideration the sunshine and climatic conditions of the area, could determine significant energy savings resulting in reduction in emissions. In this regard, the principle of *zuo bei chao nan* 坐北朝南 'sit north and face south' still proves to be useful and continues to be applied. China is located in the Boreal Hemisphere, east of Eurasia and most of its territories face north of the Tropic of Cancer, so a southern orientation is optimal for sunlight. In addition, due to the presence of the monsoons, the southward direction allows to exploit the capacity of the summer winds to reduce the heat inside the house in summer, and to avoid the cold of the icy winds from Siberia in winter.

However, the application of *fengshui* theories is not just limited to energy-saving projects, but encompasses all aspects of architectural design. It involves the shape of the building, as well as its layout and direction. By interpretating the energy movement between *yin* and *yang,* the circulation and transformation of *qi* between the five phases, it is possible to manage the relationship between energy, materials and human beings in the architecture of the living environment and pursuit of true harmony and balance between human beings, the built environment and nature, responding to environmental and ecological concerns.

4. Application of *fengshui* theories in modern buildings

The principles of *fengshui* have been applied for several architectural projects. The first example is represented by the Huxi Campus of the University of Chongqing, where great attention has been paid to detail and to the creation of green spaces for common use. In the southern part of the campus, an artificial lake (Fig. 1) has been designed so as to provide the campus environment with a lively

atmosphere that allows students and teachers to enjoy a unique landscape. The design of all the spaces on the campus are based on the concept of *tianren heyi* expressed in the theories of *fengshui*, creating a perfect system integrated with the environment. The effort to recreate the best relationships with nature is significantly revealed in the design, aimed at creating the most suitable environment for carrying out activities and developing all kinds of environments on the campus. [7]

The second architectural project in which we can retrace the influence of *fengshui* principles is the Zhuzhou Automobile Expo Park (Fig.2), where they were employed in the different stages of design and implementation of the project. First of all, in order to integrate the structures with the surrounding environment, the largest structures were placed on the north-east side, facing the car show skyscraper on the east side. Furthermore, on the north and east sides, a large green area has been created in accordance with *fengshui* theories which pay great importance to the presence of vegetation to the east and north since it attracts good fortune. Apart from the symbolic auspicious value, this area reveals useful because the vegetation offers shelter from the summer heat and protection from the winter winds, as well as positively influencing the geothermal environment.

As for the vertical design, the structure follows the idea of keeping the lowest ground level in the south and the highest in the north. The presence of the basement is used to divide the lot into two zones, which will keep the fengshui model intact, reduce the number of square metres excavated for the basement and for levelling the ground, resulting in a significant saving of energy and materials.[8]

Fengshui have had a great impact also in the megalopolis of Shanghai, as we can see from the design of the Jin Mao Tower, the Shanghai World Financial Tower and the Shanghai Tower, which have geomantic references.

For example, as for the Shanghai World Financial Centre (Fig.3), the original design was characterised by a circular opening at the cap of the building, as a symbol of the round heaven and the square earth. This opening was not meant just to convey a cosmological reference to *fengshui*, but was conceived so as to control relative wind pressures on the structure. Then, two cosmic arcs, symbolising the heavers, intersect a square prism, which according to ancient Chinese theories, represent the earth, so that the tower rises up to the sky. This interaction gives rise to the building's form, creating a square sky portal at the top of the tower providing balance to the structure and linking the two opposing elements, i.e. the heavens and the earth. Rising above the city skyline, the Shanghai World Financial Center stands as a symbol of commerce and culture. [9]



Fig 1: Yu hu lake in Huxi Campus of the University of Chongqing



Fig. 2: Zhuzhou Automobile Expo



Fig3: Shanghai world financial tower

5. Conclusions

The present paper has described how the doctrines of *fengshui* make it possible to exert changes on the ecological environment and optimise the ecosystem from many perspectives, at many levels and in all directions. They are therefore *an irreplaceable incentive to strengthen the construction of ecological civilisation and create a harmonious home for man and nature*. [9] In the whole process of realising the policy statement of 'vigorously promoting the construction of ecological civilisation' (大力推进生态文明建设 *dali tuijin shengtai wenming jianshe*), traditional Chinese *fengshui* plays a significant role. Indeed, its principles, concepts, theories, environmental model have many values which can be applied to sustainable development in contemporary China. For example, the interpretation of the energy movement between *yin* and *yang* and the circulation and transformation between the five phases provides an inspiring and comprehensive aid to educate the relationship between energy, materials, human beings and information in the architecture of the living environment. In this way one is able to integrate architecture with environmental and ecological concerns applicable in the pursuit of true harmony and balance between human beings, the built environment and nature. The theories of *fengshui* thus constitute an alternative tool for environmental assessment and are emerging as a new paradigm for achieving harmony between humans and nature. Furthermore, with the rapid development of remote sensing and geographic information technologies, spatial data on vegetation and land use patterns can be easily integrated into *fengshui* theory in landscape and urban planning, and improve its scientific rigour.[10]

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An Effectiveness of Spreading Fire Mitigation by the Traditional Knowledge Using Group of Trees in Japanese Historic Districts

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Abstract
In the historic districts of Japan, trees are not only preserved as important elements of cultural value and ecological transition. The purpose of this paper is to evaluate the mitigation effect against spreading fire in high density historic area by the group of trees using a mathematical fire simulation model. In case of Tonaki-jima historic district of Okinawa, Fukugi as one of the domestic trees in southern region has been used for making a forest fence to protect inside from frequent typhoons. In the same time, it is also said to be a protection barrier against spreading fire coming from neighbor houses. In case of Kanaya-machi historic district of Toyama, most of traditional Machiya townhouses have their private middle courtyards with garden trees in each narrow and long site occupied in side by side order. These courtyards' trees said to be a shared barrier against spreading fire within density traditional blocks. Mathematical simulation model was developed to evaluate the effectiveness of traditional trees as a fire barrier, and proved the importance of conservation of trees for fire safety until now. For the extraction of the challenge on the site for trees conservation, the research carried out the interview to the stakeholder of the management and future preservation. As the result of fire simulation, it reveals the group of trees can reduce the numbers of burnt buildings and delay the speed of fire spread. And the result of interview reveals that aging of inhabitants and increase of the vacant house affect tree preservation.

Keywords: traditional knowledge, trees, Urban Fire Spread Model, historic district, fire mitigation

1. Introduction

1.1 Background
Important Preservation Districts for Groups of Traditional Buildings, which are nationally designated cultural properties, have been selected to preserve the historic townscape in Japan. Even though such areas are culturally rich tourist attractions that present a spatial view of historical facts, they are also living heritage that presents the cultural values and lifestyle of the current inhabitants.
On the other hand, the historical townscapes that fall under the category of Important Preservation District for Groups of Traditional Buildings generally comprise clusters of wooden buildings and narrow lanes. These clusters make them vulnerable to fire disasters. Such areas have often witnessed fire disasters over the years.
In a few cases[1)] traditional methods of tackling disaster, known as "traditional knowledge for disaster mitigation", have been passed on for generations along with the history of the particular townscape. Many of the areas characterized as Important Preservation District for Groups of Traditional Buildings are surrounded by specific types of greenery which forms an essential component of their historical

landscape. Studies have shown that that greenery may have a certain mitigating effect on the spread of fire in areas that have groups of trees[2].
Areas characterized under Important Preservation District for Groups of Traditional Buildings are not just a cultural heritage but are also home to the local residents who spend their lives there. Therefore, in order to ensure the safety of local residents and curb any possible damage, it is important to quantitatively assess the risk of fire spreading in the area and explore the possibility of increased fire safety, while keeping the cultural value of the green belts intact.

1.2 Objective

The objective of this study was to analyse the effectiveness of traditional green spaces in mitigating the spread of fire. This study is based on the "Physics-based Urban Fire Spread Model[3]". To this effect, we interviewed the residents who owned the green spaces and the authority in charge of the Important Preservation District for Groups of Traditional Buildings, and highlight the challenges involved in utilizing traditional green spaces for mitigating the spread of fire. Based on the above, we aim to demonstrate the possibilities of both preservations of historical townscapes and improvement of disaster safety.

1.3 Method of survey and analysis

a) Outline of Physics-based Urban Fire Spread Model

In this paper, the Physics-based Urban Fire Spread Model4) was used to scientifically assess the dangers of fire spreading across the area. This is a numerical model which describes the phenomenon of fire spreading in urban areas based on physics-based knowledge. In this model, urban fire is assumed to be an ensemble of multiple building fires. The fire behaviour of an entire urban area can be predicted by predicting the behaviour of individual building fires under the thermal influence of neighbouring building fires.

b) Structure of survey and analysis

In this study, we shall assess the effectiveness of traditional green spaces in mitigating the spread of fire in historical densely-built wooden areas from macro (overall) and micro (partial) perspectives, and analyse the issues involved in recommending the preservation of green belts. The procedure of study shall be as shown in Figure. 1.

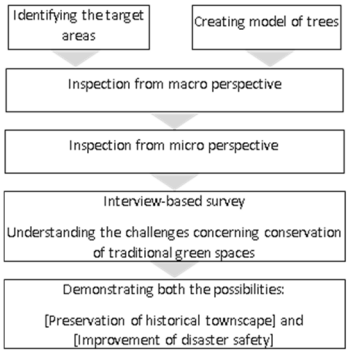


Fig.1 Survey and analysis flow

2. Choosing the areas for inspection

2.1 Identifying the areas

First, in order to choose the target areas, we adopted the approach followed by Matsumoto et al.[2] in studying on fire prevention performance of trees in historical urban blocks.
We first referred to the "Features of the townscape" column of the List of Important Preservation Districts for Groups of Traditional Buildings[4] published by the Agency for Cultural Affairs. We found that Tonaki Village Tonakijima (Important Preservation District for Groups of Traditional Buildings) was the only area with references to the greenery in the description, specifying that the greenery was designed to mitigate the spread of fire. Hence, Tonaki Village Tonakijima was chosen as the target area.
However, although the description of other places in the list does not specify that the greenery was particularly designed to act as a firebreak, the possible effectiveness of the greenery in controlling the spread of the fire has already been identified[2]. Therefore, we decided to choose an area that was surrounded by greenery but had a high burn-down risk as our second target area. We identified areas that were either partially or entirely densely populated districts (DID), where the wooden building ratio was ≥40%[5]. Based on the above criteria, we chose Kanayamachi Takaoka City (Important Preservation District for Groups of Traditional Buildings) as our second target area.

2.2 Overview of areas selected for inspection

a) Tonaki Village, Tonakijima (Important Preservation District for Groups of Traditional Buildings)

Tonaki Village, Tonakijima (Important Preservation District for Groups of Traditional Buildings) situated on the Tonaki Island of Okinawa Prefecture has a unique townscape of groves of Fukugi trees surrounding the houses. Planting groves of Fukugi trees around residences (Fig. 2) to act as windbreaks and firebreaks has been an age-old practice[6]. Many of these house-embracing groves have been designated as environmental assets. 224 house-embracing groves have been identified to be conserved[6] as a part of historical landscape. In this paper, we aim to scientifically evaluate the

effectiveness of house-embracing groves in mitigating the spread of fire by inspecting the simulation of firebreak function.

b) Kanayamachi Takaoka city (Important Preservation District for Groups of Traditional Buildings)

Kanayamachi, which is an Important Preservation District for Groups of Traditional Buildings, is situated in the Takaoka city of Toyama prefecture, and has a prosperous history of being a caster's town. Kanayamachi has a layout of buildings such that most of the area is divided in strip-shaped plots, with the main buildings facing the street, storehouses built across courtyards, and workshops placed further ahead. That is, the traditional layout[7] and plotting is such that even if fire breaks out in the workplace having sources causing fire, it will not spread to the main building. If this layout is followed at block level, with the courtyards placed at the back of the blocks as shown in Fig. 3, the courtyards will act as firebreak belts. Hence, we simulated the spread of fire to inspect the effectiveness of courtyards as a group in mitigating the spread of fire.

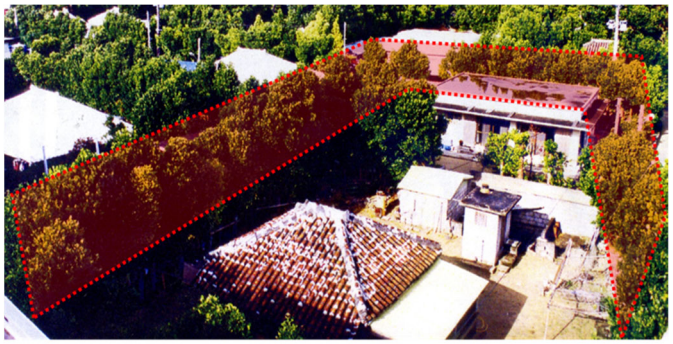


Fig.2 House-embracing groves of Tonakijima (Important Preservation District for Groups of Traditional Buildings)



Fig.3 Interlinked courtyards at Kanayamachi (Important Preservation District for Groups of Traditional Buildings)

3. Representation of greenery

3.1 Firebreak function of trees

First, we tried creating models of trees to represent greenery in fire spread simulation.

Fukushima[8] has revealed that trees have two fire protection functions — "Fire resistance (the ability to withstand fire)" and "heat-shielding ability (the ability to shield from heat)". We focused on the heat-shielding ability which is expected to have a significant effect on the mitigation of the spread of fire. We considered trees to be "mock-up buildings with heat-shielding mechanism" and created models to simulate the spread of fire.

The heat resistance ability of trees, however, depends on various complex parameters related to living organisms, such as the water content or constituents of various types of wood, or the structure of the surface of the wood. Therefore, no concrete progress has been achieved in analysing this ability[9], which makes it difficult to assign parameters. However, it is clear that "living trees" that are maintained in a particular manner in normal atmospheric conditions do not catch fire even if they are ignited. Based on the findings of [8)10)11)], we assumed that trees were non-inflammable objects.

3.2 Representation of heat-shielding ability

The heat-shielding ability of trees, that is, the ratio of heat shielded is expressed as "heat-shielding rate". The previous studies[12] have reported that the heat-shielding rate of trees is directly proportional to the shading factor with proportionality constant 1. In other words, the heat-shielding ability of trees can be evaluated by calculating the shading factor of trees. Saito and others[13] divided trees into three components—tree crown, crown base, and inside the crown—and calculated the shading factor of trees using the following equation (1).

Shading factor of trees = (Crown ratio) × (1 - Under branch height) × (Crown density) (1)

We adopted the same method in our study and multiplied the shading factor by the tree height to represent trees with height reduced in accordance with the shading factor. However, to avoid excessive changes in the external shape of the tree, we made changes to the bottom of the tree while keeping the top intact (Fig. 4).

The components are categorized into classes, and the values corresponding to each class are organized in Table 1. We referred to previous studies[13)14)] for understanding the physical properties. Here, we highlight that since the crown density value is the average of experiment values of each type of tree, the result does not always indicate the safety aspect.

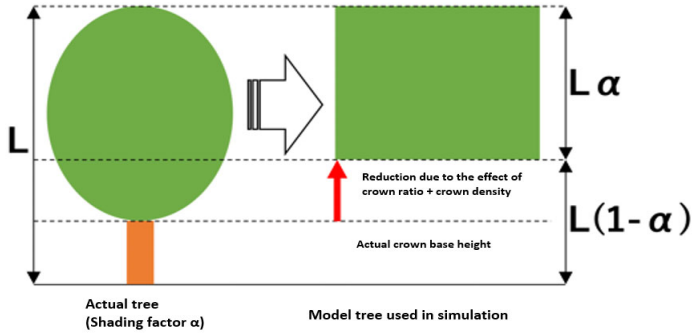


Fig.4 Representation of shading factor

Table 1. Heat-shielding ability of trees

Component	Class	Physical property
Crown ratio	Class I	0.5
	Class II	0.6125
	Class III	0.725
	Class IV	0.8375
Under branch height	Class L	0.02
	Class M	0.27
	Class H	0.42
Crown density	Evergreen broad-leaved tree	0.884
	Deciduous broad-leaved tree	0.827
	Conifer	0.942

3.3 Collection of the greenery data

Greenery data were collected from each area as input for fire spread simulation. Tree areas were marked based on field and data surveys. The attribute values of each tree area were collected. Five types of attribute values, namely location, height, crown ratio, under branch height, and type of leaves were collected. Table 2 shows the details of the attribute values.

4. Inspection of the effectiveness of fire spread mitigation

4.1 Collection of necessary data

a) Building data

In order to gather inputs for simulating the spread of fire, we collected and organized attribute values on every building in the target area. For the layout of buildings, we used the building polygons provided by the Geospatial Information Authority of Japan. Three main attribute values were collected for every building—height, number of stories, type of structure. Details of the attribute values are shown in Table 3.

Table 2. Items for collecting the attribute values of greenery data

Tropism	Remarks
[1] Position	
[2] Height	
[3] Crown ratio	Class I: Class II: Class III: Class IV:
[4] Under branch height	Class L: $H_c / H_T = 0.02$ Class M: $H_c / H_T = 0.27$ Class H: $H_c / H_T = 0.42$
[5] Type of leaves	Evergreen broad-leaved tree Deciduous broad-leaved tree Conifer

Table 3. Items for collecting the attribute values of building data

	Attribute value	Remarks
[1]	Height	
[2]	No. of stories	
[3]	Type of structure	Wooden Fire-retardant wooden Semi-fireproof Fireproof

b) Weather data

Weather data on the wind speed, wind direction, and temperature between 2009 and 2018 were collected randomly from the nearest observation stations (Fushiki weather station, Kume-Jima weather station). Since at both the sites, weather data of 400 or more items with an appearance probability of 1/10 or more for a period of 10 years was used, it was deemed feasible to verify abnormal weather conditions to a certain extent.

4.2 Fire spread simulation on the urban scale (Macro)

a) Assigning the calculation conditions

We adopted the Monte Carlo Simulation Model (a method of obtaining average by random sampling) to assess the overall burn-down risk (i.e., the percentage value of the frequency of ignition/number of simulation sessions) from a macro perspective, while also taking into account the uncertainty associated with fire outbreak and weather conditions. Roads and rivers of width 12 meters or more[15] were considered as physical firebreak belts, and the area within these belts was considered as the target area.

For each of the simulations, the point of fire occurrence, the wind direction, and the wind speed were selected randomly, and the fire was allowed to take its course without attempting to control, and then calculated up to 24 hours later. In order to obtain an average, the number of simulations was set

Table 4. Calculation conditions (Macro) for fire spread simulation

Conditions	Calculation conditions	
	Tonaki	Kanayamachi
Inspection method and objective	Calculation of building burn-down risk by Monte Carlo Simulation	
Range	Range within which fire is likely to spread without obstruction	
Calculation period	24 hours (maximum value)	
Number of sessions	426 (Equivalent to the total number of buildings)	492 (Equivalent to the total number of buildings)
Building of origin	Random	
Weather conditions	Random	
Greenery conditions	Without greenery, With greenery (existing)	

equivalent to the total number of buildings in the area, assuming that on average there will be one outbreak of fire at every building in the area. The aforementioned calculation conditions are shown in Table 4.

b) Results

Fig. 5 shows the burn-down risk obtained from the calculations of the spread of fire. For every area, two scenarios were assumed—one where the area is vacant and has lost the current greenery [1,3] and the other where the area has the current greenery [2,4].

c) Discussion

Comparison of both the areas revealed that the overall risk of burn-down was higher in Kanayamachi, probably due to the narrow space between the buildings in Kanayamachi'

In the case of Tonakijima (Important Preservation District for Groups of Traditional Buildings), the burn-down risk decreased on the whole in scenario [2] where the greenery was present as compared to scenario [1] which had no greenery (as shown in Fig.5). However, although the burn-down risk was reduced to nearly zero in some blocks, no significant reduction in burn-down risk was observed in the region outlined by the dashed line (scenario [2]). Our results showed that the green cover had already disappeared in some of the blocks, resulting in the reduced fire-mitigating effect of the greenery.

Even in the case of Kanayamachi (Important Preservation District for Groups of Traditional Buildings), the burn-down risk had significantly reduced in scenario [4] where the greenery was present, as compared to scenario [3] which had no greenery. This suggests an effective role of greenery in mitigating the spread of fire. Reduction in burn-down risk was also observed in the region outlined by dashed-line in scenario [4] where courtyards are relatively interlinked, which suggests that interlinked courtyards may also have a deterrent effect on the spread of fire.

4.3 Fire spread simulation at the block level (Micro)

a) Assigning the calculation conditions

Based on the results of inspection from a macro perspective, we studied the spread of fire from a micro perspective, focusing on the blocks of land which are at a relatively higher risk of being burnt down and which are thought to represent the characteristics of every green space. The two areas surrounded by dashed lines in Fig. 5 were considered as the target blocks, and simulation was performed by considering the characteristics of each block. In order to inspect the effect of the disappearance of house-embracing groves in Tonakijima (Important Preservation District for Groups of Traditional Buildings), a block of land where greenery is added (regenerated) around the houses was assumed, and compared with the existing situation. For Kanayamachi Important Preservation District for Groups of Traditional Buildings, models of various species of trees were created based on the characteristics of different species and studied thoroughly. Species of trees to be planted in the courtyards were decided based on the results of door-to-door surveying. The calculation conditions are shown in Table 5.



Fig.5 Building burn-down risk (Macro)

Table 5. Calculation conditions (Micro)

Conditions	Calculation conditions	
	Tonaki	Kanayamachi
Inspection method and objective	Observation of fire behavior over the period of time, and calculation of burn-down risk	
Range	Blocks decided based on the results of macro perspective	
Calculation period	60 min (10-minute intervals)	
Number of sessions	31 (Equivalent to the number of buildings in the target block)	50 (Equivalent to the number of buildings in the target block)
Building of origin	Each building of the target block, once	
Weather conditions	Temperature: 23.3 degrees (average) Wind speed: 39 m/s (maximum speed in the past 10 years) Wind direction: North-East (most recurring)	Temperature: 14.3 degrees (average) Wind speed: 18.7 m/s (maximum speed in the past 10 years) Wind direction: South-West (most recurring)
Greenery conditions	Without greenery, With greenery (existing), With greenery (additional)	Without greenery, With greenery (existing)

b) Results

The burn-down risk was determined by superimposing all the results of random events of fire in each building of the target block. A representative case of the burn-down risk after 1 hour (60 minutes) of the fire outbreak is shown in Fig. 6.

c) Discussion

In the case of Tonakijima (Important Preservation District for Groups of Traditional Buildings), a comparison of the simulation results of scenario [2] (existing greenery) and scenario [3] (additional greenery = regenerated greenery) indicated no significant impact of the regeneration of house-embracing groves on the burn-down risk. One of the reasons may be that the natural fire-mitigating impact of the neighboring house-embracing groves may have already been in play to a certain extent. On the other hand, a comparison between scenarios [1] (no greenery) and [2] (existing greenery) highlighted differences in the burn-down risk, particularly in the region outlined by a red line. This shows that the risk of fire spreading across the entire townscape increases significantly if the green cover of the house-embracing groves falls below the current level.

Even in the case of Kanayamachi (Important Preservation District for Groups of Traditional Buildings), an overall difference in the burn-down risk was observed in scenarios [4] (no greenery) and [5] (existing greenery). This may be because the trees planted in the courtyards suppressed or delayed the spread of fire. Moreover, the fire did not spread to the opposite side of the courtyard in the scenario [5], which suggests that the trees planted in the courtyard may have acted as heat shields to a certain extent. It became clear that the disaster safety of the entire townscape can be maintained by making provisions for a courtyard and maintaining proper trees and plants in the courtyard.

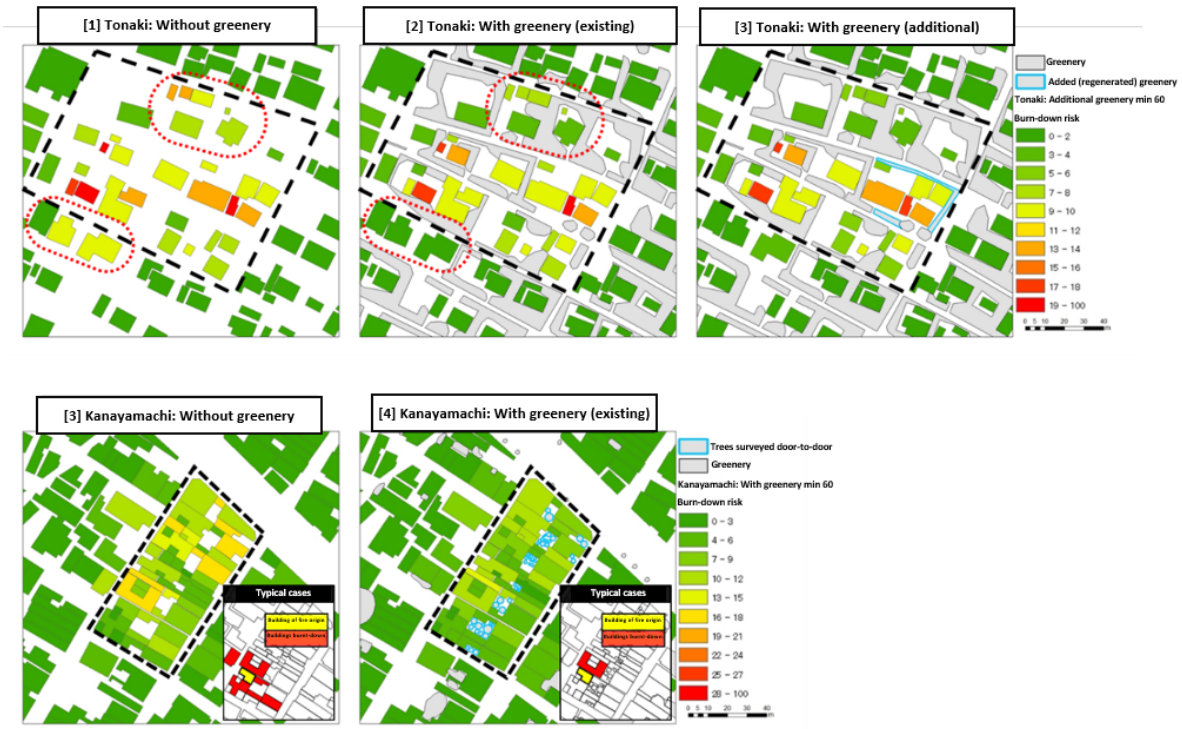


Fig.6 Burn-down risk after 60 minutes of fire outbreak

4.4 Results and discussion

The following points were observed from the simulation sessions at the macro and micro scales:

- Inspection from the macro perspective highlighted that areas with greenery were at a relatively lower risk of being burnt down compared to areas with no greenery since the greenery might have acted as a fire deterrent to a certain extent.
- The presence or absence of groves around a single house had no significant impact on the burn-down risk. However, a significant decrease in the house-embracing groves could increase the burn-down risk of the entire area. Hence, it is important from the safety point of view that groves are maintained and restored as much as possible.
- It was confirmed that trees planted in courtyards had a certain fire-mitigating effect. Therefore, it is also essential to conserve greenery in the courtyards to achieve the fire-mitigating effect.

5. Understanding the challenges concerning the conservation of traditional green spaces

5.1 Interview-based survey

a) Overview

The above results highlighted how maintaining traditional green spaces had a certain fire-mitigating effect. However, we need to understand the issues involved in maintaining and conserving the greenery and study the required measures in order to achieve the desired effect in the future.

Therefore, in order to understand the challenges faced in conserving traditional green spaces, we interviewed the local residents, who are the direct owners of the green spaces and also the administrative authority responsible for formulating the plan for maintaining the Important Preservation Districts for Groups of Traditional Buildings. These interviews helped us gain two different perspectives on the challenges associated with conserving traditional green spaces. Table 6 shows an overview of the survey.

Table 6. Overview of interview-based survey

Item	Tonakijima (Important Preservation District for Groups of Traditional Buildings)		Kanayamachi (Important Preservation District for Groups of Traditional Buildings)	
	Administrative authority	Local residents	Administrative authority	Local residents
Date	December 2019	January 2020	December 17, 2019	December 16, 2019
[Survey target]	Person in Charge of Educational Administration Division, Board of Education, Tonaki Village	Members of Tonaki Village Deliberation Council for Groups of Traditional Buildings	Person in Charge of Cultural Heritage Division, Board of Education Secretariat, Takaoka City	Former President of The Council for Area Development and Management of Kanayamachi
Method	Email or written	In writing through the administrative authority	In-person interview	In-person interview
Interview Item	Changes in traditional green spaces Fire outbreaks in the area Efforts undertaken with regard to greenery Thoughts on conserving greenery in the future Challenges faced in conserving greenery			

b) Result

Results of the present study are summarized in Table 7.

Table 7. Summary of the results of interview-based survey

	Tonakijima (Important Preservation District for Groups of Traditional Buildings)		Kanayamachi (Important Preservation District for Groups of Traditional Buildings)	
	Administrative authority	Local residents	Administrative authority	Local residents
Summary	・Previously the Public Welfare Department used to maintain the house-embracing groves, now it does not.	・Work such as pruning the branches is done by owners.	・We haven't been involved in the conservation of courtyards because they do not fall within the purview of the system of Preservation Districts for Groups of Traditional Buildings. However, essentially, we do want to conserve greenery.	・Raising plants and trees and looking after them is a tough job. The task of pruning the branches can also pose a financial burden.
	・It is basically a private property, and hence the owners are responsible for maintenance.	・There have been instances where the house-embracing groves have provided protection from cyclones.	・If the role of courtyards in preventing fire is recognized, there needs to be a serious discussion on the administrative authority's responsibility in conserving the courtyards.	・With the increase in the number of elderly people, many households find it difficult to maintain the courtyards.
[Efforts] and [Challenges] of Greenery Conservation	・Ageing of population has made it difficult to manage at individual-level.		・We cannot discuss issues such as demolition of courtyards under the system of Preservation Districts for Groups of Traditional Buildings because courtyards cannot be seen from outside.	
			・Ageing of residents and rise in the number of vacant houses has made it difficult to find managers for maintaining trees and plants in courtyards.	

5.2 Challenges

The interview-based survey shed light on the following challenges:

- Traditional green spaces in both areas are owned by individual owners, who are also responsible for their maintenance. However, in Kanayamachi, some people believed that the administrative authority should be substantially involved in conserving the traditional green spaces as these green spaces are also elements of the historical landscape.
- As courtyards do not affect the appearance of the area, they do not come within the purview of the system of Preservation Districts for Groups of Traditional Buildings, which makes it difficult for the administrative authority in Kanayamachi to assist the residents in maintaining the courtyards. In some cases, there is no one available to maintain the trees and plants, owing to the aging population and the increase in the number of vacant houses.
- Even in the case of Tonakijima as with the case of Kanayamachi, the aging of the population seems to have made it difficult to manage and conserve the groves properly as the conservation of the groves around their houses is currently left to individuals.

While traditional green spaces are a personal property of the owners, they also qualify as a landscape component of the townscape. It can be concluded that systematic assistance to the owners and management assistance by local residents was important to maintain and conserve traditional green spaces in the future.

We, therefore, need to create public awareness about the importance of conserving greenery by sharing facts on how the loss of greenery increases the risk of fire spreading throughout the area. Promoting the conservation of green spaces from the perspective of disaster prevention based on the fire-deterrent effect of traditional green spaces observed in this study may help in examining a framework for simultaneously implementing administrative support and fostering awareness among citizens.

6. Conclusion

6.1 Summary of findings

This paper revealed the following points.

- By creating a model based on the heat-shielding ability of trees, the effect of greenery on the previous fire spread simulations can be examined.
- Greenery was proven to be a component of the historic landscape (i.e., traditional green spaces) and had a certain mitigating effect on the spread of fire.
- Interviews of concerned parties revealed the challenges involved in conserving traditional green spaces.

Furthermore, the method used to assess the burn-down risk of areas with traditional green spaces, constructed for this study, can be applied generically to other areas with a different type of traditional green spaces.

6.2 Challenges in the future

In this paper, the heat-shielding ability of trees is expressed in a simple manner by simulating a situation where a bunch of objects floats in the air. It may be possible to express the heat-shielding ability of trees more precisely by modifying the fire spread simulation program. A more in-depth inspection of the fire-resistance ability to live trees may be possible if the thermal characteristics of trees are understood through experiments and surveys taking into account factors such as the impact of seasonal fluctuations on deciduous trees. Surveying green spaces that are likely to be lost in the future and inspecting them through fire spread simulations may help formulate greenery conservation guidelines for the future.

In the course of selecting the target areas, 23 districts that had traditional green spaces were identified. Categorizing the characteristics and forms of traditional green spaces observed in these areas, and running fire spread simulations may give us a clear understanding of the necessary proper greenery conditions to achieve the desirable fire-mitigating results.

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"Sub specie æternitatis": the role of the ruin and the ancient in the process of architectural renewal between metamorphosis and resurgence

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Abstract
Composing new works of architecture inspired by vestiges from antiquity or archaeology. The reflections and the case study which will be proposed, pertaining to a recent design experiment for the archaeological area and *Antiquarium* of Tyndaris, are dedicated to this theme.
Over and above any charm exerted by such places, by landscapes in which the ruins appear identical in substance and which sometimes manifest themselves as "*sub specie æternitatis*", there are reasons linked to the very profession of architect and to the gashes in the crucible of controversies around the role of history in its contentious relationship with architectural design.
That apart, the aporias revealed by Michel Foucault, in questioning what he proposed as a global history project, laid emphasis on discontinuity, fractures, and thresholds; in short, transformations that counted as the basis and renewal of the very foundations themselves. Within this conception of history, or rather a methodology for history that "leans towards archaeology as an intrinsic description of the monument", architectural works and projects appear protagonists of a dramatic action centred on the opposition between the permanence of a 'structure' and the thrill of change.
That thrill which, in the Humanist age, animated the minds of architects, treating the fields of philology and architecture identically, studying ancient monuments as texts in order to "generate new forms and thereby bring a new classical tradition to life".

Keywords: ruin, architecture, Tyndaris, metamorphosis, resurgence

1. Section "*Sub specie æternitatis*"
Over and above any charm exerted by such places, by landscapes in which the ruins appear identical in substance and which sometimes manifest themselves as "*sub specie æternitatis*", there are reasons linked to the very profession of architect and to the gashes in the crucible of controversies around the role of history in its contentious relationship with architectural design.
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That thrill which, in the Humanist age, animated the minds of architects, treating the fields of philology and architecture identically, studying ancient monuments as texts in order to "generate new forms and thereby bring a new classical tradition to life".
In this regard, it is enlightening to reflect on the extraordinary effect produced in Milan, in 1481, by the engraving of a goldsmith, Bernardo Prevedari, after a drawing by Donato Bramante. This interior of a mysterious temple, an ancient ruin and, at the same time, an image of the invention of original

architectural forms, assumed, with great clamour, the role of a manifesto of a new, modern architecture, brimming with references unknown to the dominant guilds of the Gothic masons.
Bramante himself, asked in 1488 to give his opinion on some doubts which had arisen on how to complete the lantern tower of Milan Cathedral [3], established and corroborated the criterion of "conformity"; a criterion which was not merely stylistic, but, on the contrary, affirmed the continuity of a monument over time, according to its own "constitution", which the architect must identify with, must take possession of.
Such a "constitution" is a principle of an internal economy, according to which new forms also originate materially from preceding ones: a "*metamorphosis*".
In this perspective, the time of works is not reduced to that of the chronology of their dates; it is not the time of the past, but that of memory, which proceeds backwards, not descending from time, but returning to it [4].

2. Architecture – The ruin and the cyclic nature of life

Architecture has always featured a twin component: one, current and contingent, belonging to the present time of any epoch, and another universal one which generates a profound, symbiotic, and osmotic bond between present and past, also and especially when far apart, in a continuous, cyclical *palingenesis*.
Francesco Venezia has stated, with impeccable reasoning, that when it comes to architecture we should not be discussing archaeology, but "ruins", that is, the main object of the passionate activity of those ingenious predators, the authors of those countless cyclical Renaissance events from the 15th century until the end of the 18th century, that constituted the palingenetic rhythmic form of the construction of Western civilization.
Into the bargain, "the ruin" plays a fundamental role in man's psychic and sensory experience, since it projects us into a mental journey accompanied by a synaesthetic and bodily journey if the ruin is 'inhabited' in an existential sense. It lets us lose ourselves in a deep temporal perspective which feeds our innate need for infinity. The same congenital need for infinity and continuity which had Francesco Venezia state that the birth of archaeology, understood as an autonomous discipline, conventionally dated to 1810, was to determine that fatal separation between architecture and the ruin (that is, its generating germ), which marked "the self-same decline of architecture" [5].
Consequently, archaeology, or – to use a more appropriate term – "the ruin", must necessarily be seen as an unforgettable deposit of beauty and architectural knowledge and must be adopted as an inexhaustible and unexhausted deposit of history, outside any chronological limit, any temporal categorization, which are often an ideological-disciplinary garb not suitable to be worn by architecture.
Against this background, the project is based on the intention to offer a different key to reading and experiential knowledge in the field.
Only in this way can an attitude of renewed attention arise towards the great Italian archaeological heritage along with a greater awareness aimed at preventing the processes of "commercialization" to which many cultural sites have been subjected with the onslaught of mass tourism. These days, it is possible to generate a conception of cultural heritage in which the archaeological heritage is the original testimony, as a tool of identity-building awareness and a primary factor of social advancement, by carrying out a semantic and cultural conversion.
It is no coincidence that the inseparable relationship which must necessarily be forged between architectural design, archaeology and restoration, can still be affirmed notwithstanding the seamlessness instituted between archaeology and architecture.
In the present, more than in other epochs, the need has emerged to overcome the habitual standardized point of view of the subordinate role – that of "service" – which contemporary architecture generally plays at an archaeological site, through solutions often invalidated by their hypersensitive nature. Hence, an inevitable renewal of architecture, between metamorphosis and palingenetic resurgences, must lead us to explore to the very end the tendencies of contemporaneity to weave renewed relationships with the physical substance of haunting testimonies of a remote past ("ruins"), often destined to manifest nothing but their own inexorable decay.
In short, if it is inevitable to rebuild the link between architecture and archaeology, it is time to move on, to urge a new beginning.
By abandoning the presumptions of objectivity, as well as the stereotypes and disciplinary barriers, the project must resume its task which lies precisely in the depth of its experience, welding itself to the richness and multiple meanings of ancient artefacts [6].

3. The design experiment for the archaeological area and *Antiquarium* of Tyndaris

The recent design experiment for the archaeological area and *Antiquarium* of Tyndaris[1], was based on the idea of composing some "new architecture" in a rapport with the vestiges of antiquity at one of the most significant archaeological areas of Messina, the object of several studies and excavations since the second half of the 18th century [7]. Founded in 396 B.C. by Dionysius of Syracuse, Tyndaris rose

on top of a rocky bluff overlooking the large Gulf of Patti, offering a marvellous, wide-angle panoramic view of the Tyrrhenian Sea towards the distant Aeolian islands and the landscape of the hinterland of eastern Sicily [8].
Ancient Tyndaris, like any other archaeological site, is a playbook for architectural design of every age and it is for this reason that the project was based on the essential principle of underlining and bringing out the geometric plan which regulated the layout of the ancient city as it stretched along the length of the plateau, bringing unity to the long front on the main *decumanus* – where the Theatre subsists as a protagonist – in order to underline the perspective axis whose backdrop is the Basilica.
In the area between the Theatre and the Basilica, the new buildings are to be erected on the foundations of the existing ones, adjusting the imposts and heights to suit, while connecting terraces and plinths with shallow flights of steps, integrating and completing the existing ground plan in formal terms.
To the north-west of the Theatre, the area dedicated to new services echoes the dimensions of the *insulae* with a re-proposal of the quoins which delimit them. The new builds follow these measurements and the rule of building on sloping terraces, and are also connected to each other by flights of steps, as the bones of an overall landscaping design which includes green roofs.
First and foremost, the planned buildings define the morphological blueprint, in adherence with the city's geometric layout and in conformity with the principles which established its relationship with the ground and its views of the sea.
The architectural part is simple and exacting, to avoid introducing incoherent connotations foreign to the dominant theme of the rhythm of the *insulae* arranged on and in the ground.
A single spectacular accent is given by the arcade-gallery of the *Antiquarium*, where the reconstructed fragments of the Theatre's *scænæ frons* are offered to the sight of the visitor as a protrusion from the wall from inside the Museum, proposing a virtual image of the same *scænæ frons* on a large scale against the background of the sea, with its smaller-scale model incorporated.
The roofs over the archaeological remains evoke the spaciousness of the original environments without seeking to mimic them, but instead entrusting a decisive task to the zenithal light, screened by beams arranged in a dense sequence which act as a *brise-soleil*.
The construction system developed allows the volumes to remain clearly defined, even where they impact the ground or ancient walls, abiding by criteria to safeguard the latter's integrity.
Similar modalities preside over the constructive definition of the walkway with amenities, whose design yet again underlines the course of the *decumanus* and the dimensions of the *insulae* which it flanks.
The new builds are positioned on sloping ground, using the extant foundations and rising according to cross-sectional conformations which match the lines of the terracing, connected via itineraries consisting of flights of steps and stairs.
The green or gravel roofs blend into the surrounding land without introducing dissonant elements with respect to the old and new walls, their colour hues mirrored thanks to the limestone slab cladding. Consequently, the character of the buildings resumes and updates the plastic/masonry conception of the ancient ones, accentuating their thermal inertia and implementing appropriate measures for best habitability, such as the environments' bilateral ventilation.
Both the outdoor and indoor spaces conform to connections and sequences in which all the itineraries adhere to the salient features of the site as well as the proposed new additions.
A kind of centrality is attributed to the circular open-air atrium, as a sort of stopping place and an introduction to the *Antiquarium*, whose entrance it embraces.
In turn, the layout of the *Antiquarium* conforms to its interior spaces, at a different scale in coherence with the objects displayed therein, but at the same time linked in sequences which enhance the relationship between the museum finds and the landscape which constitutes their backdrop and reinforces their identity.
The *Antiquarium* museum layout project is part and parcel of the specific archaeological museum framework, in which it is necessary to harmonize, in terms of the displays, the heterogeneous, fragmentary and multiple presence of various sets of grave goods, furnishings, figured ceramics and terracotta, fragments of painted plaster and ancient coins, with the imposing and striking sculptural figures depicting winged *Nikai*, togaed male celebrities, theatrical masks, or remains of columns and capitals. The intention behind the layout, "as the art of offering; that is, to show with restraint and to offer with intelligence" [9] has led to design choices dependent on the narrative visit of the *Antiquarium*, but at the same time able to exalt the peculiar qualities of the spaces, imagined not as a sequence of individual rooms, but as a single spatiality consisting of different spaces on several levels, effectively interconnected and immediately visible from the museum entrance. Consistent with these design choices, the shapes of the display cases vary constantly, thus achieving the impression of stage sets. In this way, each space is presented as a fragment of an "interior landscape" which has been recomposed within the unity of the layout.
With respect to this museum logic, based on the continuity of the exhibits, there is one exception, namely, the "Elliptical Projection Room" which introduces, albeit sporadically, the dimension of an

“integrated layout” based on a union between the predominant display of archaeological finds and advanced technological tools, and the art and interactivity of systems to explain the museological contents [10].
The services building is the part built from scratch. For this reason it has been positioned according to the rules which preside over the original foundation plan of Tyndaris, with a design which proposes a continuation of the conformation; in particular, making evident and recognizable the urban nature of the architecture in which the buildings are bricks which build the city.
The layout of the rooms dedicated to the various activities extends over three levels/terraces discernible from the green roofs which include gravel strips above the corridors.
The limestone walls feature ends left windowless to be covered by trees, or dense successions of solids and voids. The dimensions of the *insula*, which the building espouses, are determined by the quoins alongside which steps follow the slope of the ground and are connected, via some level stopping areas, with shallow flights of steps that outline the triangular portion of the adjacent *insula*, crossed diagonally by the road.
The deposit for the archaeological remains does not come into play as a separate building, but it too adopts the transverse measurements of an *insula*, nestling in the slope of the ground and opening onto air and light wells which allow access from the *decumanus*.

4. Conclusions

The goal of the proposed project – aimed at the redevelopment of a quite extraordinary cultural, historical and landscape heritage – is, above all, to respond to the urgent need to enhance its rediscovery by eliminating certain physical barriers, but most of all those “ideological” protective barriers which, in addition to necessary, indispensable and incontestable conservation protection, determine unnatural processes of isolation and decontextualization with respect to the archaeological area’s place of origin, which paradoxically ends up becoming almost a “foreign” body.
Instead, a targeted and informed design, with a keen sense of being rooted in the morphological character and specific qualities of the site, still expressed by the archaeological area, can lead to a real enjoyment of it, in terms of an experiential dimension based substantially on structural synaesthetic cognition, in turn founded on visual, tactile, auditory, and therefore multisensory stimulation. The only form of enticement that can allow us to understand the profound “physiological breath” of this place. For this reason, the project’s construction strategy, frequently based on the principle of excavation, has unfolded starting from the objective of achieving a real melding between the architecture and the site, in the poetic character deriving from what it represents, in the recall and memory of the traces found within it.
An architecture which ‘digs to build’ verges on archaeology, which, in turn, digs to reconstruct the residual patterns of a vanishing but evocative conformation. An architecture which tends positively to self-omit, but not to be invisible, rather with the aim of being a silent work of a meditative nature; a work which “integrates” according to the meaning given to this adjective by T. S. Eliot, poet and theorist of poetry. “The emotion of art is impersonal. And the poet cannot reach this impersonality without surrendering himself wholly to the work to be done. And he is not likely to know what is to be done unless he lives in what is not merely the present, but the present moment of the past, unless he is conscious, not of what is dead, but of what is already living.” [11]
In the project for Tyndaris, the fundamental ambition is that of a relationship of rooting which sees the ground as a plinth, and seeks to challenge time by reaching out towards eternity and the universal. The new architectural volumes imagined emerge almost as fragments among the ruins of the ancient city of Tyndaris, now concealing, now emerging in the absolute stereotomic purity of their forms and in the assonance of the materials, among “light” elevated walkways which cross over the *insulae*, tracking the ancient vestiges of the Dionysian *polis*, immersed in the silence of space and dedicated to contemplation and meditation, skirting a naturalistic and landscape path with multiple emotional allusions.



Fig. 1: Perspective view of the Tyndaris Archaeological Park with the project interventions.

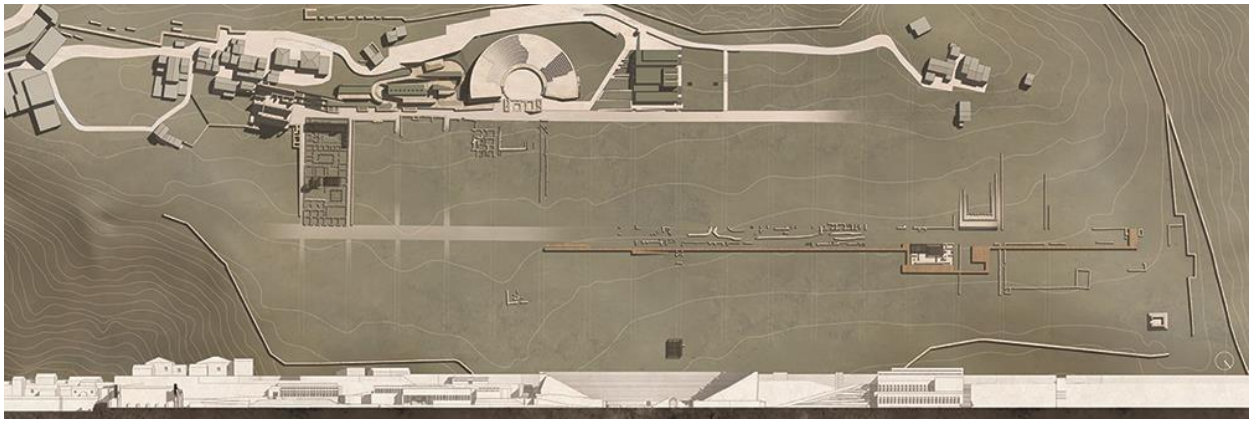


Fig. 2. Profile and general plan of the archaeological park of Tindari with the project interventions.

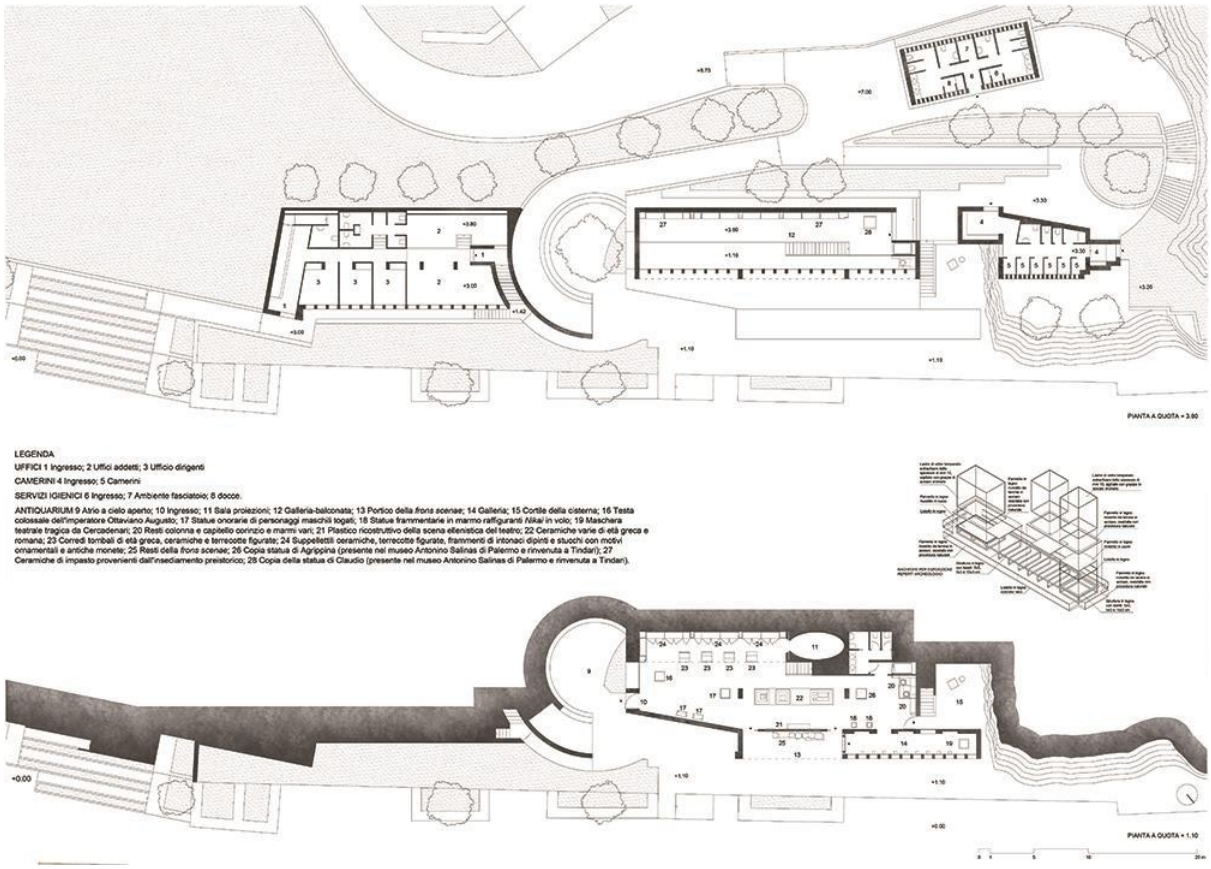


Fig. 3: Bottom, plan of the semi-basement of the *Antiquarium*. Above, plan of the mezzanine of the *Antiquarium* and, on the right, the administrative offices of the Archaeological Park.

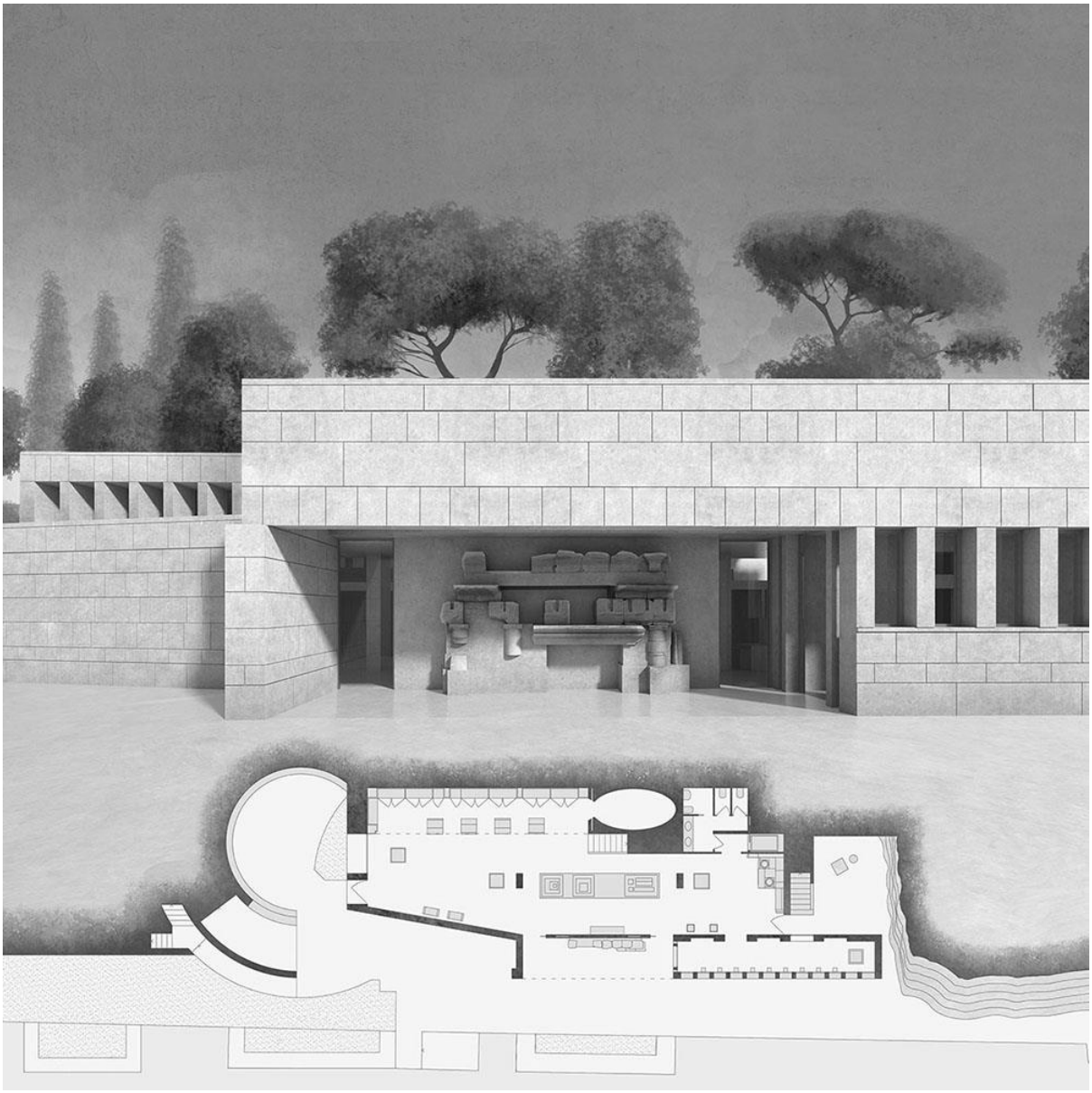


Fig. 4: Portico-gallery of the *Antiquarium* with the reassembled fragments of the frons *scænæ* of the theatre and plan of the semi-basement of the *Antiquarium* with the exhibition rooms

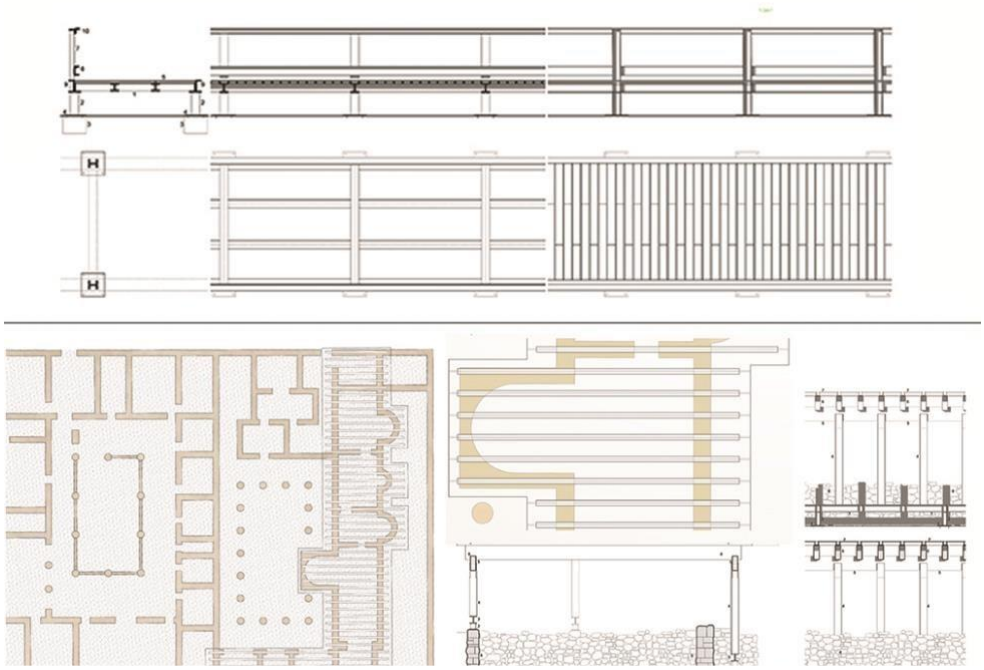
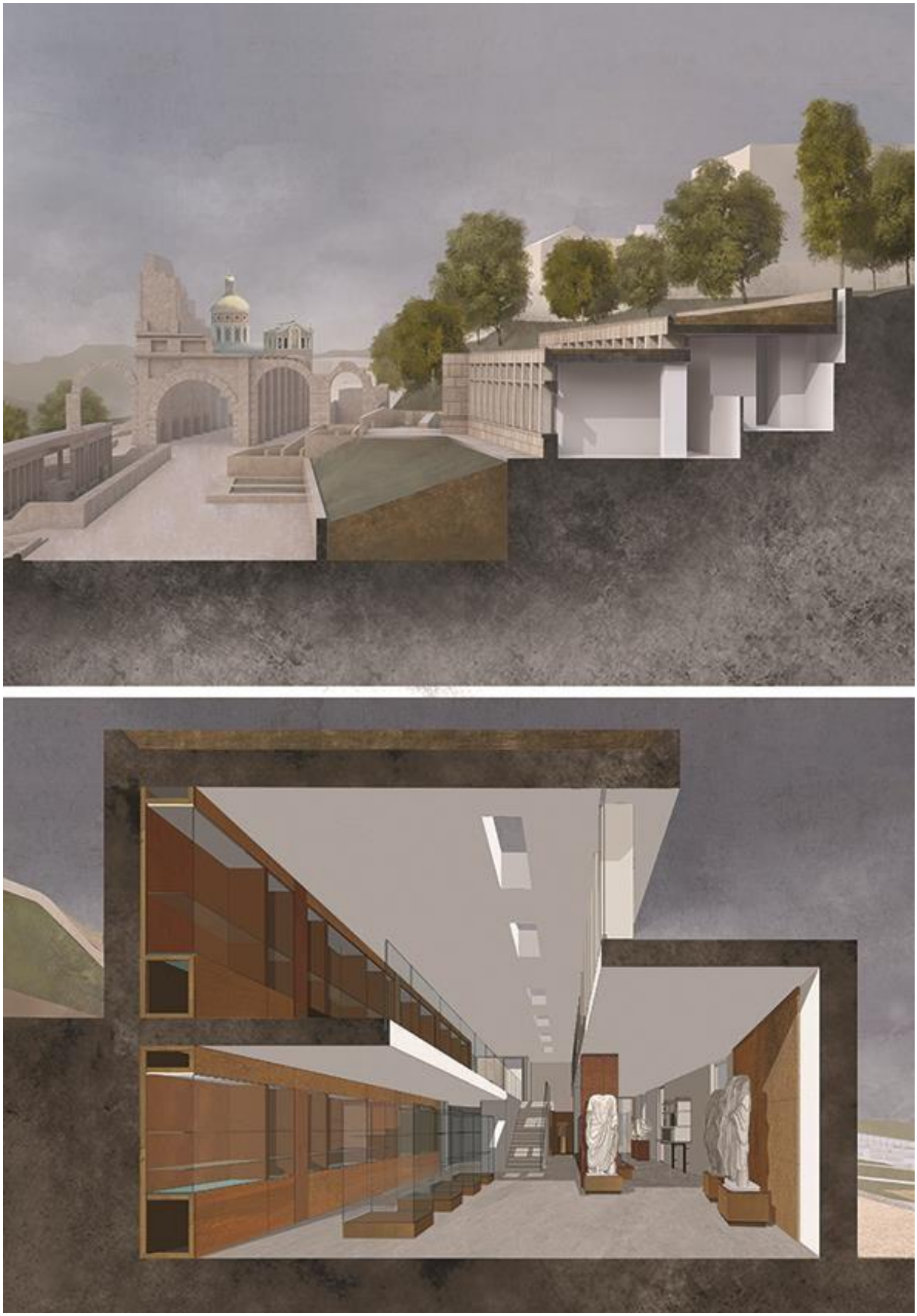


Fig. 5: Construction details of the equipped walkway crossing the *decumanus* and the *insulæ.*
Fig. 6: Construction details of the roofs of the archaeological remains.

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Figg. 7-8: Perspective sections of the administrative office building and the interior of the *Antiquarium* with the exhibition design.

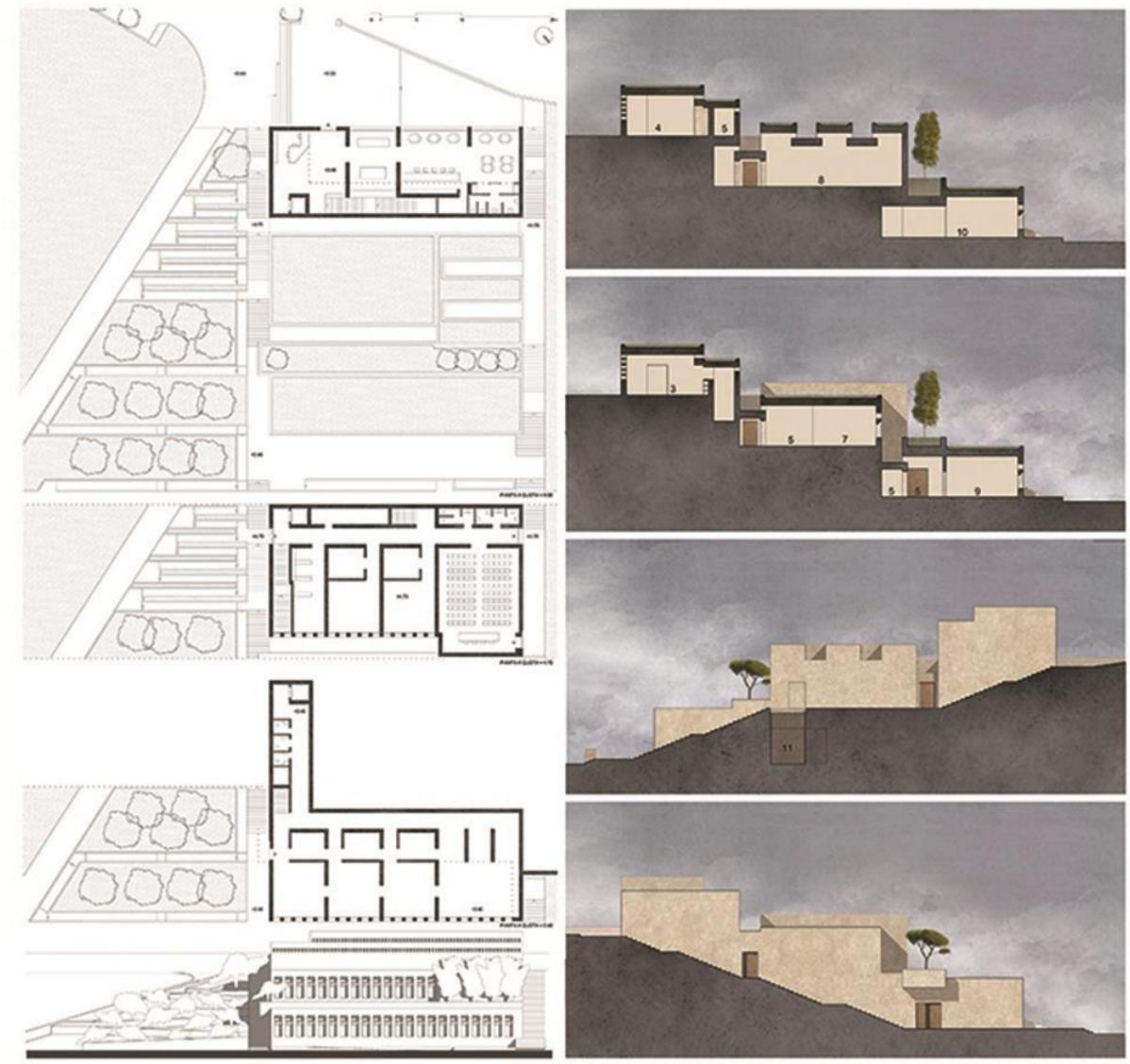


Fig. 8: Plans, elevations and sections of the reception services building for visitors to the Archaeological Park.



Fig. 9: Perspective view of the archaeological park with the visitor service building in the foreground and the Roman *Basilica* and the Sanctuary of the Madonna Nera in the background.

Notes

1. The reference is to our November 2020 entry in the architectural design competition for the "*Redevelopment and enhancement of the Archaeological and Antiquarium Area of Tindari*" in Messina. The design group's members were: Angelo Torricelli (group leader), Giuseppe Di Benedetto, Riccardo Catania, Marco Filippo Ferrotto (structures), Giovanni Pecorella (technical installations); consultants: Aurelio Burgio (archaeology), Calogero Cucchiara (structures); associates: Elio De Blasi, and Ambra Lofrano.

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The rural architecture enhancement through the sustainability search in the ecological transition era

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Abstract
The objective of ecological transition makes it possible to look at the recovery of rural architecture from a new perspective that focuses on processes of economic growth to preserve the environment. This allows us to look at this heritage as a resource, in the sense of built economic capital. The paradigm shift seeks sustainability with even stronger tones that emphasize the need for action. The PNR promotes the development and valorization of rural areas by adding new meanings and new opportunities to challenge the depopulation of agricultural territories.
As a resource, the rural built heritage favors the preservation of the landscape and cultural and building traditions, but it is also a model for formulating a correct methodological approach to support sustainable recovery policies. In addition, today's living looks to the environmental context to meet an ever-increasing need for sustainability. It is true that the bioclimatic character belongs naturally to the rural building tradition, but today the design approach to renovation should be integrated with the possibility of producing energy from renewable sources. Therefore, rural architecture is particularly suitable to be inhabited according to a more than active energy balance ("Plus Zero Energy Building").
The rural house object of the study, situated in a location not too far from the city of Naples, acquires methodological value, pursuing the objective of recovery with a proposal that is not only tangible, but also innovative in its approach.

Keywords: recovery of rural architecture; sustainability of rural architecture; bioclimatic tradition of rural building; rural building and energy production

1. Introduction
In design of a building, both new and recovered, sustainability has become a fundamental theme for the designer over the years. This paper analyzed the main aspects of conservation planning and, at the same time, the redevelopment and innovation of a rural building located in the province of Naples, in the south of Italy. The objective of recovery has the need to look to the future, reinterpreting living in harmony with the climate, the environmental context and above all with the current regulatory requirements for satisfying internal comfort parameters.
Therefore, the space of the rural house must integrate the original bioclimatic matrix with the resources that the climate context makes available, so that a new balance between rural landscape architecture is defined. The result is a necessary redesign of the rural-energy system, developed in a sustainable way through natural solutions with minimal impact, which tend to define real strategies of approach. The synergy between passive and active solar systems offers, to an ever-greater extent, high potential to regenerate internal spatiality by combining recovery of rural architecture and energy production.
All interventions which are designed and analyzed in this paper, are respectful of the original architectural features of the building under study, without distorting them and all strictly necessary to give the building better energy performance than a new identity completely different from the rural context in which it is inserted. In fact, the approach to the rural patrimony should depend always on the principle of “minimal intervention”, i.e. avoiding a sensible change of the original constructive concept of the building to be conserved, without excluding however reviews and upgrades, in order to reconcile the

objective of the functional and energetic requalification and the capacity of the modern technology to preserve the value of existing rural building.

2. Rural builds and bioclimatic

Rural buildings can be included in what is called "minor architecture". The territory of Campania is rich of these kinds of buildings that characterize current rural landscape defined by the European Landscape Convention as an “essential component of the life context of the populations, an expression of the diversity of their common cultural and natural heritage, as well as the foundation of their identity".
Vesuvian rural area can be considered an example for a planning of all Italian rural areas, for its strong agricultural characterization thanks to its soil fertility and the favorable climatic conditions.
The rural house is the result of a popular and poor culture, free of any superfluous element, as an expression of the way of life that is reflected in the morphological and typological structure of the building. For this reason, bioclimatic approach is inherent in the nature of construction itself. In fact, the natural propensity of rural buildings to bioclimatic behaviour is given by intelligence of human communities to achievement of goals with the minimal depletion of resources and energy and is strongly connected to the territory where they are erected. For example, the first thing that it is possible analysed for rural building is the orientation of the plant with respect to the cardinal points. Most of the rural houses have a south-facing main facade, the only one that receives solar radiation all day in Winter. The second key element of the passive building is the low surface-volume ratio also present in the structures of the time especially in cold climates.
The type of building envelope and the materials used depend on the climatic context where the building is located. In cold climates isolated structures were made up of compact volumes that reduce the dispersion of heat towards the external environment and the buildings are rectangular in shape with the main front facing south to favour exposure to maximum sunshine. Since the structures have a rectangular development, the east and west fronts, having little depth, allow the solar rays, in the Winter period, to be able to pass through the perimeter glass components, striking a large area of internal surface. Furthermore, the building was built with local materials capable of accumulating energy and thus limiting internal thermal oscillations. The heaviness or massiveness of the wall guaranteed high characteristics of thermal inertia or damping and thermal phase shift. These insulating characteristics were a valid tool for protection from the cold in Winter and heat in Summer. Massive walls capable of promoting high thermal and wall storage capacity. In addition to the massive walls, another important element was the arrangement of the stable. The stable in many construction types was placed below the housing unit, so the heat of the animals was used as a supply of free heat for the home.
Vice versa, in areas near the sea where the climatic context was certainly warmer or at least mild, the buildings were constructed with a pitched roof and relative space below. The motivation lay in using this space as a heat accumulator in the Winter, and thermal insulation in the Summer.
Another key element in these constructions was the dark and light colours used to favour the absorption or reflection of solar radiation respectively depending on the exposure and needs. In the Vesuvian area typically used was Pompeian red, to favour and increase surface absorption. On the other hand, in some areas we can observe the presence of a white plastered band, which ran all around the windowed openings. It is also a solution based on the principles of bioclimatic, as it exploited the high reflective capacity of white to increase the entry of solar radiation, guaranteeing better illumination of high-volume spaces

3. Innovation through energy design

With the 2002/91/EC regulation called EPBD (Energy Performance of Building Directive) and subsequent 2010/31/EU (called EPBD recast), the concept of nearly Zero Energy Building (nZEB) was introduced. These describe the energy efficiency of a building, ie a building with an energy consumption is “nearly” zero. The nZEBs, as expressed in the 2010/31/EU standard, are high energy performance buildings whose energy needs must be covered, for the most part, by renewable energy sources.
Evolution of the nZEB building is the Zero Energy Building (ZEB), for which, in the building sector, we mean a building in which the amount of total annual energy produced on site, using renewable sources, is such as to be able to satisfy all the needs of the occupants. A zero-energy building produces enough renewable energy to meet its annual energy consumption needs, thus reducing the use of non-renewable energy in the building sector.
Today, however, it is also possible for a building to be able to produce a surplus of energy, leaving the excess to the electricity grid. These are described as Plus Energy Building (PEB).
There is no univocal and pre-established rule for the construction of a nZEB, ZEB or PEB building but rather some basic principles to be respected and implemented so that the project is as efficient as possible. Designing the envelope (or redesigning it in the case of building rehabilitation) is certainly the first design step so that there is an understanding between building and environment that allows reducing the use of non-renewable energy sources and increasing those renewable type. It is necessary to conceive the built environment, structure and envelope, as a living and dynamic organism able to

regulate itself to climate changes and exchanges of energy and heat with the outside, guaranteeing heating in the Winter and cooling in the Summer. In other words, it is necessary to build an ideal bioclimatic house that is able to change its behaviour, with the external environment (sun, temperature, winds), with the changing seasons. The building must be able and able to exploit solar radiation in cold periods both for natural lighting and as a heat source, minimizing heat loss (through careful design of opaque and transparent closures) and maximizing the accumulation and 'thermal insulation of walls, roof slabs and first trampling. On the other hand, in hot weather it must guarantee cooling by installing an optimal shading and cooling system for the rooms and/or natural ventilation (where possible). To realize a PEB it is therefore important to create a project that is energetically attentive to the control and reduction of heat dispersion through the envelope, also using natural systems for collecting solar radiation. The rural building, which since its realization lives in tune with the climate and the landscape, seems particularly suitable to be redesigned and transformed at least into building nZEB, using passive and active systems.

4. Conservation and Innovation: case study

The building case study is located in the municipality of Torre del Greco, Na - Italy (Fig. 1).
The area of intervention analysed is characterized by the presence of two complexes: an historic one, dating back to the beginning of the twentieth century and one of more recent construction, realized in response to the expansion of the working activity.
Among the building types falling within the Vesuvian Area, the case study has composed of a basement which acts as a cellar (said cellaio), which implies the wine activity carried out in the territory. The cellar plant is almost square and consists of three rooms, in addition to the staircase, one of which has a flat roof and two, instead, have a vaulted ceiling, made in a lowered vault. In addition to this, the house is composed of a ground floor which has a distribution in a modular layout equal to that of the basement. Access to the house is from the south and/or north front. An internal stairwell, located to the north, now without a roof, provides access to the roof terrace on the first floor. To the west of the central nucleus of the house there is a stable, subsequently adapted to a kitchen.
The aim of the conservation and innovation design is to give new life to the existing building through a new functional distribution.
The design solution is based on the conservation of existing volumes in the name of maximum respect for an example of rural architecture and minimum induced impact. Furthermore, the specific re-functional choices respond to the comfort needs of living today and a growing dimension of sustainability that creates the conditions for a rapprochement with the landscape. These needs materialize project recovery and finalize it to re-inhabit, respecting the principles of the conservation of the built rural heritage, with the knowledge that only the use of the build guarantees its preservation and frees it from the abandonment to which it is a candidate.

4.1 Climate context

The build is located in the mountainous area to the north-east of the territory of the municipality of Torre del Greco (Naples – Italy) in the area of Vesuvius National Park. Annual solar path, study of wind and temperature variations has been determined to analyse the climate context.
From the geographical coordinates of the site (Long. 40°, Lat. 14°) the map of the solar paths in polar and cartesian coordinates was obtained. In this way it has been possible to predict the impact of solar radiation on the building during the different months of the year. the limit radiation conditions have been recorded during the solstices: 21 December for Winter and 21 June Summer.
These two paths taken by the sun, together with the direction and intensity of the wind, have been considered for the design.
Monthly average external temperatures recorded by Naples Capodichino weather station have been used and the variation of the average hourly daily temperature in the different months of the year was obtained.
The minimum value of the outdoor air temperature was about 3°C while the maximum one was approximately 32°C (Fig.2).
Because the building is located at an altitude of 247 m above sea level, higher than the weather station considered (71 m), it was necessary to calculate the actual Day Degrees (DD) of the analysis area, considering the influence on the temperatures, especially the minimum ones recorded in the Winter period, that the altitude entails. Compared to the 1034 DD planned for the municipality of Naples, falling in the climate zone C, for the case study considered, from the calculations carried out, the DD were equal to about 1543, placing the building, on the basis of what reported in the Italian law “DPR 412/93”, in climate zone D. The high value of DD has involved a much more careful design of opaque and glazed components, especially in terms of transmittance, in order to satisfy the needs for thermal comfort in the winter period.



Fig. 1: Rural building and its landscape context

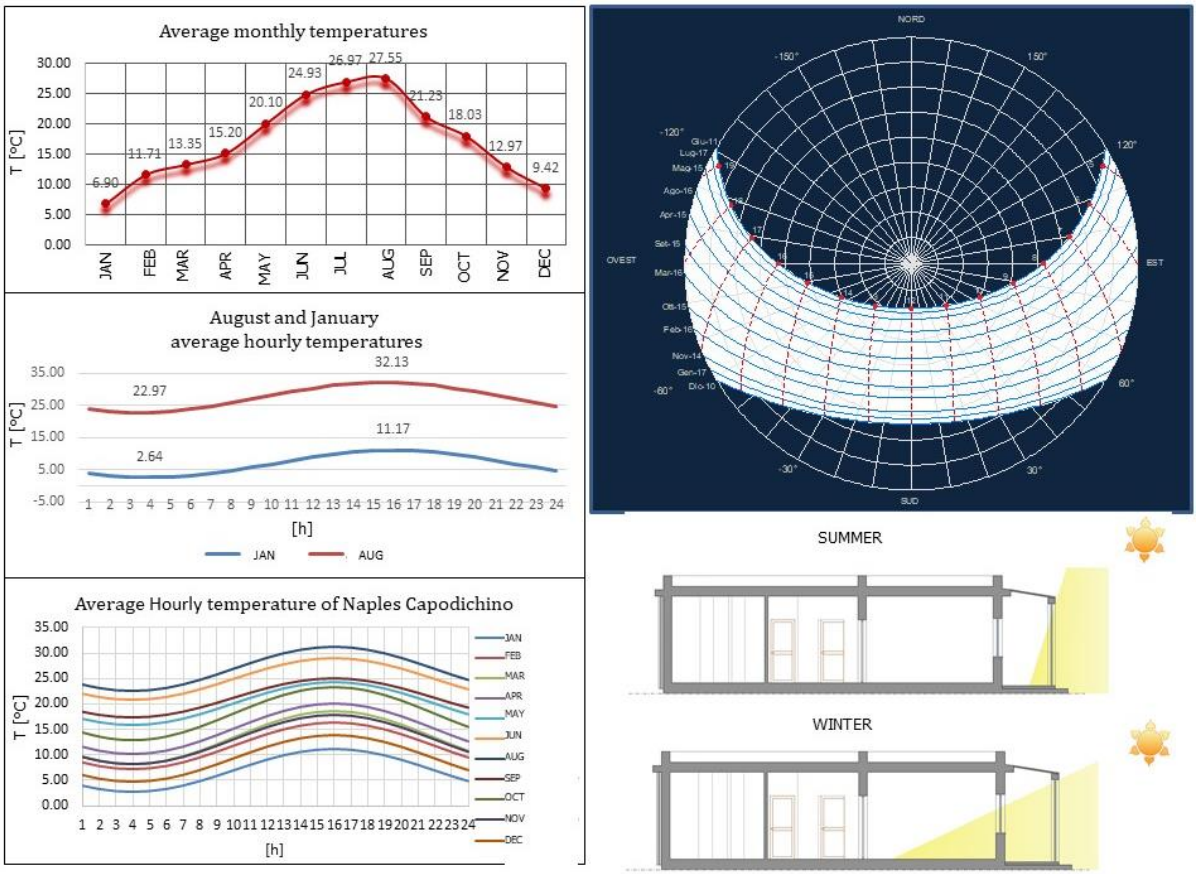


Fig. 2: Climatic data of the area of intervention: temperature, polar map of the solar paths and inclination of the sun's rays

4.2. New functional distribution

From the bioclimatic point of view, the building is compact and rectangular, with the longer side perfectly parallel to the heliothermic axis. This configuration favours the exposure of the southern front to the solar rays in the winter period, increases the free daily energy supply. Further bioclimatic elements found are the presence of few openings and buffer zones towards the north, as well as the massiveness of the walls which gives good characteristics of thermal inertia. These massive walls can promote high thermal and wall storage capacity.

To have a good behaviour in terms of energy efficiency, it was important to define the functional redistribution of the internal environments, in line with the criteria underlying the bioclimatic practice. Furthermore, by making a careful and correct study of vertical and horizontal opaque components and integrating them with passive solar systems, it was intended to implement the original bioclimatic matrix to give the building a basic passive behaviour on which to base integration with active solar systems, both for the production of electricity and for the production of domestic hot water.

The design philosophy that characterizes this advanced recovery approach is aimed at creating a building that is at least nZEB.

As far as functional distribution is concerned, the design solution is based on the conservation of existing volumes in the name of maximum respect for an example of rural architecture and minimum induced impact. Furthermore, the specific re-functional choices respond to the comfort needs of living today and a growing dimension of sustainability (Fig.3).
As regards the specific choices, given the impossibility of connection between the two volumes of the rural house, it was decided to exploit the already existing opening on the north wall of the former stable, connecting it externally with the building of more recent construction. Furthermore, a layout of the rooms in both buildings was hypothesized, trying to orient, in a joint manner, the division of the pre-existing spaces according to the bioclimatic design logic, arranging buffer zones to the north, and finally the living area, bedrooms and study to the south and south-west. The only exception to the bioclimatic principles is represented by the provision of two smaller rooms on more unfavourable fronts than the annual solar radiation (Fig.4).
The construction of a solar greenhouse was envisaged, which is not only one of the passive solar systems, but also a “space-non-space” that unifies the two buildings. The southern exposure behind the former stable and the more recent building remodels the southern front of the entire complex. Moreover, the solar greenhouse can reduce conduction losses through the elements of the enclosure that face onto it and allows to reverse the thermal flow when the internal temperature of the greenhouse is higher than the temperature of the adjacent rooms.
From the point of view of the project result, the greenhouse is configured as a solution that uniquely allows the energy redevelopment of the housing unit and, by accepting solar energy through specific transparencies, creates, at the same time, a relationship environment between building, people, and nature.
As regards the stairwell of the rural house, the construction of the roof slab in steel beams and corrugated sheet was envisaged, resting on load-bearing walls made of perforated brick blocks. From the staircase it is possible to access the small terrace from which it will be possible to enjoy the surrounding natural beauties.
The most substantial change in the rural house concerns the main environment, designed with double height through the construction of a loft in steel and structural glass. In this way it is possible to make the most of the volume of height above the current standards of use of the interior space, without changing the original volumes. In fact, the hypothesis is that of closing at the top the environment, currently without a roof, by means of a solution of a single-pitch roof that substantially joins the existing walls, without resorting to elevations (Fig.3).
The characterization is entrusted to structural glass, which, discreetly, realizes the new closure through a large glass surface supported by beams also in structural glass. In this way it was also possible to combine natural lighting with the free thermal gain system. To limit problems of overheating in the Summer, caused by direct solar radiation, which would limit thermal comfort, a natural ventilation system was used. The use of the fresh wind coming from the south-west that creates the chimney effect with the window facing north, allows a minimum natural internal ventilation, which can be increased with plant integrations.

4.3. Passive and active solar system

The choice of passive solar systems becomes a fundamental element in this approach, to the extent that the sun is a free resource that activates a basic behaviour in line with the climate. In the wake of a reading that analyzes and quantifies the bioclimatic approach from which the construction originated, this choice becomes a set of technological solutions that enter the project at the detail scale and maximize the exploitation of natural resources. In this way, the building to be re-built passively gains a basic energy behaviour which, without installations and without management and maintenance costs, requires only minimal integration from the active systems.
The two main passive technological solutions are the solar greenhouse and the Trombe wall, to which are added other small choices in relation to specific materials that offer further free contributions in terms of performance. The solar greenhouse, as a passive solar system, can accumulate and transmit solar radiation to the adjacent environments of both buildings both by radiation, through the glass component, and by conduction, through the building component.
Specifically, the latter will be treated internally with plaster containing microcapsules in PCM (Phase Change Material) to increase its storage capacity. The PCM, at specific temperatures, very close to that of human comfort, undergoes a phase change from solid to liquid, during which it can accumulate and transfer thermal energy, but above all intelligently, maximizes the efficiency of the greenhouse solar.
From the structural point of view, the greenhouse is designed in steel and glass and, to avoid overheating of the internal areas in the Summer, it is expected to use openable windows. But the most unique feature of this solar greenhouse lies in the choice to install photovoltaic glass on the roof. In addition to guaranteeing a certain production of electricity, it also acts as a shielding element for doors and windows in the Summer, at the same time allowing direct thermal gain in the winter period.



Fig. 3: Plan of the rural building after the intervention with the redistribution of the interior spaces

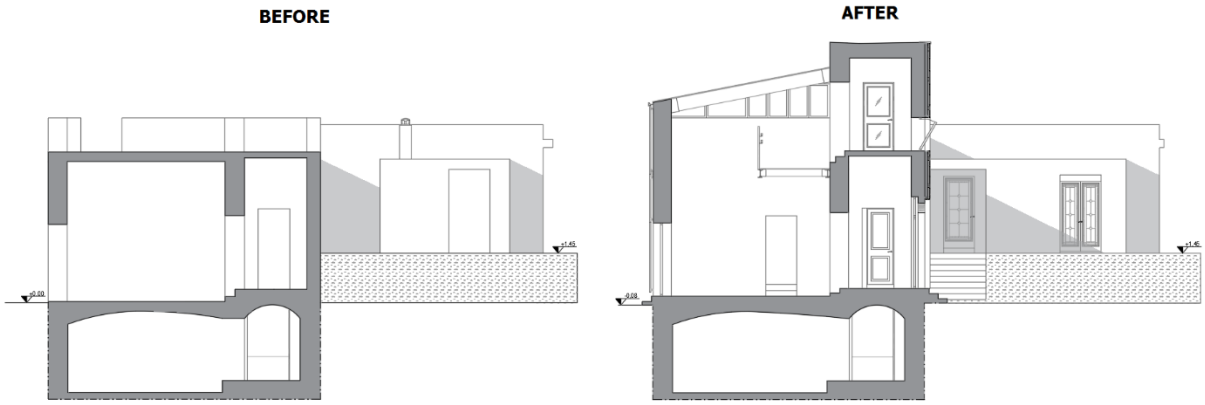


Fig. 4: Sections of the rural building before and after the intervention

As far as the vertical and horizontal opaque closures are concerned, the design choices have been outlined to reduce heat losses, respecting the minimum thermal transmittance requirements of climate zone D according to the provisions of Italian law D.M. 26/06/2015. Attention has been paid to dry technologies, so that the closure solutions could boast a certain reversibility and limit the substantial impact.
To this end, it was suggested to differentiate vertical closures, proposing the solution of the ventilated façade with different finishes between the two buildings. For the older one, an "outer skin" was conceived in lava stone, to reinterpret the use of the lithic material of the place in material continuity, but in a modern key.
The southern front of the oldest building is an exception in which the transformation of the load-bearing masonry closure into the Trombe wall was hypothesized.
From the external point of view, this passive solar system with indirect thermal gain uses the glass mirroring to leave the original masonry texture in sight and to render a singular quotation of the historical technique. Composed of small stone tombs very dark, of irregular shape, placed in a disorderly manner, this constructive solution is typical of this part of the Vesuvian Area. From the energy point of view, instead, the goal is to exploit both the thermal inertia of the pre-existing masonry and the colorimetric characteristics of the Vesuvian stone that would act as an absorber to enhance the build-up characteristics of the masonry itself (Fig.5).

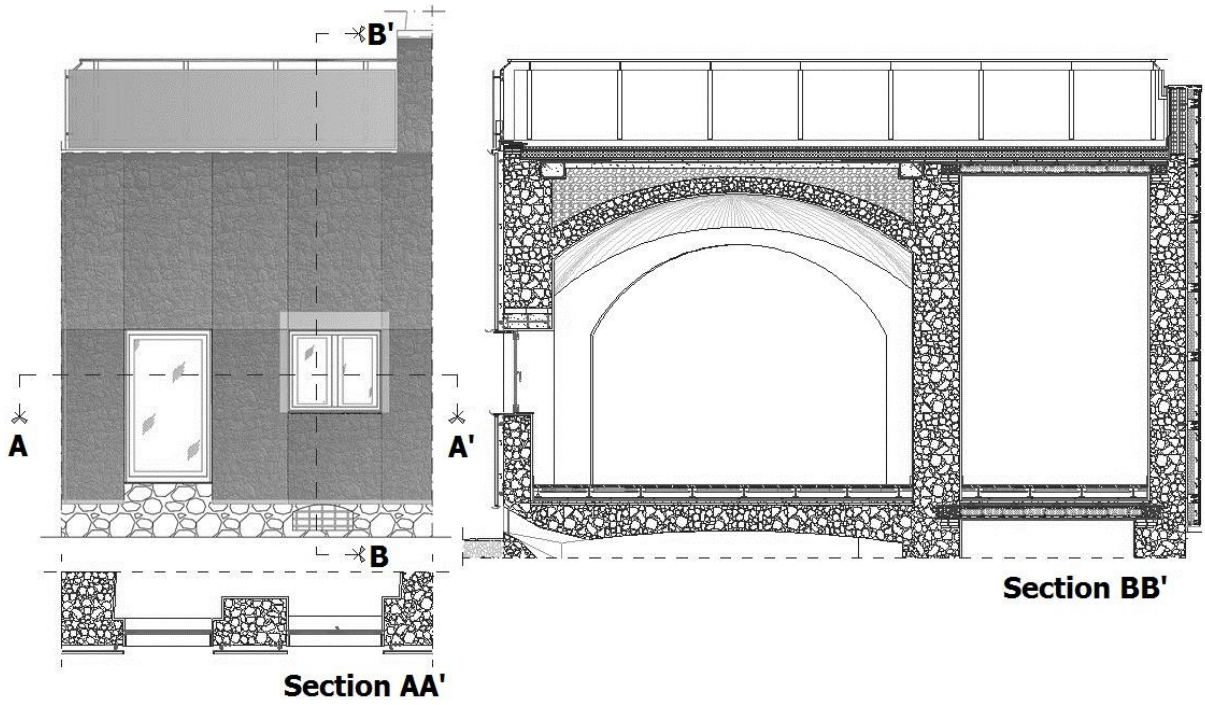


Fig. 5: Trombe wall particulars

In the project hypothesis, the Trombe wall consists of a glass façade, suspended by traditional fastening devices, and spaced from the accumulating masonry wall so as to leave a gap. The thermal energy trapped in it is accumulated by the stone masonry and transmitted to the internal environment both by radiation and, albeit to a lesser extent, by convection thanks to the creation of small openings made in the wall itself at the base and at the top. This passive system makes it possible to supply free energy during the winter, but, if not correctly designed, it could cause overheating in the areas bordering it during the Summer. To control this imbalance in behaviour between opposite seasons it is possible to choose between the various types of passive glasses, those with angular selectivity. The advantage of passive glass, in prismatic panels, laser cut or with special slats placed between the two glass plates is the possibility of capturing solar radiation inside the cavity in winter and reflect it outside in Summer, in relation to the different heights of solar radiation, which occur in the two seasons. This reduces the phenomena of overheating in the summer period. A necessary condition for the wall to always be able to perform its function is that the windows are always clean. Another small supplementary choice is the use of self-cleaning glass technology, in which a thin film of titanium dioxide makes the external surface of the glass hydrophilic, that is, able to make water and dirt slide more easily.
The choice of the ventilated wall on the other three fronts makes it possible to combine several advantages, which go far beyond those that can be foreseen with external insulation and the elimination of thermal bridges, because it is a removable dry covering system that covers and protects the original walls of the building. Furthermore, the ventilated wall technological system is a complex multilayer system which, through the interspace, adds the effect of natural ventilation, which is fundamental for the transfer of thermal flows and for the transpiration of the building especially in Summer, with significant thermal gains above all in Mediterranean climate.
To guarantee the limit thermal transmittance values established by the legislation, two insulating panels have been used, mechanically connected to the structure, consisting of material obtained from the recycling of plastic bottles. This dry coating system makes it possible to vary the exterior configuration of the two buildings, thus dating the recovery intervention.
Particular attention, however, has been reserved for the first trampling, envisaging the use of a particular floating floor, such as the dry radiant raised floor. It is composed of two elements that integrate well with each other: radiant panel heating system and removable modular finishing panels. This floor system allows instant verification of all the systems placed between the flooring and the under flooring

5. Conclusions

Focusing on an economic growth process that respects the resources of the natural heritage is the goal of the ecological transition. To make it possible, sustainable development plans are needed in the field of rural architecture for the conservation and enhancement of the landscape by promoting new economies that are more attentive to the reasons of rural communities and territories.

The project to re-inhabit the rural building, starting from the scale of the building, allows to finalize and exceed the recovery target by examining new residential opportunities. The possibility of living sustainably meets the basis for a high-performance energy efficiency action that ensures exceptional conditions of comfort in the bioclimatic matrix that characterizes rural heritage. The quality of the space is entrusted to the design choices, which can maximize conservation and innovation, to the point of outlining an approach that, going up the building ladder, opens up to the environment and lays the foundations to give new life to rural architecture. Bioclimate characteristics, traditionally belonging to rural heritage, can be implemented through passive and active solar systems, to the point of declining the goal of recovery, and obtain buildings capable of producing energy.
If is true that sustainability more than a philosophy, is a way of looking to the future that reinterprets living in harmony with nature, the rural building and the context redevelopment on the edges of the city corresponds to a life expectancy in which one looks at the horizon without limitations, with a dimension of the living of freedom and breath.

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20th World Heritage and Ecological Transition
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Towards a Sustainability of Cultural Heritage

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Abstract

In the EU project, UPCREATE, we focus on Cultural Heritage. In the conventional optic, Cultural Heritage includes archaeological sites, historic buildings and artefacts, importantly we find it also includes the meanings, values, and contemporary social behaviour associated with these tangible forms of heritage. In UPCREATE, we consider place attachment, sense of place, and associated forms of intangible heritage as major societal factors that must be integrated into consideration of the sustainable transitions.

It is our thesis that with point of departure in Cultural Heritage we can promote creativity, innovation and productivity. Understanding ecological transition as a concept that aims on new social and economic models in order to respond intelligently to ecological challenges, our aim is to rethink the way cultural institutions can renegotiate their identity by interacting with their audience through new innovative approaches.

It is our belief that UPCREATE will strengthen the vital commitment between young people and their environment with new, innovative participatory approaches letting them engage with, develop and innovate the creative and cultural sectors. Doing so, UPCREATE will foster the creation of innovative solutions young people can use to face the current societal challenges, and which will support the recovery resilience of the culture and creative sectors through an ecological transition.

Keywords: Cultural Heritage, Innovation, Interdisciplinary cooperation, Creativity, Sustainable Transition

1. Towards a Sustainability of Cultural Heritage

As our society takes on more social responsibility and action, creative fields such as architecture, sculpture, painting, music, performance and other various artforms have followed suit. Our project UpCreate follows in the footsteps of Sustainable Transition of Cultural Heritage, hosting five National competitions for young artists in Europe [1]. It is our hope that the young coming up artists in the project will join the current dialouge surrounding sustainability and use their work to send a message, either by its theme or by the media used to create their "art piece".

It all started in 1983, in an effort to encourage global cooperation toward sustainable practices that should benefit both the economy and the environment, the United Nations established the World Commission on Environment and Development. This group, now known as the Brundtland Commission, first worked to define sustainable development (including art as a profession), creating the 1987 guidelines that have been used to anchor environmentally conscious decisions in a variety of industries in the decades since. With the motto: "*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [2] many has since worked hard to fullfil the task.
The UpCreate project have embraced this definition with the launch of five competitions for young artists in five different EU countries, all involving the specific art direction the participating European House Museums or Organizations represent and involving food as a synthesysing element.

When it comes to art, the term "sustainability" can take on many meanings, and we find that the public opinion on this social and economic movement has expanded dramatically in the past few decades. While the Brundtland Commission was an important first step toward fundamental change, policies and regulations aimed at reinforcing sustainable practices, this have continued to evolve in the years since, to reward those who follow sustainable practices and encourage the adoption of these.
In 2015 the "2030 Agenda for Sustainable Development" was created by the United Nations [3]. The agenda outlines seventeen core goals across a variety of categories to help the world become a more environmentally friendly, peaceful, and prosperous place. Most resonant with the art world is goal twelve, centered on responsible consumption and production [4]. This goal requires companies to work towards environmentally conscious practices throughout every facet of their operations, and increase the use of natural materials within their products. Many items in mass production are experiencing a manufacturing overhaul, forcing artists to reevaluate the pillars of design in order to comply with this new mandate.
While the policies are evolving at a high level, the idea of sustainability is also affecting the daily lives and work produced by individual artists. The main idea of sustainable art is to intend to provide new perspectives on the world in its current state, suggest potential solutions, and raise awareness for issues that artists are passionate about and working with.
However, in the very start of 2020, the world faced a new challence, with the pandemic, the COVID-19 spread rapidly and the World Health Organization (WHO) declared a Public Health Emergency of International Concern on 30 January 2020. The ongoing COVID-19 situation has and will continue to have, a huge impact on people of all age groups, social classes, and cultural backgrounds. Among the most challenged from the pandemic, are young people and cultural institutions. Educational, cultural and social activities everywhere have been, and still are, severely limited or suffering from a long lockdown and, consequentially, social exclusion among young people is rising. Among these young people are future artists, creative entrepreneurs, writers, composers, design innovators, craftsmen and women, who have a huge potential to contribute to European society and culture.
The COVID-19 situation also severely affects the cultural and creative sectors, and as a consequence, many of them are threatened on their livelihood with small scale museums also generally struggling to attract young people. There is therefore a great need for cultural institutions to renegotiate their identity by interacting with their audience through new innovative approaches.
This is why the European project UpCreate have created a new interdisciplinary and cross-sectoral partnership between 7 partners from 5 European Countries that has the goal to provide new, innovative solutions and opportunities for young people in Europe – and at the same time for the European cultural and creative sectors in general.

UpCreate has a partnership of 5 cultural institutions representing 5 different disciplines of art, one culinary actor, and one higher educational institution and is led by Aalborg University, Denmark. UpCreate involve the following competent partners: Museum and Galleries of Ljubljana, Slovenia, Associazione Marchigiana Attività Teatrali, Italy, Art Museums Skagen, Denmark, Einar Jónsson

Sculpture Museum, Iceland, ARGE Gustav Mahler Festival Steinbach, Austria, and Alchemist Taste Lab, Denmark.
The aim of UpCreate is to create new, innovative participatory approaches to how young people can engage with, develop and innovate the creative and cultural sectors. Doing so, it is the expectation that UpCreate will realise new synergies between fields of education, training and youth and the profession of European creative institutions.
Furthermore, by combining two essential cultural fields – Food and Art – in new, innovative ways, UpCreate will foster the creation of innovative solutions young people can be inspirered of to face the current societal challenges. Solutions, which also will support the recovery resilience of the culture and creative sectors.

2. Promoting Sustainability through Cultural Heritage

In UpCreate we thus focus our work on Cultural Heritage and Sustainability. In the conventional optic, Cultural Heritage includes archaeological sites, historic buildings and artefacts, importantly we find it also includes the meanings, values, and contemporary social behaviour associated with these tangible forms of heritage. In UpCreate, we therefor consider place attachment, sense of place, and associated forms of intangible heritage as major societal factors that must be integrated into consideration of the sustainable transitions.

"*The theatre has become immersive of social and community interaction; one-on-one, participatory, performative, in residence, of awareness, sociological and more. A theatre that, to recover its social function and reinvent itself in the pandemic condition, needs to 'get out' of the usual places and forms, imagining new spaces and new dimensions of coexistence.*
The audience does not come to a gallery just to withdraw meaning from the art deposited there but to be part of the art, so that their movements and reactions change what is going on.
The art wraps them in. It is not just the artist's ideas and knowledge that are on display but those of the participating audience as well". [5]
As stated above by Charlie Leadbeater, art is essentially inter-subjective and dialogic, not just in the way an audience might receive and interpret a work but in its constitution. Collaboration and participation is fundamental to the creation of the art not just its presentation and reception [6].
In our work in the Erasmus+, Strategic Project, we focus on the agenda of a Sustainable Cultural Heritage, and we have explored particularly in the innovative creatice fields for answers. The first one related to the way sustainability is sensed and understood in different cultural and social contexts. The second one, to the way artists can contribute to the debate on sustainability, both at an experiential and conceptual level.
It is our thesis that with point of departure in Cultural Heritage we can promote creativity, innovation and productivity. Understanding sustainable transition as a concept that aims on new social and economic models in order to respond intelligently to sustainable challenges, our aim is to rethink the way cultural institutions can renegotiate their identity by interacting with their audience through new innovative approaches.
In "The Art of With" Charlie Leadbeater explores what kinds of culture will emerge with more participative, collaborative approaches, which can encourage a different kind of engagement between artists, producers and audiences. Leadbeater analyses the new phenomenon of mass creativity exemplified by web sites such as YouTube, Wikipedia etc., and he gives a public criticism and revision of the phenomen, argueing that participation and sharing, rather than consumption or production, will be the key organizing idea of future society [7].
With point of departure in the thought of participation and sharing, we argue that we in general can gain more participative, collaborative approaches, which can encourage a different kind of engagement between artists, producers and audiences. It is our belief that the project UpCreate will strengthen the vital commitment between young people and their environment with new, innovative participatory approaches letting them engage with, develop and innovate the creative and cultural sectors. An argument for this thesis is that in these decades, especially in the field of performing arts, we have witnessed an almost imperceptible change of accent, all full of implications. If the avant-gardes and movements of the second half of the twentieth century were defined above all based on the content of the shows and the working methods - theatre of actor, direction or group, research or experimentation, laboratory, avant-garde and post-avant-garde - the most recent artistic phenomena, rather put the accent on the relationship with the public.

As explained by John W. Bennett in his book "Cultural Anthropology and Human Adaption", the Sustainable Transition studies the relationships between humans and the physical environment. According to Bennett, the Ecological Transition assesses some converging approaches in cultural

anthropology, including cultural ecology, economic anthropology, social exchange, and behavioral adaptation. In other words, when Bennett say Sustainable Transition he refers to the process by which humans incorporate nature into society.
We point out that Bennett discusses how to formulate a policy-oriented cultural sustainability and looks at the sustainable transition as material evolution and as a problem of equilibrium. In his book, the succeeding chapters review some of the contributions of cultural sustainability, including its successes and failures. Bennett also examines the concept of adaptive and maladaptive actions in human sustainability. We find this book is useful for people who are interested in cultural-sustainability research and its implications in public policy, and to innovators in the creative fields.

Looking closer at sustainable transition, it is a concept that aims to put in place a new social and economic model in order to respond intelligently to sustainable challenges. It aims to rethink the way we live together on a territory, work and produce in order to reduce our environmental impact. In the long term, it will enable us to adopt a sustainable development approach, by favouring renewable energies, modifying our consumption behaviour and limiting waste. The aim is to provide an economic and social response to the environmental challenges facing our planet.
In their article “Towards an ecology of Cultural Heritage” Elizabeth Brabec and Elizabeth Chilton from University of Massachusetts-Amherst, has stated that Culture and Heritage affects all aspects of society and further that this define a persons “self” in the world [8].
Their reseach build on the idea that heritage is not only “what happened in the past”. With this statement they underline that heritage is not only history, i.e. like historical facts, events and timeperiods. Brabec and Chilton point out that in their view; heritage importantly is the accreation of attitudes, values and traditions that define our cultural worldviews. They say that it is an attitude that stem from our cultural heritage, and manifests in the tangible physical forms of cultural heritage [9].
We take point of departure in Brabec and Chilton’s, view, that heritage impacts a wide range of activities and decisions that people make both individually and collectively, such as how people understand and accept scientific knowledge.
Brabec and Chilton go further on, saying heritage also center on how people respond to, and adopt technology and technological change, and how they are attached to place and to each other [10].
In relation to this, the UpCreate Erasmus+ Strategic Partnership is a project, which aim to foster the creation of innovative solutions that young people can use to face the current societal challenges, and which will support the recovery resilience of the culture and creative sectors through an ecological transition. The five competitions we have launched is very different.
The Associazione Marchigiana Attivita’ Aeatrali, AMAT, Italy, is a non-profit association of local and regional authorities of the Marche Region. AMAT schedules, promotes and manages the theatrical activities of drama, dance plus non-formal education for local communities, in association with local administrations, and their competition is devoted to writing stories about Food & Memory.
The reason of the existence of an organization as AMAT, regional theatrical circuit in the Marche Region, partner of the Erasmus+ project UPCREATE, in the 70’s was the extraordinary cultural heritage of around 100 historical theatres (minimum 90 and maximum 800 seats) in this small region on the Italian Adriatic coast. Most of them have been greatly restored and are in full activity. In those venues AMAT organizes professional programs but also activities in which the citizens of any age can feel they can express themselves, implementing the intangible heritage too.
The concept for the programming of a wide range of events in those venues concerns mostly two lines of experience for the citizens: on one side a theatre of escape, of “evasion”, a relaxing pause from the daily life, mostly represented by comedies, entertainment and classical texts. On the other side a theatre of “invasion”, referring particularly to the contemporary performances, where usually audiences receive many powerful input and stimulation about fears and fragility that occupy our daily life.

But there is more. There is a suspended time or place for a “transformation” of a little personal heritage into a shared experience through the expertise of a professional artist. Therefore, the stage of a theatre is the symbolic venue of a meeting among cultural heritage, arts, technology, nature, human beings: all connected toward a sustainable approach.
In UpCreate, there will be the creation of an art piece, specifically a theatrical work to be performed, which is the result of a long process. A Call for competition called “Food & Memory” [11] is published, with the following presentation: a dish, its taste, a smell, a particular kind of food can instinctively evoke memories connected to events, people, experiences, and moments of our lives. The AMAT competition is inspired by such a simple fact, intimate and universal at the same time.
Theatre is one of the best ways to share stories. Candidates are students (18 – 25 years old) asked to write a text in which they can describe as a personal memory evoked by the idea of the competition. It could concern, for instance: a tradition of the family (or within a friendships) referred to a specific dish; a happening (a cooked food for a special person or occasion); a special event that comes to the mind only through the smell of a food; a taste, which brings our mind to childhood.

A jury will select 3 stories and the young students or authors will have the opportunity to attend a on-line workshop with an expert theatre director to prepare a performance on their story. At the end of April, the three performances will be presented in the wonderful Chiesa dell'Annunziata, a XVII century building in Pesaro [12] shared with an audience. A special jury will select one of the stories, that has been developed to a performance and the winner student will have the possibility to attend an international and interdisciplinary workshop in the context of the Art Biennale in Venice. At the workshop, the talented young person will together with students from 4 other European Countries, partners of UpCreate, build further on their work and present it together on an open Session at the Art Biennale 2022.

Alongside the performance partner AMAT, 4 smal House Museums attend the UpCreate project, representing sculpture, painting, architecture and music. Among these is the Icelandic sculpture Museum Einar Jónsson. Einar Jónsson was a groundbreaking figure in Icelandic sculpture and his influence on the visual arts in Iceland has been considerable, though indirect. Jónsson was Iceland´s "first sculptorer", he drew inspiration from the Icelandic folklore heritage for "Outlaws" and other works from the first decade of the century, but he also used mythological and religious motifs in the beginning of the 1900. For Einar Jónsson bread was a very special and important part of his meal, sometimes he did not eat his bread because he found it too beautiful. The competition on Iceland is therefore devoted to sculptures of bread, honoring the artist, and young artist are invited to create new sculptures.
In Slovenia the small House Museum, The Plečnik House, where the Slovenian architect Jože Plečnik lived and worked between 1921 and 1957 is engaged in the project. Here a competition for a new dessert is launched with the slogan: flavours from the Plečnik's garden, attached to the memory of Plečnik who attended his garden with a sincere ecological approach.



Fig. 1: Cathedral of Freedom" by Jože Plečnik, Ljubljana, Slovenia. Photo: Matevž Paternoster / MGML

3. House Museums, Creative Organisations and participatory engagement

The UpCreate project took point of departure in a partnership engaged in House Museums and small History Museums. These museums are in many ways well suited for visitor participation, since the museums often involve “real people's” stories. As cultural anthropology in general has swung away from a vision of authoritative history and towards the embrace of multiple perspectives, there is potential for those stories to come from all over the place, including visitors themselves.
House Museums are also excellent places for visitor-generated or visitor-supported research projects; this is why UpCreate has placed a National Competition on the 5 small National Partner Museums. Despite their support for multiple perspectives, House Museums feel strongly about accuracy and authenticity. In the project, we also found the small House Museums very well suited for creative visitor participation. Many of them show a creative process, and many visitors may be inspired to create their own art in response to that on display. While art historians and curators may have their own sense of what interpretations of art are most accurate or valuable, it is generally accepted that everyone has his own experience of art, and that individuals' different interpretations or preferences are acceptable.

Finally, the project take into consideration that many small art museums do fabulous, highly participatory projects that are led by participatory artists. Artists who work specifically in the realm of dialogue or active social participation.
In general, Art Museums have more significant separations between education departments and curatorial departments than other types of museums. This means that an activity construed as educational often cannot be placed in the gallery if it is perceived by curators to distract from the aesthetic experience of connecting with the artworks. Ironically, art museums often present the most radical participatory experiences for visitors, but only when led by an artist, not by internal staff members. There is also a strong bias in some art museums against amateur content, which prevents some institutions from encouraging creative participation by visitors.



Fig. 1: Art Piece with bread by Sigurdur Gudmundsson, "Mountain", Iceland, 1980-1982, Black and white photograph

In the cooperation with Skagen Museums, Denmark, this picture have been challenged. Skagen Museums have several small Ateliers in their building mass, hereof a number that is part of original artist homes. The museum has an ambition to fill these ateliers again, and not just exhibit new pieces of art, but also expose young artist while working, and at the same time creating a dialogue with the audience. Another main goal is to initiate a process of influence on the local society, a picture that was unique around the late 19th century. Here, the fishing village of Skagen became the home of a colony of Scandinavian artists. Inspired by French Realism, the artists found their motifs on Skagen's beaches, on the moors and in the cabins of the local fishermen, as well as in their own familiar environment.
The artists' colony became known as the Skagen painters. With artists like Peder Severin Krøyer, Anna and Michael Ancher, Viggo Johansen and Christian Krohg at the forefront, the group of Skagen painters were early advocates of modern painting in Scandinavia, in opposition to academic painting and the Danish Golden Age tradition. Skagens Museum has collected the works of the painters, preserving the art in the environment in which the artworks were created. In their call for competition, they are inviting young artists to continue the steps of history, giving them a chance to add to our cultural history and heritage, and by involving them as mentioned to initiate the process of sustainable transition of the cultural heritage.

4. Conclusion

John W. Bennett made an interesting work on ecological transition incoorperating anthropological materials, historical studies; he was drawing ideas from biology, systems analysis, anthropology and other fields into his general theory. Bennett suggest a path for anthropology to become more useful in the solution of contemporary problems, and offers a principal definition of his central concept, cultural ecology [13]. The definition says that cultural ecology is the study of the process in one major feedback loop in society. The loop involves the physical environment, understood as technology, social organization and what Bennett defines as "presses", which includes values, needs, goals etc. It is our thesis that artists that embrace this definition as a mean to understand their individual impact on the environment can make a new future for art, a sustainable future.
The idea of sustainability in art has in our project and the experiments we have initiated led to groundbreaking artistic works that leverage unique media and send powerful messages about climate change, political policy, and social injustice. It is through sustainable transition of cultural heritage that artists hope to, not only to change how their work is made, but to inspire social and cultural change as well.

We find it important to clarify what the understanding of the difference between Ecology and Sustainability is. In relation with this article, we consider ecology as the study of the relationship between something and its environment, this could be humans, bacterial or food growth [13]. Where sustainability is to maintain something or keep the status quo, without weakening or damaging it [14].
Sustainability is the capacity to endure. In ecology, the word describes how biological systems remain diverse and productive over time. For humans it is the potential for long-term maintenance of well being, which in turn depends on the maintenance of the natural world and natural resources [15].
This means that the difference between an ecological transition and a sustainable transition is that the ecological transition aims to gain a more profound understanding of the relationship between humans and their environment while the sustainable transition aims to find solutions that are forming equilibrium.
It is our belief that UpCreate will strengthen the vital commitment between young people and their environment with new, innovative participatory approaches letting them engage with, develop and innovate the creative and cultural sectors. Doing so, UpCreate will foster the creation of innovative solutions young people can use to face the current societal challenges, and which will support the recovery resilience of the culture and creative sectors through a sustainable transition.

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Innovative strategies to preserve the Italian engineering heritage: the historical tunnels.

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Abstract

Italy, a nerve center for Western culture, holds the largest number of artistic and cultural assets declared World Heritage by UNESCO. From the Romans to the present day, an ever-growing infrastructure system, rich in tunnels, bridges and viaducts, has been the expression of a high engineering expertise. For the management of the aforementioned complex infrastructure heritage, the development of automated control and maintenance plans is one of the issues on which the engineering and research community focuses its resources and efforts. In this study, an approach is proposed to automate the process of classifying defects in tunnels using deep learning techniques to protect and maintain the concrete tunnel lining. The acquisition of images from non-destructive monitoring techniques, such as Ground Penetrating Radar, within a supervised learning process allows the creation of an effective tool for the automatic detection of severe defects such as cracks, anomalies, and voids. The obtained results provided for a high degree of accuracy in identifying the tunnels' structural condition. The use of the developed strategy, based on machine learning and non-invasive inspection techniques, is cost-effective for infrastructure managers. Such a procedure reduces both the number of invasive interventions on the tunnel lining and the time and cost associated with employing specialized technicians.
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Keywords: cultural heritage, planning, sustainable development, technologies, data integration

1. Introduction and related works

The Italian context is of significant importance due to the presence of artistic and cultural sites, most of which have been declared World Heritage by UNESCO. Bridges, tunnels, and viaducts stand out among these heritage works as examples of remarkable engineering techniques.
The two largest mountain chains in Italy, the Alps and the Apennines, have always been natural obstacles to mobility, leading man to carved tunnels into the rock. For this reason, over time, many tunnels have been built to overcome these natural barriers to facilitate the exchange of people and goods.
Between 1964 and 1984, the most important Italian tunnels were built: Mont Blanc Tunnel (1965), Fresjus Tunnel (1980), Gran San Bernardo Tunnel (1964) and Gran Sasso Tunnel (1984).
Those listed are only the most famous and outstanding examples of civil engineering.
However, until the 1980s, infrastructures were characterized by a significant plano-altimetric flexibility that minimized the use of tunnels. The road layout evolved over time, becoming more dominatedby straight and curves with large radiuses, as well as an increase in the number of tunnels. These last,

conforming to current guidelines and being object of an increasing attention, represent an effective solution to reduce impact on the natural landscape.
In the Civil Engineering field, development, and research of possible indicators of structural state alteration have been increasingly interesting. These indicators aim at providing an "early warning" in case of upcoming danger.
Today, the Italian engineering heritage is formed by an increasing number of buildings which may be subject to collapses and failures. These events are caused by non-linear phenomena and disproportionate behavior. For this reason, the adoption of investigation technologies based on non-destructive techniques (NDT) and artificial intelligence (AI) is pivotal.
The possibility to use these techniques for risk predictive models, structural stability assessment, and optimization purposes for design is very interesting...
In particular, image diagnosis is the most widely used methodology for structural condition analysis.
The proposed work is focused on tunnels; however, this concept can be reasonably applied to other civil structures such as bridges.
The issue of tunnel safety became very important especially after the catastrophic events of Mont Blanc and Tauern. For this reason, several European countries have adopted specific safety protocols following *Directive 2004/54/EC "Minimum safety requirements for tunnels in the Trans-European Road Network"*.
The structural conditions are mainly influenced by deterioration and presence of voids that can worsen the structural conditions [1]. Other factors affecting the structural state are freeze-thaw cycles in the case of not water-proofed tunnels [2] [3], the presence of construction defects, and damages due to seismic actions [4].
Investigations and inspections are traditionally carried out by periodic and visual observations through non-destructive and non-invasive techniques. However, these methodologies are affected by several critical issues such as the cost of operator training, the strong subjectivity of the data interpretations, and the time required to perform them.
In this paper, a strategy based on a multilevel convolutional neural network for damage detection and classification is presented.
The aim is to detect and classify potential damage in structures through the synergy of artificial intelligence algorithm and structural health monitoring (SHM) techniques [6].
This would allow the creation of a rapid and robust tool that can provide a during maintenance phase by setting up structural conditionmapping.

2. AI and Convolutional neural network

The motivation for the great interest in artificial intelligence techniques, especially in the field of Civil Engineering, lies in the amazing key concept of such methodology: the ability to automate the problems resolutions and the activities typically carried out by the human mind.
The strengths of these techniques are the computation speed and, first of all, the ability to automatic manage a large number of data.
Within the artificial intelligence field, this research is based on deep learning (DL) techniques that can solve different problems starting from experimental data [7] by means of the artificial neural networks.
However, the process of extracting the needed information to perform a correct image classification is not immediate.
The result of a correct classification is based on the training process, where the images provided as input are associated with the associatedclassification. The network is then tested on a set of images to assess its accuracy and robustness.
Among the several neural networks, a Convolutional Neural Network was chosen. It is based on the convolution mathematical operation where a series of layers are intended to receive, resize, and extract significant features from images by translating the analyzed images into categories [8].
A training process based on a large amount of images, such as the present case, would haveimplied excessive computational time. For this reason. the technique of "transfer learning" was applied. It uses pre-trained neural networks determining a fast network configuration and a promising accuracy even with less training data. These networks are pre-trained on the ImageNet Large Scale Visual Recognition Challenge (ILSVRC) classification and location dataset, based on 100000 training image, 50000 validation images and 100000 test images [9,10].

3. Techniques: Ground Penetrating Radar, Algorithm, and Image pre-processing

3.1 Ground Penetrating Radar

Ground Penetrating Radar (GPR) [11] was chosen from among the various non-destructive investigation methodologies (NDTs) [12] for detection of defects in tunnel lining. Due to its ease of use and transport [13] and its penetration capacity, this instrument has proved to be a valuable tool for damage detection, location, and classification.
It is based on the transmission of pulses of electromagnetic waves of frequency in the studied material using an antenna with a frequency between 10 and 2600 MHz. The dielectric characteristics of the material significantly affect the propagation of that pulse.
The study was based on a GPR campaign focused on Italian tunnels, most dated from 1960 to 1980. Two types of GPR were used in that campaign. The first utilizes a dual-frequency antenna, the second a high-frequency antenna. Tables 1 and 2 summarize the technical characteristics.
The outputs of this techniqueare profiles with a vertical axis indicating the depth of the examined thickness and a horizontal axis representing the structural progressive distance. The described profiles were interpreted by specialized technicians during the campaign. An example of a GPR profile with relative interpretations is shown in Figure 1.

Table 1. Technical characteristics of GPR with dual frequency antenna.

GPR with dual frequency antenna features	**value**
Min. number of channels	4
Pulse repetition frequency (kHz)	400
Range (nsec)	0-9999
Min.number of scans/second	400
Power (Volt)	12
Primary dual-frequency antenna (MHz)	400-900
Secondary dual-frequency antenna (MHz)	200-600

Table 2. Technical characteristics of GPR with high-frequency antenna.

GPR high frequency antenna features	**value**
Min. number of channels	4
Pulse repetition frequency (kHz)	400
Range (nsec)	0-9999
Min.number of scans/second	400
Power (Volt)	12
High-frequency antenna (GHz)	≥2

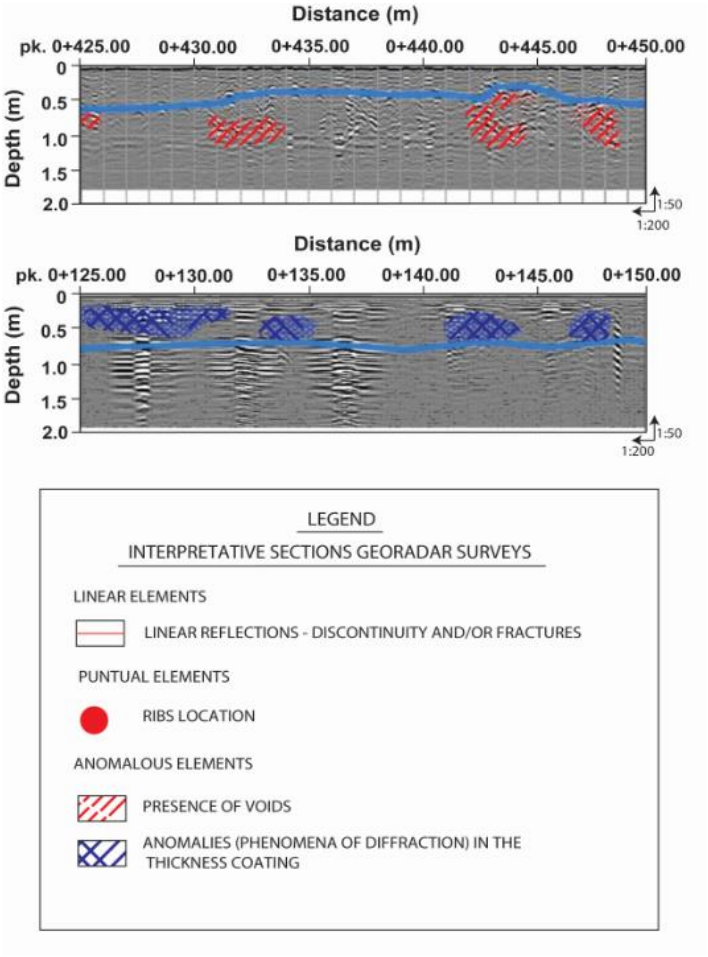


Figure 1. An example of a GPR profile with defect patterns interpretation [14]

3.2 Algorithm and Image pre-processing

Among the several pre-trained networks, Resnet-50 was chosen and was applied within the programming environment MATLAB 2020b.
The network, designed in 2015 by Kaiming He et al [15], is composed by 177 layers, of which 1 is fully connected, while 49 are convolutional. The strength of this network is the presence of "residual/skip connections" that base their operation on the presence of activating functions such as the Softmax layer and the Linear Unit Rectified (Relu).
The presence of skip connection reduces the problems related to the excessive depth of the network allowing to learn the differences between input and output layer. The choice fell on this network for its high depth and very low computational level for the resolution of classification problems. Input data of the algorithm are the GPR profiles described above. However, before using GPR profiles as input data they have been subject to previous operations, such as removing axes, applying filters to reduce the effect of noise, noise tails, and interference, by the Data Provider. Then, each profile was divided into elements of variable size through the free online module PineTools. A data augmentation technique was used to increase the data by rotating the images with respect to the vertical axis, as several literature studies suggest [15–17].

4. The multi-level damage classification

The adopted network allowed the implementation of a multi-level hierarchical procedure. Seven models were created, each performing a binary classification. The minimum number of samples in each class was used to balance the classes in each level to avoid imbalance issues between them. By moving from the lowest to the highest levels, more detailed knowledge can be gained about the presence and type of structural damage. This approach aims to associate a degree of attention to the critical issues that deserve a thorough examination of the ongoing structural decay. When a new GPR profile is analyzed, it can be associated with one of the 14 classes, as described in Table 3.

Table 3. The 14 Classes of the multi-level classification

	Class names	Descriptions
LEVEL 1	C1: Healthy and reinforcing	images associated with healthy structural conditions and with the possible presence of reinforcement
	C2: Damaged	images with at least one or more types of damage.
LEVEL 2a	C3: Healthy	images associated with healthy structural conditions
	C4: Reinforcement	images with reinforcement,
LEVEL 2b	C5: Warning mix	Images combinated with of two or more types of damage.
	C6: Warning all	images corresponding to the presence of a single type of damage.
LEVEL 3	C7: Crack	Images in this class are characterized by the presence of cracks
	C8	Images in this class may present anomalies, simply voids, detachment, or excavation.
LEVEL 4	C9: Anomaly	Images in this class show abnormalities, i.e., inhomogeneities within the cover casting.
	C10: Mixed voids	Images in this class show the presence of voids of several
LEVEL 5	C11: Simply empty	Images in this class are associated with the presence of medium-sized and deep voids.
	C12	The images in this class are related to detachment and excavation phenomena
LEVEL 6	C13: Detachment	This phenomenon produces external voids, also presenting some cracks.
	C14: Excavation	This phenomenon brings internal voids with large dimensions

5. Results

The propsed work has shown very promising results, such as a maximum value of accuracy for level 5 equal to 98.3% and for the other levels, however, greater than 90.4%. These accuracy values are derived from the confusion matrices of each level, as shown in the table 4. Such matrices represent one of several useful methods for defining the classification algorithm performance. Their rows showing the real classes and their columns representing the predicted labels. The accuracy value is determined by the ratio of the matrix trace to the total sum of its terms. Each level of the proposed classification shows the accuracy value and the confusion matrix related to an arithmetic average of the results obtained from the application of K-fold cross validation. For each classification, the elements were randomly divided into k groups (with k equal to 10) of which (k-2) were used for network training, one for validation, and one for testing. The term k was assumed equal to 10 because, according to several empirical studies, this value produced estimates of the test error rate that were not affected by either excessive bias or high variance [18,19,20].

Table 4. Confusion matrices for the 6 levels

		Confusion Matrices		**Performance Metric**
	Real Class	C1: Predicted	C2: Predicted	
Level 1	C1	93.3%	6.7%	Accuracy: 92.6%
	C2	8.1%	91.9%	
	Real Class	C3: Predicted	C4: predicted	
Level 2a	C3	98.4%	1.6%	Accuracy: 97.3%
	C4	3.9%	96.1%	
	Real Class	C5: Predicted	C6: Predicted	
Level 2b	C5	90.9%	9.1%	Accuracy: 90.4%
	C6	10.1%	89.9%	
	Real Class	C7: Predicted	C8: Predicted	
Level 3	C7	92.7%	7.3%	Accuracy: 95.9%
	C8	0.9%	99.1%	
	Real Class	C9: Predicted	C10: Predicted	
Level 4	C9	94.9%	5.1%	Accuracy: 91.8%
	C10	11.3%	88.7%	
	Real Class	C11: Predicted	C12: Predicted	
Level 5	C11	98.8%	1.2%	Accuracy: 98.3%
	C12	2.2%	97.8%	
Level 6	Real Class	C13: Predicted	C14: Predicted	Accuracy: 95.3%

	C13	96.6%	3.4%	
	C14	5.9%	94.1%	

6. Conclusion

In this paper, a hierarchical approach of a multilevel classification related to GPR profiles of highway tunnel linings is reported. Its goal is to create an automated defect classification system. The multilevel classification concerns 7 different CNN models trained through the transfer learning technique, starting from the pre-trained Resnet-50 network. The present work describes the use of artificial intelligence algorithm, as a structural health monitoring (SHM) technique, highlighting the its potentialities and reliability for the automatic classification of tunnel defects. This could be crucial. in a perspective of potential safeguard and maintenance of the Italian infrastructural heritage.

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Architecture as a in fieri work. Ecological transition to ensure the resilience of a community

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Abstract
Focusing only on the 'technological' aspects of every transformation of living places, for the purpose of energy saving, is a 'punishment' for our discipline and it becomes only a rhetoric solution. On the other hand, actions that see the paradigm of 'sustainability' as an exceptional opportunity for cultural and quality enrichment of architecture, and its ecological transition, allow to consider the existing heritage as starting point for a sustainable development over time and toward the future. The project made by Lacaton & Vassal architects in Bordeaux – the renovation of three blocks of a 1960s slab housing estate with the addition of an outer skin of winter gardens – is the occasion to develop the contents of this abstract.
This work is selected because it is an expression of their social and ecological convictions and it is a reflection of the economic, social and cultural values of our time. Furthermore, it led to see a project as a process, as something dynamic and transformative – in which every phase is important as any other –. This conceptual attitude is a characteristic, deeply peculiar, in the above mentioned Lacaton & Vassal's work and within the panorama of disciplines which work on ecological design. Therefore, looking at the analyzed case, time becomes the fundamental element of design definition, taking away from Space its condition of unique protagonist. This awareness changes the way to approach the built environment around us, makes re-thinking it as a source for the future and activates the citizen participation, ensuring the resilience of a community.

Keywords: sustainability, transition, Lacaton & Vassal, socio-ecological, change

1. Introduction
This article aims to contribute to the discussion on the conception of ecological place making and focus on what we mean by calling a building "green" outlining a social constructivist perspective on the development of sustainable architecture.
Proceeding from the fact that 'sustainability' is an ecological term that has been used since the early 1970s to mean: "the capacity of a system to maintain a continuous flow of whatever each part of that system needs for a healthy existence"[1]; the question of adaptability and flexibility towards transformations become crucial into the architectural process, in order to guarantee this flow.
At the same time, hence, the matter of transformation brings with it the concept of duration, which is necessary in thinking architecture in present and future. Seeing a sustainable building as something that is necessary and durable means innovating and overhauling the techniques for the 'old' systems, components and materials, which have proven durability[2] and, at the same time, founding 'new' light and efficient materials together with the implementations of disposal and reuse operations of the buildings.
After all, "building *within* or *on* the built is an ancient action"[3], if we think about history of architecture, it has always been done in this way because, besides leaving a mark on a place, the life in that place can be perpetuated. Often this implies a reduction in costs and sustainability is also about the smartest way how money is spent on doing something.

We are surrounded by terms as “green”, “eco-”, “sustainable” which in the design field represent a steady broadening of scope in theory and practice[4], but they are also buzzwords which risk to lead to “a demand for consumer goods that are environmentally benign will simply result in strengthening the growth of consumerism”[5], and this argument is easily applicable to the architectural field where these words are becoming increasingly vague and generic. Their significations are more linked to the marketing needs of products than are actually capable of having a non-negative impact on the consumption of energy and environmental resources.
The term ‘architecture’ itself seems being paired more frequently with adjectives such as ‘ecological’, ‘sustainable’ and ‘green’ with ever greater emphasis, as if to supplement and complement the actual meaning of the word. The concept of the environment has now become so powerful that it is possible to distinguish between correct and incorrect architecture, with the difference lying in the fact that the former is environmentally friendly and the latter is not. In this regard, it seems opportune to guide the debate back towards the actual meaning of architecture: an act of transforming the environment with an inherent combination of ethics, rationality, sensitivity and technical ability which ensures that the projects produced are as comfortable, appropriate, functional, beautiful and environmentally and socially friendly as possible[6]. An architectural project brings together all these factors.
The crucial relationship between architecture, social context and climate has been established since the time of Vitruvius: ‘*The style of buildings must be clearly different in Egypt and in Spain, in Pontus and in Rome, and in countries and regions with different characteristics. One part of the Earth is scorched by the heat of the sun, while another is frozen; then there is an area where the sun is at moderate distance, and the ‘impact’ of its rays changes accordingly*’. (Vitruvio (95), Libro VI, Cap. 1).
Yet, we can strive to be more accurate in the use of this term, and in doing so, perhaps be closer to creating a sustainable society.
The emerged challenge could lie on a reshaping of the environmental discourse considering the position of Nicholas R.G. Stanger, who suggested that there is a way to provide a more sustainable approach to contextualizing human-life and educational systems, starting from a correct use of the term –and a re-thinking of that–, in order to move “eco-” back into socio-ecological models[7].
In this scenario the work of architects Anne Lacaton & Jean-Philippe Vassal is the epitome of the ‘ecological’ approach. Their strong ethics of economy toward an ecological use of resources guide them toward architectural choices based on the achievement of the maximum of quality and freedom of space with the minimum waste of ground, materials, energy, money. They have stated that this is not an argument for austerity but rather it is an investment and an expansion[8]: avoiding building overly ambitious with expensive government buildings would implicate more resources on other projects, such as schools, hospitals and social housings.
In one occasion the ‘no architecture’ strategy was their proposal for an "embellishment" plan of a town square in Bordeaux, instigated by City Council in 1996. As a project they have proposed doing nothing apart from some simple and rapid maintenance works. Because embellishment was not necessary there from their point of view. Doing nothing decision is for them an architectural deed, and at the same time it is a demanding work because, as the French duo explains, in order to take such a decision, a serious and precise in-depth study is necessary.
The ‘economical use of resources’ is based on their African experience: the two architects, during a five-year stay in Nigeria, became obsesses with the spontaneous, almost ephemeral, highly ingenious local architecture. Observing that incredible things happen there with virtually nothing they could see how you can success in producing an event that is almost maximal with a minimal structure, wondering if we often do far too much.
This approach allows to be proactive toward the economic and ecological crises and, conceiving what exists around us – our heritage – as a resource, gives a deep value to the act of transformation. As Yehuda E. Safran stated in a poetical way “our world is alive, changing and transforming itself; so we are. In confronting the crises of contemporary reality we are increasingly in search of new forms and values while longing for some inner magic, a transformation. A new world view is developing, where spirit and matter are perceived as inseparable from each other. This first codex offers a pop-cultural vision of transformations as an alchemical allegory. Alchemy is interpreted as a process that facilitates spiritual transformations and a profound integration of body and soul. It speaks directly to the depth through the images that are present there. Ibn Umail, an Arabian alchemist of the tenth century, considered the psychic process of transformation as being the highest goal in human life”[9].
Therefore, the comprehension of the value of the act of transformation allows to also understand the fate of architecture: an endless *in fieri* work, likewise our lives and those of the people who use the space conceived by architects.
At this point we are returning to the first definition of the term ‘sustainability’ mentioned above, mainly based on the presence of a continuous flow of the different parts composing a system and on the capacity of the same system to maintain this vital flow, in order to guarantee the healthy existence of its parts.

In light of this and looking again at the main threads that define Lacaton & Vassal's methodology there is a convergence point: they are always looking for the achievement of a building that can be read as a "capacity system"[10]. The system is intended as a correlated group of architectonic elements which work together for the achievement of a single and same purpose. A purpose that comes out to end with a high architectonic 'capacity'[11]. The term 'capacity' is related to the ability to contain something, one can easily realize that Lacaton and Vassal want nothing more than a building that is able to efficiently and pleasantly contain human life itself, way beyond an elementary answer to any given program[12]. For the French duo, a 'capacity system' is a group of interconnected architectonic elements that work together to rightfully contain life[13].
This consideration seems to find an evident and concrete achievement in the realization of their work – it is not only a theoretical position – and it seem to be the proof that the architectural practice could have a natural and spontaneous approach toward an ecological transaction, embracing the future.
The analysis of their work is functional for this paper in order to illustrate the continuous process of accumulation, addition, reinterpretation, reformulation of recurrent themes and questions each time, such as capacity, flexibility, climate, comfort, uses, structures, economy, and so on.
In a specific way, the selected project of transformation of the three inhabited social buildings in Bordeaux (France), demonstrates how a simple, but smart, action could bring with it numerous meanings rather than being a merely technological façade system. The addition of a perimeter ring made of winter gardens, as buffer spaces, around a group of social towers creates a result which goes beyond the only technical efficiency improvement in terms of energy. It is a design choice that gives a spatial dignity, light, internal fluidity and projection of the inside space toward the landscape.
The integrity of this architectural work is based – almost in an astonish way – on an ultra-basic solution, which is going to be explained below as object of interest and emblematic example of how it is possible to go beyond the dark side of the "green".
Probably nothing in architecture is what it looks like at a first glance. So, by unfolding the cultural layers that are condensed in Lacaton & Vassal's work and through a sophisticated continuity with history, context, city, modernist industrial business systems, an understanding of their work could be possible.

2. The dark side of 'green'

Sustainable architecture is an ambiguous term and ambiguity makes losing integrity, which might contribute to apathy in the environmental sector[14]. Some have coined the use of "eco" and the environmental marketing trend as "greenwashing" and suggest that it is a rampant profit-grab and pseudo-moral paradigm[15]. As Howard Liddell correctly calls it, 'eco-bling' has become prevalent in 'green' buildings, characterized by a stylistic approach to sustainable architecture rather than an operationally effective and contextually appropriated approach to good design[16]. Essentially, sustainable design should be spontaneously part of the architectural process, Susan Maxman suggested that "sustainable architecture isn't a prescription. It's an approach, an attitude. It shouldn't really even have a label. It should just be architecture"[17]. The lighting, heating and cooling of buildings requires large quantities of energy and consequently cause detrimental harm to the environment. Architecture should aim to lower the energy demand of a buildings through passive means before the implementation of alternative and renewable energy technologies[18], and it is also necessary more attention toward the local resources. The use of sustainable materials sometimes needs to be transported from faraway places, polluting consequently seas or sky. Further implicit is a "process of standardization," which means that "particular local conditions" and competing "forms of local knowledge" tend to be ignored[19].
Sustainable buildings are assumed to merely represent differently configured technical structures, with particular pathways of technological innovation viewed as objectively preferable to others. Reflecting the "technocist supremacy" that dominates most environmental research programs, this perspective tends to ignore the essentially social questions implicated in the practice of sustainable architecture[20].

3. Anne Lacaton & Jean-Philippe Vassal in Bordeaux, France

The project of transformation of three inhabited social housing's buildings – named G, H, I –, from the early 60s', in the Grand Parc neighborhood in Bordeaux, has been selected as case study in order to analyze which elements, within the architectural process, could contribute to overcome the ambiguous concepts considered up until now, related to the so called sustainable, ecological, or green architecture.
Furthermore, the philosophy of intervention, implemented by Lacaton & Vassal for this project, can be a useful tool to raise awareness on the environmental vision based on the integrity of thought and on the involvement of all the different aspects which belong to responsible actions.
In order to achieve this purpose, they stayed that is needed a) to "design an architecture that challenges conventional answers"[21], b) to go beyond the usual generic terms – house, urban zone,

etc.–, c) to do not consider actions as isolated actions, but synchronized with a transformation of fragile, already-existing situations, d) to do the maximum with a minimum[22]. Those are some of the points of their thought which immediately lead back to simple principles which give an order and an orientation within the complex system of the project actions; demanding a sense of commitment.
Going through the reading of the selected project, other different points are highlighted.
Indeed, in the paper are indicated further principles which could be helpful, as critical and compositional categories, for the definition of a direction toward an enrichment of the socio-ecological models in the architecture field. It wants to contribute to the understanding of how the integrity of choices can influences human development and the construction of its vital space, together with a worldview coherent with it. Exploring this work, through the following sub-sections, hence, provides a way to incorporate a more socio ecologically-based approach of understanding the sustainable architecture and its potential rework in the realization process of architecture.

3.1 The economy to spend less and better

It is a key point of a bioclimatic concept, that simply means maximum use of natural recourse of climate. It implicates the awareness of the importance and value of the existing heritage through reuse and transformation actions. They call it “strategies of the essential”[23], where it is highlighted the importance to return to the simple, to the fundamental, indeed to the ‘essential’.
Lacaton & Vassal don’t believe that a project is much more beautiful only if it costs much more than any others, they don’t even believe that an incredibly sophisticated technique can make ah higher comfort and pleasure, because in many situations it causes consequent high expensiveness[24].
In the case study of this paper the costs for the realization have been lower than 1/3 of the planned money, and this allowed to keep the rent of people, who were already inhabiting the buildings, to stay at the same amount in their own house; even though an extension of the 50% of square meters and an improvement of the quality of space inside.

3.2 Challenging conventional answer

The concept of saving energy in a different and unconventional way means choosing a technological solution not only in relation to its efficiency grade – for instance the number of glasses layers –, but rather conceiving new ways to use the different high–performance elements to rethink the quality of the space and to give an added value place where people live in.
Therefore, instead of installing triple-layers glasses, it is possible to consider how staying between two layers of glasses and having some life in between could guarantee a sense of freedom inside the house. Indeed, looking again at the case study of the project in Bordeaux, the existing apartments

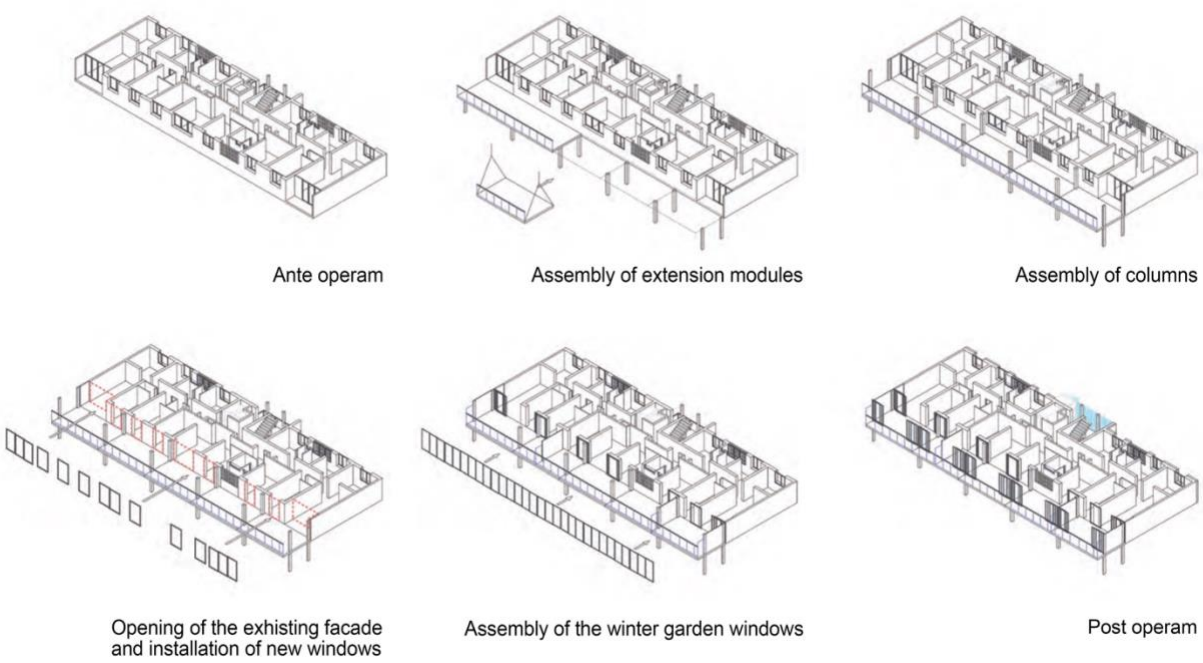


Fig. 1: Assembly process of prefabricated extension.

can now open on to large wintergardens and balconies, and offer pleasant outdoor spaces, large enough to be fully used for the daily life – eating, reading, playing, relaxing, and so on –.
It was possible through another unconventional system, related to a structural matter: modular prefabricated elements of 4 deep and 6,5 meters long, with their own foundations and with fixing against the existing facades; these last opened and replaced with large windows. It was precisely in correspondence of the south facades of H and I building and the 2 façades of G building.
During all the construction phases, the inhabitants could live inside their own dwell thanks to a particular protection installed close to the open perimeter toward the new winter gardens.
Within the modular prefabricated structural system there is the chance, for the inhabitants, to characterize their climate and ambience by the curtains, with a spontaneous movement of these elements. It is a dynamic system where each flat could never be the same. The façade has been thought to be always different in an ever-changing and moving in function of the character and situation of the inhabitants, or in function of climate. Lacaton & Vassal spoke about "an open structure for inventing climate and ambience"[25].

3.3 Porosity

Conceiving the space from inside toward outside is a project approach which allows to work at the same time with two different scales: the intimate and domestic scale in relation to the urban one.
In our case study the double scale thinking is meant to manage the process of densification which characterizes contemporary cities. From the point of view of the French duo any intention of densification must be linked to the relationship between the quality of an interior space with common areas and public spaces. Because any project of densification would fail if you don't think first that is necessary to increase the individual space of people. A city cannot be sustainable if compression is imposed to the life of its citizens. Housing is everywhere – school, public spaces – and inhabiting is a situation that has to be good in any place of the city[26]. Looking at the city from housing, defending the pleasure of living, means thinking about every space of the city and making a porose system between the two above mentioned scales. It also changes the way to look at the city: as a collection of capacities and energies to expand, and not as an inert mass for modeling. So, city is meant as an aggregation of activities and living spaces[27] interconnected with each other in a single system.

3.4 Precision

In order to make sustainable actions, the exactness is a necessary parameter which allows to monitor each phase of a project: from first analyses to the construction. The knowledge of what already exists is necessary, through researches and studies, the more precise it is, the more it will serve as useful tool for further cases and future generations.
By the early 2000's, Lacaton & Vassal, along with the architect Frédéric Druot, decided to go against the well-established solution in France, which established a scenario of large national demolition-reconstruction program of the *grands-ensembles*. Financed by the ministry of culture, they developed a study – the later well-known "*Plus, Les grands ensembles de longements. Territoire d'exception"* (2004) – where they presented a group of transformation interventions set to rekindle, in an efficient and inexpensive way, the life of the communities who live in those social buildings. The study came to have a tremendous importance in the shifting of opinion over the future of this heritage, resulting in several built repercussions throughout Europe. Furthermore, it also worked as a platform to divulge their thoughts on the matter, latter giving them the opportunity to explore it in a wide number of projects, among those our study case, with the consequent 2019 Mies van der Rohe Award[28].
As mentioned above, rigor is fundamental also during the design process. For these architects connecting the construction approach with the first conceived ideas of space, allows to have the control of the entire project and the relative costs of each single part. Every single element of the construction is important for them to determinate the final result.
This working method inevitably leads to understand in which case is actually possible to talk about ecology, sustainability and affordability in architecture.

3.5 Aesthetic as result of the process

It is not preliminary in a project, it is instead much more a good result of a lot of intentions that, as Juan-Philippe Vassal explained during the lecture at Harvard University, start from the quality of the interior space and from the relationship between the inside and outside. Each place is different for them, sometimes happens that in a site is necessary only a little layer of poetry, like the flowers at the University Center of Management Sciences, in Bordeaux, or as the tiles Café-Restaurant at the Museumquartier in Wien, or even keeping all the trees in the house project in Cap Ferret in France.
What remains important for them is starting a project with intentions, looking carefully to situations and finding the right idea. Aesthetic is one of the main points to give emotions, sensible situations, so it plays an important role in their work. It is a result of the process of a project through thinking,

participation, discussion with people, generosity, ambition; all kept at their maximum level in order to find the beauty at the end of the work.

3.6 Indeterminacy and transformation

Undoubtedly the final image of the project in Bordeaux is strongly influenced by the elements of customization introduced by the users. In an Issue of The Plan Journal, in 2019[29], the question of indeterminacy and adaptability in the architectural work of the French architects is analyzed within the theoretical framework of the Team X generation and the work by Peter and Alison Smithson called "The Aesthetics of Change"[30]. These considerations on endless architecture were followed by the architects in the aforementioned project, and Anna Lacaton in one interview explained that "they learnt to be always open to situation, and to never make a decision in the process of a project that could close it, to keep it open to allow changes, even in the construction process"[31]. This position includes again the time category in the architectural work: creations which are opened toward the flux of time allow the continuous transformation and adaptability to human life.

This topic is selected to be in the last part of the paper in order to provoke a discussion about the concept of "change" in architecture, far from the concepts of architecture based on the artwork as a finality. Could a new aesthetic of changes support a rethinking of the existing built heritage? Being a building an endless work, could be more available to new uses and future development in respect of climate and possible future ambiances? Could the acceptance of future scenarios of transformation gathers people together, contributing to peace and to social unity?

A perspective could be find again through the words of Lacaton & Vassal "The wellbeing, but also the dreams, of contemporary society seem to depend on the way in which an existing situation encounters a new situation, two temporalities, two states of mind. Each time we tackle a project we think in terms of an intervention in an existing fabric, the history of which may be real or dependent on a fiction. The goal is to superimpose our new intentions, but without imposing them onto pre-existing systems – we hope to do this with scruples and delicacy so that a third place is born, a product of the two previous ones"[32].

4. Conclusion

It has been suggested an alternative way to face the ecological topic in architecture in order to abandon the incontestable definition of sustainable building and, instead, treating the concept in a "relative rather than absolute sense" as a "mean of awareness of all the issues that can be considered"[33]. By the adopting an interpretative framework of the project of Lacton & Vassal in Bordeaux and by exploring their way of working on the social production of space, place, and environment, the challenge is overcoming the concept of environment merely as a "physical entity and resist the categorization of it only in scientific terms"[34].



Fig. 2: Life inside a winter garden designed by Lacaton & Vassal.

Individuals, groups, and institutions embody widely differing perceptions of what environmental innovation is about[35]. Each of these actors may share a commitment to sustainable design but are likely to differ greatly in their to, unsustainability. Designers have the possibility to take a position in this complex situation with their environmental visions, by treating these competing views as environmental discourses that take material form in the shape of buildings and project decisions. Architects, being the last link in the chain of the political decisions, can recognize the tension between alternative environmental beliefs and strategies.
The critical reading, offered by this paper, want to lead to reflect on certain environmental constructs and to encourage a more sensitiveness toward logic of innovation that may surface in design practice[36].
A dialogue toward a consensual and incontestable definition of green buildings is necessary, but it could happen only through the awareness of the socially contested nature of environmental design.

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The Seven Maples as Spatial and Social Places in Veles

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Abstract
There are seven maple trees in the city landscape of Veles. They are the focal points of urban texture. At the level of local neighborhoods, they are local centers. At the city level, they create a network of public places of reference through which the city is read and represented. They are the product of the traditional spatial social patterns through which the city was generated. Small public places with referent spatial and programmatic elements at the neighborhood level: the dominant tree, water fountain, bakery, and other common programs and around them, aggregations of private houses. Today they are witnessing a possible symbiosis of natural and created values. They are facts of a traditional city but little is known about their origins as well as their vital contemporary function. The subject of this research is the sequences of urban texture in the relation of individual maple trees and their surroundings. The purpose of this research is, first, documenting those unique places of the city as a dialogue of trees and architecture, second, exploring their natural, spatial and social attributes and their possibilities in contemporary contexts, and third, defining a method of reading and preserving the sensitive places of traditional contexts in contemporary cities. Becoming aware of a specific heritage provides paradigms for a possible relation between nature and architecture as an essential dialogue in our modern cities.

Keywords: maple, urban texture, social spatial patterns, nature, architecture

1. Introduction
As the landscape around us transforms more and more intensively in an irreversible and profound way, the question of our elemental attitude towards nature remains. The duality of the city and surroundings does not exhaust our fundamental notion of nature. The demographic changes expressed in the urban domination over the rural, and the new global urban reality of the city, cause a dramatic change of the urban / natural landscape [1]. Through it, cities not only change their borders by continuously extending their figure, but also the internal structure of the established urban order [2]. On the one hand, there is an increasingly dynamic transformation of the urban-natural relation. On the other, the modern paradigm of the binary and quantitative ratio remains. How can we renew an essential relation of man to nature in this new context? Can we rethink the personal relation of man to the phenomena of nature on a particular level?

As early as the end of the nineteenth century, Camilo Sitte criticized modern systems and stressed the importance of the emergence of particular greenery in cities [3]. Reviewed Mechanical Approach to Supporting the Greenery with Examples from Rome and Constantinople, with Individual, Lonely Trees in the Urban Environment as a source of Poetry of the City. Camillo Sitte wrote “All those who have seen Rome will remember that powerful palm tree at Laterano. The entire picture is enriched by the lonely tree, visible from afar, through the multitude of streets. That single palm tree gives Rome a characteristic of a southern city because this single trunk stimulates the imagination in the same way as an entire row of palm trees” [4]. It is exactly these individual trees that connect us with the essential layers of the place, with “remnants of national history and folk poetry”. Precisely, we wanted to reexamine the sensibility of the elementary relationship to nature and trees associated with the tradition

of morphological compositions of our cities through a series of specific situations related to the tree and the city and examples of everyday situations regarding the tree, the man and his artifacts.
Individual trees in different cultures acquire specific but also symbolic meaning. Multiple meanings derive from the morphology of the tree. Through the branches and leaves, they receive forces from light and the sky, through their roots they connect with the earth and water. The archetypal representation of the tree is related to the representation of Axis Mundi or World Axis, supporting and holding the cosmos. The tree represents the world axis: the branches above are the kingdom of heaven, the root below is the kingdom of the earth, the trunk is the world axis, through which the whole world is revealed [5].

2. The Seven Maple Trees in Veles: Methodology

The spatial patterns of the individual trees are also recognized in the traditional Balkan city. The individual dominant trees indicate the spatial nodes, the public spaces of the city, the centers of the local communities, the places of programmatic and social aggregation. The diagram on this pattern identifies a dominant tree, with a fountain, an oven, a tavern, a shop, around which people gather as the spatial and social core of a local cluster of houses (fig.1).

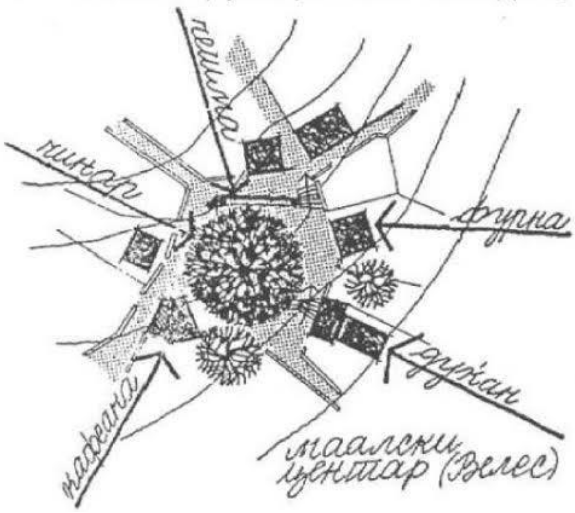


Fig. 1: Scheme of a traditional neighborhood center with an individual tree and subsequent programmatic concentration: fountain, furnace, tavern, shop.

In the case of Veles, we recognize the seven maple trees at six key positions of the city. Veles is a city where the traditional patterns of urban texture still persists, the irregular street scheme with densely built physical structure. The city is located on the slopes on both banks of the river Vardar, St. Elijah on the left and Kojnik on the right. The modernization of the city referred to the infrastructural interventions, the railway line, along the river Vardar, which locally divided the city from the natural contact with the river, but globally, connects the city through the railway system Skopje-Thessaloniki through the valley of the river Vardar. Thus, despite the interpolation of modernist compositions in the longitudinal central area, on the extreme slopes, on both sides of the river Vardar, the traditional urban layout survives with exceptional examples of residential architecture and dramatic street sequences. Of the six nodes with seven maples, four are on the right bank (Srmale, Saat Kula / the Clock Tower, Kojnik, Goren Grad / Upper Town) and two on the left bank (Chitkusheva fountain / The Holy Mother of God, Varnalii). Their toponyms represent the places and landmarks of the parts of the city to which they belong (fig.2).



Fig.2: The seven maple trees: individual trees / spatial nodes (120m X 120m) in the context of the city of Veles (860m X 860m): Chitkusheva fountain / St. Bogorodica, The Holy Mother of God (1), Varnali (2), Goren grad, The Upper Town (3), Kojnik (4), Saat kula, Clock Tower (5), Srmale (6).

There are different stories about the age of the maple trees in Veles. For the maple trees in certain localities around Veles are said to be up to 600 years old. For the seven maples in Veles, their age dates from 200 to 250 years. Our research does not refer to their chronology but to their spatial and social function in the city. Hence we have a multiple goal, first, documenting those unique places of the city as a dialogue of trees and architecture, second, exploring their natural, spatial and social attributes and their possibilities in contemporary contexts, and third, defining a method of reading and preserving the sensitive places of traditional contexts in contemporary cities.

In order to explore their particular character, the relationship of the maple tree with the surrounding open space, the character of the open space and its relation with the open system of the public space of the city, we will accept the morphological analysis of the urban space. For each specific place there has been derived a spatial frame (120 m x 120 m) as a critical area where the particular character of the separate node can be expressed, but also as an arbitrary anthropological distance in space (p = 60 m). In the original analysis, each of the selected areas is subject to three consecutive morphological analyzes. Separate samples of the city texture will be considered predominantly through the graphic representation of a convex map, axial map and through their isovists [6]. While for the construction of the axial map and the convex map we will use the initial assumptions of graphic representation and space analysis by Hillier and Hanson [7], for the construction of isovist from the particular point of view we will use the concept and methodology developed by Benedikt [8].

A convex map of spatial systems includes a maximum two-dimensional extension of a local spatial segment and is composed of a minimum number of convex spatial segments contained in that system. The convex map determines the character, size, and number of spatial segments that make up the spatial system.

An axial map refers to the maximum unidirectional extensions of space. It is represented by entering a minimum number of axial lines that connect the spatial system. The axial map expresses the geometric structure of the spatial system and their penetration into the surrounding context.

An isovist is the area of the spatial environment that is directly visible from a selected point within that area. “An isovist is a set of points visible from a given vantage point in space and with respect to an environment” [9]. The shape and size of the isovist fild depends on the position of the vantage point and the geometry of the environment. Although our research refers primarily to the graphical representation of the visual fields through the construction of the isovists from a particular point of an environment, we can quantify certain data: the area of isovist, the length of visible boundaries, and the extension of visual directions in the environment. By selecting the points of the maple trees, as points of perception of the given environment, we can construct a specific visual field for each maple tree in the spatial system of the environment.

3. The Five nodes: The Five Specific Places

The analysis will involve five nodes with five maple trees, namely, Chitkusheva fountain (The Holy Mother of God), Varnalii, Upper Town, Kojnik, Clock Tower (fig.2; fig.3). Due to the deletion of the traditional spatial patterns from the central area of the city in this analysis, the Srmale node with the two dominant maples from this area is excluded.

Chitkushevo fountain (The Holy Mother of God), is a complex spatial system consisting of five streams. If we look at them in the system of convex spaces, we can recognize the basic elements: polygonal center, trapezoidal inlets and spatial segments of street sequences. The maple tree and the fountain is in the central polygon. The axial plan represents the geometry of the axial structure derived from the street plans penetrating the polygonal centre. The isovist constructed from the vantage point positioned at the site of the maple tree shows the visual field, a four star-shaped polygon, with dominant extensions to the north, south and west through the open spaces.

Varnalii is a complex spatial system in the northern part of the city on the left bank of the city. It consists of two overlapping plateaus in the contact zone of which is the dominant maple tree and the fountain. In the topographic sense, these are two terraces that colect the street plans from the eastern slope and connect them with the northern access to the river Vardar. Four street streams flow into the south terrace, while three street streams flow into the north terrace. The isovist constructed from the vantage point at the position of the maple tree expresses the character of the visual field, a six star-shaped polygon, with the dominant extension to the north, in the surrounding texture.

The upper town is a local node on the right bank in which five street streams are connected in different directions. The convex map consists of a central polygon in which the maple tree and the fountain are positioned. The isovista constructed from the vantage point at the position of the maple tree follows the base of the figure of the knot. The visual field is represented by a five star-shaped polygon, with the dominant extensions to the north and south-west.

Kojnik is the dominant plateau in the western part of the city on the right bank, from that topographic position the streets continue and descend in different parts of the city. The convex map consists of a series of convex spaces in the west-east axial that follow the central polygon. The dominant maple tree and the fountain are located in one of the polygons that successively follow the east-west direction. The isovist constructed from the vantage point at the position of the maple tree shows a pronounced extension of the visual field in the east-west direction.

The spatial node **Clock Tower** has a central position in the old town on the right bank. The local node with the maple tree and the fountain, through one of the street streams is connected with the Clock Tower, which is a landmark of this locality and the city of Veles. The convex map consists of a central polygon that houses the maple tree and the fountain and the four street streams that are included. The isovist constructed from this vantage point at the position of the maple tree has a for star-shaped polygon with a dominant radial extension to the northeast.

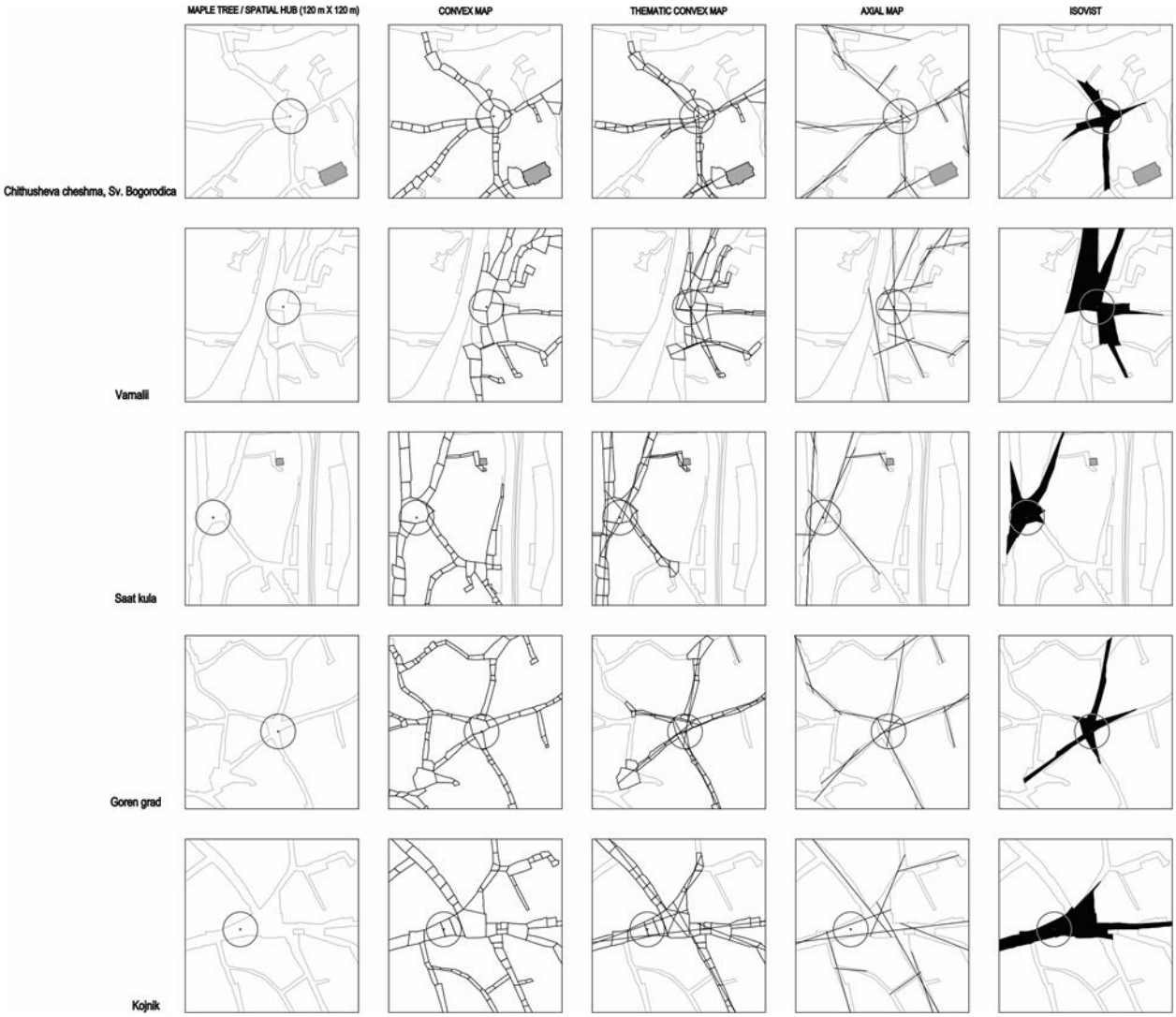


Fig. 3: The five individual trees / spatial nodes (120m X 120m) through four morphological representations: Convex map, Thematic convex map, Axial map, Isovost.

4. Interrelations

We have reviewed the selected samples according to their basic spatial characteristics but we have not yet compared them with each other. To define their spatial relations more clearly, we will compare them at each of the levels of analysis (fig.3).

On separate samples, convex maps can be differentiated into basic and thematic convex map. The basic convex map of a node will be the sum of only those convex spaces through which the axials directly converge in the central polygon. The thematic convex map of a node is the convex space through which axials directly converge through the central polygon complemented by those axials that conect the reference points of that node (fig.3). For example, in the case of the Chitkusheva fountain (the Holy Mother of God), the street extension to the open courtyard of the church of the Holy Mother of God is included in the spatial system. In the case of Varnalii, the picturesque street with the representative houses Varnalii is included in the thematic convex map. In the case of the Clock Tower, the extension leading to the Clock Tower is also included. Thus thematic convex maps include all the convex spaces through which the axials that are spatially and / or semantically connected in the given node pass. Thematic maps show complex site configurations, while basic maps address node typology.

The axial plane of the selected nodes shows the depth structure of the different axial convergence geometries. What can be noticed is that they never intersect at a single point, but their intersections form a kind of thematic core of the spatial system of the node, the central polygon, where the maple tree belongs (fig.3).

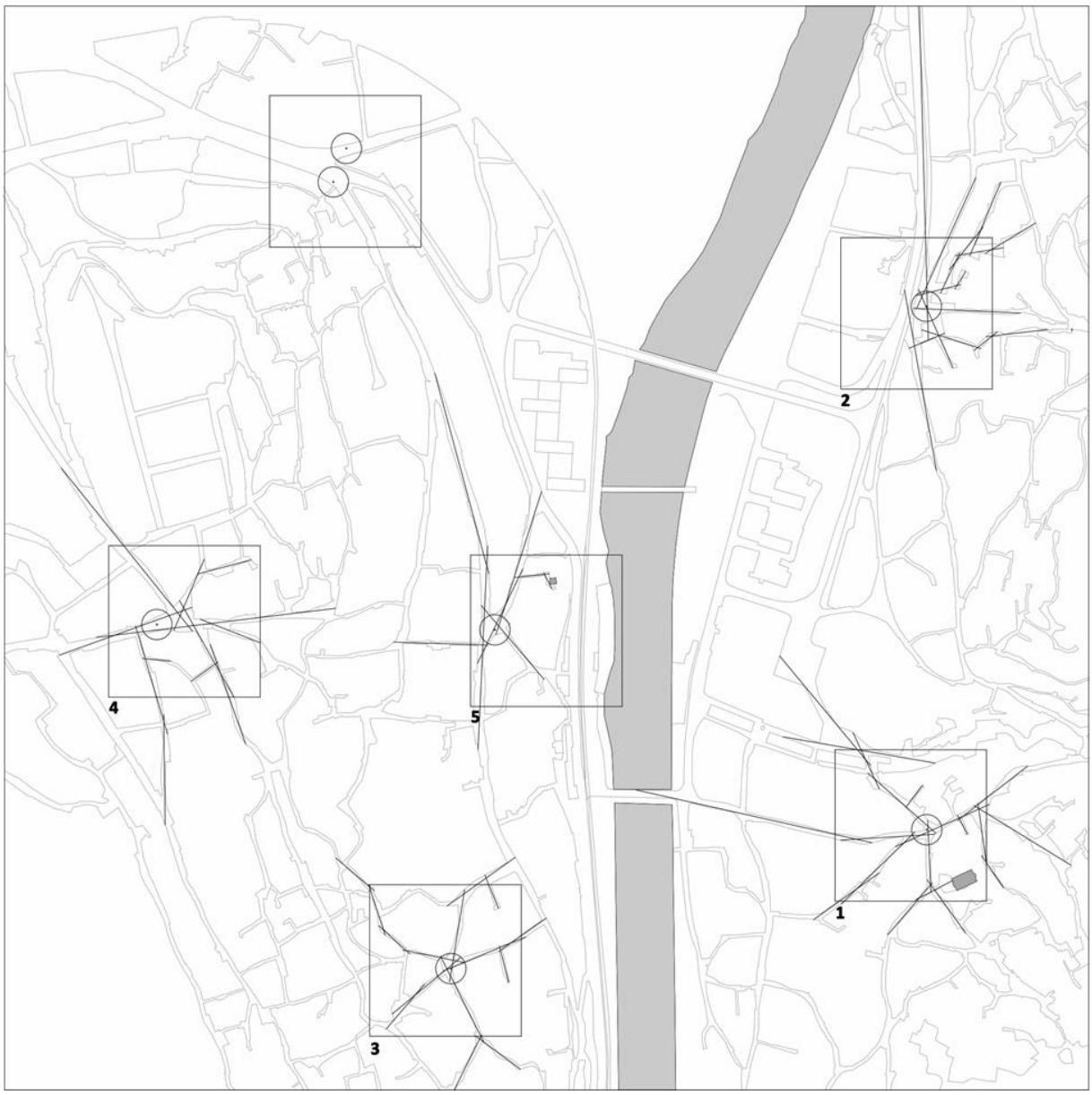


Fig. 4: Local axial maps of selected spatial nodes in the wider city context. Axial lines penetrate from the primary spatial frames in the surrounding environment: Chitkusheva fountain / The Holy Mother of God (1), Varnali (2), The Upper Town (3), Kojnik (4), Clock Tower (5).

The values of the number of axial lines, the number of convex spaces and the area of the central convex polygon express the quantity of the spatial occupation and differentiation of the particular nodes. On the one hand, the area of the central polygons is relatively small, on the other hand, they have an extensive spatial system that supports them. Exactly this property indicates that a relatively small spatial sequence can have an extensive effect on the spatial environment, thus the individual dominant trees have a significant impact on the spatial system of the city (fig.5).

Spatial node (120m x120m)	Number of axes	Number of convex spaces	Area of the central polygon
Holy Mother of God	6	36	114.4м2
Varnalii	8	27	298м2/290м2
Upper Town	5	33	106.2м2
Kojnik	6	55	312.5м2
Clock tower	7	26	280м2

Fig. 5: Quantitative structure of spatial nodes.

If so far we have considered the individual localities and their relations through the separate spatial segments 120m x 120m, we will follow their behavior at the city level in correlation with a larger spatial segment 860m x 860m which covers the historical segment of the city (fig.2). Axial plans of individual sites superimposed on the wider city layouts indicate integration with the context (fig.4). These are local places, neighbourhood centres, but also global points in the spatial system of the city. In the same way, the isovists constructed from the individual dominant trees indicate penetration into the adjacent environment (fig.6). These are both local and global urban phenomena.

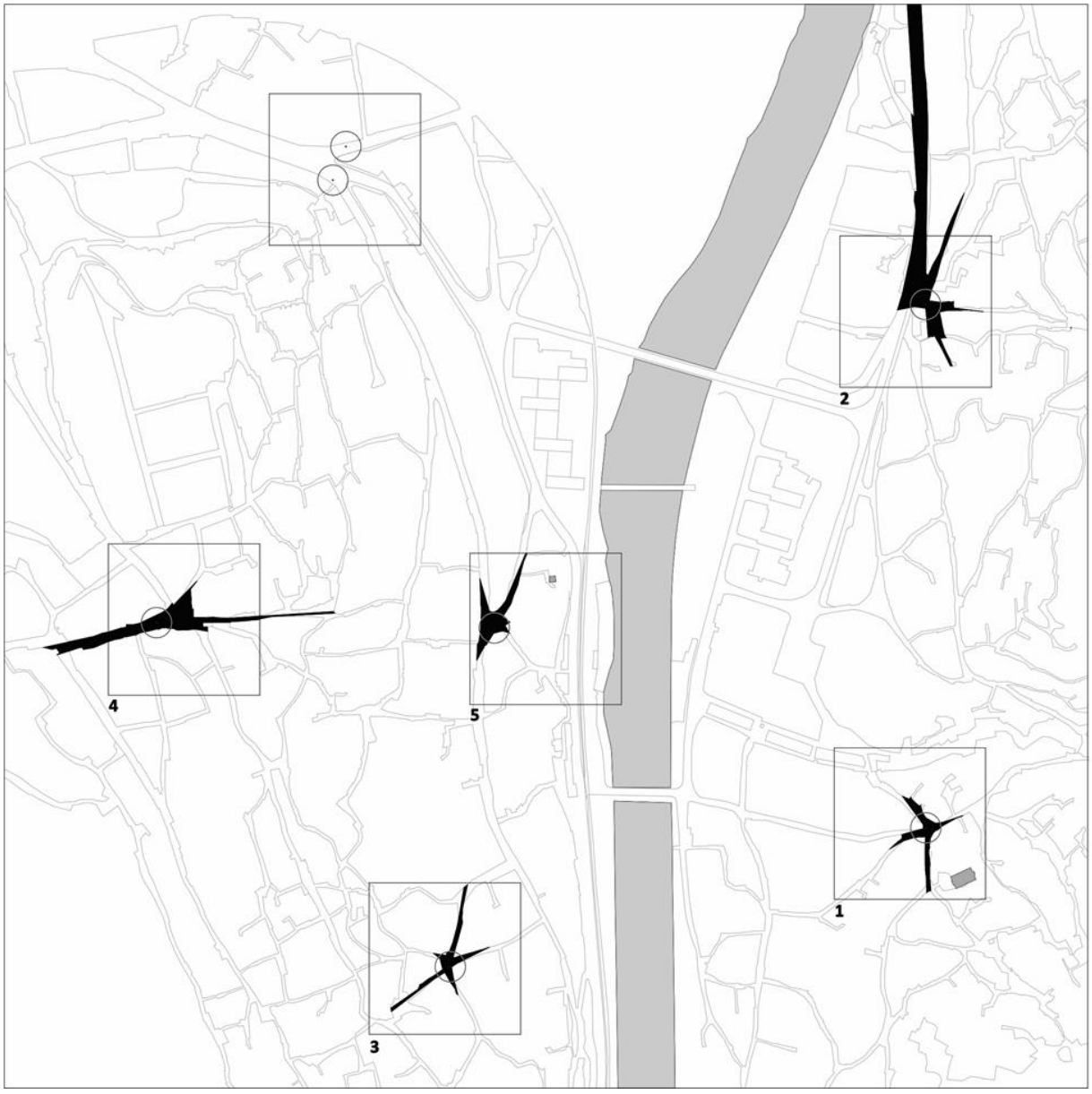


Fig.6: Local isovists constructed from the point of view of the position of the individual trees in the selected spatial nodes in the wider city context: Chitkusheva fountain / Sv. The Mother of God (1), Varnali (2), Upper Town (3), Kojnik (4), Clock Tower (5).

Certain numerical values of the isovists can confirm their properties (Fig. 7). Through the shape, surface and radial perspectives of the isovists in the surrounding environment, we can follow the properties of certain sites in relation to the urban context. The shapes of the visual fields of the isovists derived from the geometry of the spatial environment are complex asymmetric figures of star-shaped polygons. The figures of the isovist fields reflect the spatial environment of the nodes, but also the dominant porosity of the open spatial system of the urban texture. The dominant expansion of the figures on the selected isovists fields is north-south and they reflect the reference direction of the open spatial system. The reference direction of the city layout is north-south, parallel to the reference axis of the river Vardar and normal to the topography of the terrain. Only in the case of the locality Kojnik, as topographic dominant, the radial length east-west is most pronounced. In this way, the shape and deformation of the figures of the isotovists reflect the natural, but also the artificial values of the environment (fig.8).

Spatial node (120m x120m)	Min radials of lenght	Max radials of lenght	Area of the isovist
Holy Mother of God	19.8м	50.4м	533.90м2
Varnalii	31м	238.2м	3565.30м2
Upper Town	17.1м	58.6м	548.30м2
Kojnik	19.8м	141.75м	1583.45м2
Clock tower	12.9м	64.3м	705.50м2

Fig. 7: Quantitative structure of isovists.

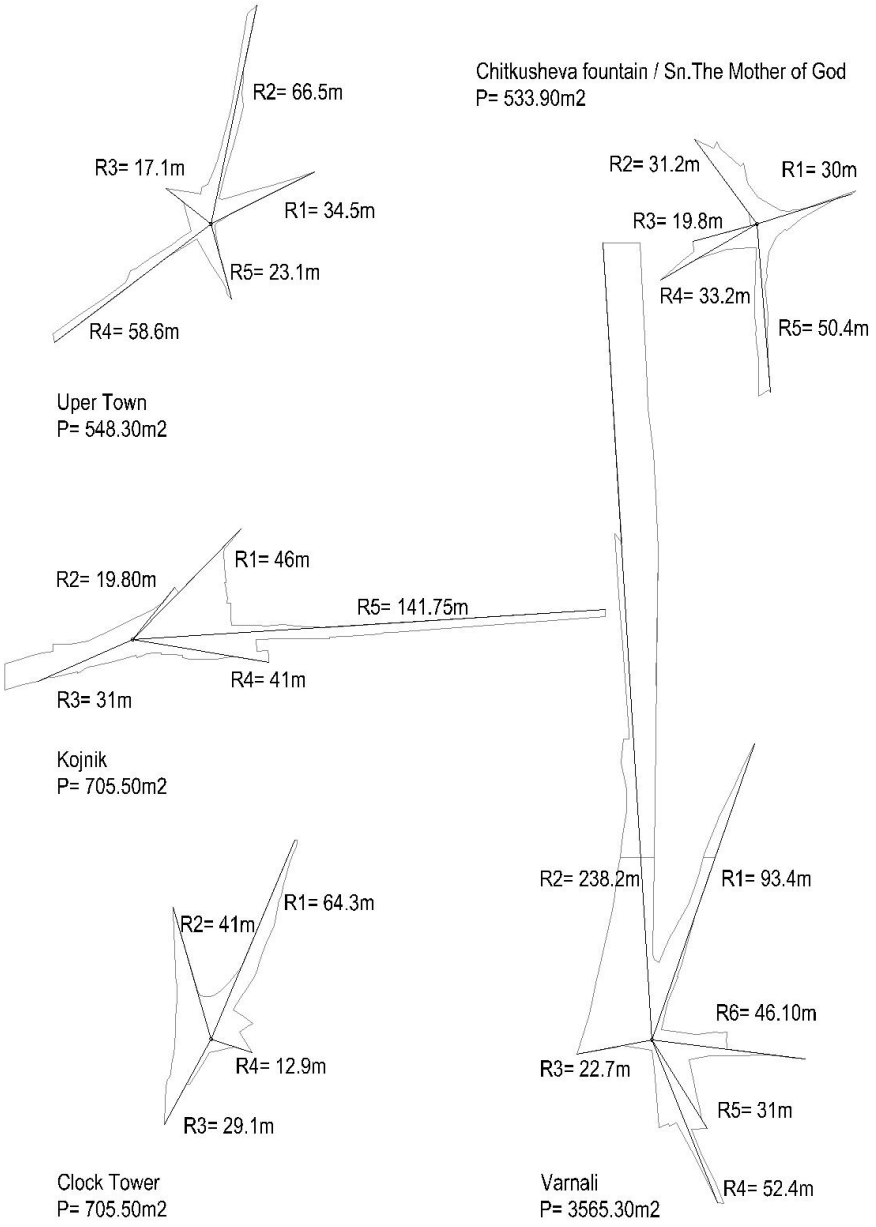


Fig. 8: The shapes, areas and radial lengths of the selected isovist fields.

But what exactly does this analysis indicate? Is the convergence of the axial lines unambiguous and / or does the concentration simultaneously indicate decentralization, an inverse spatial state? What if these nodes are seen as a concentration of directions to the sites of monumental trees, but at the same time as sites of divergence, scattering and opening to the environment? Something similar to the spatial structure of the reverse perspective.

The construction of the isovists shows us the spatial nature of the environment. The position of the vantage point from the location of the maple trees indicate the concentration of the spatial system but at the same time its dispersion. The properties of local centres can be perceived inversely. At the selected points, the spatial directions are concentrated, collected, but at the same time dispersed in the surrounding environment.

In the case of the inverse perspective, the geometric vintage point is located in the perceived space so that the parallels converge towards it [10]. With the inverse perspective structure, a network of rays is directed from the image to the interior of the space, from the displayed environment to the viewer, located in the conceptual centre of gravity or the conceptual centres of the gravity of the image. Instead of converging on the horizon as in the linear perspective, the lines diverge towards it [11]. Analogous to the construction of the inverse perspective, the places of the monumental trees, the maple trees, can have a double character, they can be urban places, centres but also places of inverse urbanity. Places where the city gathers and overturns, points where the city can be connected to the primordial primary ground. In that sense, the urban system and the natural basis should not be seen as separate contradictions, but as an ambivalent state of possible natural and urban synthesis. Thus, the position of the monumental trees has a dual nature, part of the urban life but also a place of opening to nature, the trees as axis mundi, are places from where the city opens and is dispersed towards the environment. They are a system of cohesion of the urban texture, but at the same time places of adhesion to the urban, cracks to the natural grounds (fig.9).

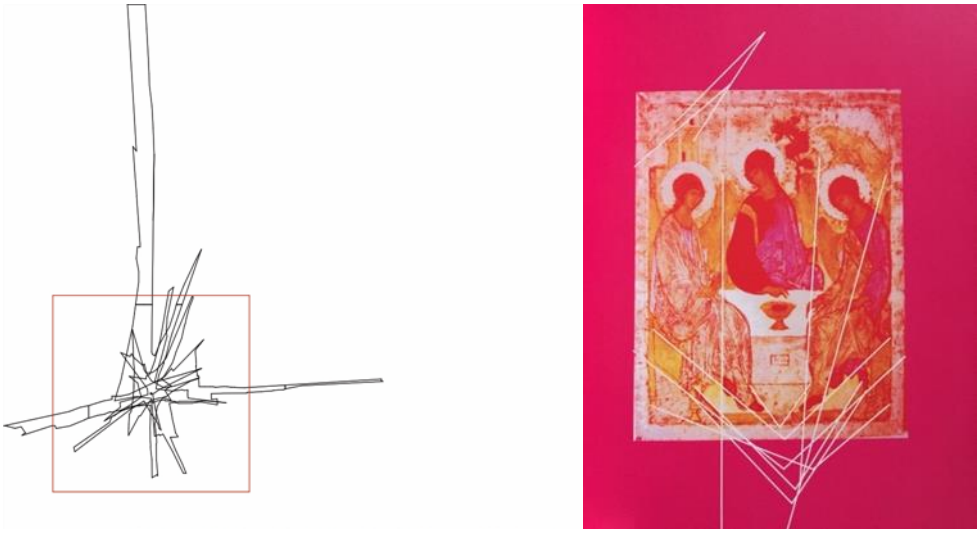


Fig: 9. Superposition of the isotovists of the five spatial nodes in relation to the position of the individual tree and the primary frame of 120m X 120m.; Analysis of the inverse perspective of the icon St. Andrey Rublev (1410). The Holy Trinity [12].

5. Conclusion

Contradictory issues of the urban reality have brought the elementary relationship of the natural and the artificial in human environments into question. On the one hand, the binary and quantitative relation to nature is emphasized. On the other hand, the authentic places of personal generation of this relation are suppressed and marginalized in the contemporary urban reality. This research started from those repressed and forgotten, but unique and, specific places of dialogue between nature and man as a resistant level of the city.

In the example of the seven maple trees in Veles, we saw the complex and contradictory functions of the individual trees in the specific places of the city. They are spatial, social and programmatic focuses of the city. However, they are also places of opening, "disappearing" of the city towards the "phenomenal" nature of the city. In the morphological analysis of the three principle levels, the convex map, the axial map, and the visual fields, constructed from the positions of the individual trees in the selected nodes, we observed the typological and syntactic properties of the selected urban nodes. This analysis of urban nodes indicates their ambivalence and dual nature. Analogous to the inverse perspective model, these nodes become conceptual themes of converging street flows, concentrating but also opening the city and transcending its physical nature. This dual nature of concentrating and

dispersing the space in which the most intense experience of the urban overlaps with the deepest direct experience of nature is the basic quality of our environments.



Fig. 10: The maple tree from the urban node Clock tower (source: Viktorija Bogdanova).

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The Ecological Transition Role in the Sustainable Development of Historic Urban Ports. *The case of the old urban Port of Lattakia in Syria*.

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Abstract:

Most of the historic Port City has undergone urban development and changes in use, often damaging and interrupting the historic urban path of the Port City, losing the relationship with the original morphology of the Port City, and the authenticity and integrity of the maritime and terrestrial urban heritage. In recent years, with the development of society, the awareness of environmental protection for people has been increasing. While port promote the economic development and employment levels of port cities, they also have a negative impact on the environment of Port City.

In this paper we present the situation of the old urban port of Lattakia in Syria that has developed, not respecting its historical lines and those of its City, reflecting three trends: the first one is the major changes and ongoing challenges that the old port of Lattakia faces today in relation to the City; the second concerns the valorize and historical-critical analysis of the urban fabric of the Port-City to identify the values present in the place to be recovered; the last one is the ecological transition role in the sustainable development of Lattakia Port, to recover the relationship with the historical fabric of the port city in a way that respects the environment and in favor of the society that uses it, safeguarding the original identity of the heritage port city, offering more social spaces of relationship and less transport traffic within the connected area between the sea and the city.

Keywords: Heritage Port-City, Sustainable & Ecological Port, Identity & Integrity.

Introduction

The historic urban port is a part of the historic urban fabric of the city and the constructive development of the historic urban port is a very complicated operation, because it is linked to many naval, maritime

and terrestrial historical factors. These factors should be studied all together, analyzing the problems of each factor in detail, trying to solve them without damaging the other factor.

The main problem that is defined with the phrase "the relationship between the port and the city". It is a very complicated situation in most cases it is not well studied, for reasons of lack of direct administrative and scientific relations between the port authority and the municipality of the port city. Therefore, the Port- City topic highlights the need to understand and evaluate the consequences of port developments with respect to the more general infrastructural system that must be supported by the municipal authority. The port master plan is often studied by itself, instead of being related to the city master plan and taking into consideration the social and cultural side of the local inhabitants.

The Ecological Transition role in the sustainable development of Historical Urban Port offer us a perfect solution to recover the relationship with the historical fabric of the port city in a way that respects the environment and in favor of the society that uses it, safeguarding the original identity of the heritage port city, offering more social spaces of relationship and less transport traffic within the connected area between the sea and the City, and turn it into decarbonized traffic.

The situation of the old urban port of Lattakia in Syria that has developed, not respecting its historical lines and those of its City, is an example through which we would try to find a solution to recover the lost relationship between the ancient urban port and the City itself, using some elements of the ecological transition. *This article briefly presents the result of Dr. Hanan KAFFOURA's doctoral research completed in 2015 at the University of Rome "Tor Vergata".*

1. The major changes and ongoing challenges that the old port of Lattakia faces today in relation to the City.

The city of Lattakia has gone from a coastal city with a natural port, to a port city with a modern port that has invaded and transformed everything. The increase in container traffic has put the port in the need to develop rapidly, without taking into account the relationship of the city with the sea. The port of Lattakia has developed parallel to the city itself, but each in a different direction, without bearing in mind that the port has always been part and must be part of the identity of the city. Unfortunately, the Municipal Administration and the Port Administration have always made decisions according to their own interests, without thinking about the urban, architectural, economic and social context as a whole. The City master plan has always been designed and built with reasons that do not take the port into consideration as a vitally important space that connects the city to the sea. Even the Port master plan has always been designed and implemented with reasons that do not take into consideration the city and the surrounding area as the original context in which it was born; the function of the port was thought exclusively with the aim of increasing its space to respond to the increased container traffic, as if it were independent of the City.
Lattakia developed in three directions: south, east and north, forming an arc-shaped development from south to north. To the west, the pointed-shaped coast is very rocky in the south, less rocky in the central part and 80% sandy in the north. The port developed starting from the first construction towards the south and then towards the north. At the southern edge of the port there is a popular tourist area with housing around it, while at the northern edge the area is of an international tourist character.



Fig. 1: Syrian Map, the position of Lattakia. it is the fourth most important City in Syria and the first coastal City.

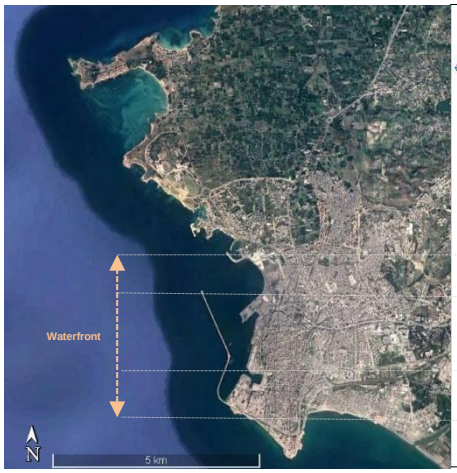


Fig. 2: Lattakia Waterfront, Google Map.

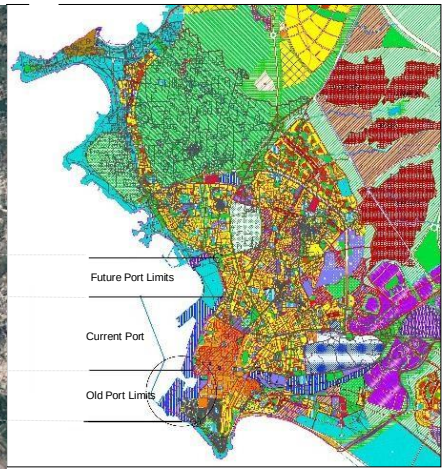


Fig. 3: Lattakia Municipal Master Plan.

1.1. Lattakia Port in relation to the historic, cultural and commercial center of the city.

Lattakia is the only city in Syria that has almost lost the identity of its historic center with a chaotic development that has failed to respect neither the urban set-up nor the character of its architecture. The historic urban fabric has been gutted and its ancient and historic architecture has also often been demolished; all this has transformed it into a contemporary city, depriving it of its historical value as well as its urban and architectural identity. This happened especially after the eighties with the complete construction of the port which cut the relationship between the city and the sea and after the nineties with the closure of the port area. Therefore, the use of the center of Lattakia has been transformed into a mixed residential, commercial and cultural use and there are still some places and buildings that still have their history, especially regarding the French and Ottoman rule. The Roman remains, on the other hand, are rare, but important, such as the square triumphal arch and some columns. With the construction of the commercial port, the traces of the Phoenician civilization have been lost, of the city of Ramita which was located south of the ancient port and south-west of the city of Laodicea. With this complicated situation, what can be done for Lattakia? I do not think that a reconstruction project that brings the city back to how it was in ancient times could be useful because, apart from the complete loss of its original historical evidence, this would be difficult from an economic point of view because it would mean demolishing the contemporary and reconstructing the fake ancient.

Lattakia needs a philological redevelopment project of the area of the ancient port in favor of the city to recover the relationship between the city, the port and the sea, thus recovering the memory of the people. Such a project should be refined, modern and meaningful and with fewer "fort" interventions ie with lots of spaces that allow people to find an open meeting place that can connect the city and its remaining historical symbols with the sea through area of the ancient port. For these reasons, there is a need to understand the position of the ancient port with the virtual limits of the historic center of Lattakia, with the historic buildings and archaeological remains remaining through the current road network that does not respect the historical road system.



Fig. 4: Lattakia Old Port, aerial view, 1935.

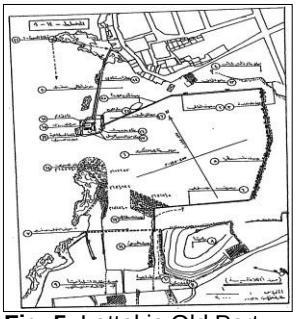


Fig. 5: Lattakia Old Port, Plan,1935.

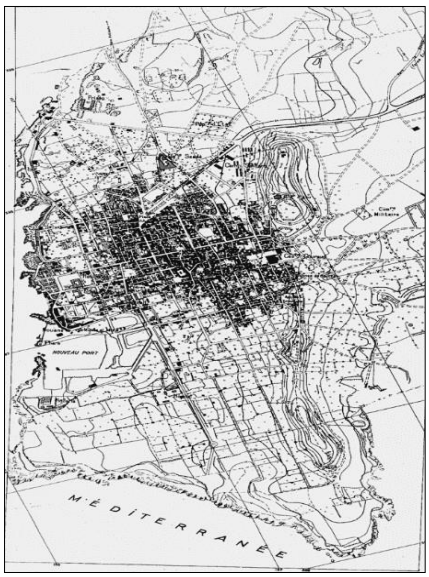


Fig. 6: Lattakia Plan,1935.

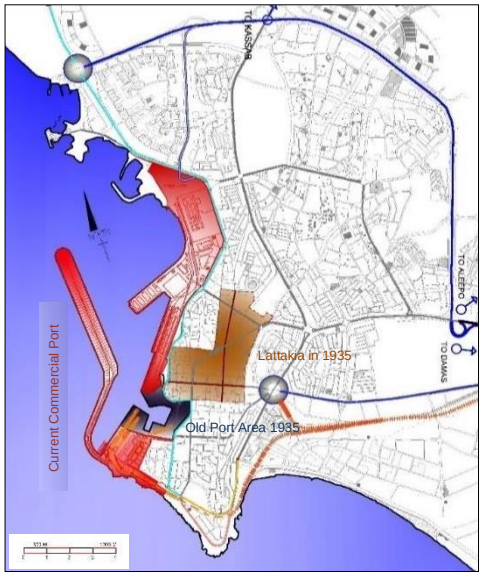


Fig. 7: Lattakia Current Plan, Port- City.

1.2. Lattakia Port in relation to the *Waterfront* of the city.

As the Port expanded northward, the City's Waterfront was completely covered by the expanded commercial port. With this realization the movement of the people has moved towards the south promenade in a completely modern urban context, instead the north promenade has been slowly abandoned, remaining only in the memory of the people due to the loss of its main function. The general society of the port of Lattakia since 1996s has always proposed to develop its port, risking to lose more and more its relationship with the sea. Because the required development included the entire north area up to the marina, indeed it proposed to take the entire area of the marina as well. I believe that it is possible to revive the city and its waterfront, redeveloping the old port and the southern part of the port for the recovery of the relationship with the sea, with which the northern part could be connected through the redeveloped old port (with a new tourist destination appropriate to the character and original identity of the city) to the southern part of the coast. In this way the redeveloped ancient port will become an

important lung for the city, trying to open a new view towards its waterfront. This would save the marina, leaving the commercial port between the north marina and the old port area in the south, developing the port in this space in a correct and functional way and protecting the north part of the Waterfront open to the sea. But If a commission or a management composed of expert specialists from both the Municipality and the Port Authority is not formed, the port and the city itself will find themselves in serious development difficulties, with the risk of losing their original identity for both. So, with this situation, the redevelopment project for the recovery of the original identity becomes difficult and theoretical and there is a risk that it will remain on paper due to the absence of coherent programs for its implementation.



Fig. 8: The direct relationship City- Sea, 1935s.



Fig. 9: The current indirect relationship City- Sea.

2. The historical development of the Old Urban Port of Lattakia in relation to the urban development of Lattakia.

The old urban port of Lattakia has been developed in parallel with the urban development of the city itself during their historical path starting from the Phoenician period and up to now, but passing through two important phases relating to the margins of development and functionality of the Port of Lattakia:

2.1. The pre-industrial development of the Port respecting its natural limits, inside:

During this phase Lattakia has undergone many changes which in some way have drawn and given the natural urban form of the city including its port, going through the following periods: Phoenician (1600-1200 BC); Hellenistic (333-64 BC); Roman (64 BC-395 AD); Byzantine (395-637 AD); Christianity (First century AD); Islamic (638 -1097 AD); Crusades (1097 – 1188 AD); Ayoubi (1188 – 1250 AD); Mamluks (1250 – 1516 AD); Ottomans (1516 – 1916 AD) and French (1916 -1946 AD). During all these periods, the following five important events are particularly noticeable who built the history of Lattakia:

- **Birth of the city in the Phoenician period (1600-1200 BC)**, Lattakia was a small village built on a rocky hill with an area of about one and a half hectares. It was called Ramita, the oldest name of today's Lattakia. Ramita belonged to the Kingdom of Ugarit founded by the Phoenicians on a hill 16 km north of Lattakia. Ramita used its natural Port which was well connected to the Port of Ugarit, the main port on the coast of the Near East.
- **Foundation of the city in the Hellenistic period (333-64 BC)**, It was Seleucus I Nicator who refounded Lattakia and called it Laodicea (in honor of his mother). The city became an important Port especially for the export of oil, wine, tobacco and fabrics that were produced in the hills of the hinterland. Laodicea formed the north central part of Syria with Antaquie, Seleucia and Aphamea. The Hellenistic civilization spread to Lattakia.
- **Freedom and the urban and architectural growth of the city in Roman period (64 BC-395 AD),** Freedom was granted to Lattakia and built a triumphal arch and several buildings. In 193 AC, several privileges were granted. In that period the two main streets (Cardo and Decomano) decorated with two rows of columns were built and the Arc de Triomphe, which still exists today.
- **First steps in the development of the city in the Byzantine period (395-637 AD),** It was a period of great development for Lattakia, in fact an important port was built that served the City of Aphamia and all of central Syria. And there were two terrible earthquakes, in 484 and 555 AD, which demolished a large part of the city which, however, was restored, the civil and religious buildings were rebuilt and the city passed under the direct rule of the Byzantine emperor.
- **The birth of trade through the sea routes in the Period of the Crusades (1097 – 1188 AD),** In 1097 A.D. Lattakia fell to the Crusaders and in 1106 AD. they killed most of its inhabitants. In their place came many Venetian and Genoese merchants, so much so that Lattakia took the name of "City of merchants". At that time the market, the Suq, was born and again in 1157 AC. Lattakia was destroyed by another terrible earthquake. In 1188 AC. And then it was restored in subsequent periods.

- The presence of new methods of developments in the French period (1916 -1946 AD), Urban and architectural development with European methods, and the end of the pre-industrial era and the beginning of the industrial era.

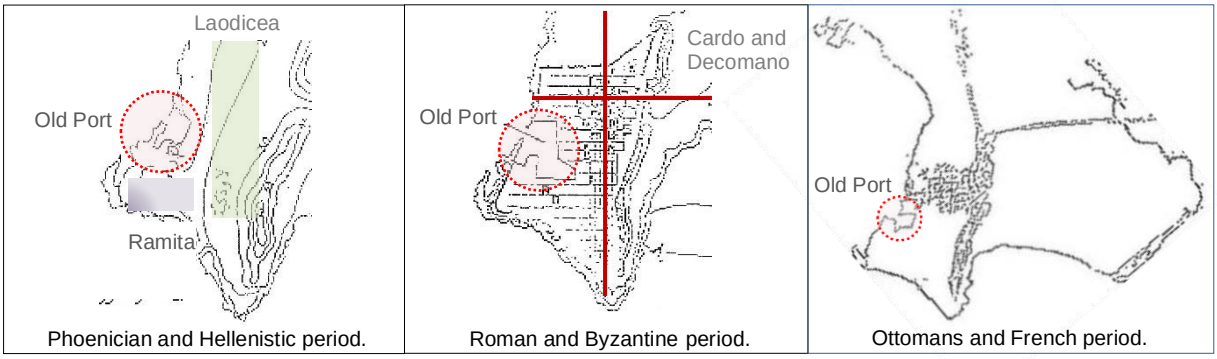


Fig. 10: Historical Development of the relationship Lattakia- Old Port.



Fig. 11: Original form of the Old Port of Lattakia, 1930s.



Fig. 12: Anchorage, Northeast Border.



Fig. 13: Anchorage Area, North Border.

2.2. The industrial development of the Port not respecting its natural limits, outside.

Until 1930s, the old natural port of Lattakia did not have a real extension with major construction works and had remained within its natural limits. The real port construction began in 1931s with the installation of a quay and, later, in 1950s it acquired the first and significant port form, still leaving the city a close relationship with the sea. With the last construction phase in 1980s the city, however, completely lost this relationship. In 1996s the construction of the port was required in response to the development of container traffic. The port was studied by many international companies, but no proposal was applied. However, the construction of the current Port went through the following phases:

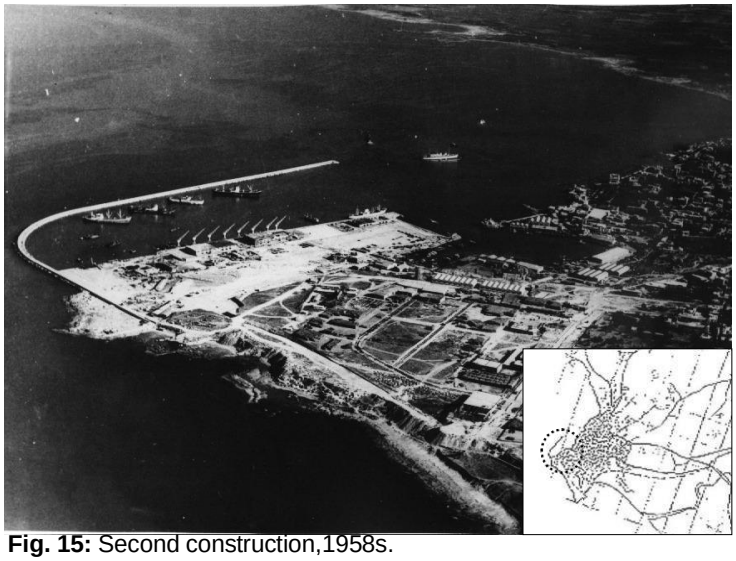
- First construction built after 1930s, the port of Lattakia during the Ottoman rule was not important because all commercial ships disembarked in the port of Beirut. When the French entered Syria in 1920s, with the Balfour Declaration (known as the Balfour Pact of 1917s), Syria was divided into four states Syria, Lebanon, Jordan and Palestine. Therefore, Syria needed its own commercial port, for this reason that of Lattakia was developed by building a quay in the northern part of the ancient port.
- Second construction built after 1950s, the Syrian government, after independence from the French, decided to establish, in 1950s, the port of Lattakia managed by the public sector with the aim of building a modern port capable of receiving merchant ships. For this purpose, it established the General Society of the Port of Lattakia, under the supervision of the Ministry of Transport, to which was added the Maritime Transport Agency, the General Directorate of Ports and the public institution for maritime transport. In 1953s, the general company of the port of Lattakia was commissioned to build the port from the previous situation. Then, in 1954s the official construction project of the port was approved, through which all the infrastructures and port buildings in the surrounding area were built, leaving out the north face of the city. The breakwaters were built from 1953s to 1956s with a length of 1432 m, to protect the 55 hectares of the built port. In 1958 the port was completed with the construction of the grain silos with a capacity of 35-40 thousand tons 22. The city of Lattakia really became a commercial port city, without losing its relationship with the sea, restaurants and other structures were built north of the port that allowed it to continue to feed a certain vitality on the seafront, independently of its appearance. commercial transport.

- Third construction built after 1980s, after the eighties the port was no longer able to respond to the demands of the increased container traffic, therefore the Syrian government took the decision to expand the port by developing it towards the north. This decision was configured as a strategy of total separation, the consequence of which was the loss of the relationship between the city and the sea. The port was extended twice, the first in 1981s and the second in 1984s by increasing the embarkations to 14 and the quays to 11 with the length of 2190 meters, at the end of this phase of expansion the capacity of the port became 15 million tons.
- Fourth construction after 1996s, this phase is still open and in a state of debate, it has been studied and analyzed by interested companies, but they have not yet found an adequate response. No decision could be taken because the area north of the current port up to the marina represents an area "suspended" between different objectives and positions, in constant discussion between the port authority of Lattakia and the City Council. According to the City Council, there would be a risk of completely ruining the relationship between the city and the sea, if the marina were taken. Instead, the Port Authority, to respond to the increase in traffic, would like to develop the port including the marina. The dispute is therefore centered on the navy: demolish it or not.

Solutions should be sought to develop the port according to the needs and the vision of an expansion strategy, structured for traffic and tourism, but at the same time, keeping anyway, a visual space in the north. A project is therefore envisaged for the redevelopment of the ancient port area including the southern area of the port which leaves all the urban and architectural symbols of historical value.



Fig. 14: Lattakia Port Development.


Fig. 15: Second construction,1958s.

3- The ecological transition role in the sustainable integrated development of Lattakia Port.

The port area of Lattakia would need a new requalification project to recover the relationship with the historical fabric of the port city in a way that respects the environment and in favor of the society that uses it, safeguarding the original identity of the heritage port city, offering more social spaces of relationship and less transport traffic within the connected area between the sea and the city.

3.1. The international proposals for the new Masterplan of the Lattakia port area.

The Syrian government and the authorities responsible for the port of Lattakia have received many proposals for the development of the Port of Lattakia and they are the following:
- In 1996s, Japan International Cooperation agency (JICA), 3 proposals;
- In 2003s the Russian Institute "Suezmone Project", 8 proposals;
- In 2005s, the UNDP Experts, 1 proposal;
- In 2007s, the Russian Institute "Suezmone Project", 1 proposal;
- In 2010s, the Russian institute "Suezmone Project", 1 proposal;
- In 2012s, the Russian institute "Suezmone project", 2 proposals.

All the solutions chosen by the international institutions for the port of Lattakia followed the requests of the Port Authority of Lattakia. Therefore, they found themselves in a difficult situation to solve the following problems: Expanding container terminals; Expanding the General Cargo terminals; Move the

Grain terminal and the passenger terminal. But it was not easy because the port area is limited from a geographical and urbanistic point of view. So, the differences were few, so their decision was limited and changed following these problems: To save the navy or not, due to the fact of development towards the north for geographical reasons; The shape of the inlet channel and the shape of the terminals orthogonal or parallel to the coastline.

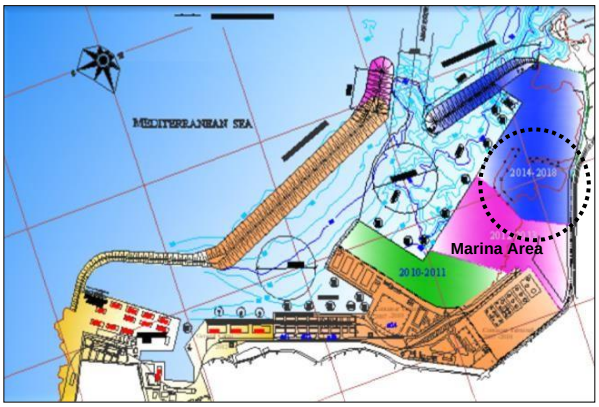


Fig. 16: Suezmone Project Proposal, 2007s.

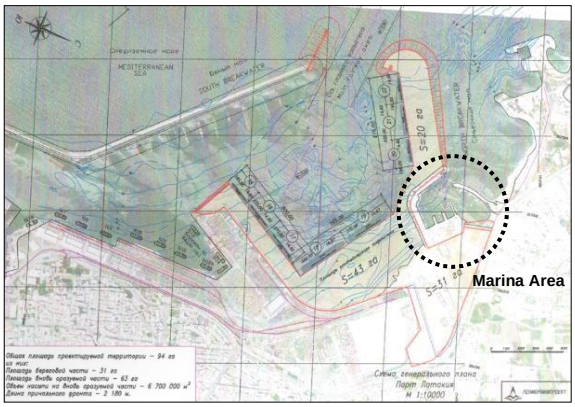


Fig. 17: Suezmone Project modification, 2012s.

For this reason, similar solutions have been proposed, but the most important argument which is the relationship between port and city has been abandoned. Hence, the recovery of the relationship between the Port and the City and how it would be possible. The historical factor of the ancient Port of Lattakia has been forgotten or abandoned, which presents the memory of all the people of Lattakia as a place that is part of the City, indeed it is a place that has grown in parallel with the development of the City itself.

3.2. New strategic Zoning Masterplan of the Port of Lattakia, in relation to the City Master plan.

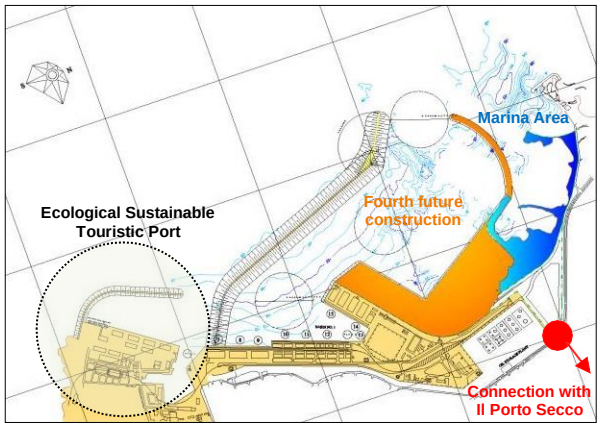


Fig. 18: First new proposal.

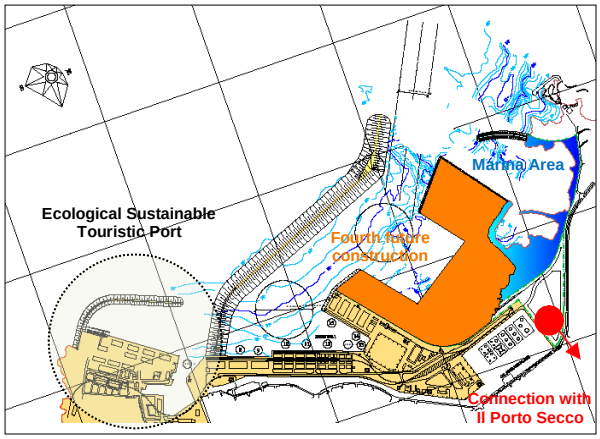


Fig. 19: Second new proposal.

Referring to the international proposals of the Master Plan of the Port of Lattakia, considering the purposes of each individual proposal, the requests of the Port Authority of Lattakia and the municipal council of Lattakia and with particular attention to the relationship with the city itself, it is possible to define the principles of a new Strategic Zoning Masterplan of the Port of Lattakia which are the following:

- Expand container terminals, and connect the container terminals with internal dry ports, based on Eco-innovation transportation systems.
- Expansion of the General Cargo terminals;
- Move to the Grand Terminal;
- Create an independent area of the passenger terminal;
- Respect the location of the marina;
- The location of the freight terminal near the road exit;
- The shape of the new terminals should be orthogonal or parallel to the coastline;
- Newly built areas must be neither seismic nor expensive;
- Do not occupy the facade of the City;
- Recover the relationship between people and the sea, then the relationship between the port and the city through the maintenance of the Marina function and a redevelopment project of the old port, offering more ecological spaces.

It is a new solution in which the two important factors have been respected:
- The needs of the commercial Port;
- The relationship between the Port and the City, based on some elements of the ecological transition.

For the needs of the commercial port, a new port area was created up to the border of the marina. And three forms of the new port area have been chosen, in which not much changes for the capacity of the containers, but what changes is the construction costs which depend on the shape of the quays between orthogonal or parallel to the coast line in relation to the depth. of the water below. Furthermore, by creating a railway and road connection with dry port, it is possible to build it in regional areas outside the urban area to increase the capacity of the containers. (*All layouts of the new proposals are made by Dr. KAFFOURA Hanan and documented in her PhD thesis*).

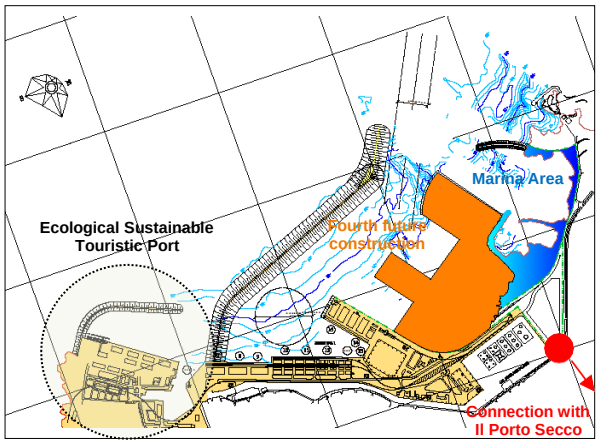


Fig. 20: Third new proposal.

For the relationship with the City two areas of connection with the city have been created: The first is the area of the historic old Port, trying to hope for it from the commercial port and redevelop it, opening it again to the city as a historical tourist area, it presents all the identity of the City of Lattakia. In addition, make this area in connection with the southern part of the coast which has the popular tourist features; The second area is that of the marina, although it has no historical value, but it has an ancient, social and economic value for most of the families in the north of Lattakia. Hence, save the north facade of the City from the expansion of the commercial port and save the internationally valuable tourist features of the north coast of Lattakia.

3.3. Transforming the area of the ancient port of Lattakia into an environmental, ecological, social and cultural center.

Lattakia should have its own social tourist port area separated from its commercial port and inserted into the urban and environmental context of the city itself in relation to the surrounding urban area through the current use of the architectural, urban and environmental elements present on site. In order to mend the relationship between the port area studied and the urban area of the city. Based on the following principles and guidelines:

- Historical and symbolic, saving the buildings of historical and symbolic value in the old port area and around, and transforming the ancient deposits into a photographic exhibition presenting the history of the birth of the port;
- Environmental, ecological and social sustainability, recreate significant connecting open spaces between the saved and transformed buildings and the urban area around, bringing people to the ancient story of the birth of the port of Lattakia in a philological way, saving the traces of the place, creating more meaningful ecological green urban spaces, using the original names of the places (such as Ramita and Laodicea) which are the original roots of the city of Lattakia.
- Improve the Marine Environmental fact, decreasing the mass of container traffic and limit this type of traffic in a maritime area under control and monitoring;
- Touristic at local, regional and international level; transform some buildings in and around the ancient port area into maritime tourist structures and Planning tourist sea routes that connect the ancient port of Lattakia with the cultural heritage sites of Syrian positioned along the Syrian coast and other routes maritime connections with other Mediterranean countries;
- Economical and commercial; Transforming some buildings in the old port area and around it into commercial services, markets and restaurants, and creating an area for outdoor maritime games in the southern part of the port;
- The using of Sustainable Energy, using solar energy (green energy) for all buildings and open spaces. Furthermore, improve the Eco- innovation transportation system and decarbonisation policy for maritime and land traffic, reducing pollution in the area.
- Maritime, railway, vehicular and pedestrian Viability:
a- Naval Station: Transforming the current passenger lounge into a naval station suitable for the new project, expanding it in space and adding a space for temporary naval maintenance;
b- Railway station: it is proposed to build it in the southern area at the entrance;

c- Car station: for buses and coaches, it is proposed to build it in the south area at the entrance;
d- Create parking lots in suitable places close to the pedestrian entrances of the old port area;
e- Create pedestrian paths that connect all the buildings and spaces present in the area of the old Port.
the general purpose is to recreate an urban tourist port for Lattakia, that is an open relationship between the people of the city and the sea through a tourist, social and ecological port space that has an urban form well inserted in the general urban context of the city itself and making it open in all senses to the sea on one side and the city on the other.

The design hypothesis of the "Master Plan of the ancient port" redevelopment starts from the general idea of the general Master Plan of the port of Lattakia proposed in the previous part, suggesting dividing the current port of Lattakia into two separate parts with two different uses:

- Creating an ecological and cultural environmental area, transforming the area of the ancient port into an ecological tourist, social and cultural port. Then, connect the city with the sea through the new proposed reuse in the tourist port area, thinking of attracting the attention of the citizens of Lattakia and transforming this area into an ecological healthy lung, bringing a new clean area to its body of the city of Lattakia;
- Less commercial shipping traffic and reducing total water logging, through a limited commercial port between the old port area and the marina and connecting it with internal dry ports outside the urban area. Then, connect the north seafront with the south one through the new use of the ancient port, creating a single seafront that surrounds the coast of Lattakia from south to north and, in the middle, the tourist port square is presented as an ecological and social meeting point tourist.

The process of Transforming the area of the ancient port of Lattakia into an environmental, ecological, social and cultural Center, uniting it to the urban area of Lattakia. (*All layouts of the new Master Plan are made by Dr. KAFFOURA Hanan and documented in her PhD Thesis*).

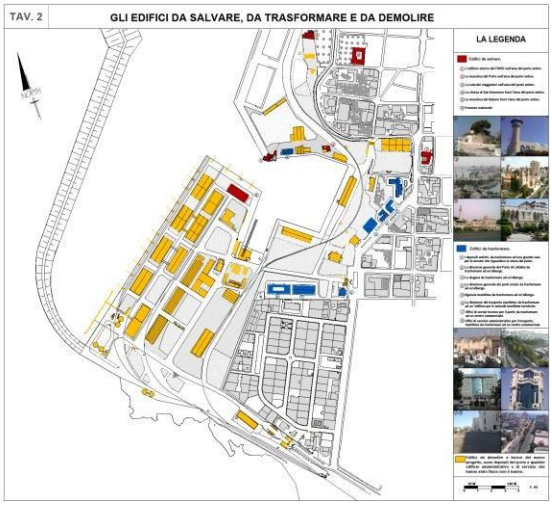


Fig. 21: Buildings to be saved, transformed and demolished.

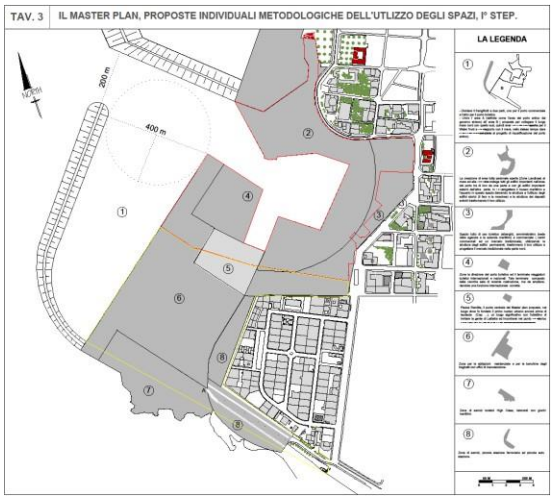


Fig. 22: Zoning Urban Guidelines, first step.

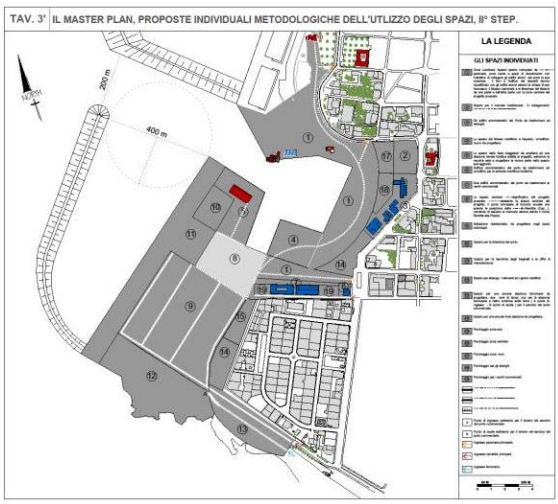


Fig. 23: Zoning Urban Guidelines, second step.

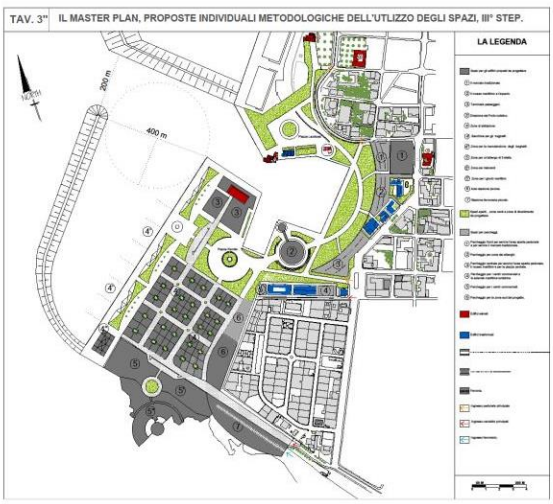


Fig. 24: Final Urban Use Proposal.

Conclusion

If we could read the history of the place well, the character of the port city, it could be planned on a stable and significant basis, using the appropriate principles of the ecological transition to recover the identity and the historic and cultural value of the place in a philological and significant way. Through the proposed final Master plan, a new vision could be created for the citizens of Lattakia, for Lattakia itself and for its Port. the sensibility of the designer comes from his competence to know the elements of value to consider, in order to be able to build the guidelines of his project, adding a touch of modernity but at the same time increasing the historical value and with the aim of saving the environment and culture of the place*,* respecting the international guidelines of the United Nation Development Program UNDP; UNESCO; ICOMOS and the International Maritime Organization IMO. This article offers my country Syria a philosophy and a methodology that has never been proposed for the City of Lattakia and its Port. We hope to transmit it to Syria in the future.

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Renato Avolio De Martino architect of the SME

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Abstract
Renato Avolio De Martino (1909-2006) was one of the most talented Neapolitan architects in the Second Post-War. Graduated in Naples shortly before the war, he began his brilliant career during the years of the Reconstruction, when his most important works were commissioned by the SME (Società Meridionale di Elettricità), the company founded in 1899 responsible for the construction and distribution of electricity networks in mainland Mezzogiorno, from 1937 also thanks to the support of IRI (Istituto per la Ricostruzione Italiana). In the post-war period, the SME continued its important work with the intervention of the Cassa del Mezzogiorno (1950), constructing new electricity plants, including the Vigliena power station, designed by Avolio De Martino (1950-52). In addition to this work, in the same years the architect designed for SME: the building in via Bracco (1950-55) and the mountain village employees in Roccaraso (1954-56). Shortly afterwards to Avolio De Martino with Mario De Renzi and Renato Contigiani was entrusted to design the RAI headquarters in Naples, built between 1958 and 1963 in via Marconi, in Fuorigrotta district. The project was commissioned by Marcello Rodinò, from 1954 general manager of SME, who became RAI's managing director from 1956 to 1965. With the reconversion of SME into ENEL, De Martino continued to work with the company and his last major work was the ENEL Towers at Centro Direzionale of Naples (1990-95), with Pica Ciamarra, Giulio De Luca and his son, Francesco. The paper aims to highlight the architect's outstanding contribution to these important works that mark the economic boom of Naples, a period still to be rediscovered and enhanced.

Keywords: Postwar architectures, Reconstruction, SME, RAI, Centro Direzionale of Naples

1. Renato Avolio De Martino
Renato Avolio De Martino was born on 11 June 1909 in Milan. His childhood was marked by various moves around Italy with his father Francesco, who was serving in the military: other stops were Rome, Salerno in 1915 and finally Naples, where he settled with his mother Evelina and older brother Gastone. The Avolio De Martino family actually came from the Avellino area, from Montefusco, where the palace of the Avolio De Martino dei Silvi family still stands today.
After attending the scientific high school, enrolled in the newly founded Regia Scuola di Architettura directed by Calza Bini, which was based at the Accademia di belle Arti. On 19 November 1933 he graduated with Mario De Renzi, presenting a project for a Clinic-hotel in Naples whose simple and expressive lines already demonstrated his adherence to a functional and stylistic modernity.
De Martino belonged to the "first generation" of Neapolitan architects, along with, among others, Carlo Cocchia, Giulio De Luca, Sirio Giametta, Vittorio Amicarelli, Francesco Di Salvo, Giovanni Sepe and Francesco Della Sala. The only woman was Stefania Filo Speziale, who graduated in 1932 with Marcello Canino.
Her first assignment, as was the case for the most talented young architects of the time, was at the Triennale delle Terre Italiane d'Oltremare. As he himself said: "We had a fixed salary and always worked there, also because the major building activity of the time was precisely that which took place inside the Mostra" [1]. For the Triennale he built the Albergo delle Masse and the Casa Littoria, both located outside the exhibition complex, and the Pavilion of the Mostra della Tecnica, included in the northern sector, next to the pavilions designed by Filo Speziale.

Immediately after the war, he took on numerous public offices that contributed to his numerous assignments. In addition to his participation in the Commisione Edilizia immediately after the Liberation, from 1945 to 1947, he was a member of the newly founded Ordine degli Architetti. Under the presidency of Roberto Pane, he was a councilor from 1947 to 1949, and between 1949 and 1951, under the presidency of Ferdinando Chiaromonte, he became treasurer together with Pane, Marcello Canino and Michele Cretella. He was then a member of the Consiglio Nazionale degli Architetti from 1954 until 1957. Before devoting himself exclusively to his profession, he briefly embarked on a university career: he worked on De Renzi's “Interior Architecture and Furniture” course, Piccinato’s “Urban Planning” course and was appointed lecturer in the same subject until 1949.
In the field of town planning, after joining the INU (National Institute of Urbanism), he became a member of the Comitato Tecnico Amministrativo del Provveditorato alla Opere Pubbliche from 1946 to 1949, and then enrolled in the register of designers for the Cassa del Mezzogiorno and Gescal. His first public housing projects were the Ina-Casa Miano-Piscinola (1957-59, with Filo Speziale), the Ina-Casa Secondigliano II (1959, with De Luca and Filo Speziale), the Ina-Casa RAI employees' house in Via Testi (1962) and the Gescal settlement in the Traiano district (1967).
At the same time, he began an intense professional activity in the private sector, first with SPEME (Società Edilizia Moderna ed Economica) for which he built the Lancilloti building in Via Orazio (1948-49), the company's office building. At number 10 of the same street, he designed one of the first apartment blocks on the Posillipo hill for Lauro-Cafiero and Fiorentino (1948). For the same client he also designed the nearby residential complex of Villa Orazio (1968), where he moved his studio [2]. Other residential buildings include the “cutain wall building” in Via Partenope (company Russo-Scarano, 1952), the buildings in Parco Margherita (company Russo-Scarano, 1958), the two buildings in via Andrea D'Isernia (company Totaro, 1968), the Parco Stazio in via Stazio 118 (company Lauro-Cafiero and Fiorentino, 1972), the building in via Petrarca 197 (1958), plus the restoration of Villa Quercia in via Posillipo 8 (company Russo-Scarano, 1964).

2. The architect of the SME

De Martino’s professional breakthrough came with the work commissioned by Società Meridionale di Elettricità, SME, with whom he began working in the early 1950s to create his most important buildings. Founded in 1899 under the auspices of the Banca Commerciale Italiana and directed by Giuseppe Cenzato from 1928, the SME had been absorbed in 1937 by IRI (Istituto Ricostruzione Industriale), consolidating its electricity monopoly over the years and making a significant contribution to the industrialization of Southern Italy [3]. Cenzato was born in Lonigo, and after graduating from Milan Polytechnic, he moved to Naples where he became a leading figure not only in economics. After World War II, as head of SME and the Fondazione Politecnica del Mezzogiorno, a member of the board of directors of the Società per il Risanamento di Napoli, a collaborator with IRI, president of Svimez from 1960 to 1969 and a consultant to the Marshall Plan, he managed an important part of the reconstruction of the Mezzogiorno, until he resigned as president of SME in 1956 [4].
De Martino reports that the relationship with Enel was “the result of a series of family contacts and friendships established before the war” [5]. Among these was Marcello Rodinò di Miglione [6]. Son of Giulio, a Catholic nobleman, politician, one of the founders of the Italian Popular Party, Minister of Grace and Justice in the first Bonomi government and Vice-President of the Council in the second, Marcello was one of the most influential Neapolitan managers in the immediate post-war period. He was a member of the “SME group”, a group of technocrats, mostly engineers, whose activities and cultural inclinations were linked to the great economic and financial center that conditioned the city's entire economic life [7]. In an article in “L'Espresso” Eugenio Scalfari placed him among the “Sette dell’Orsa Maggiore” along with Giuseppe Cenzato (SME), Luigi Tocchetti (Risanamento), Ivo Vanzi (Banco di Napoli), Stefano Brun (Isveimer, Camera di Commercio), Costantino Cutolo (Unione Industriali), Mario Origo (Circumvesuviana, IACP) [8].
After graduating from the Politecnico in Naples, Rodinò began his climb up the SME ladder. At first deputy director of Sedac (Società Elettrica della Campania), then deputy director and, in 1954, general manager of SME, he became Cenzato’s “right-hand man” to all intents and purposes, fighting with him for the monopoly of the company's electricity sector and against nationalization, which was supported by Fiat, Montecatini and Confindustria [9]. The outcome was, as is well known, the creation of ENEL in 1962, the national electricity industry, and Cenzato’s side came off worst. His resignation in 1956 marked an important change in the industrial world of the Mezzogiorno and also led to a new appointment for Rodinò, who in fact was ousted from SME to take up the post of RAI’s managing director until 1965. In the same period, moreover, the absolute majority of RAI shares were transferred to the IRI group [10].
Shortly before, also thanks to the massive intervention of the Cassa del Mezzogiorno, SME built new electrical plants in exchange for the reduction of electricity tariffs by the State. These included the important thermal power station of “Vigliena” in San Giovanni a Teduccio, the design of which was entrusted to De Martino (1950-54). It was in fact an extension of the “Maurizio Capuano” power station, built near the bourbon fort of Vigliena in 1924. In order to increase thermoelectric production, in the post-

war period, SME had already built the power station on the Coscile river (1949), the Orta diversion, the Abruzzo plant on the Sangro (1952) and was building the power station on the Mucone and Volturno [11].
The project, partly financed by ERP funds, provided for the modernization of the “Capuano”, which had been damaged by bombing, the raising of the quay by 190 meters to increase the possibility of mooring tankers and the creation of a new body. The Marshall Plan funds were used to equip the power stations with technically advanced equipment to guarantee production capable of competing on international markets [12].
On the day of the inauguration on 2 March 1953, Rodinò presented the project to Prime Minister De Gasperi. The new power station was made up of a series of box-shaped architectures designed to house the machinery, not without morphological research. The horizontal lines of the volumes with their narrow windows were contradicted by the verticality of the chimneys and the inclined freight elevators for transporting materials. The building to the west, with the company’s sign, gave access to the complex and had stone cladding over the entire façade, as well as an alternation of solid and hollow strips that gave it extreme lightness and formal elegance.
At the same time as the assignment for the Vigliena power station, De Martino was carrying out another important collaboration with the SME. As early as 1950, Cenzato and Rodinò had chosen the architect [13] together with the engineer Guido Palestino, for the design of their company’s office building in partnership with SEC (Società Elettrica della Campania). The so-called Palazzo SME in via Bracco was built by the Società Immobiliare ed Industriale del Mezzogiorno and was inaugurated in 1955 in the city's new business centre, the Rione Carità. With its 50 m height, over an area of 1400 m2, it went down chronicle as the first Neapolitan skyscraper [14]. The reinforced concrete structure made it possible to build a ten-storey tower on top of a four-storey base on which the top floor with a heliport was set. The cladding material was travertine, while the interiors alternated between marble and linoleum. Published alongside the Pirelli skyscraper of the same period in Milan (1954-58) in the pages of “Edilizia Moderna” [15] which also dedicated the cover to it, it soon became a symbol of Naples during the boom, until the competition for the nearby “La Cattolica” skyscraper (1954-58), won by Stefania Filo Speziale, sparked off the well-known controversy over the setting of tall buildings in the old city [16].
Having become SME’s trusted architect, De Martino also designed the mountain village SME employees in Roccaraso (1954-56), in the upper Sangro valley. It was built on 20 hectares of land, laid out with gardens and terraces, and comprised three buildings, two of which were intended to house the dormitories and the third for management and services. The day after the inauguration, which took place when the facility was already in use, the chronicle described it enthusiastically: “Four hundred and fifty children have already been cared for this year and each shift has been attended to by health, social and about 40 service personnel. The Roccaraso colony is the first mountain colony organized by SME and managed directly by the Group's general management, in addition to the other six seaside colonies located in Southern Italy. [...] The stay in Roccarso is the result of the well-being achieved by the company’s own family” [17].
Shortly afterwards to Avolio De Martino with Mario De Renzi and Renato Contigiani was entrusted to design the RAI headquarters in Naples, built between 1958 and 1963 in viale Marconi, in Fuorigrotta district. The project was commissioned by Marcello Rodinò, who had recently become director of RAI. Given De Martino's closeness to Rodinò, for whom he had been working on important projects for a few years, it is easy to understand the reason for his direct involvement, as well as the undoubted authorship of the work. De Renzi's contribution, on the other hand, remains to be ascertained.

3. The RAI Production Centre in Naples

In 1952, with the agreement between the State and RAI (since 1944 Radio Audizioni Italia), the management of the body was moved from Turin to Rome. Two years later, regular television broadcasts began and RAI, which had become Radiotelevisione Italiana, gradually began to spread throughout the country. Since 1955, on Thursdays at prime time, the famous programme “Lascia o raddoppia?” was broadcast from Milan, directed by Mike Buongiorno, “a sort of Italian home version of the American dream” [18], which kept Italians glued to their screens, dreaming of becoming millionaires together with the participants in the game [19].
In the meantime, the directorate of building services was created within the organization, which started the construction of RAI offices throughout Italy. The one in Rome was built between 1957 and 1959 in via Teulada 66 by the architect Francesco Berarducci [20]. Other projects were drawn up between 1958 and 1959 for the extension of the center in Milan and Turin, for the new offices in Cosenza and Bari, Pescara and Perugia. In the same period, the RAI Production Center in Naples was built in Via Marconi (1958-63), a symbol of RAI's investment in Southern Italy. The area was Fuorigrotta, where the San Paolo Stadium by Carlo Cocchia and Gerrado Mazzioti (1948) had recently been built, not far from the Mostra d'Oltremare (1952), which had been built following the restoration of the Triennale (1940) destroyed by bombing. The new RAI complex was added to the new broadcasting center near the

Benedictine monastery of Camaldoli and replaced the first studios built in the Singer building in Corso Umberto and then in a former garage in Pizzofalcone [21].
In addition to the television production of prose and dramas, the RAI Centre in Naples was to host the Radio (Radio Napoli, a Neapolitan broadcaster since 1926, moved here) and a large auditorium intended for broadcasting classical music concerts. The latter was renamed “Alessandro Scarlatti” when in 1964 the symphonic seasons of the orchestra of the same name, founded in 1919 and employed by RAI in those years, were held there.
The project covers an area of 18,400 square meters, 10,000 of which are covered, and consists of five bodies. The offices and services, together with the auditorium, are located on viale Marconi, while the radio and television studios are located at the back, filtered by a courtyard, with rooms for pre-production (costumes, furnishings, set design, etc.) and post-production (editing, publishing, etc.). The layout of this television and radio citadel is therefore made up of various buildings of different volumes and heights, which find in the nearby former Triennale, where De Martino himself had worked not long before, a strong pre-existing morphological reference for the project. It is no coincidence that the report accompanying the RAI center highlights the context in which the work fits.
The large 62-meter-high office building with its clinker cladding and large windows marks the entrance to the citadel. Next to it are the lower plastered bodies of the canteen and the chapel, whose rational forms are reminiscent of De Martino's first projects outside the Triennale. Great importance is given to the connections between the various sectors which are resolved by glazed overhead walkways or staircases juxtaposed externally to the buildings.
The auditorium is undoubtedly the most successful piece of architecture of the complex. Designed with structural engineers Giuseppe Sambito and Guido Mele, it is an imposing reinforced concrete structure composed of six 25 m high pylons supporting 75 m pre-stressed beams supporting 850 tons [22]. From the outside, the structure is perfectly legible: an imposing closed volume inclined according to the slope of the cavea, supported by concrete partitions with beams breaking through the façade [23]. With its 74 square metres and a thousand seats it was then the largest in Europe.
Although the center had already begun to function in 1961, when the first prose programme “Le acque delle luna”, a comedy in three acts directed by Mario Lanfranchi, was recorded in its halls [24], the inauguration took place on 7 March 1963 in the presence of the Prime Minister Amintore Fanfani and the ministers Bo, Jervolino and Corbellini, with the highest officials of RAI and IRI.
The first concert of the Scarlatti Orchestra with pianist Arturo Benedetti Michelangelo was broadcast on 31 March of the same year in the presence of the President of the Republic Antonio Segni [25].
After the Neapolitan headquarters, two other projects commissioned from De Martino by RAI followed: the RAIway in Sorrento (1967) and the project for the new headquarters in Palermo (1971), which was never completed.

4. Last works

The RAI’s headquarter was an important project opportunity for De Martino and a real factory for Naples, for those who worked there. At the end of the 1960s there were 523 people: 5 managers, 462 employees and workers, 15 journalists and 41 maestros of the Scarlatti Orchestra [26].
The auditorium, with its 9200-pipe brass organ designed by Fernando Germani, broadcast on national television was to be the headquarters in Naples for years, while the Guarracino Fountain, by sculptor Lello Scorzelli located in the square in front helped celebrate the golden age of Neapolitan song.
De Martino's career ended many years later, in the 1990s, when he realised his projects for the Centro Direzionale in Naples (1995). The idea for a business centre dates back to 1964, when Luigi Piccinato identified the need to relocate the functions already established in the Rione Carità to the Poggioreale area, not far from the Central Station. After Giulio De Luca's initial project in the mid-1970s, the task passed to Kenzo Tange and coincided with the 1984 merger of Mededil (owner of the land) with Italstat, IRI's finance company.
De Martino's most important work in the new city business centre was the Enel Towers (1990-95, lots 1 A and 2 D), commissioned directly by the group, this time designed with Pica Ciamarra, Giulio De Luca and his son Francesco, with whom he had founded the AM studio in those years. With their 33 steel floors, a height of over 100 metres and lifts running along the entire iron and glass façade, they still mark the entrance to the Centro Direzionale and the city's skyline [26]. The SME skyscraper, symbol of the economic boom, is its counterpart.
De Martino's professional career reveals a trajectory studded with numerous works of great value, linked above all between the 1950s and 1960s to an industrial clientele that was able to attract public funds to Naples and the Mezzogiorno by employing talented architects.
The designer can be counted among the cultured Neapolitan professionals, not tied to the university, attentive to technological innovations and the demands of clients, capable of producing works not

lacking in formal research and aesthetic value. Many of his architectures remain to be re-evaluated, along with this period and his professionalism.

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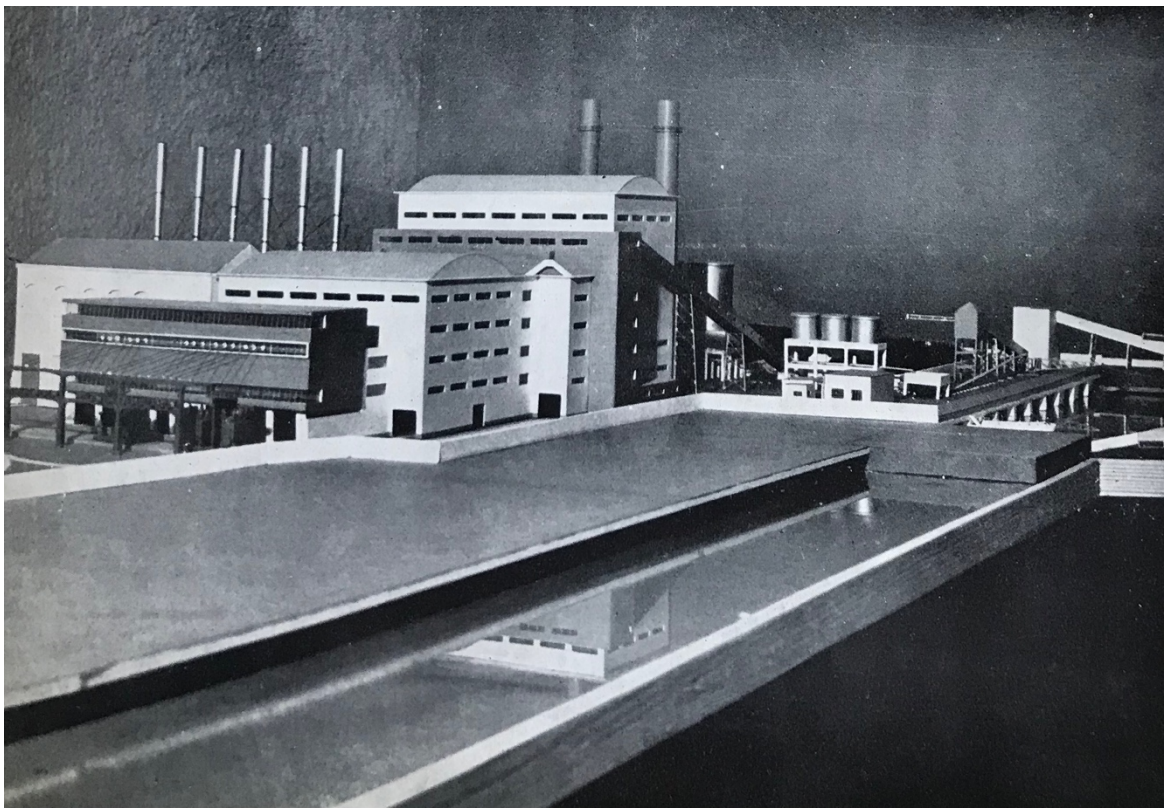
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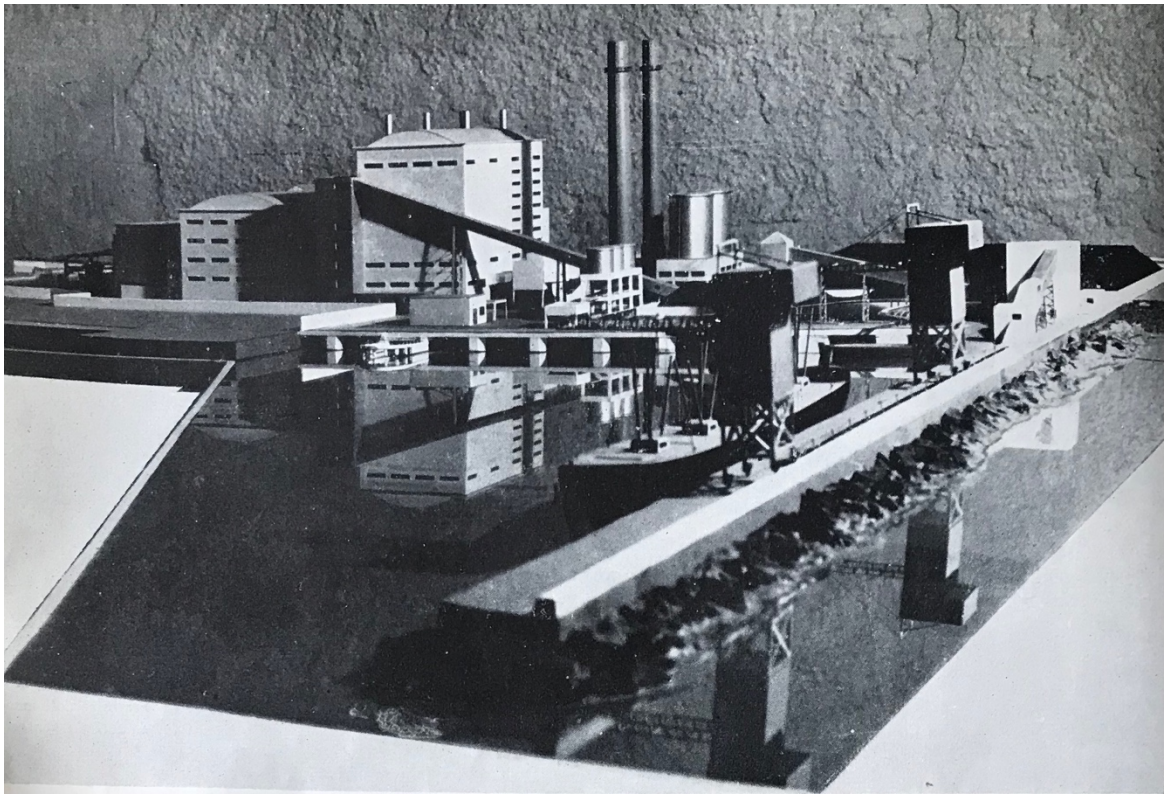


Fig. 1- 2 R. Avolio De Martino, views of the model of the "Vigliena" power station, 1950 (De Martino Archive)

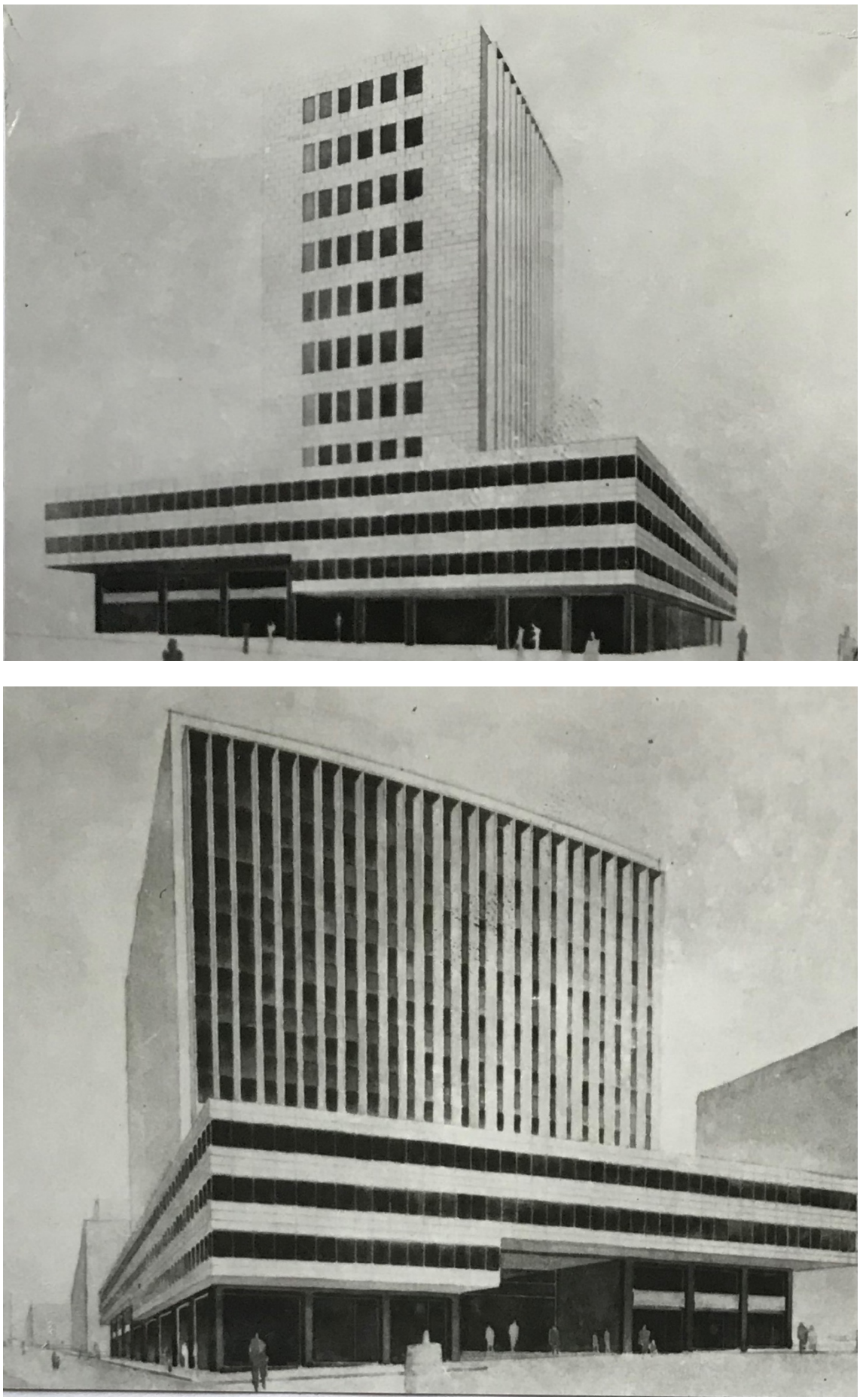


Fig. 3-4 R. Avolio De Martino, Palazzo SME, study perspectives, 1950 (De Martino Archive)



Fig. 5 R. Avolio De Martino (on the right) with Marcello Rodinò on the RAI headquarters sites in Naples, second half of the 1950s (De Martino Archive)



Fig. 6 R. Avolio De Martino with Guido Palestino (in the centre) working on the project for the Palazzo Sme, first half of 1950s (De Martino Archive)



Fig. 7 RAI headquarters in Naples built between 1958 and 1963 (De Martino Archive)



Fig. 8 The Auditorium of the RAI headquarters in Naples (1958-1963) (De Martino Archive)

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Urban regeneration, climate adaptation, and territorial governance. Experimentation and innovation in the Plan for an integrated strategy between urban planning and ecology.

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Abstract
The profound changes resulting from the processes of metropolisation, which characterise the new urban question, induce significant changes in the meaning of the problems linked to town planning, the environment and the landscape, highlighting the inadequacy of certain conceptualisations and recalling, today, more than ever, in the current situation of global health emergency, the urgency of activating policies, strategies and tools which provide integrated responses to the instances of environmental regeneration, social revitalisation, cultural and economic enhancement of the city. This is done by prioritising the protection of health and the wellbeing of settled communities, in order to restore prospects of equity, urban-ecological quality and efficiency to the governance of contemporary cities and territories.
This scenario, which recalls the need for intersectoral and interinstitutional convergence between all policies affecting urban regeneration and territorial governance, is reflected in the most recent Community programs and policies and is also a transversal objective of the NRP (Mission 5 *Inclusion and Cohesion* (Urban Regeneration and Social Housing), as well as of the NRP 2021/2027 (AT 2 *Humanistic Culture, Creativity, Social Transformation, Inclusive Society* in close correlation with AT 5 *Climate* and AT 6 *Environment*).
In this context, the contribution presents some of the results of the research activities carried out by the authors that highlight, starting from the analysis of national and international planning experiences and *best practices*, the urgency of defining new perspectives and new theoretical-methodological and operational references for an innovative planning system, as a tool for a sustainable and resilient regeneration of contemporary cities and territories, at the supra-municipal, municipal and local scale, with significant impacts on mitigation of and adaptation to the effects of climate change.

Keywords: Urban regeneration, climate change, climate-proof urban planning, strategic plan, local plan.

1. The contemporary city and the new urban question. For an integrated and inter-scalar regeneration strategy
The metropolisation processes that have interested contemporary Italian and European cities and territories in recent decades have induced profound transformations in territorial assets, as well as changed the meaning of issues related to urbanism, environment and landscape [2], highlighting the inadequacy of some conceptualisations, and the need to overcome those traditional logical devices connoted in terms of *separation* and *opposition* [3].
The outcome of these processes, the contemporary city is one in which the contradictions induced by the effects of globalisation, physical degradation, socio-economic marginality [4], environmental fragility [5, 6], extreme climate change, population ageing, the increase in chronic diseases and psycho-physical stress [7], the change in household structure, and in the population's value system [8, 9], the pressure of migratory flows [10], overlap with the "genetic anomalies" that have characterised, since the 1900s, the development of Italian cities [11], highlighting the emergence of a new *urban question* [12].
An urban issue that underlines, particularly in the current situation of global health emergency, the urgency of activating policies, strategies and tools that provide integrated responses to the instances of

environmental regeneration, social revitalisation, cultural and economic enhancement of the city, according to principles of sustainability, combining quality of life and quality of the environment, and prioritising the implementation of a new *urban welfare* to guarantee local communities the right to health, education, public mobility, housing, and to the city [3, 13].
The realisation of this new *welfare* calls for and constitutes, therefore, the priority objective of an integrated and interscalar public government strategy aimed at urban regeneration and territorial rebalancing [14], which is contextualised in the EU policies for the promotion of sustainability and efficiency of cities from a *smart* perspective [13, 15, 16], finds operational references in the *Green new deal* (2019), the *Just Transition Fund* (2021) and the *Horizon Europe Programme* (2021/2027), and constitutes, at the national level, a transversal objective of the PNRR (2021), in particular for Mission 5 *Inclusion and Cohesion* (Urban regeneration and social housing), and a founding content of the six *"Major Thematic Areas"* of the 2021/2027 NRP, in particular TA 2 *Humanistic Culture, Creativity, Social Transformation, Inclusive Society* in close correlation with TA 5 *Climate* and TA 6 *Environment.*
In this, it fully grasps the meaning of the global guidelines sanctioned by the United Nations, with the identification of the 17 "*Sustainable Development Goals*", within the "*2030 Agenda for Sustainable Development*", adopted by the Member States in 2015, and, in particular, the need to "make cities and human settlements inclusive, safe, resilient and sustainable" [13], through the experimentation of forms of innovation for the improvement of citizens' living conditions and for the cultural, economic and social growth of communities.
Hence, the eminently social and integrating character of the strategy [15, 17, 18], which, for this reason, assumes the public city, the set of public components or components of public use relating to open spaces, green areas, services, mobility, social housing, as the framework of coherence of an overall and compensatory process of regeneration of contemporary cities and territories, physical structure of reference and supporting framework for the creation of a new *urban welfare*, through the construction of a network of material and immaterial, interactive and integrated *networks,* which guarantee a widespread territorial protection and endowment.

In this framework, new issues, such as the fallout of climate change, the role of infrastructure networks in the redesign of cities and the reorganisation of their economic base, social inclusion and public city building strategies, social *housing*, the circular economy, green infrastructure and ecosystem services, energy renconversion and replacement of the building stock, digitalisation, land use containment and sustainable mobility, represent foundational objectives of regeneration programmes launched in major European cities [3].
In Italy, on the other hand, where the traditional tools for the construction of the public city - the PRG (the General Urban Plan), expropriation for public utility, urbanisation costs- have long proved inadequate, also for the purposes of guaranteeing a fair redistribution of income in favour of the public, to substantiate urban regeneration, taking it on as an integral part of an ordinary policy for the city, and, therefore, as a significant chapter of the National Urban Agenda [12], it appears necessary to address the unresolved knot of a reform of national urban planning legislation.
A reform for the government of the territory which, in line with the integration character of the strategy, also responds to the need for a cross-sectoral and inter-institutional convergence between all the policies that refer to this issue [19], from the policies of development and reorganisation of the settlement and infrastructure system, to those of protection and enhancement of the environmental system [3], and of its ecological, landscape, historical, cultural, social and economic values; from local 'territories' policies to national and supranational ones; up to those of economic, social and territorial cohesion.

2. Integrating urbanism and ecology into the Plan. For an environmental perspective of regeneration

This need for convergence requires, more generally, the implementation of a new concept, which, through an experimental approach, characterised by high levels of interdisciplinarity, inter-scalarity, iterativity and integration, acknowledges the new demands of the contemporary city, responding both to the need for an overall vision, capable of interpreting the outcomes and potential for regeneration after the phase of urban explosion, and to the need for a renewed relationship with the planning and design processes.
This objective includes research and experience conducted at national and international level which, through concrete experimentation in plans, programmes and projects, has produced new points of view and practised new approaches, in any case characterised by a tendency to practice thematic and interdisciplinary sharing.
These approaches are reflected in new perspectives and new theoretical-methodological and operational references, which use the physical-territorial dimension as a structural reference for integration and interaction, grasping *"the direct link between the productive and social transformations of the country and the effects on the cities and the territory"* [20], also recovering significant relations between understanding and proposal.

Among these, in particular, this contribution places the accent on some planning experiences, at the level of vast areas and at the local level, conceptually ascribable to an ecological-environmental perspective of urban regeneration, examined in the research context carried out by the authors [21].
These research experiences, show the search for a transcalar continuity of objectives and actions, in the dual strategic and regulatory form of plans, and take on and operationally decline crucial issues at the heart of EU policies for sustainable development (Europe 2020 Strategy) and *climate change*, for the improvement of territorial connectivity and the harmonisation of ecological, landscape and cultural values (EU, 2011), the promotion of city efficiency in a *smart and green* perspective, concretely pursuing an integration between urban planning and ecology.
With these aims, the plans direct urban transformations towards redevelopment and modernisation of the existing city, triggering virtuous processes of environmental regeneration, based on the concepts of *compensation* and *ecological-environmental potential*, linking each intervention to actions to improve the fundamental resources air, water and soil; highlighting the role of environmental components to provide integrated responses to the instances of anthropic development and preservation of natural capital, combining morphological, cultural and social redevelopment interventions with actions of an ecological and landscape nature [18].
The interventions are therefore aimed at implementing new strategies for adapting to and mitigating the effects of climate change and settlement pressures, which take the form of integrated actions to reconfigure the environmental components; reducing soil consumption, environmental regeneration and soil renaturalisation; the protection and enhancement of biodiversity, through the creation of green infrastructures, hierarchical ecological networks, *green ways*, as true "regeneration matrices", united by indicators/requirements/standards, including ecosystem services, soil permeability, water management, social inclusion, tree and shrub density, and the promotion of new environmental values; to hydraulic invariance through sustainable stormwater management, water saving and sustainable urban drainage; to the reduction of sealing levels, energy saving and safety of existing buildings, favouring the formation of an urban environment with high climate adaptation performance; the mitigation of the 'heat island' effect by reducing the energy used in cooling and heating buildings; the reconversion, adaptation and implementation of sustainable and non-polluting collective mobility systems; the reclamation of contaminated soils in abandoned areas; the regeneration of the existing building stock [22].
Starting from these experiences, it is therefore possible to outline new theoretical-methodological and operational references for an innovative planning system, able to support urban regeneration strategies according to the specificities of territorial contexts and to pursue, through urban planning instruments, actions that have significant effects on mitigation and adaptation to the effects of climate change.
New references that, in a perspective of reform of the national urban legislation, allow to integrate the tools' contents, answering to that need, already present in the reformist plans of the nineties, of a wide and organic "dilatation" in the field of competence of the urban and territorial planning, that reaches the ecological-environmental contents, developing a model of urban sustainability centred on the ecological regeneration of the city, and therefore on the set of actions for the qualitative improvement of environmental resources activated directly by the plan, in the awareness that *"modern urban planning discipline was born rigidly linked to the city asset, but progressively involved (also by force of laws) the territory and then the landscape, the environment and today it involves the entire ecosystem*" [23].
Therefore, new references to innovate operationally, paradigms, legislative and regulatory apparatuses; programmes; forms and contents of instruments; implementation mechanisms, parameters and *performance* indicators; prototyping; levels of governance, as well as practices of the urban plan as a tool for a sustainable and resilient regeneration of contemporary cities and territories, on a supra-municipal, municipal and local scale, in order to substantiate the notion of urban regeneration, build the public city and realise the new *welfare*, implementing a concrete policy of planning and production of services [24].

3. Planning and climate adaptation: strategic and regulatory dimensions

The need to identify new references for a sustainable transformation of the territories affected by the risks and degenerative processes related to climate change [25, 26, 6, 27], has solicited, therefore, in the last decades the scientific and disciplinary debate on the key role of urban and territorial planning, as well as on the urgency of an update of the planner's competences and of the instruments of territorial government in the elaboration of possible strategies of regeneration [14] and resilience to climate change [28].
Strategies that imply, as we have seen, an overcoming of the traditionally sectoral approach on these issues, in favour of an integrated approach to urban complexity [29, 30]) ascribable to the *Ecosystem Based Approach* [31], as also advocated by the document *Guidelines for Ecosystem-based Approaches to Climate Change Adaptation and Disaster Risk Reduction* [32], placing, in particular, emphasis on the need to define the elements of a knowledge process [33] aimed at a spatial definition of the vulnerability of territories to climate change, with specific reference to the possible impacts on the landscape-

environmental system, settlement-morphological, infrastructural and territorial endowments, and on the system of socio-economic relations.
Process capable of introducing and accompanying the construction of integrated strategies of *climate-proof* regeneration, in coherence with the objectives of the *European Strategy on adaptation to climate change* [34], combining the emergency dimension with a perspective of design and transformation of the territory in a sustainable key, in which all the elements of the built environment adapt to the new balances with efficiency and high performance levels [35].
In the general framework of the research activities carried out by the authors, the contribution gives back part of the results of a work of analysis and critical evaluation of some planning experiences carried out at national and European level, which allowed, through an inductive method, to identify two different approaches of the tools promoted by the Local Authorities and Territorial Agencies in a *climate-proof* perspective [36].
A first approach refers to a strategic dimension, related to the supra-municipal planning level (metropolitan or regional area), which identifies the main strategies for adaptive and resilient cities to climate change.
A second one recalls a regulatory dimension, mainly referred to the municipal planning level, which highlights a gradual process of integration of the plan contents, both in terms of implementation of the cognitive framework of the vulnerability of the territories, with the preparation of management drawings that give the consistency of the areas affected by the risk phenomenon, differentiated by level of hazard and in relation to possible time horizons analysed (heat islands, floods, alluvial phenomena, subsidence, etc.); both in terms of identifying possible mitigation and adaptation project actions on "target" areas identified by the Plan, from which to identify quantitative and qualitative indicators/requirements/standards, referring to the measures adopted [37].
The research activities focused on a selection of six case studies referring to the European context [38] and six case studies referring to the national context [39], favouring those experiences in which it was possible to find a *multilevel governance* and *downscaling* planning approach [40] between the *strategic* and *regulatory* dimensions of the instruments implemented by Local Authorities and Territorial Agencies at regional/metropolitan and municipal level.
In particular, the activity of analysis and critical analysis was based, on the one hand, on the study of dossiers and reports prepared by public administrations (PAs) and published on institutional websites, articles and scientific *proceedings*, and, on the other, on interviews and meetings with representatives of the PAs concerned.

4. The national context. A multilevel governance and downscaling planning approach

With reference to the national context, in coherence with the *European Strategy for Adaptation to Climate Change* (2021), the Ministry of Ecological Transition (MITE) (formerly the Ministry of the Environment, Land and Sea) has defined the *National Strategy for Adaptation to Climate Change* (SNACC, 2015), delegating the implementation of adaptation measures and actions to subsequent *Action Plans.* In this, however, it did not provide specific objectives or obligations for the local government bodies to adopt an ad hoc planning tool.
Following the SNACC, MITE undertook the process of preparing the *National Climate Change Adaptation Plan* (2018), which was then submitted for consultation to regional and local administrative levels, and is still in the process of approval.
From this, *Regional Adaptation Strategies* and *Metropolitan City Adaptation Strategies* will be developed, as well as *Local Adaptation Plans of Unions of Municipalities/Municipalities.*
In this context, the analysis of the two case studies of the "*LIFE16 Veneto Adapt"* strategy and of the *"Guidelines for the construction of the Climate Adaptation Plan*" of the Municipality of Padua was of particular interest for the purposes of this research.
The Strategy "*LIFE16 Veneto Adapt"* [41] is driven by the objective of reducing exposure to risk phenomena and improving resilience to climate change, especially those related to hydrogeological risk and heat waves, of a conurbation of about 3.5 million inhabitants, consisting of the territories of the Metropolitan City of Venice and the municipalities of Padua, Treviso, Vicenza, Cadoneghe, Curtarolo and Vigodarzere.
In order to implement these objectives, the Strategy identifies a methodology of intervention consisting of:
- *structural or guiding actions* to avoid or reduce exposure to climate risks (building standards, green roofs to protect against overheating in summer and lamination of water in winter, construction of flood defences, provision of *green infrastructure*, etc.);
- *actions deriving from the use of ICT technologies*, useful to increase the capacity to find, analyse and disseminate information concerning the relationship between territory and climate change.
The Strategy also foresees that, for each action identified in the individual *Local Adaptation Plans*, to be prepared by the municipalities concerned, a sheet will be drawn up containing:

1. the reference to the sector or planning instruments concerned by the individual action, in order to ensure more effective coordination between the contents of the individual instruments;
2. the cataloguing of actions to be tested within the strategy in relation:
(a) the time horizon of implementation;
(b) the scope of its application;
(c) the level of effectiveness (payback time).
(a) with regard to the time horizon for implementation, actions are divided into three categories:
. "*coping*' (action taken in response to the emergency, aimed at managing the event and then recovering/rebuilding the previous state);
. "*incremental*" (adaptive actions aimed at curbing the phenomenon, quick to implement, with short or medium payback periods);
. "*transformative*" (systemic actions of territorial transformation, which require a substantial financial investment in the immediate future, but which allow a reduction of economic and social costs in the long term);
(b) with regard to their scope, the actions are divided into three categories:
. "*physical'* (adaptation measures that act directly on the urban structure, at any scale);
. "*organisational*" (measures which, while not interacting with the built environment, propose policies and methods of governance or intervention capable of promoting adaptation: permanent working tables, agreements with monitoring bodies, etc.);
. "*economic*" (adaptation proposals based on local taxation or detaxation of behaviour that is more or less helpful in reducing the impact of climate change).
(c) with regard to the level of effectiveness (payback time), the actions are divided into four categories:
. "*ordinary*" (a measure useful for managing events that are not particularly intense, occurring every year or over a period of a few years);
. *between 5 and 10 years* (a measure capable of dealing with non-routine but nevertheless frequent events);
. *between 30 and 50 years* (measures designed for extraordinary events);
. *between 100 and 300 years* (measures capable of coping with extreme events).

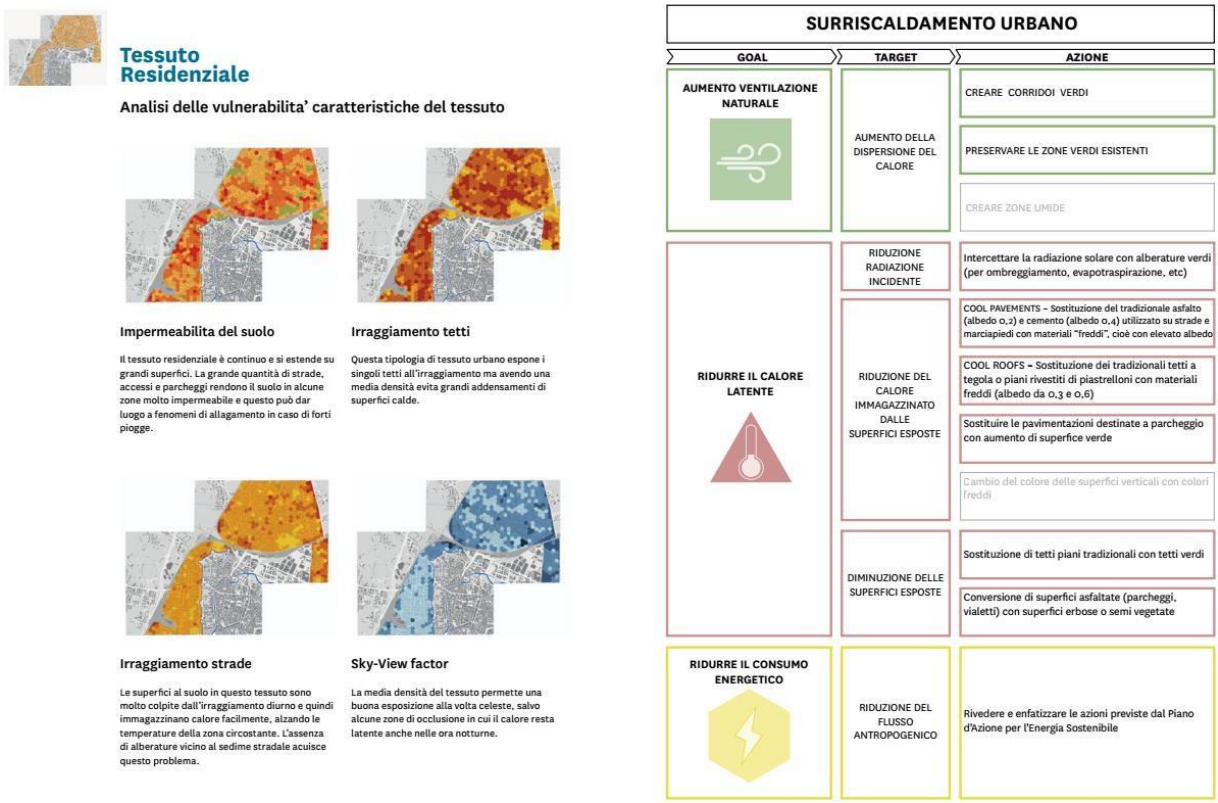


Fig. 1 Prontuario azioni "*Guidelines for the construction of the Climate Adaptation Plan of the Municipality of Padua*"

The *"Guidelines for the construction of the Climate Adaptation Plan*" [42] of the Municipality of Padua, preliminary to the preparation of the *local Adaptation Plan*, acknowledge the objectives of sustainability and resilience to climate change of the "*LIFE16 Veneto Adapt"* Strategy and decline the *regulatory* dimension with reference to the:

- identification of the actions necessary for the environmental and landscape regeneration, and for the functionality of the settlement and production system, identifying, where necessary, setting bands, in order to mitigate or compensate the impacts on the surrounding territory and environment;
- verification of the morphological and functional structure of settlements, with the definition, for the areas at risk, of regeneration and possible functional reconversion interventions and, for the most compromised parts, of possible strips or mitigation elements;
- regeneration of the public space system and improvement of the overall ecological functionality of open spaces.

Starting from the explication of these general objectives, the *Guidelines* identify a methodology for the definition of the abacus of *site-specific* adaptation actions for the municipal territory that foresees, with reference to the *target* area identified for the experimentation, a preliminary mapping of the territory by fabrics, referable to the zoning of the local urban planning instrument in force (PAT Territorial Planning Programme).

With respect to this typification, the "*Prontuario delle azioni*" was finalised, organised according to the *vulnerability/goal/target and site-specific action* structure, which takes into account the impacts and vulnerabilities present on the territory, returned in specific integrative elaborations of the cognitive framework, and which allows the Administration to recognise the most suitable measures in relation to the specific characteristics of the municipal territory and the criticalities identified.

By way of example, in relation to an area classified as "*Residential fabric*" for which vulnerability to the heat island phenomenon has been highlighted, with consequent urban overheating, the map identifies as goals *the increase of natural ventilation*, the reduction of *latent heat* and the *reduction of energy consumption*, to which correspond specific targets, such as, for example, the *increase of heat dispersion*, the *reduction of heat stored by exposed surfaces* etc., which can be achieved through specific actions such as *creating green corridors*, *intercepting solar radiation with green trees*, cool *pavements* and *cool roofs*, *converting asphalted surfaces with grass surfaces* etc.

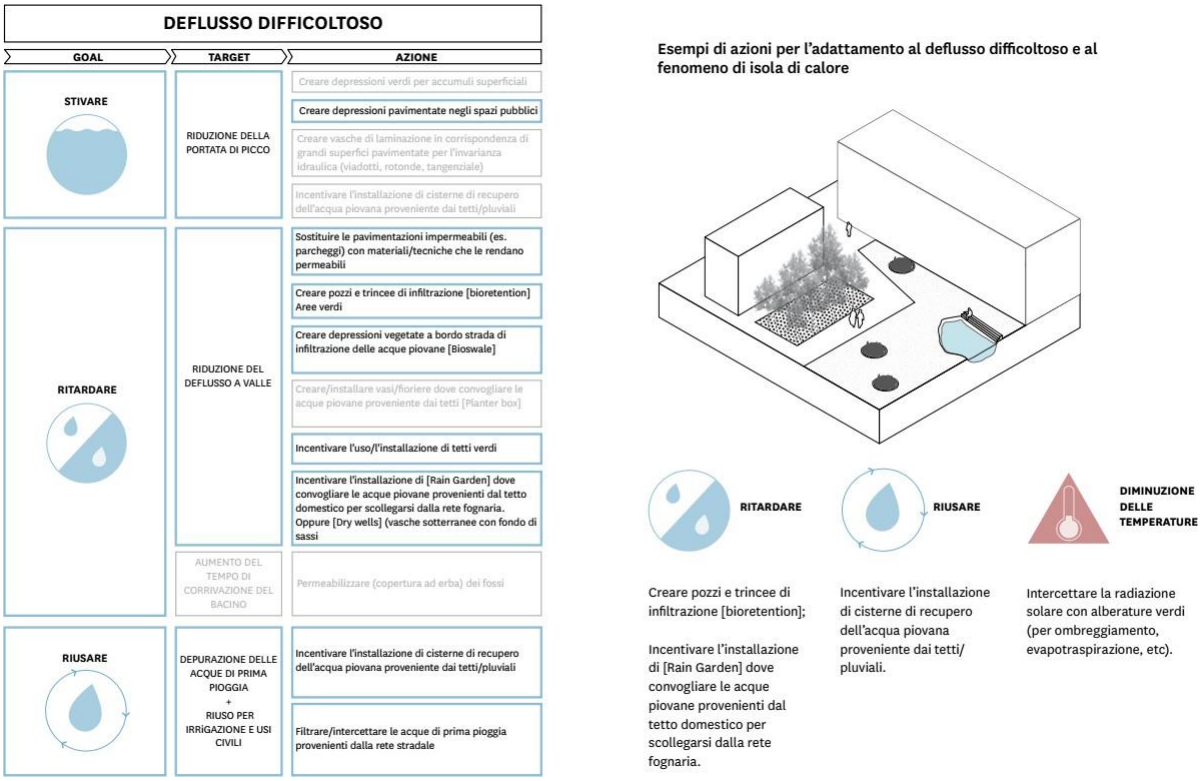


Fig. 2 Prontuario azioni "*Guidelines for the construction of the Climate Adaptation Plan of the Municipality of Padua*"

Monitoring of actions is a very important aspect of a successful *adaptation plan,* as is the case for any spatial planning tool.

The main difficulty in monitoring urban adaptation to climate change arises, in fact, when trying to measure (in quantitative terms through indicators) the effects of an action defined by the plan and its contribution to increasing the resilience of the area targeted by that action.

In this sense, the need is highlighted for a constant updating of the *cognitive framework of the territory*, through innovative elaborations and databases able to manage and share environmental, climatic, urban and economic information and a periodical evaluation of the results obtained through the

implementation of strategies and *site-specific climate-proof* actions, which allows, in relation to new instances and monitoring results, to start a constant process of updating and adjustment of the Plan.

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Restoration of the Østerå river system as an ecosystem service for the ecological transition of Aalborg

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Abstract
The first document approved by the European Community on sustainable urban development was drawn up in Aalborg in 1994. The Danish city has distinguished itself on the international scene for pursuing sustainable growth through energy transition, nature conservation and urban regeneration.
To increase the city's resilience to climate change and to improve the quality and ecosystem balance of urbanized environments, Aalborg has launched projects for the reactivation of interrupted natural cycles and the renaturalisation of abandoned urbanized areas. One of the most significant projects is the restoration of the Østerå, the river that ran through the city and which, at the end of the 19th century, was channelled into underground pipes to make room for urban growth. The entire course of the river will be brought back to the surface, redeveloped and equipped as a new ecological corridor according to an innovative approach that rediscovers the aesthetics of wild nature.
The project will increase the multiple benefits that a river can bring in an urbanized context as an ecosystem service. The opening of the river will contribute to the mitigation of flood risk with Rainwater Harvesting and Management systems, will increase the value and quality of public spaces and will allow residents to have a direct experience of nature in the city.

Keywords: Sustainable Urban Development, Ecological Corridors, Green Wedges, Rainwater Harvesting and Management (RWHM), Aalborg.

1. The opening of the Østerå river
The Østerå River is a 15 km long watercourse in Northern Jutland (Denmark) that originates north-east of Størving and flows into the Limfjord. In Viking times, the river was wide and deep enough to be navigable, which is why its mouth was identified for the construction of a port settlement on which the city of Aalborg later developed.
Originally the river flowed through the city of Aalborg from south to north, at the present Østerågade road (Fig. 1). Its waters were used for domestic purposes and to power the operation of the mills. The river was also used as a place for washing and draining sewers.
When in 1869 the railway line connecting with southern Denmark reached the city of Aalborg, it was necessary to divert the river to be able to build the railway station. In 1872 the river was channelled into pipes which, flowing under the current Kanalstien road, convey its waters into the Limfjord (Fig. 2).



Fig. 1: Plan of Aalborg, published in *Resen Atlas Danicus*, 1677.

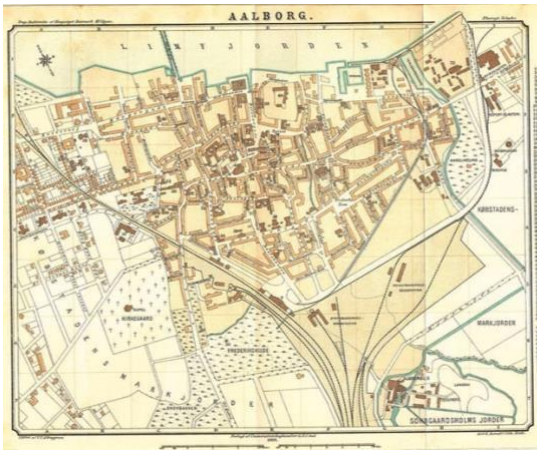


Fig. 2: Aalborg, 1900. Kort over købstaden. V.F.A. Berggreen.

For over a century, the river disappeared from the urban landscape and continued to flow under the city. At the beginning of the 21st century, when a greater awareness of sustainable urban development was established, the hypothesis of bringing the river back to the surface began to emerge, evaluating the multiple benefits it could bring in terms of ecosystem rebalancing in the urban environment (Fig. 3). Therefore, in 2008, the municipal administration started studies for the construction of an ecological corridor within which to bring to light the waters of Østerå, in a continuous path that starts from the natural area of Østerådalen south of the city, enters the district of Østerådalen Kærby near the Gabriel textile factory, passes through the transformation areas of the railway freight yard and the Karolinelund Park and ends with the outlet of the waters in the Limfjord near Mussikens Hus (Fig. 4).



Fig. 3: The fjord and the river valley of Østerå [1].

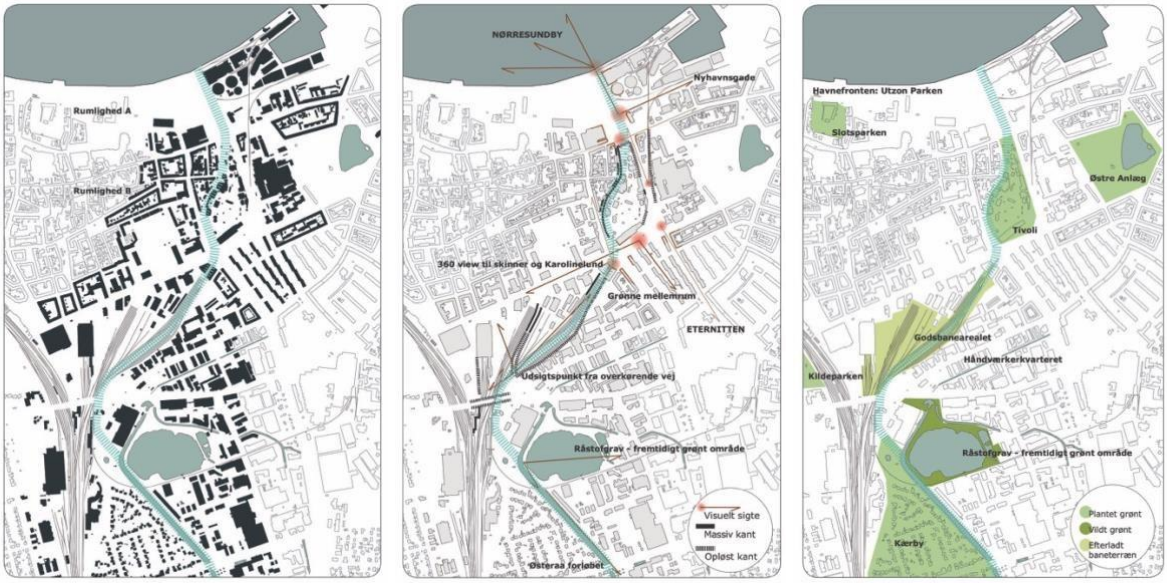


Fig. 4: Studies to bring the Østerå river back to the surface and create an urban ecological corridor. From left: new route of the riverbed; stretches of river to be designed with natural bed or with protective barriers and visual interconnections; types of vegetation to plant [2].

For the construction of the ecological corridor, it was necessary to change the intended use of the soils affected by the passage of the river. Therefore, between 2010 and 2020, the municipality developed four local urban plans for the transformation of the area overlooking the Limfjord between Musikkens Hus and Østre Havn (2010); the disused railway areas of Godsbanen (2010); the disused amusement park of Karolinelund (2016); the southernmost area near the Kaerby district and the suburban area (2020).

2. The first step: bring the mouth of the Østerå river back to the surface

The first part of the project was the reopening of the northernmost stretch of the river between Musikkens Hus and Østre Havn, completed in 2018. The reopening of the final stretch, where Østerå flows into the Limfjord, is part of the regeneration project of the Aalborg waterfront [3] (Figg. 5-6).

The opening of Østerå has helped to increase the attractiveness of the area and, consequently, to increase the real estate value of the soils. The property development company Enggaard A/S, owner of the soils and contractor of the works, benefited from this increase in value and, as negotiated with the municipality, participated in the reopening project of Østerå co-financing the works for the removal of the slab of coverage of the canal, arrangement of the embankments, planting of trees and plant species and lighting systems [4].

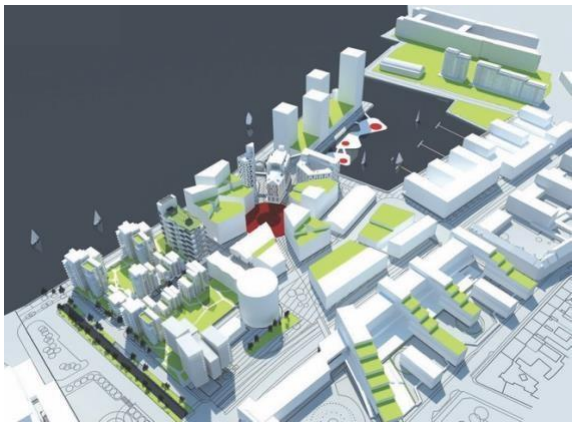


Fig. 5: Overview of the redevelopment project of Østre Havn [5].



Fig. 6: Reopening of the terminal section of the Østerå river between Musikkens Plads and the Limfjord.

The project was drawn up by the Polyform architecture studio. The banks of the canal have inclined planes covered with filter soil, where trees and vegetation have been planted, which act as a filter bed for the rain. At the bottom of the channel rocks have been placed at different heights to create an environment favourable to fish fauna and aquatic vegetation.
To offer the possibility of enjoying the river in a diversified and close-up way, the project envisaged the construction of stairs that allow reaching the water level. The limited size of the water channel, the murmur produced by the obstacle rocks on the bottom and the presence of a rich vegetation have the purpose of reproducing the image and the sensations of a stream [6].

3. The second step: create an urban ecological corridor

After the reopening of the mouth, in 2019 a tender was launched for the proposal of a masterplan for the area between Teglgårds Plads and Gabriel Erhvervspark, with the aim of reconnecting the end of the river with the urban crossing section up to the natural areas of Østerådalen (the competition was won by the design studios Rambøll and SLA Architects).
This area is located in a transition zone between the dense city and the green wedges. The masterplan intends to re-establish the continuity of the river by aiming at the dual objective of creating an ecological corridor in the urban environment and re-functionalising parts of the city that are no longer used.
The intervention area was divided into three sectors, characterized by the presence of large green areas: the former Karolinelund amusement park, the former Godsbanearealet railway area and the Gabriel Erhvervspark industrial area (Fig. 7).
The Karolinelund park, which originally housed a military garden and then an amusement park, is a green lung awaiting redevelopment; after the rides closed, the park was simply opened to the public as an urban park, but without a renovation project. The context is characterized by the presence of centuries-old trees and historical traces of past functions; the park is intensely used by the inhabitants of the neighborhood.
Godsbanearealet is a vast railway area left to itself; between the tracks, the cranes and the lampposts that characterize this residual railway landscape, a luxuriant spontaneous vegetation grows whose biodiversity has been enriched over time by the passage of trains that transported seeds from other regions to the city, wedged between the wheels and the wagons.
Gabriel is the area where the river meets the city, where water mills and, later, industrial plants used the water and hydroelectricity of the Østerå River. The area opens up to the natural areas of Østerådalen, characterized by an intact and lush natural environment, populated by numerous species of fish, birds, animals and wild plants.
The masterplan has identified three main objectives to be achieved: environmental redevelopment, adaptation to climate change and urban regeneration. As regards the first objective, in each of the three parks the environmental requalification must be based on the enhancement of the characteristics of the local vegetation, in order to restore the natural ecosystemic balance. To achieve the goal of climate adaptation, the Østerå catchment area will have to be valued as an ecosystem service: the renaturalization of the riverbed, the provision of rain beds and the modelling of permeable soil can greatly contribute to making the city more resilient to extreme rain events, phenomena that are recorded more and more frequently. Finally, as regards urban regeneration, the presence of a redeveloped watercourse within the city can contribute to the attractiveness and enhancement of the urban parts it crosses.

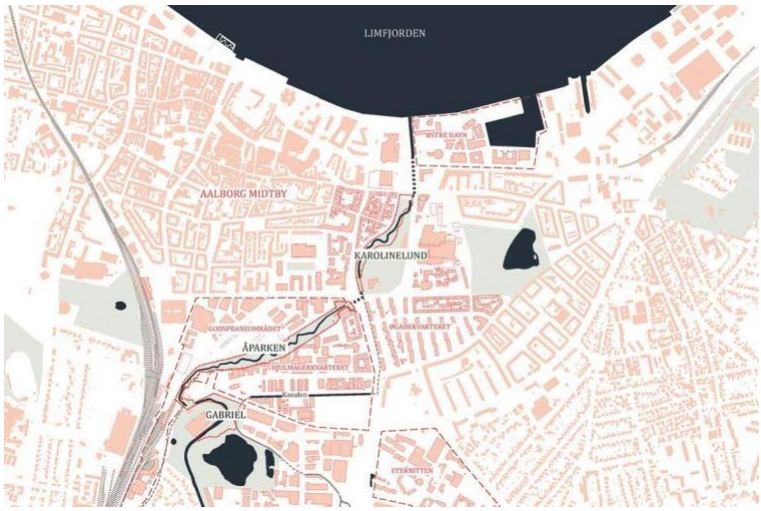


Fig. 7: The three new riverside parks of the Østerå River: Karolinelund, Åparken and Gabriel [1].

3.1 The first sector of the ecological corridor: the Karolinelund Park

The area on which the Karolinelund Park stands was originally owned by the municipality of Aalborg. In 1824 the municipality ceded the property to the officers of the city army who, on the initiative of Colonel Louis le Normand Bretteville, transformed the area into a romantic garden dedicated to music, entertainment and garden management. In 1839 the park was dedicated to Princess Carolina, wife of Crown Prince Ferdinand, on the occasion of the visit of the princes to the city. Originally reserved for soldiers, the park has been open to public use by citizens since 1840.

In 1946 the land was bought by the Lind family who built the Tivoliland amusement park, which was opened to the public in 1947 (Fig. 10). The park has been in business for about sixty years, becoming one of the largest and most famous tourist attractions in Aalborg. In 2007 the park was closed due to a general change in entertainment tastes. In 2010 the municipality bought the property and definitively dismantled the amusement park [7].

The park's once peripheral location had become central to the city's expansion and was close to two new urban centralities, Nordkraft (the disused power plant transformed into a health and sports centre [8]) and Musikkens Hus (the new concert hall designed by Coop Himmel(l)au). The municipality has therefore started a process of transformation of the site by activating a wide public involvement. From 2011 to 2015, before the start of the transformation works, the park was opened for temporary use, as requested by the citizens [9].

The park's temporary activities were coordinated on the basis of an agreement between the voluntary user association "Karolines Venner" (Friends of Caroline) and the municipality of Aalborg.

In this phase, a slight redevelopment of the park was carried out: the surrounding wall was partially demolished to create four new entrances and the remaining fragments of the wall were made available for the creation of graffiti; easy to maintain sports equipment, such as a skateboard track and a bowling green, have been built; a part of the park has been granted for the cultivation of urban gardens; the Påfuglen building was reused as a bar and meeting place for debates and workshops.

The project for the transformation of the park was drawn up by the architectural firm Cobe in collaboration with the municipality of Aalborg and with the contribution of the users of Karolinelund. Based on the contents of the project, in 2015 the municipality drew up the local urban plan 1-1-124 (Fig. 8) to make the transformation of Karolinelund feasible [10]. The local plan envisages the construction of an urban park with multiple functions, the opening of Østerå River and the location of a kindergarten of about 700 square meters (Fig. 9).

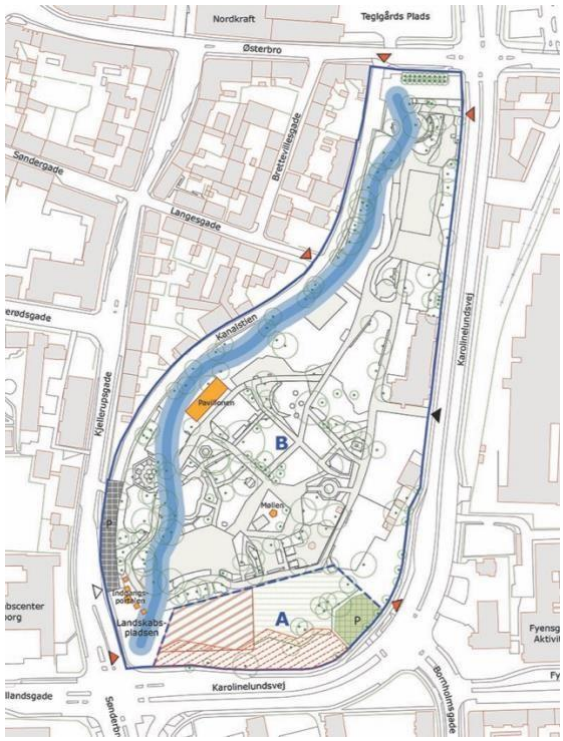


Fig. 8: Local urban plan 1-1-124 for the Karolinelund Park: area for the construction of a kindergarten (A) and area for the park (B) [10].



Fig. 9: Karolinelund Park recovery and renovation project [10].

The project has the river as its strong point: it involves hydraulic reconnection to the north with Musikkens Plads and to the south with the former Godsbanearealet railway area. Inside Karolinelund, the watercourse will be brought back entirely to the surface and will have a sinuous path to favour the rooting of aquatic vegetation and ensure a favourable microhabitat for fish fauna, contributing to the enrichment of biodiversity and environmental regeneration.
One of the most relevant aspects of the project is its contribution to adaptation to climate change. The global increase in temperatures and increasingly recurring extreme weather phenomena cause more and more flooding with extensive damage and inconvenience, which can be felt to a greater extent in urban areas. The project extracts the benefits of the river into the urban environment as an ecosystem service for the disposal of excess rainwater. To this end, the profile of the riverbed has been designed on several levels, in order to guarantee both the regular flow of the river water in periods of regular rainfall, and to receive a greater inflow of water in the event of extreme rainfall.
Already in its transition phase, Karolinelund has proven to have much more added value than when it was used as an amusement park. The park is used at different times of the day and by a very different audience, from children to adolescents, from university students to the elderly. The urban gardens have been so successful that the municipality had to create a waiting list for the concession of cultivable flower beds; the owners of the garden love to share their products even in collective banquets set up in the areas equipped with benches and outdoor tables (Fig. 11). The park, in addition to offering citizens a space to reconnect with nature without leaving the city, has a peculiar local property that manifests itself in the ability to accommodate differentiated functions, a sort of underground culture of living in collective spaces even with spontaneous uses [11].
The project took note of these considerations and envisaged the differentiated and flexible use of the park areas that can be used at different hours of the day and night. For this reason, no area of the park will be used for residential functions, considering this function incompatible with the recreational activities, shows and musical events that are planned in the park.



Fig. 10: Entrance pavilions to the disused amusement park of Karolinelund.



Fig. 11: Urban gardens created within Karolinelund cultivated by the inhabitants of the neighborhood.

3.2 The second sector: the disused railway areas of Godsbanearealet

Godsbanearealet (the freight train parking and loading area) is a predominantly flat area southwest of the historic centre of Aalborg, where a branch of Østerå flowed. At the end of the nineteenth century the area was levelled and the river channelled into an underground pipe for the construction of the freight train terminal [12]. An industrial district has developed on both sides of the railway area. At the end of the 90s, the railway functions ceased and almost all the industrial activities were closed or relocated, freeing an area of about 23,000 square meters [13].
The area is very interesting for the urban growth and sustainable development of Aalborg because it is located near the historic centre and acts as an ecosystem connecting corridor between the Østerå river valley and Karolinelund Park.
The municipality of Aalborg has started a process of transformation of the area with the aim of creating a zero emissions eco-district in which residential and commercial functions are integrated with the recovery of the naturalistic values present in the area [4]. As regards climate sustainability, the goal is to create a climate-friendly district in which CO2 emissions deriving from the district's energy consumption are minimized.



Fig. 12: Masterplan for the re-functionalization of the Godsbanearealet area [1].

Once again, the river is the main design theme: it is brought back to the surface to bring new natural qualities into urbanized areas, to enrich the biodiversity of the urban context, to contribute to adaptation to climate change and to create new places for socialization [1].
In 2010, the local urban plan 1-1-110 was drawn up for the transformation of the area [14]. In 2014, the architecture studios Rambøll and SLA prepared the masterplan of the new urban park, called Åparken, and provided specific indications for the recovery of Østerå [15] (Fig. 12).
The masterplan will make Aalborg more resilient to climate change: to this end, greater rainwater drainage capacity is planned throughout the Østerå catchment area [16].
Normally, rainwater is disposed of through the sewer system, where the white water flows along with the black and grey water into the underground pipes. This solution has been questioned both by a greater ecosystemic attention to the recycling of rainwater, and by climate changes which, causing a significant increase in rainfall, would require an expensive dimensional adjustment of the sewage system.
The low open spaces of the former freight railway area are one of the largest flood prone areas in the city. Instead of channelling rainwater into the sewer networks, it was decided to manage it over the entire urban surface using Rainwater Harvesting and Management (RWHM) solutions. The rainwater will be collected in the rain beds where it can evaporate or be filtered and subsequently recycled for irrigation of green areas.
Åparken will be able to handle large amounts of water. The park will have the shape of a river valley and the impluvium towards the river will give space to even high flow rates. In the lower areas, where the railway tracks used to run, no buildings will be built but a linear park with sports fields, children's play areas and outdoor picnics. These areas are designed to be flooded in case of heavy rain.
All non-built surfaces must be covered with draining soil and modelled with suitable slopes, while all built surfaces must have green roofs. In situations of even more intense rain, rain beds must have an overflow to drain excess water into pipes connected to deeply excavated areas, used as collecting tanks. In the event of exceptional rainfall, the collection tanks, in turn, can overflow and flood the rest of the park, thus gaining extra volume. When this volume is exhausted, in the event of a storm, an underground overflow channel will be activated to accommodate the excess flow (Fig. 13) [4].

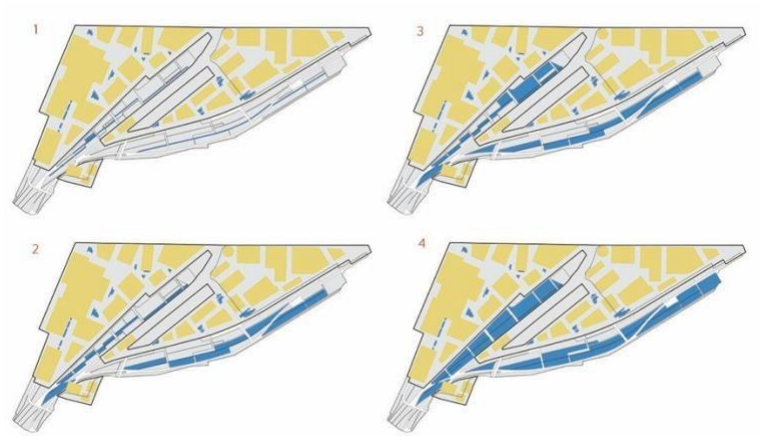


Fig. 13: Godsbanearealet floodable space filling scheme: 1 - the rest areas and the river course will be filled first; 2 - as the water level rises, the connecting channels between the cisterns and the areas adjacent to the river will be filled; 3 - a further rise in the water level will inundate sports fields and playgrounds; 4 - in the event of extreme weather conditions, that can occur 1-2 times every 10 years, all areas of the park will be flooded [17].

RWHM solutions can manage rainwater not only where it falls but also as it flows. Controlling the speed of the water and the direction in which it flows allows it to be directed and collected so that it does not cause damage. By delaying rain, for example with green roofs and rain beds, the urban space contributes to the hydrological cycle by increasing the evaporation time and delaying runoff. Delaying rain also helps in extreme situations, as a delay of just half an hour, for example, in a stormy situation can give the drainage system time to properly dispose of water without collapsing [4].
Thanks to the RWHM systems, the project fully achieves the objectives that the municipality has defined with the city water management plan. In the near future, the municipality plans to separate the white-water collection and management system from that of black and grey water. The reopening of the Østerå River will be part of the urban stormwater management system and will replace the settling ponds that currently filter the waters. Thanks to the rainwater collection and disposal capacity ensured by the restored catchment area, it will not be necessary to carry out works to adapt the sewer network. Kloak's sewage company will save the cost of expanding the capacity of the sewerage network and, in agreement with the municipality, will contribute to the co-financing of the works.
Another source of co-financing for the realization of the project could come from the real estate agencies involved. In fact, the project envisages the construction of houses and commercial activities with building rights of 38,000 square meters [18].
The masterplan also includes climate adaptation devices for built-up areas. To protect buildings from flooding, the height of the ground floors should be 35 cm higher than the park overflow. Along the perimeter of the buildings, grids must also be provided for the fall of rainwater which is collected by the park's canalization system.
In situations of normal water flow, the watercourse is located one meter below the ground level. To increase Østerå's recreational value, pedestrian walkways have been designed at the watercourse level. The whole area of the park is made up of terraces sloping down towards the river accessible to the public; according to the increase in the flow of the river, the terraces will gradually flood, always allowing access to the park.
In addition to the objectives of climatic adaptation and environmental redevelopment, the masterplan has indicated as a design criterion the maintenance of the historical memory of the place [13]. The executive project of the Godsbanearealet area (Werk architecture studio) has kept some tracks, large lampposts and container cranes, residues of the railway landscape, as elements of street furniture and recycled them to perform new functions [12]. Some sections of the tracks, for example, have been integrated into the design of the equipped rest areas: the rest areas are conceived as drainage areas that interrupt the waterproof pavement of the pedestrian areas. The tracks, laid on draining soil, act as separators of the flower beds, where various plant species are planted, and as a support for the benches made with wooden planks. In case of abundant rain, the flower beds are flooded receiving the water that falls on the waterproof floors and then slowly drain it towards the river (Figg. 14-15) [19].
The vegetation project, as previously mentioned, enhances the peculiarities of the local environment. The seeds transported by freight trains have given rise to a unique vegetative mix rich in biodiversity capable of withstanding local climatic conditions and which does not require special irrigation, maintenance, pruning and cleaning. The different plant essences born spontaneously in the area were then used as street furniture and create an appreciable landscape continuity along the entire course of the river, from wild nature to its urban path.



Fig. 14: Equipped rest area in Godsbanearealet. The disused tracks were used for the composition of seats and flower beds which, in case of rain, act as rainwater storage tanks.



Fig. 15: Rainwater collection and channeling system in Godsbanearealet.

This approach to urban green design based on respect for nature, which prefers to use spontaneous vegetation rather than ornamental plants, is increasingly winning the favour of designers who deal with urban design.

3.2 The third sector: the Gabriel Park

The system of interconnected parks ends with the Gabriel sector, at the southern edge of the compact city. Since the Middle Ages there were mills in the area that exploited the motive energy of the Østerå waters. Since the mid-nineteenth century, industries have established themselves that have benefited both from the proximity to the city and from the use of hydroelectric energy produced by the river. One of the oldest factories, still present on the site, is the Gabriel textile factory (hence the name of the locality), built in 1851, which used the waters of the river to wash and dye fabrics.
The area is characterized by high naturalistic values and by the presence of historic industrial buildings, including the Limfjordsbanen locomotive depot, now used as a museum.
According to the municipality's plans (Fig. 16), the transformation of the Gabriel sector is expected to begin in 2023 and be completed by 2025 (Fig. 17).



Fig. 16: Local urban plan 1-1-110 for the transformation of the Gabriel sector [14].



Fig. 17: Rendering of the natural park project to be built in the Gabriel industrial district [1].

4. Conclusions

Quite often the rivers that flowed through cities were diverted or channelled into underground pipes to make room for urban growth and to protect settlements from the risk of flooding. Today there is a greater awareness that rivers are an important factor in the rebalancing of urban habitats and can contribute in an ecological way to the mitigation of risks caused by climate change.
The case study of the reopening of Østerå, the river that flowed in the centre of the city of Aalborg and which had been channelled in underground pipes, highlights the benefits that can be drawn from the presence of a watercourse in the city.
The river reopening project has created an urban ecological corridor, uninterrupted from the natural suburban areas to the mouth, which restores the ecosystem balance of the river valley, helping to improve the quality of the urban environment.
The project enhances the benefits of the river as an ecosystem service: the river constitutes the main infrastructure of a local stormwater management system that provides effective solutions for the disposal of precipitation, which is increasingly abundant due to climate change.
For the construction of the ecological corridor, the project has identified a path that intercepts urban areas no longer in use; the river becomes an element of redevelopment of abandoned areas, increasing their value. The new green wedge is equipped with paths, rest areas, playgrounds and sports equipment, offering public spaces and places for socializing in close contact with nature.
Attention to environmental ecosystem balances and a new aesthetic sensibility of wild nature are the innovative aspects that characterize the project, offering new food for thought for the resilient and sustainable design of cities.

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Ecological Redevelopment
A territorial (re)generation of the interior region of Portugal*

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More than half of the world's population now lives in urban areas, and by 2050 that number will have grown to 6.5 billion people, two-thirds of humanity. With the onset of globalization, rural areas have become peripheral to cities, and we now see that, with a rapidly ageing population, the passing down of ancestral knowledge is threatened. Seven of Portugal's ten million inhabitants live in that 30-km wide coastal strip. The remaining three million are scattered across a territory of about 250km by 750km. Cities and villages in the 'interior' lost in average an astounding 10% of population each ten years, over the last decades. If this progression were to continue, Portugal's interior would have virtually no population left by 2100.
The dominant imaginary that arises from air pollution, climate change or the COVID-19 pandemic, imagines, and conceives a world in which nature must be protected from human action. However, the human condition cannot be separated from nature because it is an intrinsic part of the same socio-ecological metabolism. We need imaginaries that instigate all generations to think about a more livable planet.
As such, and as an example of a concrete program in the concrete scenery of the interior, this article will consider Art(e)facts, that introduces the theme Supernatural Togetherness to propose alliances between humans, generations, species, and knowledge to save the future, proposing territorial developments and climate change adaptation. A curatorial approach coordinated by the author that explore the idea of an alliance creation between generations and species. The project aimed to care for the intangible memory of the territory. To do so, it proposed to rethink dialogues for the construction of a contemporary heritage of artistic works focusing on the enhancement of the region and the reinterpretation of traditional knowledge.

Keywords: Climate Change, Contemporary Heritage, Collaboration, Ecology, Rurality

1. The moral question

Kant wrote in his book Conjectural Beginning of Human History (1786) that Humanists should study the moral life of species and not the animal life that is studied by scientists. (KANT, 1786)
In the context of this article, and as researchers in the disciplinary field of architecture we come across the importance of the notion of nature and the ecological as something that starts from nature and makes of it what is essential, universal and subsistent. In other words, we can summon the idea of Darwian humanism that confronts the more empirical tradition transmitted from Hobbes, through Hume, who starts from the human moral feeling, with what we call the humanist tradition, inherited precisely by Kant or by Rousseau, who sees in human freedom its starting point. In introductory synthesis, this is a thought that is structured on the humanist notions of freedom and dignity. (KIRKMAN, 2009)
The problem is that animal life is now a much more expanded universe, derived from what we ingest, the energy we process, technology, everything we do that confronts us with a general distributional crisis. So right now, we are facing, or being forced to ask, a moral question: In the light of all the problems we face what should we do? That is a moral question.

Popular culture is filled with images of environmental apocalypse. Images of climate dystopia saturate contemporary media. From a superficial point of view, these images share a common certainty: humanity's technological arrogance produces dramatic environmental change.
There are two very different visions of the future that encompass divergent constellations of society's hopes and fears. This divergence has implications on how conception and planning work to mediate the present and the imagined future. One reports scenarios of water scarcity and another of a submerged world. The dry apocalypse verses the wet apocalypse.
Sea level rise is predictably a significant aspect of the wet apocalypse, although the underlying causes are contested in history: from corporate genetic manipulation to bioterrorism.
“Human is an unstable category, even an unstable being. It is not a clearly defined biological organism with a particular form and set of capacities that collaborates in social networks to change things around it.” (COLOMINA, WIGLEY, 2016, p. 22) In this human condition of thinking, we can guarantee the contrary. We are defined by diversity and the ability to modify our abilities. In other words, if on the one hand we live in this radical instability, on the other hand this is the basis of our impact. We take from Colomina's and Wigley’s words the idea that as the world is redesigned, it simultaneously redesigns the designing animal. Our objects and our systems are never simply produced by a subject in order to dominate the material world. The human acts in a collective social body, but aware of our interdependence with artefacts. “The act of imagining ... is a magical act. It is an incantation intended to make the object of thought, that which one desires, appear in a world that allows one to take possession of it.” (SARTRE, 1971) However, what seems important to emphasise is the essence of the hand, which as Heidegger says "can never be determined or explained as that of a grasping organ. Every movement of the hand in each of its actions leads to thought; the whole weight of the hand carries itself upon the element." (HEIDEGGER, 2010) All animal species that build possess a high technique of manipulation, and this is especially evident in the case of the three main classes of builders. Spiders and insects derive their technique in the fact that they are endowed with multiple articulated legs and subtle mouthparts, while birds have sharp beaks attached to extremely mobile heads, allowing very precise movements. Constructive technique based on manipulative skills is well exemplified by the almost human-like way certain species of weaver birds weave, braid and knot. An inventory of the knots of these birds could easily be confused with a page from the Scouts' Knot Manual. (PALLASMAA, 2020, pp.29-30)
The problems arising from climate change could open up a new epistemological horizon. This can be seen in the ways of approaching the notion of scale, through non-modern ontologies.
We may be referring to hyper objects, flat ontologies and vibrant materials that cannot be made legible unless we abandon our inherited epistemological frameworks and invent new ones.
It was on this premise that the paradox of the architectural and territorial programme that we create for the bid of Guarda to become the European Capital of Culture 2027 (ECOC 27) was based.

2. An ecology of bodies

Portuguese populations are drawn to a narrow strip of highly urbanized coastal land, leaving behind increasingly depopulated heathlands. Seven of Portugal’s ten million inhabitants live in that 30km wide coastal strip. The remaining three million are scattered across a territory of about 250km by 750km. A further 5 million emigrated or departed.
With Portugal's integration in the European Union and the abolition of national borders, a reversal of the historical trend in this diaspora could have been expected in recent decades. However, what we are witnessing is an increasingly asymmetric distribution of integration funds, leading to several towns and villages losing an average of 10% of their population every ten years over the last decades. Young people were systematically pushed out, either to study or make a living leaving the older generations left behind. If this trend continues, by 2100 the interior of Portugal will be depopulated.
The narrative of the architecture and territory programme of the candidacy of Guarda 2027 looked at the region from its natural landscapes and its historical heritage, rich in tradition, activating contemporary culture as a crucial element of an urgent social, economic and ecological regeneration.
Ecological regeneration implies the transformation of cultural perceptions towards the ecosystems and natural resources that support a substantial part of the region's identity and cultural offering. Nature is not to be taken merely as a commodity for the tourism economy. It should instead be adopted as an essential component of local people's heritage: “something to be taken care of for future generations; something with which to work with, so as to enhance biodiversity, environmental quality, climate resilience but also a distinct cultural identity for the near future. This involves projects with a pedagogical spirit, but also with proposed reconnections with the original and ancestral features of these fecund territories. This may range from the cultures of agriculture or traditional land, forest and water management, to new issues of circular economy, food security, rewilding or the return of commons as renewed forms of social organisation in rural areas.” (AA.VV, 2022)

Rural people and family farmers living in these sites often possess a broad knowledge base underlying the intricacies of local and complex ecological systems. As Liana John wrote about the GIAHS – global important agricultural heritage systems - proposal: “This knowledge of plants, animals, soils and the general environment has been accumulated through a long series of observations transmitted from generation to generation. Farmers are aware that biological diversity is a crucial factor in generating ecological services and in conserving the resource base and foods on which they depend. In many cases women are the main holders of traditional knowledge and thus play a critical role in the sustainable conservation and utilization of biodiversity.” (Food and Agriculture Organization of the United Nations)
More than half of the world population today lives in urban areas and by 2050 this number will have increased to 6.5 billion people, two thirds of humanity. With globalisation, rural areas have become peripheral to cities and now the ageing population, the last generations who have kept their ancestral knowledge, leaves their legacy in danger. Meanwhile in the city, the digital natives are growing up, hit by the Great Recession of 2008 and now immersed in the uncertainty. of a global health crisis and climate emergency.
“Architects should be asked to participate in the process of anticipation and not merely serve to respond to the patches needed in the immediate. We are inside our body, we have the opportunity to question new functionalities, intentionalities and new spaces of transition and mediation. We all know now what the absence of the touch is, the smell, the echoes of our own city, to which we were confronted in the covid-19 pandemic.” (GARCIA, 2021, pp. 53-54) We must recover the *eyes of our skin.* (Pallasmaa*,* 2006)
Unlike the young people who saw man reach into space or the conquest of the welfare state, the younger generations do not allow themselves to imagine the future. If art and architecture construct the imaginaries of each era, uncertainty and precariousness have diminished the daring of artists and architects to think of an emancipated world. We cannot lose the memory of Portugal's interior, but its history is not written only with human narratives. The cosmos, the climate, bacteria or technology also have their history here. Art(e)facts contributes to preserve the legacy of the region and to renew its future as a heritage for new generations.

3. Supernatural Togetherness

Art(e)facts proposes to strengthen these fragile contexts of the interior of Portugal. To build intergenerational scenarios that guarantee the survival of the rural environment and of the planet, conditioned to improve cooperation between the interdependent relationships that maintain all the beings and agents that live in the interior.
We proposed to combine the last generations - who kept the ancestral knowledge of the Portuguese countryside - and the younger generations - refounded by an uncertainty that does not allow them to imagine the future. Can art and architecture rescue an endangered legacy and an uncertain future to rewrite it from a point of view beyond the human?
Art(e)facts is a learning platform located in the interior of Portugal and inserted in the architecture and territory programme of the previous candidacy of Guarda to the European Capital of Culture. Every two years, Art(e)facts proposes a situated knowledge space implemented from artistic residences, a polylocalized exhibition, and a forum of ideas.
More than an event, it is a research facility. With a climate and rural emergency in the making, it is possible to interfere in the relations between institutions, art and the public with the aim of creating new strategies that we can use on the macro scale outside and inside.
Climate change is evident, and the cultural production of the last decades reflects the current state of emergency. But perhaps this effort is not yet effective. The term "anthropocene" draws an apocalyptic future, where the hand of human beings is the cause of irresolvable changes on the planet. Great natural catastrophes or hungry polar bears appear as distant images for the majority of the population. We need imaginaries that instigate all generations to picture a more habitable planet today. Only now, when young people see that this future is closer than ever, do political changes arise in order to avoid disaster.
Many discourses still maintain that humans dominate nature. But for many years now, thinkers like Bruno Latour have been noting that non-human agents, such as microbes, are fully-fledged actors in the world. Life is not a body, but a flow intervened by humans, microbes, data, institutions, non-human animals, economic speculation or media. (LATOUR, 2014)
The dominant imaginary of air pollution or the coronavirus pandemic imagines a world in which nature must be protected from human action. A story that does not distinguish the profit of big financial companies that extract raw materials on an industrial scale from small local practices that sustain their lives with their hands.
But the human condition cannot be separated from nature because it is an intrinsic part of the same social-ecological metabolism.

From the eastern Fertile Crescent to the Amazon, the interdependence of the human species with other non-human species has been shown to encourage ecosystem diversity. "Life did not conquer the planet through struggle, but through cooperation. Life forms multiplied and became more complex by associating with others, not by killing them," suggests Lynn Margulis in Acquiring Genomes: A Theory of the Origins of Species (2003). (MARGULIS, 2003) "We have to think very carefully about how to elaborate abstractions," points out the American thinker Donna Haraway. Stories and fictions build worlds: "it matters what stories we tell in order to tell other stories," Haraway adds. (HARAWAY, 2916)
Faced with the history of faith in progress and the scientific positivism of Modernity, we must think unexpected cambios that bring about changes in the colonial patriarchal narrative, the Promethean tale of the hero, salvation, and redemption. In interview on Art(e)facts the Director and Curator of Art(e)facts, Garcia, explained that we must now revisit secular practices where life forms multiplied in symbiosis on a transplanetary scale. Art(e)facts proposes to open the door to an alternative fictional universe where we can speculate on the past and the future of the relationship between agents, reividing the capacity to speculate to wonder at something so natural that it seems supernatural. (Garcia,
As Hannah Arendt described with the concept of "worldless", it is about maintaining the bonds between living beings. Preserving the centuries of effort to build a socio-political life that must now be extended to all agents who conceive the world; boldly imagining a new world out of local and artisanal imaginaries. Faced with the sad task of thinking how to survive an apocalypse, this project proposes to convene ideas to speculate the world, with life at its centre.
Art(e)facts' first edition introduced the theme Supernatural Togetherness to proposed alliances between humans, generations, species and knowledge in order to save the future. Ongoing until September, the programme has involved an international call for projects that resulted, during May, in artistic residencies in local artisans' workshops. This collective exhibition is simultaneously located in six distinct locations in the region — Alcongosta, Janeiro de Cima, Telhado, Famalicão da Serra, Gonçalo and Fundão —, as the mirror of several dialogues and of the scenarios that hosted them. The invitation to this visit suggests, therefore, paying attention to the places that hold memory and the experience of immersion and permanence. (GARCIA, 2021)
"In a moment of ecological disruption, the qualities of rural life are again at the centre of the international debate. Rural life is no longer seen as evolutionary state that must be overcome by ideas of urban-centric progress." (AA.VV, 2022) Rural settings are again valued for their closeness to the nature. That is the reason why in Europe and other Western countries, many speak of a rural renaissance. Unsurprisingly, the rural contexts, draw a new crop of ecologically-minded framers.
Through these aims we present three of the six projects as examples of how this approach can represent an opportunity in what is required for short and long term thinking.
"The Baskets" is the result of a non-verbal collaborative design process with the chestnut basket makers Joaquim and Irene Venâncio from Famalicão da Serra with Studio Lapatsch|Unger from Berlin. "An experiment, that resulted in a new typology and open-ended object that exaggerates the character of its construction, the core of the craft in itself. The object appears simply, yet it illustrates the knowledge of lifelong experiences that still requires the human hand. Nowadays basket makers are true conservationists. They practice the most humble and cyclical craft, used over the millennia to make functional objects for all daily aspects. The project is driven by these connotations of the practice; that represents the complex relationship between the natural and the manmade respecting the natural plant cycle within the forest. Since ancient times, Mediterranean forests have been a habitat for human activity; the ground of destruction and attempted resurrection; of ritual and tradition; of growth and decay; of history and future." (STUDIO LAPATSCH|UNGER, 2021)



Fig. 1: The Baskets. Authorship: Studio Lapatsch|Unger and Oficina Joaquim & Irene Venâncio. Photo by: Pedro Santasmarinas



Fig. 2: The Baskets. Authorship: Studio Lapatsch|Unger and Oficina Joaquim & Irene Venâncio. Photo by: Pedro Santasmarinas

Starting from the relationship between sculpture, architecture and text, Fernanda Fragateiro and Alberto Carvalhinho used wicker and handmade basketry techniques to build sculptures that appear to be drawings woven in space. In working with the artisan, for Fragateiro, the main challenge was to change the scale: moving from the domestic scale of the basketwork object to the scale of the architectural space, as a way to enhance the characteristics of wicker as a natural, flexible, delicate and strong material with great potential for use in sculpture and architecture. “Throughout the residence, long and narrow sculptures were created in whole woven wickerwork, as well as several mats woven in cracked wicker, which explore the idea of an unfinished and endless space. The pieces are suspended from the ceiling, across the rooms, or are integrated into the house overtures, in a permanent tension with the architectural space. In this beautiful manor house, made of granite and long unoccupied, we found a symbolic place to show these works and reflect on the urgency of caring for and recovering what is precious and in danger of disappearing.” (FRAGATEIRO, 2021)



Fig. 3: Unity Is Strength. Authorship: Fernanda Fragateiro. Oficina Alberto Carvalhinho. Photo by: Pedro Santasmarinas



Fig. 4: Unity Is Strength. Authorship: Fernanda Fragateiro. Oficina Alberto Carvalhinho. Photo by: Pedro Santasmarinas

Building up a contemporary heritage of artistic works that take into account the valorization of the territory and the recreation of traditional knowledge, and more broadly the collaborative action between human beings, species or knowledge as a response to environmental emergencies, is what guides Art(e)Facts. (GARCIA, 2021) About the work “Wet Grafts; For the End of the Concept of Nature”, Nuno Vicente explained that “According to the scientific journal Plos One, 75% of European insect species have disappeared in the last 30 years, including pollinating agents such as bees and butterflies. The consequences are serious and it is urgent to think about solutions to minimize this massive loss. It’s essential to develop new ways of being among humans, non-humans, and non-living beings. It’s urgent to learn new ways of approaching the territory and approaches that favour mutualism, attention to micro scales and that enable the balance of ecosystems. The project is based on a systemic conception of the environment and explores spaces interpreted as secondary — the spaces that Gilles Clément calls the ‘Third Landscape’ — territories that escape human control and that globally represent the last strongholds for species that do not adapt to the human life. Using technical precepts, the project intends to provide discreet assistance to a life that is in free expansion: an art form that could be called Transpublic, because it extends beyond an exclusively human cultural attention.” (VICENTE, 2021)



Fig. 5: Wet Grafts; For The End Of The Concept Of Nature. Authorship: Nuno Vicente Casa Do Barro: Cátia Pires. Photo by: Pedro Santasmarinas



Fig. 6: Wet Grafts; For The End Of The Concept Of Nature. Authorship: Nuno Vicente Casa Do Barro: Cátia Pires. Photo by: Pedro Santasmarinas

"Empathy is a conscious process in which the individual uses his or her own body as a template that allows him or her to 'feel' into the experience of the other". (GALLESE, *apud* MODELL, 1976) This biennial demonstrated local handcrafts and techniques at risk are a heritage on which contemporary artists, architects and designers can generate new ideas. The residency strategy is unavoidable to develop empathy, only in this manner will these communities feel empowered to become the region's agent of change. By having artists, architects, designers, scientists and other creators living closely with these communities for periods of weeks, or months. With this is possible to expect to have innovative ideas woven out of practices, memories and insights that carry ancestral cultural data.

4. Conclusion

"Perhaps the whole human race is only a temporary limited, developmental phase of a certain species of animal, so that man evolved from the ape and will evolve back to the ape again, while no one will be there to take any interest in this strange end of comedy." (COLOMINA*,* WIGLEY*, apud* NIETZSCHE, 2016)
As seen, our approach to the question of ecological transition in architecture is not based on the most orthodox approach to the discipline, the question of construction and its materials, but on its immaterial dimension. Our heritage, the true value of landscapes, historical landmarks, local immaterial culture, endogenous crafts, communities across generations, diaspora heritages, old and new migrant expressions, etc. This is for us the more ecological way to seek to activate an existing strong sense of heritage through today's creative practice, promoting new readings of traditional identities, as well as stimulating its intersections with contemporary art, architecture, and design. Our connection to the future is based on the everyday ecosystems approach that will create new possibilities and practices to the low-density territories, depopulation, environmental emergency, ecological alternatives, etc. This thematic line will allow for creative proposals that link emergent global concerns to the local reality of a territory that, for now, has the benefit of a relative protection from immediate climate and environmental collapse.

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Material and immaterial culture of the internal minor centres. Studies and researches for the ecological transition of the Madonie inner mountain area in Sicily

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Abstract
Presently, the European Union strategies aim at strengthening the rural areas that are characterized by a deep depopulation, people aging, and a weak employment market. In these "marginalized" areas, the urban regeneration process may be assisted by the creation of smart villages, realities that will cooperate and create innovative small towns.
The Sicilian inner mountain area, in particular, consists of twenty-one villages - mostly dating back to the Middle Age - that present an attractive localization due to naturalistic, landscape and cultural features, also qualified by a well-preserved geographical area whose main building typological features were not altered during time.
This paper presents the results of a research finalized to an implementation of a sustainable technological design aimed at creating a network of smart villages able to enhance the urban centers and their cultural, anthropic, and natural heritage, also bringing them back to a contemporary well-being and smart life conditions. Moreover, transmitting to the future generations the material and immaterial values that must be preserved and reconsidered as regenerating sources for this territory is of fundamental importance, also to generate a novel green economy and boost, once again, the local performance. The proposed strategies of intervention will activate virtuous procedures and guidelines for a sustainable progress. Taking care of communication and technological design, it is advisable to improve the connection between all these urban centers, taking advantage of the whole natural and built environments. Finally, the proposed methodology could be intended as an efficient guideline that could be easily applied to other similar national and international contexts.

Keywords: smart villages, rehabilitation strategy, immaterial patrimony, ecological transition

1. Smart villages as a territorial connection system: from the green economy to the digital transition

Among the implications of the current global pandemic from SARS-CoV-2 and Covid-19, the rediscovery of the small towns has become extremely stimulating for human lives. The prolonged and forced lockdown that was experienced worldwide generated a “surprisingly” rediscovery of a forgotten diffuse built heritage that must be re-evaluated in its urban, naturalistic, cultural, historical and economic values [1]. After years of distancing and forced isolation, the deep contact with these places became an even stronger value, precisely in terms of rediscovering the naturalistic, constructive, and historical heritages. Moreover, also intangible values such as the culture of food and local traditions came to the fore [2]. Actually, we are experiencing a new "Renaissance" of the villages, that are often improperly defined as "minor", even if they are able of outlining the distinctive characteristics of a local country [3].
The inland areas of Sicily are also going through a period of recovery. The case of the Madonie Park, constituted of 21 villages, deeply different one from the other, is the protagonist of the current socio-economic inversion that, at the same time, is highlighting, however, the technological gap with the

increasingly developed smart cities. Those, indeed, made ICT the innovative core of management and public services provision, being – consequently - steps forward. These smaller realities, however, benefit by a better quality of life that is, actually, very different from the large and chaotic cities. The inner and marginal areas are the guardians of a well-preserved architectural and naturalistic heritage and, at the same time, witness to the history of the peoples who have crossed them. However, the technological backwardness tends to increase their state of isolation [4]. To achieve a predominant and more quality-oriented and sustainable role, in the regional – and national - context, they must become “smart”. That means enhancing the territorial differences that could make them protagonists of high standards of life through the experimentation of widespread and shared policies aimed at increasing the competitiveness and the territorial attractiveness. An initial possible approach is the green one [5]. Being a green community means, for instance, triggering a plurality of actions aimed at reducing carbon dioxide emissions: taking thoughtful actions to plan and implement good practices is fundamental to extend to the territorial governance, with specific attention to social cohesion, the dissemination of knowledge, innovation, creativity, accessibility, usability of the environment, and the quality of both the landscape and the life of citizens in a more sustainable way. That translates into the immediate improvement of the mobility among the urban and territorial use through the creation of a more sustainable mobility. This is probably the best way to achieve a real CO_2 reduction and efficient waste management, along with a greater dissemination of information, fundamental to create a virtuous network of connections among the various potentials of each place.

Currently, the opportunities offered by the digital transformation are oriented towards goods and services such as health and education; other processes are based, however, on the aim of strengthening the internal organization and the administrative performance, or for the local tourism development and the production system. Therefore, the first step to achieve the concept of green is embodied by a digitization that could embrace all these issues and make these territories real "smart villages". Among the green digital technologies, it is worth mentioning the Internet of Things (IoT) which allows to collect, spread, and interact with a large flow of data that, if properly processed, can be used to improve human life in such marginal areas. The process of digitization for an effective management of Information and Communication Technologies represents a decisive role in overcoming the difficulties of these marginalized territories [6]. The digitization of services, functions and procedures is a significant factor of growth, directly proportional to the ability of a territory to emerge and develop. Digitization directly means the possibility of increasing the spectrum of services along with improving the effectiveness that necessarily involves administrations, resident communities, and new citizens. Similarly, for connections, and therefore for mobility, digitization can support the individuation of alternative routes to the main and secondary roads which, even today, and particularly in the South, are greatly affected by an almost non-existent ordinary and extraordinary maintenance caused by an atavistic lack of funds.

The digitization process, in the Madonie mountain area, would allow to highlight the historical routes that traditionally connected the 21 villages. Among those, the ancient royal “trazzere” (Sicilian old routes that were used to connect inner rural areas), the “Francigene” and pilgrimage itineraries [7] as well as the bridleways, the geological routes, in respect, and guaranteeing, the requests of the European Union on decarbonization. The use of alternative and sustainable connections could facilitate the rediscovery of these areas that may become a virtuous green alternative and, at the same time, would allow the revaluation of long-forgotten historical routes. That would also mean a novel use of immense green areas, offering an opportunity for a deeper contact with nature in safety, quality, and environmental health, also favoring the fauna and flora typical of the variegated territory of the Madonie Park (Fig. 1). To date, if these places are not known in depth, it is almost impossible to identify them and their beauty as well as to reach them, precluding the possibility of improving their proper fruition. The large urban centers, proper smart cities, have built their importance and fame on digitization, allowing a wide-ranging knowledge of their intrinsic culture and territory, by promoting it worldwide through digital platforms which, even before being intelligent, are platforms of knowledge. If that was reversed on the internal marginalized areas also, the contribution for development would be of a considerable importance not only to attract new tourists, but - above all - new inhabitants eager for an innovative, dynamic, sustainable lifestyle in direct contact with nature, preferring the body, mind, and spirit. Therefore, the main goal of such a digitization will be generating smart rural areas, capable of communicating one with the others, networking, innovating and digitizing: combining green and technological aspects.

2. Knowing by crossing the paths of memory

The Madonie Park mountain areas express with their features the different typical and traditional characters of such territory: from historical to social memory, from naturalistic to immaterial memory [8]. All passes through architecture that is precisely the key to understand and interpret the society that has chosen, built and lived in, the natural result of intersections between different and inextricable components. Specificities of the places, stories that have left their deep marks, cultures that have grown autonomously, even immaterially as ideal paths that cross troughs, farms, streets of ancient memory and panoramas of stunning beauty with, often, uncontaminated nature.

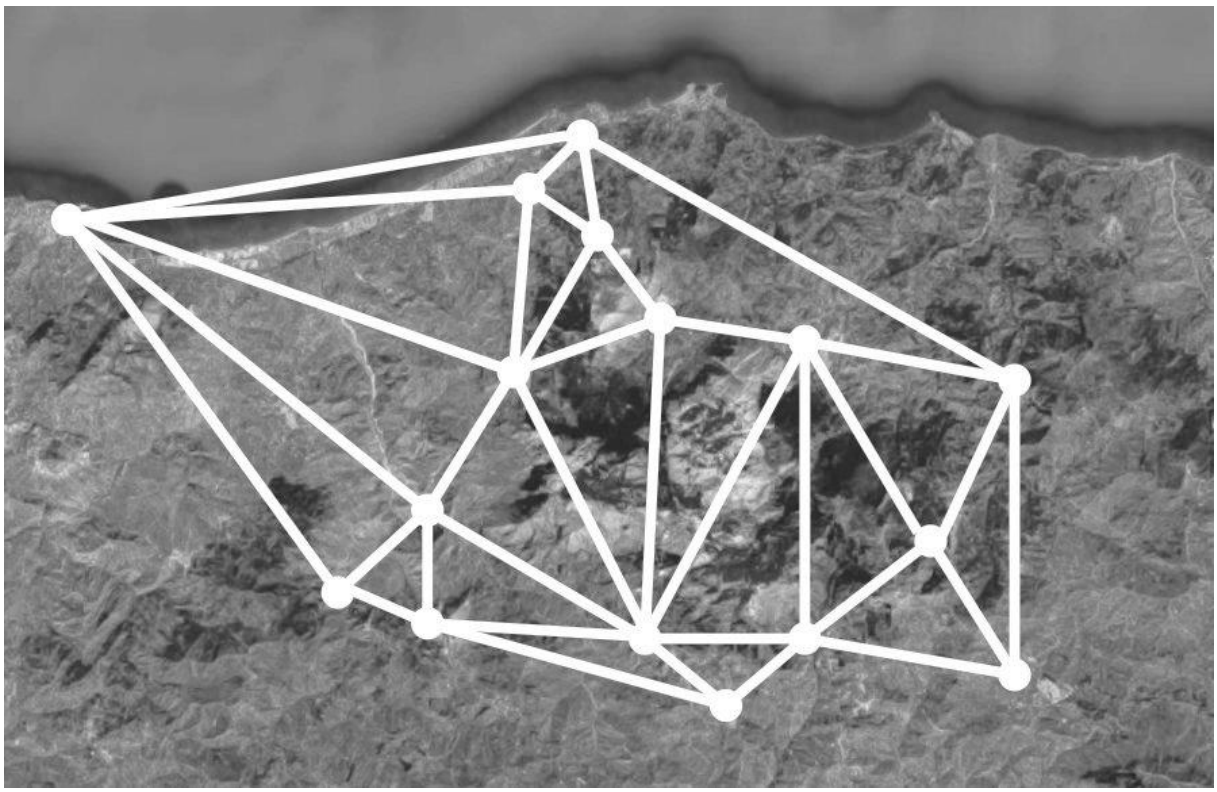


Fig. 1: Madonie inner mountain area in Sicily: potential system of spatial, social, and economic interconnections (© image by the authors).

"*Leaving not to die, walking to live every single second of life more deeply. After a long break, maybe this is the right moment to take back your backpack, put your boots on... get your pace back in motion*" (G. Librizzi - the mayor of Polizzi Generosa).

On the traces of the historic Via Francigena (Fig. 2-3) which, instead of following the sea, from Palermo to Messina zigzags up splendid reliefs, various local associations (in particular the Friends of the Francigeni Routes of Sicily) started meticulous historical research and "georeferenced" topographic mapping [9]. The ancient Royal Trazzera, nowaday renamed "Francigena route from Palermo to Messina among the mountains", represents an ideal and real fascinating itinerary that traces the ancient connection between the two Sicilian centers through the mountains edge of the Madonie, Nebrodi and Peloritani mountains. From the city of Palermo, a unique and continuous path winds its way for about 400 km, in almost 20 stages, connecting the snowy peaks of the Madonie to the mountainous landscapes of the Nebrodi, up to the peaks of the Peloritani, to finally reach the city of the Strait of Sicily, Messina. From the beauties of the Arab-Norman culture capital the to the beaches of Aspra, from some of the most beautiful villages in Italy, Gangi and Montalbano, to the Norman castles perched between the Madonie of Caccamo, Caltavuturo, Polizzi Generosa, and Petralia; from the villages immersed in the Nebrodi woods, such as Floresta, Capizzi and Cesarò, to the first capital of the Great Count Ruggero, Troina.

Indeed, from the pilgrims' point of view this road was a real Via Francigena, meaning that is a pilgrimage route as along its route, in addition to the aforementioned Carolingian toponyms that marked the itinerary, there were several *hospitalia* already present from the 12th century. These structures, as in the rest of Europe, were built exclusively to accommodate pilgrims, only later they were used as health shelters. Symbolically, the route bagins in Palermo close the Church of Santa Cristina la Vetere, along the "Pilgrims' Road" which, as the ancient toponym indicated, is a testimony of the pilgrimages culture in Sicily. Then, it runs up to Messina through an articulated path that can be divided into 22 stages. This route, equipped with adequate signs and posters, could also be viewed by contemporary pilgrims in a digital format, by downloading the GPS maps and accessing all the information with a mobile phone or tablet via Wikiloc, or by consulting the official website.

Similarly, there are many paths of sanctuaries in which, in August 2009, the Associazione Sicilia Jacopea, for the project "St James's Roads in Sicily", inaugurated the itinerary "Gratteri (PA) - Galati Mamertino (ME)" with a group pilgrimage on foot. During the five days of walking, in addition to the places of departure and arrival, the communities of Geraci Siculo (PA) and Capizzi (ME) were involved, also with a marked devotion for San Giacomo Maggiore, through visits to the Sanctuary of the Saint Spirit of Gangi (PA) and the passage along the Cerami river, site of the famous and decisive battle for the Normans victory, led by Count Ruggero, over the Saracens.



Fig. 2: Madonie inner mountain area in Sicily: potential system of spatial, social and economic interconnections. (© https://viafrancigena.madonieoutdoor.it/vie-francigene/via-francigena-montagne)


Fig. 3: Francigena route on the Madonie mountains, Palermo - Messina, Sicily (© Via Francigena, Madonie Outdoor).

Another stage was added to the aforementioned itinerary, again with the aim of creating a permanent link between the "Saint John communities", for the generation of a religious-cultural district: the Collesano - Gratteri route. That, called the "Route to the Stars", recalling an ideal embrace with the burial place of the Apostle, extends along the highest mountains in Sicily, with a well-defined historical reference: Pietro Lo Squilio baron of Galati (1628-1640), a nobleman from Collesano that is a town where the Apostle was already venerated, donated to the community the reliquary of Saint John, still in use today, giving a strong impetus to the development of the cult for that Saint.

The path extends along historic routes that were already described by the ancient geographers (i.e. the Arab Idrisi) and was also used by the Great Count Ruggero who crossed the Nebrodi mounts along the Byzantine way of Mangalaviti (according to the reconstruction of Malaterra). The Route to the Stars includes the municipalities of Galati Mamertino, Capizzi, Geraci Siculo, and Gratteri where St. James is always the patron - or protector - and is honored with solemn celebrations. Along the way, as evidence of the widespread diffusion of the cult for Saint John, there are two other churches dedicated to him, one private rocky sanctuary located in Gangi, the other in Nicosia.
The Route of the Stars, that is about 140 km long, can be walked in about 6 days by normally trained people and is characterized by the passage across villages included in the national association of the most beautiful villages in Italy (Gangi, Geraci Siculo, and Sperlinga) and for the enchanting naturalistic landscapes suspended between Etna, the Madonie, the Nebrodi and the sea with the horizon that is lost over the Aeolian Islands. The journey is configured as an experience of personal research and meditation, but is also a journey into uncontaminated places, with natural beauties yet undiscovered, as well as repositories of sacredness and mysticism [10].
Of greater naturalistic impact is the path of the Madonie sanctuaries that could be done in 4 days, for a total of about 65 km. It starts from the Sanctuary of the Holy Spirit in Gangi passing through the Madonna dell'Olio in Blufi, the Madonna dell'Alto in Petralia Sottana and it finally ends at the Madonna di Gibilmanna in Cefalù. Retracing, on foot, the ancient pilgrim paths that connected all the sanctuaries of the Madonie area, it crosses some of the most beautiful naturalistic and cultural Madonie landscapes: starting from the lowest altitudes of the southern Madonie area, a modern pilgrim would cross the countryside rich in crops, small livestock farms, drinking troughs, farms and underground archaeological settlements built more than 4000 years ago, tholos, villas and thermal baths of Roman origin, up to the highest Marian sanctuary in Europe, Tindari, and the high altitudes of the Madonie Park, from which it is possible to observe all the Sicilian mountains as well as the infinite sea. Then, it descends towards the north, to admire the last specimens of the *Abies Nebrodensis* (Fig. 4) and, in the heart of Piano Battaglia, some geo-sites, recognized as UNESCO Geopark Heritage, with the beech forest, the largest in Europe, up to the manna ash trees in the hilly areas close to Gibilmanna.
The numerous guided tours allow to discover these wonders of nature through many panoramic points: in Piano Pomo the particular microclimatic conditions allow the hollies to develop in an unusual way, creating real groves. The large hollies, some even reaching 20 meters in height, grow all around the basin of the plane, forming a sort of natural circle. Nature also provides the traveler with its fruits and, consequently, it is possible to taste the typical products of the different seasons ranging from mushrooms, hazelnuts, beans to the precious manna. Object of great market demand in ancient times – as well as today - for their healing properties.
These material and intangible peculiarities of the Madonie places, if systemized through a computerized network of communication, could become a real tourist flywheel of considerable importance, mostly because they could allow to activate sustainable, light touristic strategies that have, as a necessary corollary, the building system of the villages that are around and constitute the places useful to welcome and shelter customers, whether they are tourists or potential residents, according to criteria of livability and environmental comfort that require ever high levels of comfort and technological innovation [11].



Fig. 4: Left: a royal trazzera on the Madonie Mountains (Palermo-Messina, Sicily) (© F.I.V.E.). Right: an emblemathic exemplum of Abies Nebrodensis, Vallone della Madonna degli Angeli, Polizzi Generosa (© Eng. Luisa Lombardo).



Fig. 5: Fountain in the inner court of the masseria Gangivecchio in Gangi (© image of the authors).

3. Regeneration strategies and innovative technological solutions

Royal trazzere, sanctuaries, farms, drinking troughs, endemic flora and fauna, slow food presidia, etc., constitute a dot line of material and intangible events typical of the Madonie territory. The simplicity of the construction techniques, used to build them, allowed these architectures to resist hundreds of years, maintaining their original characteristics (Fig. 5). The most recent history has taught how the simple recognition of the values of the historical construction is a precondition to transmit their essence without being compromised. Poor, simple and cheap architectures have proved to be valid and current, capable of suggesting guidelines for a cultured and aware recovery project. The direct knowledge also becomes a useful tool for an effective economic revitalization [12]. The richness of the identified repertoire emerges and the innumerable potentialities offered by these artefacts which unfortunately, in many cases, are very little known today, often falling into conditions of abandonment and decay (Fig. 6).



Fig. 6: Masseria Regaleali (© Eng. Andrea D'Amore).

Forgotten by the community itself, however, they could constitute a resource that needs to be preserved and enhanced, artifacts in symbiosis with the natural landscape that has strongly desired them, produced and, despite everything, preserved. The knowledge of these architectures promotes a policy of improvement, supporting not only a sustainable relaunch of the material and immaterial function, intended for the local community strengthening and promotion of light tourism, but also for their protection. It is known, in fact, that the possibility of including these buildings in a touristic network, a project that is fortunately returning to the island, would make them the key elements as stopping and refreshment points in such itineraries and paths aimed at creating a rural system of farms, castles, mills, paper mills, monasteries/abbeys, spas and many other architectures of the Sicilian landscape [13].
The detailed analysis and the study of such rural architecture, that has recently brought the attention of the scientific community, has, in fact, triggered a new impulse to the Sicilian agriculture and tourism, providing renewed elements of analysis that could be intended as project and new frontiers for their recovery, that must always be compatible with the original characteristics of the buildings themselves. The objective of this larger study, that is under development, is the regeneration of these places [14] starting from the recovery of such architectures which, organized in a network of real and ideal connections, will constitute the connective tissue for the regeneration of the Madonie Park and the villages that, like precious jewels, are set in the rock of the inner mountains (Fig. 7).
The proposed strategies of intervention refer to a continuous dialogue between the Italian and the European smart villages, activating virtuous procedures for a sustainable development. Through technological development, and putting together a multitude of correlated actions, the improvement of the natural, social, and economic environment can be boosted. The digitization and dissemination of the information, together with an accurate sustainable technological requalification of the living environments, could improve the connection among these urban centers. Consequently, the entire natural and built environment will benefit from it. Smart and sustainable development means implementing useful services specifically for the weakest areas and establishing links to make societies inclusive: a configuration of cooperating and operational elements, hand in hand, where rural areas with their historical and architectural beauties could enhance the others with environmental qualities [15]. From this point of view, it is useful for the valorization that the network of villages returns to be smart. In this way, it is witnessing, through technology, a shared platform of knowledge that plays a fundamental role, both locally and in Europe, involving the population in a project that enhances its territory and stakeholders who bring out, and combine, their skills for the benefit of the project itself. A bottom up approach strongly pushed by the EU. This system will give new life to the economy of the villages and generate new opportunities also guaranteeing an active participation and involvement of technicians, companies, along with the third sector, strongly present in these areas and significantly compromised in the recent years [16]. All the system networks have the task of producing circular economy. With this in mind, it is necessary to have a continuous flow of users to develop the designed projects, but also to keep the reality of the place alive and make it more attractive. The network could guarantee, indeed, the rural communities' survival and prepare them for a technologically advanced future, thanks to a system of actions based on urban regeneration by making good sustainable development practices that favor culture, history, art, nature, material and immaterial tradition of the place. A challenge that can be applied by means of projects that combine tradition and innovation at the same time [17].
The study of the material and immaterial features of the built and natural environments is an unavoidable phase for the intimate knowledge of a territory and a subsequent proposal for preservation. Talking about traditional architecture, a rehabilitation project might be as more respectful as possible not only of the native architectural configuration and the original volumes, but also for the technological specificities – witness of the different constructive phases – that will enable the building valorization. Furthermore, a profound examination of the typological characters is fundamental to define a sort of regional code of practice intended as a valuable instrument to all the people working in architecture. Rural architecture is one of those symbols representing the immaterial features that must be preserved at the best and re-proposed as a guideline to improve the territory features, representing a uniqueness because of the different environmental and cultural background that itself involves as a mix between regional culture and traditional economy. To investigate the susceptibility to modification, and the subsequent compatibility of the proposed reuse, it is fundamental to distinguish whether the environmental quality is attributable to the vernacular architecture itself or to the surrounding natural landscape, passing through a compromise between the evaluation of the present conditions and the susceptibility to transformations. However, it often happens that high architectural or environmental quality contexts show a quite limited and rigid transformability; this condition is worsened when the anthropic presence has generated, or could generate, interference between humans and environment (restriction of visitors in sensitive environments) or in the need of a greater infrastructural network (transport and services). Therefore, the valorization of rural heritage, either architectural and natural, needs to pass through a choice of quality privileging a discreet and selected tourism rather than a mass one, certainly more remunerative but not always adequate to maintain the environmental sustainability and the real compatible preservation of the places.



Fig. 7. Madonie Villages, Palermo, Sicilia (© Eng. Luisa Lombardo)

The change of use is deeply influenced by many factors: farms are naturally suitable to be transformed into touristic structures, such as rural hotels or B&B, with the maintenance of landowner's house for the direction/management and control of the new structure, and the creation of tourist accommodation (rooms and apartments) in the accessory parts (ex-stables, warehouses, etc.) as they have a major susceptibility to changes. Moreover, the introduction of recreational activities should follow the criterion

of utilizing existing buildings or erecting new structures in a separate and distinguishable space avoiding aggregations to pre-existent structures: swimming pools, playgrounds and related accessory buildings are placed outside or in secondary and hidden spaces that would not visually and functionally conflict with the other activities [18]. A not secondary design aspect is represented by an appropriate rehabilitation to the most modern equipment and systems, such as the enlargement of water resources for the new residential functions, wellness centers and spa, recreational-sporting activities, irrigation of new green areas: from this matter derives the necessity of large water tanks in a region, Sicily, where this liquid is highly precious being often very little. Similarly, room air conditioning, lighting and artificial ventilation represent a priority, qualifying the design and making the complex more comfortable and appreciable in terms of receptiveness.
The evaluation of the susceptibility to transformation allows also the possibility to introduce greater modifications in order to maintain the residential use along with new functions including rehabilitation. In such cases, people should always be induced with a particular benefit in relation to the environmental condition: the amenity and health of places, the possibility to perform agricultural, breeding, or open-air activities. Rural structures could actually give hospitality to disabled people or drug addicts. Then, green transition passes also through the rehabilitation of people lives. Here, the contact with nature plays an important therapeutic function; thus, the design proposal must deal with long time residential pattern that shows different requirements from those related to tourism. Whereas possible, it is very important the re-discovery of primary environmental conditions and the presence of paths as a primal relationship between architectures, nature and surrounding territory. In such a way, it is possible to promote touristic routes and modern pilgrimages paths or take account of environmental resources: the identification of ancient roads, creation of picnic areas, bike paths, routes to neighboring towns and villages, horse trails, presence of streams for canoeing, exploitation of channels for kayakers.

4. Effects for the mountain area

These actions can generate, as a primary result, the creation of a communication network between public and private subjects, boosting their relationship, when already present, or even giving new light. An effective collaboration that leads into the realization of the proposals for innovative, almost dreamlike, projects. More particularly, that will boost the creation of useful guidelines intended to propose, plan and implement a development program in the Madonie area, in its various stages of development. A *modus operandi* that can be applied and implemented in the local reality, and that will be highly transposable in other situations characterized by similar features. The proposed strategies, as a whole, are extremally convenient also from an economic point of view, both in the medium and long-term perspective, especially in regard to the possibility of reusing properties that are currently in disuse, in need of energy or structural requalification interventions, or in a state of complete abandonment. Moreover, that will produce, as a direct consequence, a further strengthening of the receptive activity of the various villages, taking advantage of single events spread in the territory. That is the case of the solution already in place of the rural hotel which implies punctual interventions in the historical fabric. Specific energy and structural retrofit actions can, therefore, implement a virtuous induced not only for tourism but also for driven micro-activities related to management and communication. The example of the Regaleali farm (cf. fig. 6) is a valid example for all. That, from an old wine farm to a real industrial wine reality, has activated an induced activity into the rural tourist accommodation action in terms of strengthening the catering, maintenance of spaces (cleaning, technical repairs, etc.) as well as boosting communication (creation, strengthening and management of networks computerized for the circulation of information, social media, networks, etc.). This, as a diffusible example, and goal, to be achieved in the short term: systematize the already few but virtuous realities in the Madonie territory.

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For ecological transition: analysis and projects in “sciclitano” landscape (RG)

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Abstract
The United Nations, with Agenda 2030, proposes the theme of sustainable development in the economic, social and environmental dimensions. In Italy, in 2021, the Ministry of the Environment was transformed into the Ministry of Ecological Transition; this topic reveals a strategic and political objective: to address obvious critical issues in the current human-context relations. The term transition is related to the process of technological innovation to bring about a change in our society taking into account compliance with the criteria for environmental sustainability.
Winston Churchill’s statement that "first we give shape to buildings, then they give shape to us" takes on an added value in the case of buildings that have lost all function and only partially retain a "shape" having over time taken on the consistency of ruins. In the sustainable development, where the ruin has taken on a new balance with the geo-anthropogenic environment, the analysis of the forms built relies on the multiscale survey with the new technologies.
These are the methodological bases for research that, starting from the ecological approach, addresses the theme of urban rehabilitation and regeneration of historical parts of the city.
The case study deals with abandoned historical buildings and partly ruins in a cultural and significant context for the Sicilian Baroque, such as Scicli. Ruins of ancient convents, churches and civil buildings.

Keywords: regeneration, rehabilitation, survey, ecological transition, agriculture.

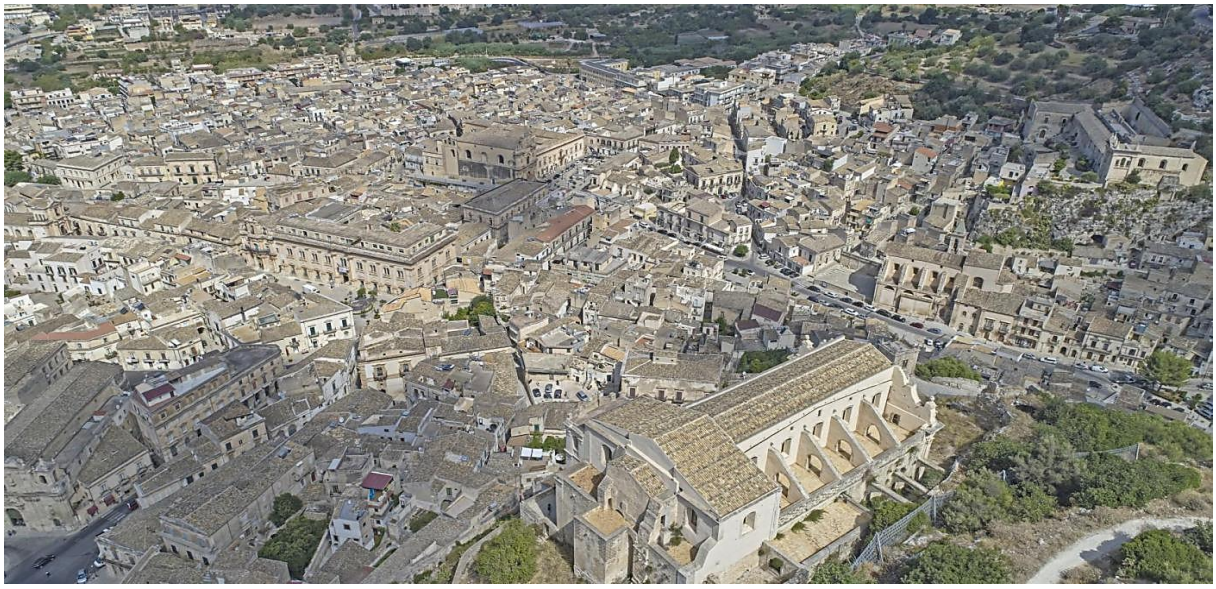


Fig. 1: Aerial view of Scicli (RG), Sicily.

1. Introduction

According to the objectives of the 2030 Agenda for Sustainable Development, (environmental, social, economic components) the project must focus on limiting the spread of settlement and the reuse of existing buildings through recovery and regeneration actions. Already in 1972 in Stockholm, for the first time, the United Nations held an international conference on the subject of the human environment by issuing the "United Nations Declaration on the Human Environment" in which man is both a creature and the creator of his environment. Subsequently, in the late 1980s, the UN Commission's Report coined the term "sustainable development", launched at the Rio de Janeiro Conference in 1992. This term reaffirms the compatibility between the protection of ecosystems and socio-economic development [1]. Today the scientific society speaks of ecological transition. The objectives of the ecological transition identify a framework of priority needs for the current conditions of the planet Earth.

The Italian policy wants to promote specific strategies to address the critical issues in the current human-context relationship; it also intends to assume a role of management of the production processes of goods and services with particular attention to material and energy resources. This is the result of the change of name of the Ministry of the Environment that has become the Ministry of Ecological Transition. The words transition and sustainability have appeared in the language of international research and debate on environmental protection issues since the 1970s. In particular, we recall the essay "The limits of development" [2] in which the authors identify the principles of the model of development adopted since the Second World War, highlight the criticalities related especially to economic and demographic growth and the consequent ecological risks: "The model we have constructed is, like every model, imperfect, oversimplified, and unfinished." The authors, through a detailed analysis of the factors that support the growth and the demonstration of the scarcity of resources now overused, propose an innovative vision, based on the displacement of productive behaviors: from growth towards a condition of balance for the protection of eco-systemic relations. "The equilibrium society will have to weigh the trade-offs engendered by a finite earth not only with consideration of present human values but also with consideration of future generations. Long-term goals must be specified and short-term goals made consistent with them" [2].

The requirement to impose limits on development arises from the need to verify life patterns in order to promote their transformation/adaptation in a logic of compatibility with resources. The awareness of the finite resources available, expressed in the Stockholm Declaration of 1972 and reiterated in the Beyond the Limits report of 1992, makes man responsible for the environment, and imposes virtuous behaviors for its protection and management. The aim is to transfer a wealth of resources capable of reproducing to future generations.

Here, we don't want to go into detail of the results of the numerous international summits that since 1972 have dealt with the issue of environmental protection of the planet and that have given rise to complex and articulated forms of political bargaining and commitments to different level of effectiveness. However, we consider it useful to recall the COP21 in Paris in 2015 in which for the first time all countries recognized the need to mobilize finance and the economy to combat climate change with structural interventions aimed at limiting the increase in global temperature of 1,5 degrees Celsius. However, commitments were not met and should be taken up again with the necessary amendments and updates of the emission reduction plans. The introductory document to the COP26 in Glasgow 2021 reads as follows: "Despite the opportunities we are not acting fast enough. To avert this crisis, countries need to join forces urgently. […] The targets announced in Paris would result in warming well above 3 degrees by 2100 compared to pre-industrial levels. If we continue as we are, temperatures will carry on rising, bringing even more catastrophic flooding, bush fires, extreme weather and destruction of species. […] Countries need to manage the increasing impacts of climate change on their citizens' lives and they need the funding to do it. The scale and speed of the changes we need to make will require all forms of finance: public finance for the development of infrastructure we need to transition to a greener and more climate-resilient economy; private finance to fund technology and innovation, and to help turn the billions of public money into trillions of total climate investment" [3].

The most significant aspect of the term transition emerges from these considerations: the idea of an unavoidable change, supported by the awareness of current critical issues. Man, today, must govern dynamic processes with innovative dialogues between available resources, transformation processes and consumption. The transition presupposes a path towards socio-economic innovation of practices and a time to achieve it. The desire to restore and/or redefine relationships of natural order highlights that they have clearly been altered and that it is necessary to encourage the reference to ecological relationships. All the issues of politics revolve around the climate emergency, the scarcity of fossil resources used for energy production and the role played in the alteration of environmental conditions. However, the theme of resources should expand to include soil, water and built heritage as additional elements of interest. The poorly regulated use of soil and water contributes significantly to the systemic conditions to which climate change refers, while operating on the built heritage helps to enhance the gray energy incorporated in it and to return to communities living spaces adapted to contemporary needs. Therefore, the proposed structural reform identifies the principles of the circular economy and

the use of renewable energy sources as the main elements to implement a gradual decarbonisation of production processes, identified as a priority objective to counteract the storage in the atmosphere of greenhouse gases.
Urbanization of agricultural areas leads to the change of the use of soils, transforming the soils, previously used for production or as habitats of living species, into impermeable surfaces. The dynamics of the water is altered, the microclimate is changed, the small villages are gradually abandoned, many historic buildings are transformed into ruins. A chain process that involves all the components of the environment system, which directs towards regeneration strategies aimed at restoring the relationships between the elements of the system [4].
The case studies that we propose are examples and experimentation of a methodology to align the requirements of knowledge and the preservation of the historical heritage with broader objectives of environmental protection. According to the principles that define the ecological transition [5], the object of the protection is the complex system of a territorial fragment in which the built heritage, the soil and the water resources converge.



Fig. 2: Sant'Antonio da Padova Complex in Scicli (RG), Sicily.

2. Survey of the ruins in the process of ecological transition

Over time, there has been an awareness that it is easier to address and effectively resolve sustainability issues at local level, particularly at the urban level.
In order to reduce land consumption, the political actions adopted are directed, also in the architectural field, towards the reuse of the existing buildings and its eventual regeneration.
In particular, the theme of the recovery and regeneration of architectural artifacts that are in a serious state of neglect, can be assimilated to a kind of recycling, perfectly in line with the assumptions of the ecological transition.
Winston Churchill's statement "first we shape buildings, then they shape us" takes on added value in the case of buildings that, in local communities, have lost all function and only partially retain a "form", having assumed over time the texture of ruins.
Intervening on this heritage implies a thorough knowledge of the works spread throughout the territory. These, with their resistance to time in the form of ruins, have helped to shape the anthropo-morphological order of the places.
The reading of the information taken from the signs (more or less legible for the status of ruins) of these artifacts serves the "preservation" of memory, as a contrast to any action of cancellation dictated by the conformative evolution of the urban system. Memory and matter, in this sense, are intertwined because the measure of the sign of the memories of the past constitutes the foundation of the collective memory of the community. According to this approach, knowledge is of fundamental importance as a tool to implement protection. Information and the dissemination of research help to keep alive the memory of the city palimpsest against any degenerative process of cancellation.
The architectonic works, with a strong historical value, placed on the edge of the inhabited centers are of great interest; they have contributed to create a limit to the urban expansion and to the abuse of soil, even if they keep as ruin and having lost, in the time, every function.
"In a semiotic perspective, each work is an open work, a sign that flows without pause into other signs, a form that is drawn in time" [6]; therefore, interest in architectural works, now in the form of ruins, leads to an unconscionable design approach that can be expressed in the words of Barthes: "the measure of the work no longer lies in its purpose (the finished product it constitutes) (...), but in the work it sets out: (...) it is not just a question of achieving a result, but of modifying a problem, that is, a subject: free him from the quicksand of the purposes in which his departure remained blocked" [7].

For the sustainable development of these territories, where the ruin has in fact taken on a new balance with the geo-anthropic environment, the analysis of the built form, in relation to new and integrated possibilities of "life", relies on the multi-scale survey with new technologies.
The survey, with its elaborated 2D and 3D, ensures the sustainability over time of the documentation and the results of visualization of cultural heritage according to the purposes of the London Charter for the Computer-based Visualization of Cultural Heritage of 2006. It has been established strict methodological principles: with the current tools, the communication of the CH arises from a technical and intellectual rigor, able to provide scientific authority; it is based on accessibility and sustainability.
The analysis needs adequate information on data collection methods; it needs to be well structured and provided with adequate digital documentation. Only in this way it is possible to guarantee a reliable diffusion of the contents and the sustainability of the products of the survey, in the perspective of the protection of the good.
In general, digital graphs of the state of conservation of cultural heritage, produced by geometric-morphological acquisition, are able to provide the necessary formal information based on accuracy, precision and exportability of data. In the case of ruins, the survey must address specific problems similar to the archaeological survey, in which the interpretation of the data is fundamental for the achievement of the expected results. The study and analysis of architecture in ruins are, specifically, a form of interpretation of the preserved reality.
In this sense, the most appropriate methodological approach depends on different reasons: the size of the Cultural Property investigated, the geo-morphological context, the expected results depending on the intervention, the availability of public bodies to grant permits, the regulations in force in the territory concerning the possibility of using airspace in order to use an aero-photogrammetric survey.
If the matter is degraded and the geometries do not retain the purity of the lines, the technological devices developed in geomatics are well suited to be used in the data acquisition phase with the instrumental survey. Even the returns through 3D models obtained from point clouds often allow a better and faster knowledge of the ruins, allowing you to make, in an easier way, the reading of the material elements.
Today the digital transition of Cultural Heritage is seen by the international scientific community as "a driving force in the development of new paradigms for cultural heritage" [8]. In addition, the power to combine different approach strategies (terrestrial laser scanner (TLS), automatic digital photogrammetry based on terrestrial and aerial Structure from Motion (SfM) algorithms) produces significant advantages in terms of sustainability (automated acquisition, precision, reduction of time and costs) and the return of high-quality documentation and cognitive products.
This process is preparatory to the protection of the CH which "consists in the exercise of the functions and the regulation of direct activities, on the basis of an adequate knowledge activity, to identify the assets constituting the cultural heritage and to ensure the protection and conservation for the purposes of public fruition" [9].
The primary objective is to enhance the cultural heritage in ways compatible with the protection and implementation of new, coherent and integrated landscape values; The fundamental approach to achieving this objective is a deep knowledge based on scientific criteria. In this sense, the survey, carried out with the current methods, is a privileged instrument of knowledge and interpretation of the forms of matter.

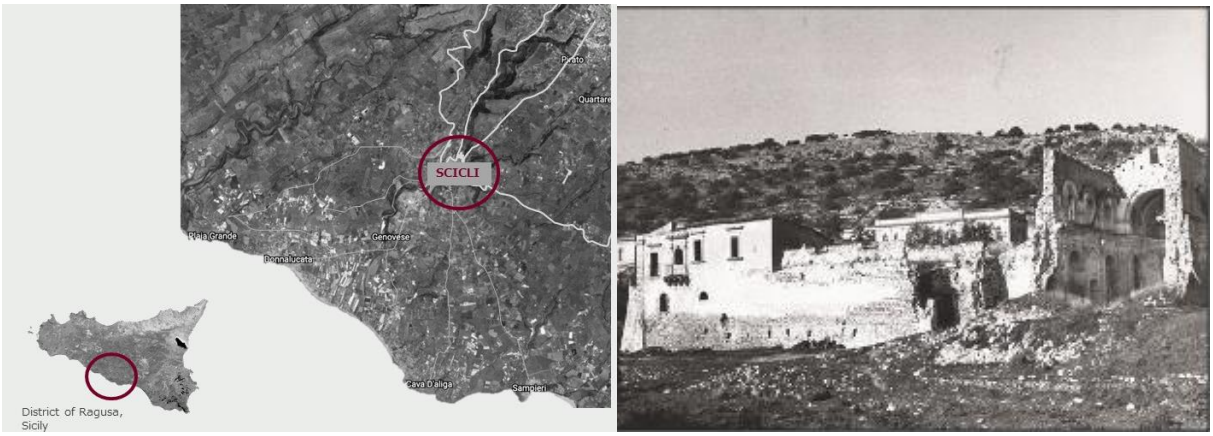


Fig. 3: Scicli, in the southern of the Sicily, the Convent of Sant'Antonio da Padova and Church of Santa Maria Immacolata.

3. The study case

In the second half of the twentieth century, the rural areas of Sicily were abandoned in favour of urban areas. Today, despite the depopulation and the lack of exploitation, this territory presents up in itself a wide range of historical and cultural specificities that make it a laboratory of extraordinary interest.
Scicli is a small village of about 27,000 inhabitants in the district of Ragusa, in the south of Sicily. Since 2002, its historic center has become a UNESCO World Heritage Site. Its birth is certainly prior to the arrival of the Saracens in Sicily. The 1693 marks the destruction of Scicli due to a strong earthquake that killed 2000 people and led to rebuild further downstream. The 1700s was the century of reconstruction and many churches and convents were built in the style of the purest Sicilian Baroque, the '800 brought extensions and the twentieth century gave the current shape. The complex of the Convent of Sant'Antonio da Padova and the adjoining Church of Santa Maria Immacolata, is located in an area originally *extra-moenia*, away from the town and along the banks of a stream [10].



Fig. 4: Plan of the ruins of the Sant'Antonio da Padova Complex, Scicli.

The convent of Sant'Antonio has an uncertain date. It was founded between 1226 and 1363 but little remains of the building of that time. The convent today consists largely of the post-earthquake realizations of 1693, among them are the 1514 chapel, built by Master Pietro Rovetta [11] and part of the cloister of 1522 [12]; some rooms were made for novices between 1560 and 1624 [13]. The church was entirely rebuilt in the first half of the 1700s. The reconstruction work resulted in substantial changes



Fig. 5: Longitudinal section.

to the plan, elevations and decorations but respected the formal rules of the period. In 1866 the complex passed to the State Property and was later sold to private individuals who placed a matchbook factory there. An explosion damaged the complex and the bombing of World War II completed the destruction. Since then, there has been a slow decline.

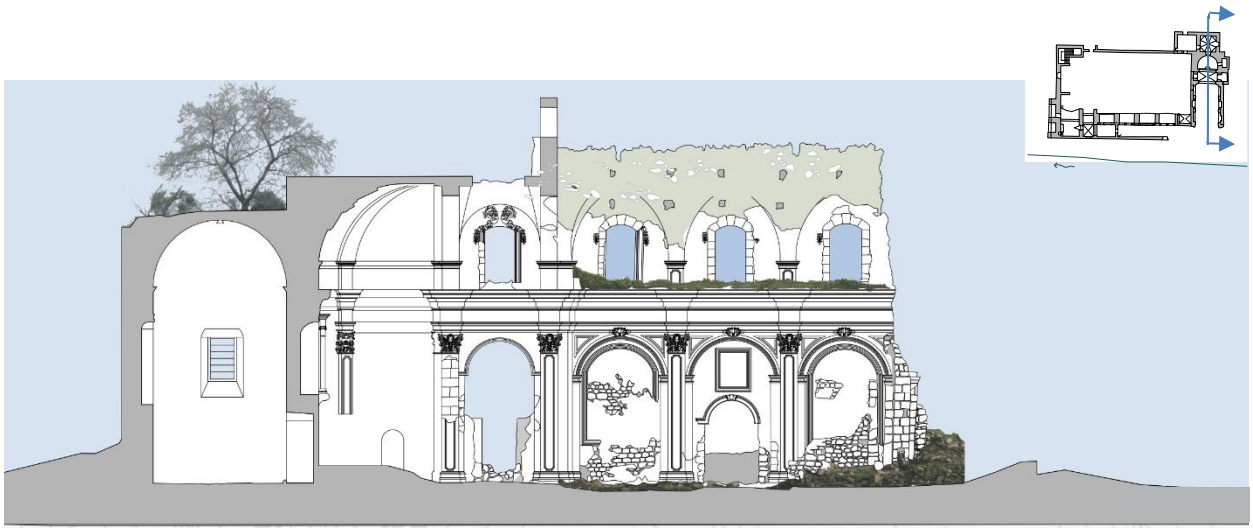


Fig. 6: Section A – A'.



Fig. 7: Section B – B'.

Today we can only perceive the ruins of the church inside, we can still distinguish the decorative stucco apparatuses, the perimeter walls of the complex and some internal divisions.

4. The research

The ecological transition can and must intervene on existing buildings, pursuing the objective of environmental, social and economic sustainability. The research therefore aims to demonstrate how the goal of sustainability can be achieved through rigorous scientific behavior that invests the processes of information acquisition, both the methodology of analysis.
First of all, the study aims to enhance the historical and cultural specificities of the territory. In this sense, rural areas of Sicily are a workshop of extraordinary interest. In fact, historical-monumental and cultural heritage of medieval and baroque villages possess splendid examples of civil and religious architecture. In these places there is a traditional component unchanged for centuries: the environmental natural heritage; it is a historical memory of events, traditions, culture, often not appreciated. Ecological transition, in this sense does not mean going back but appreciate and value with the tools, studies and technology of today.
Another reflection deserves the place. The case study is located in a marginal area of the historic center. It is an outpost of the town, surrounded by abandoned land and crossed by a small river. The buildings around are quite far away and the lack of interventions has preserved their nature. Once these places were lived by religious and frequented by the community that gathered here. The land was cultivated and served for the survival of the convent [14]. Today, the public and private space of the Sant'Antonio da Padova Complex certainly represents the

historical landscape, the place of memory and sociality with a decisive role in the image of the city.
The study has had a very accurate phase of survey that goes well with the sustainability intents outlined above. The base was a survey held by the Municipal Technical Office, quite accurate, but not updated: the complex has in fact suffered recent collapses that have changed its appearance irremediably. Even the weeds have taken over the built. Trees are born from the cracks of the vaults and have grown significantly. The relief has therefore produced very accurate graphics that have allowed to identify the texture and the precarious state of the complex. Through these elaborations, the study proposes a global vision of the complex but goes down to the scale of the single technological element thanks to the instruments of photographic straightening and digital survey. From this information it was possible to verify the precariousness of the walls still standing and the need for urgent consolidation.
The research then addressed the theme of sustainability with a phase of interviews and discussions with the community that led to the project of urban regeneration. The characteristics of the area once concerned agriculture and this will be the objective of the project. Through the requirements related to the conscious use of land, the choice of functions close to the needs of residents, energy saving and production, the project intends to create an



Fig. 8: Project of Urban Farm. Plan and longitudinal section**.**

Urban Farm, a form of return to agriculture that today is certainly at the center of everyone's life and not just for food issues. In this case, the Urban Farm is not a fashion, but a real need of the community that wants to keep the traditions alive.
It identifies as an Urban Farm, a container that responds to the demands of the community, enhances the values of the territory, stimulates the economy and boots the aggregate component. In this context, the project rethinks the ruins in a contemporary key, proposing an idea that preserves, reuses, communicates and exploits the potential of the building and the

space around it: an urban farm in the Sant'Antonio da Padova Complex. The creation of such an Urban Farm system in the recovered complex will host a "house of Sicilian crops" to reacquire and spread the ancient tradition of "cannavataro", a man familiar with the local agricultural tradition who cultivates the land as if it were the primordial mater and sells it directly to the consumer. Here you can buy or devour the products of the "cannavate", the biological archetype of the past that produces native varieties.
The cloister, the heart of the convent, will host a Garden of Sharing around which will develop the activities to start up a Therapy Garden based on the desire to rediscover a slower rhythm of life, revaluating the beneficial properties of the fruits of the earth and regain possession of the territory, cultivating the land, an area of Research and Development with laboratories for the research into ancient grains and native seeds, a small meteorological station, a Kitchen Garden with native crops, respecting the cycles of each crop and following the Slow Food principles.
The tradition of "*cannavate*" will be continued in the area that runs along the stream, forming small plots of land of 1000 or 2000 square meters at most, surrounded by citrus trees.
The complex will be completed by social and collective functions such as a restaurant in the refectory of the convent, a common room for aggregation within the church, a temporary shop under the barrel vaults of the sixteenth-century loggia, to sell both processed products in laboratories and those produced in the Area of *Cannavate* and in the Kitchen Garden.

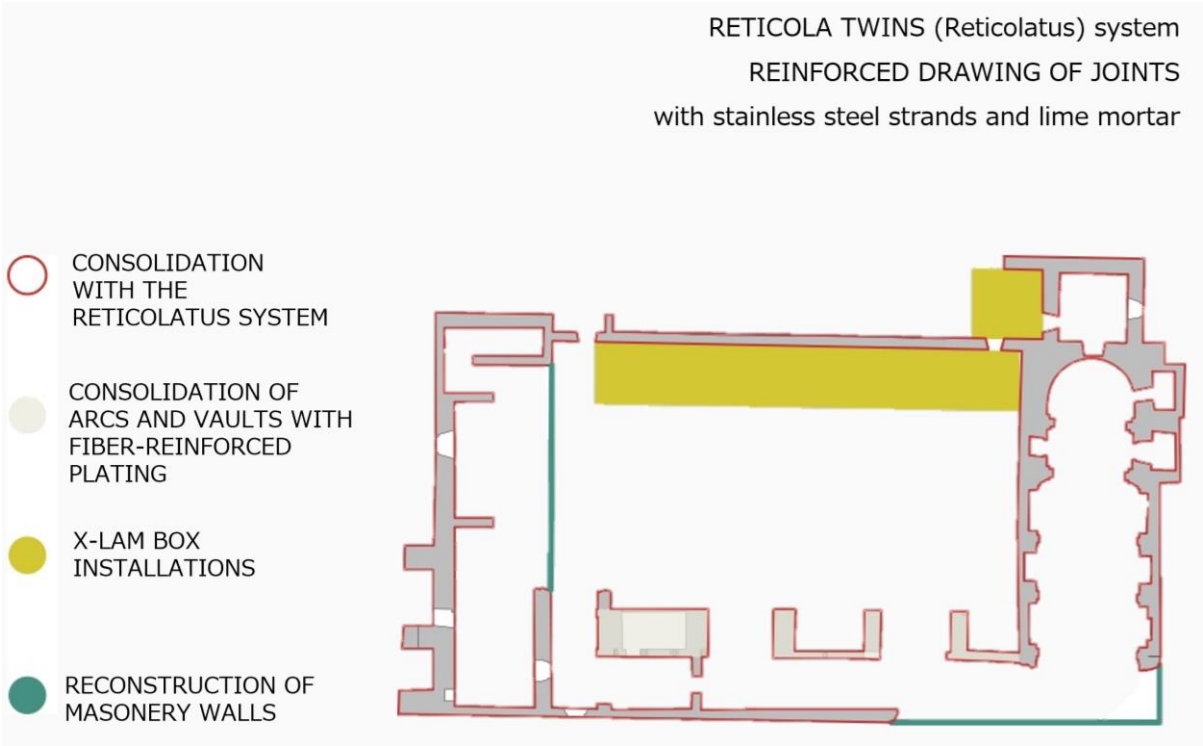


Fig. 9: Consolidation project of the Complex, Scicli.

From the technological point of view, the project involves the consolidation of the walls through a series of different interventions depending on the conditions of the supports. In areas with exposed masonry, the intervention involves the consolidation and preservation of the walls with a system which occurs the reinforcement of the joints with the use of stainless-steel strands and lime mortar. This system (reticolatus) improves the shear and flexural strength of the masonry allows to upgrade the resistance to cutting and bending of the masonry, while, at the same time, maintaining the original appearance. On the partially collapsed walls of the church indenting interventions will take place. For the restoration of the wall box, tie-rods and the creation of an upper curb that closes and connects the walls will be employed. For the reuse of the most damaged spaces, the project involves the reconstruction of the spaces with X-lam panels, placed in adherence to the internal masonry. The choice of X-LAM is linked to the excellent characteristics of resistance to seismic stress and thermal performance and air tightness. Some completely collapsed walls will be replaced by large windows.

Internally fixing and cleaning of the existing grouts will be undertaken.
The betontex fibre-reinforced plating system will be used to consolidate the existing vaults. It is composed of fabrics, nets, flakes, sheets and preformed bars in carbon or glass fibres to be impregnated and/or glued on the turned surfaces by means of epoxy thermosetting resins. This type of intervention is used to prevent local and global collapse mechanisms and to achieve an increase in mechanical strength and ductility to the extrados of the vaults.
The project is therefore environmentally sustainable, respectful of the ruins and the technological culture of the past.

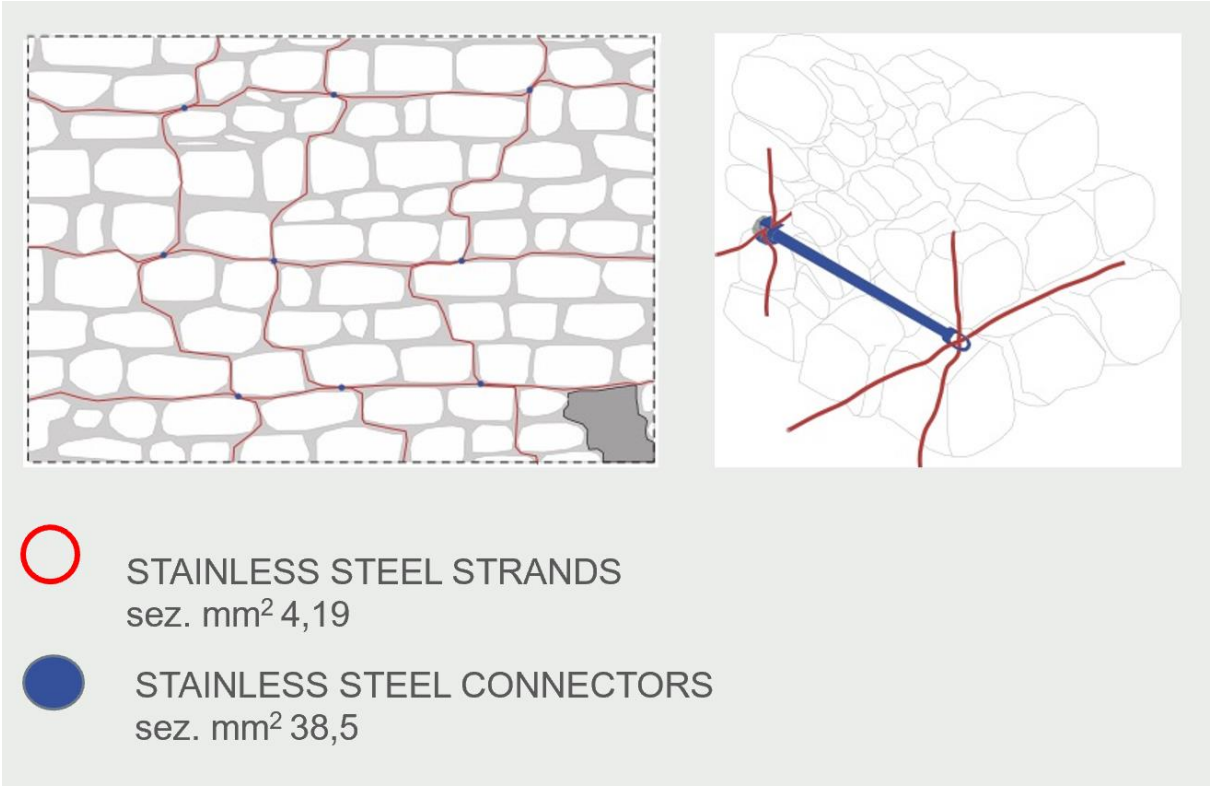


Fig. 10: Consolidation of the walls.

5. Conclusions

The goal of this millennium is certainly a conscious and careful use of the building, based on the economic autonomy of the management of the dwelling. The Urban Farm of Scicli will be a space for the production, processing and sale of seasonal agricultural products, typical of the area and the microclimate; it will be a commercial space with a 0-carbon impact, a cultural, educational, social and urban green space. Here it will be possible to combine agricultural experiments and social relationships through collaboration between academic and commercial activities, leaving ample space for the aggregative capacity of the human being. These sites become the perfect place for aggregative but also economic functions, places of meeting, relaxation, profit and commercial development, they also become a way to spread culture and respect for the past, a vital past, full of meaning and activity. The consolidated public space, and the historical buildings around, become a fundamental network for cultural, social and economic well-being.
The research therefore proposes a model of regeneration project that combines sustainability with the relationship architecture/ nature that the ruins impose.

Acknowledgment

Interventions on Convent and Church of Saint Anthony and relative images are taken from the degree thesis of Stella Liuzzo entitled*: Rehabilitation of the Convent and Church of Saint Anthony of Padua in Scicli (RG)*. Supervisor: Prof. F. Cantone, Catania University, SDS of Architecture, Syracuse, Sicily. Academic year 2020/21.

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The Valorization of Cultural Heritage to Preserve "Biodiversity" in Lifestyles

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Abstract
Today's ways of living are excessively impactful on the ecosystem and our living environments are no more extensions of the nature. The valorization of cultural heritage at all levels including our ways of building, working, living, eating etc. in relation to nature preserve a sort of "biodiversity" in lifestyles. Thus, this process of turning back to "vernacular" style can be the key element that can heal this accelerated process of environmental changes and related problems also contributing to people's well-being and happiness.
This paper aims to underline the role of tangible and intangible cultural heritage on the well-being of human population and the well-being of our environment and discuss how these cultural values can be supported and enriched by space and architecture through the concrete example of eating and drinking rituals that change from culture to culture. If space as the tangible counterpart of culture can be woven in harmony with the intangible cultural heritage, the cultural experience can be more complete and support both individual and society well-being which are inevitably linked to each other.
Biodiversity conservation is usually associated with tangible elements of the environment, whereas this paper aims to emphasize that biodiversity also consists of intangible elements: thus, socially and contextually appreciated cultural rituals creates a platform to come together and share common values also protecting local ties, sources and therefore biodiversity This attitude can also protect our planet and contribute massively to the necessary ecological transition.

Keywords: Intangible Biodiversity, vernacular space, eating rituals, well-being, interior environment

1. Well-being and Cultural Heritage

Well-being is in fact a far more wide reaching concept, encompassing basic physical needs such as decent quality housing, nutrition, healthcare and freedom from violence and oppression, through to the requirements for each individual to be able to engage in society to their fullest capacity [1]. It is also related to many other factors including psychological state, level of independence, family, education, wealth, religious beliefs, a sense of optimism, local services and transport, employment, social relationships and the environment [2]. Well-being' is about individuals and the creation of an enabling environment that can holistically support their physical, mental, emotional, social, cultural, spiritual and economic needs, so that they can achieve their potential [1].
In literature conceptions of well-being appears to follow two main approaches which are the hedonic and eudaimonic traditions. The hedonic tradition gives importance to constructs such as happiness, positive affect, low negative affect, and satisfaction with life [3] [4] [5] [6]. On the other hand the eudaimonic tradition concentrates on the positive psychological functioning and human development [7] [8] [9]. In this perspective, well-being can be understood as a combination of hedonic and eudaimonic traditions, as the positive state of mind and body in relation to the complex system of interconnected components that built up living. Living environments are essential to prepare the basis for all the qualities that enrich our lives both physically and emotionally. In this sense the concept of well-being related to space goes beyond quality of life embracing all aspects of interaction between human and space. Our perceptions, emotions, experiences and their outcomes play an important role on our happiness and

satisfaction. A real concept of well-being cannot be established without a broader and deeper understanding of human space interaction [10].
Self-determination theorists [11] [12] maintain that well-being hinges on the fulfilment of three basic innate which are defined as: competence: Seek to control the outcome and experience mastery; relatedness: desire to interact, be connected to, and experience caring for others and autonomy: desire to be causal agents of one's own life and act in harmony with one's integrated self. Relatedness is a feeling of connection with other people, often accompanied by affection, trust, and a sense of personal security [13]. So, relatedness can be also regarded as a social dimension of psychological needs. People need to care for other people and they need to be cared about by others. From a cultural, more precisely a societal or country point of view, the conceptions of individualism and collectivism have become pervasively prominent [14]. In this conception, individualism relates to autonomy, whereas collectivism relates to relatedness [15]. At this point, it can be assumed that today's societies need to enhance the feeling of relatedness, which has been dominated by the effects of individualism. We can say that cultural heritage and getting involved in cultural activities increase relatedness. The existence and sharing of cultural values in society strengthen social ties and belonging. Regarding the dominance of individualism in today's societies, it is necessary to promote relatedness, which can benefit greatly from cultural heritage as a link between individuals and societies. Of course cultural backgrounds of societies vary greatly but even this diversity can become a strong aspect of exploration, which can lead to appreciation of diversity. We can say that with our different cultural backgrounds we all have different conceptions of well-being and this can effect the way we interpret other cultures but it can also create consciousness about individual and shared values.
The Covid-19 Pandemic has thought humanity that well-being of each individual is strongly linked to the society they live in and also to other societies that live in other parts of the world. Although well-being in itself is subjective and it differs from person to person, at the point that we have arrived it is difficult to think of individual well-being as a process independent from the rest of the world and independent from other people and other societies.
Human well-being and healthy societies are threatened by a multitude of growing factors, and for many people the future seems more uncertain than ever before. The role of heritage in mitigating some of this change and how the loss of heritage compounds the effects of rapid change in terms of contemporary human well-being are important issues that are in need of better discussion [16]. The emergence of the coronavirus had a dramatic effect on social well-being and increased rates of anxiety and depression in almost all societies. Both tangible and intangible heritage values have become less accessible. In a difficult situation like this, the role of cultural heritage needs to be rethought. Culture and cultural heritage are fundamental determinants of what makes life meaningful. According to Tacon [16], strong cultural identity is underpinned by connection to places, landscapes, tradition, heritage, shared stories and communal histories. Thus, well-being is here defined as a positive sense of psychological, physical, emotional and spiritual satisfaction that results from being part of a culture and community that actively engages with its environment, heritage and traditions.

1.1 Tangible and Intangible cultural aspects

Cultural heritage both includes tangible and intangible aspects [17]. Tangible cultural heritage includes movable cultural heritage (paintings, sculptures, coins, manuscripts), immovable cultural heritage (monuments, archaeological sites, and so on) and underwater cultural heritage (shipwrecks, underwater ruins and cities) while intangible cultural heritage includes oral traditions, performing arts and rituals. Both tangible and intangible heritage has great potential to contribute to individual and society well-being. According to Dawson [18], cultural heritage should speak through the values that people give it and not the other way round. Objects, collections, buildings, etc. become recognized as heritage when they express the value of society and so the tangible can only be understood and interpreted through the intangible.
The Istanbul Declaration, adopted at a round table of 71 Ministers of Culture, organized by UNESCO in Istanbul in September 2002, stresses that "an all-encompassing approach to cultural heritage should prevail, taking into account the dynamic link between the tangible and intangible heritage and their close interaction." Intangible heritage only attains its true significance when it sheds light on its underlying values. Conversely, intangible heritage should be made incarnate in tangible manifest-tations, i.e. in visible signs, if it is to be conserved. Even if tangible and intangible heritage are very different, they are two sides of the same coin: both carry meaning and the embedded memory of humanity. Both the tangible and the intangible heritage rely on each other when it comes to understanding the meaning and importance of each [19].
Society and values are intrinsically linked. Thus intangible heritage is essential to interpret the real values and meanings embodied in tangible heritage. Otherwise tangible heritage rests as only a physical existence without the meanings associated to it by the society. So, we can also say that intangible heritage has even more potential to penetrate into social life as it is part of living itself and it is also linked

to everyday activities even very simple and repetitive ones such as eating and drinking. In this respect, the role of intangible heritage in promoting well-being is predominantly important.
In particular, the value of rituals, defined by the cultural context and experienced on an individual, family or social level, has so far been underestimated in the preservation of cultural heritage. As can be seen from the WELL certification system, on the one hand the components of well-being are to all intents and purposes components of sustainable development, on the other hand attention to the cultural context of the inhabitants of buildings is not particularly emphasised. A sustainable development should therefore consider them more, besides the fact that some elements of the architectural heritage are closely linked to the rituals they host.

2. Collective activities and the value of eating/drinking together

Food has been reported to be one of the specific aspects of life that affects subjective well-being [20] [21]. The influence of foods on perceived well-being can be explained by its influence on different aspects of life, including body functioning and physical health [22], mood and emotions, as well as global life judgment and social relationships [23] [24] [25]. Food fulfils a utilitarian function for the body, but at the same time it acts as a product for pleasure and for social construction, supporting the construction of personal identity [26]. In many cultures the most common way of social gathering is through eating and drinking. According to Yiengprugsawan [27], having a meal is not only important for nutritional and health outcomes; it is also a vital part of daily social interaction. Their study provides empirical evidence from a non-Western setting (Thailand) that sharing meals could contribute to increasing happiness.
It has been discussed that well-being is a complex issue that is strongly connected to cultural issues. Recently Saglar Onay and Minucciani [28] have developed a well-being framework (Fig. 1) that tries to structure the main dimensions of well-being related to human needs and space. The structure of the framework is based on contextual, functional, psychological, social, sensory, aesthetic and ergonomic requirements, which are always in relation to each other. In the framework cultural aspects are considered to effect all these requirements and this relativity is also proven by case studies made in different cultural contexts.

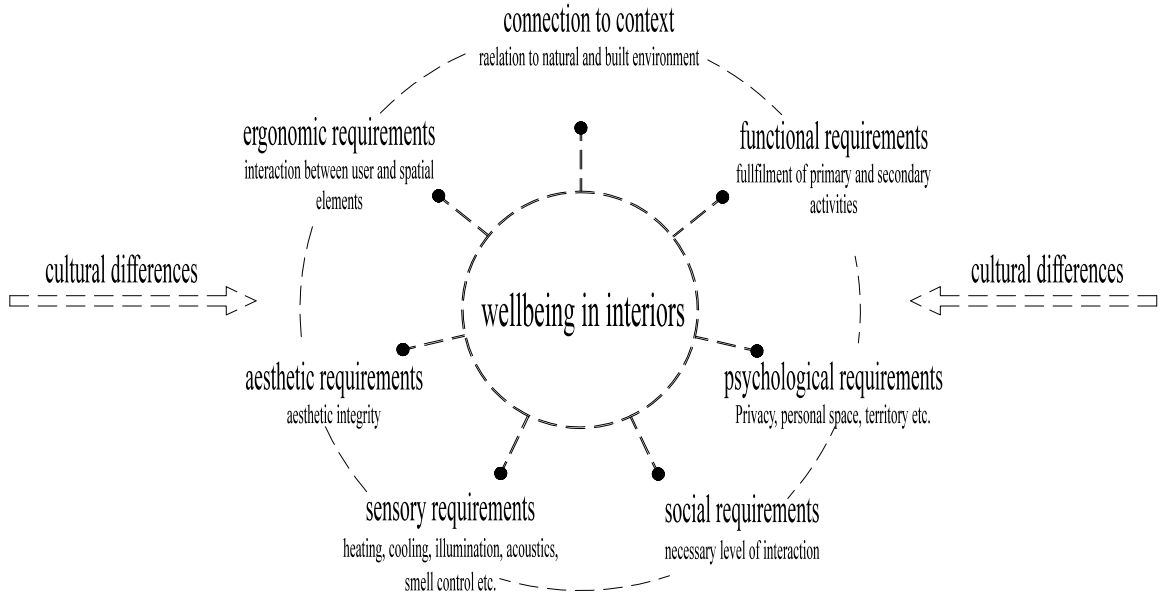


Fig. 1: Well-being framework for interior space [28].

Eating is also (or above all) a cultural fact: according to the Russian semiologist Lotman, a culture also needs to be organised in 'stereotypes' which shape people's way of thinking [29]. Culture, in short, is also a question of practices: and 'getting together at the table' is one of these practices. Mary Douglas compared the meal to language because both impose order and hierarchies [30].
When we evaluate eating as a collective activity, we can see that it has the potential to touch many spatial aspects that build up well-being including all the requirements listed above in the framework of Saglar Onay and Minucciani [28]. Food especially if considered locally is in direct relation to context. The act of eating requires specific functional organisation and ergonomic considerations. Both food itself and the space the act of eating takes place is subject to sensory and aesthetic considerations. And the collectivity of this activity brings about the social and psychological dimensions. Therefore when food becomes the subject of collective activity it has an incredible potential to contribute to well-being. But in order to evaluate all these dimensions in a correct way, culture becomes the key element. The act of

eating becomes a ritual when it is considered in its specific cultural context. If studied correctly, this ritual becomes a powerful source of sharing and interaction for everyone also because it is an essential repetitive activity.

2.1 Eating and drinking rituals in different cultures and their spatial correspondences

Boyden, in his research in 1971 [31] distinguishes between “survival needs” and “well-being” needs. Survival needs deal with aspects of the environment that directly affect human health, such as clear air and water, lack of pathogens or toxins, and opportunity for rest and sleep. Well-being needs, on the other hand, are more indirect in their locus of impact. These needs affect overall health through their relationship to fulfilment, quality of life, and psychological health. Where failure to satisfy survival needs may lead to serious illness or death, failure to satisfy the well-being needs produces the “grey life” of psychosocial maladjustment and stress related illnesses. Food and drink on its own is a survival need for human while the fulfilment of this requirement in certain ways is a well-being need that changes from society to society.

According to Hosey [32] our most intimate contact with nature occurs when we eat it. Traditions of building and cooking both evolve around local ingredients, often the same ones. The olive tree was the center of the economy and diet of the ancient Greeks, who built with its wood and ate and traded its fruit and oil. For South Pacific islanders the heart of the sago palm provided a staple starch, while its leaves served as thatching for huts. In this sense it has penetrated into every aspect of living and culture. While food as a survival need is a shared need for human, well-being needs can vary greatly as they are in close relation to culture. While these aspects reflect the differences in material culture, ways of eating and drinking especially in groups also represent differences both in relation to the material culture of food and other aspects linked to social relations and traditions (Fig.2)

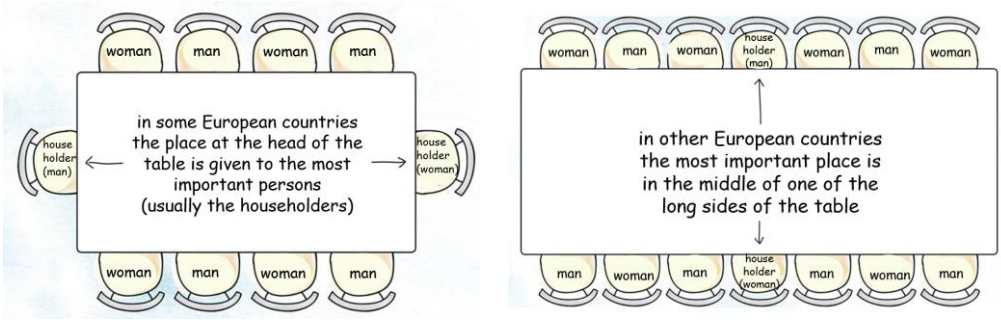


Fig. 2: Eating rituals also accord with the importance of the diners roles, following spatial rules that may vary in different countries

In many cultures, food is consumed together, in the same space and time, but conviviality is not always the rule. In some cultures, people do not eat together, while in others - such as Italy - conviviality is fundamental. Moreover, food can create and strengthen social ties, or vice versa, break them. Conviviality in food does not necessarily mean equality: in fact, relationships, but also hierarchies, within the family and the group are established and reaffirmed around the table.

The ritual of eating reveals social class and gender hierarchy, together with codes of behaviour. In the Italian countryside, in the past, women did not sit at the table until the end of the meal, when the men had been served.

According to Chang [33] basic foodstuffs, preservation, preparation and cooking methods vary considerably across cultures, as do the compositions of meals in terms of amount and variety. This diversity is reflected in culinary tastes and practices [34]. For example the Mediterranean diet has entered the UNESCO intangible cultural heritage list in 2013 involving a set of skills, knowledge, rituals, symbols and traditions concerning crops, harvesting, fishing, animal husbandry, conservation, processing, cooking, and particularly the sharing and consumption of food. Eating together is the foundation of the cultural identity and continuity of communities throughout the Mediterranean basin. It is a moment of social exchange and communication, an affirmation and renewal of family, group or community identity. The Mediterranean diet emphasizes values of hospitality, neighbourliness, intercultural dialogue and creativity, and a way of life guided by respect for diversity. It plays a vital role in cultural spaces, festivals and celebrations, bringing together people of all ages, conditions and social classes [17]. Today a great number of researches underline the positive effect of the Mediterranean kitchen on well-being [35] also because it is deeply rooted in local territory, it protects biodiversity (Fig.3), and it ensures the conservation and development of traditional activities [36]. This rich and contex-related type of eating has its reflections also on space and architecture with a tendency towards strong

contextual ties with nature and agriculture. The dominance of natural materials, open-air spaces, appropriate response to climate and the potential to support social encounters define the common values of Mediterranean spaces. Together with specific decisions that define spaces, every region has its own spatial identity depending on the cultural background and contextual potentials of the specific location. Here we can see the strong relationship between intangible and tangible heritage. The real experience of space is defined by atmosphere enriched by intangible aspects including tastes, smells, accents, expressions etc.

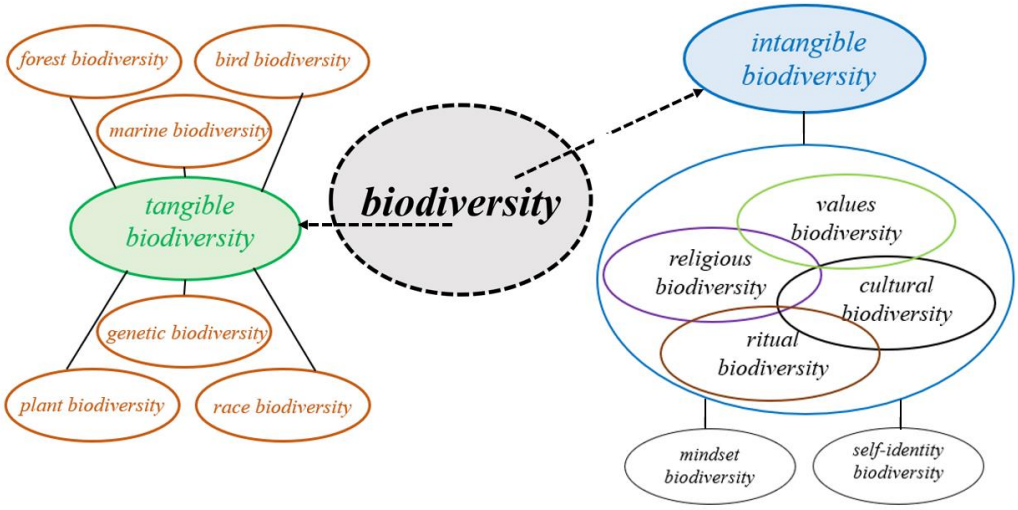


Fig. 3: The Biodiversity aspects, both tangible and intangible, and their components (V.Minucciani, N. Saglar Onay)

We have mentioned that the intangible heritage is actually the complement of tangible heritage. While historic environments are enriched with appropriate intangible cultural aspects, they have more potential to communicate common values of the society. For example the Turkish coffee tradition is a symbol of hospitality, friendship, refinement and entertainment that permeates all walks of life and also has strong spatial correspondences (Fig.4). In villages coffee houses, in homes coffee corners are meant to be significantly important and they are consciously or unconsciously sources of happiness shared by the members of family, neighbours and friends. An invitation for coffee among friends provides an opportunity for intimate talk and the sharing of daily concerns. The Turkish coffee also plays an important role on social occasions such as engagement ceremonies and holidays. Its knowledge and rituals are transmitted informally by family members through observation and participation [17].



Fig. 4: The Turkish coffee tradition. Photograph: Kadir KIR, © Ministry of Culture and Tourism [17]. An Ottoman coffeehouse in Tophane, Mıgırdiç Civanyan, late 19th century [37].

2.2 How can cultural rituals be maintained both in historic and contemporary environments

As cultural rituals are part of living cultural heritage, they need to be integrated in social life in order to resist to time. Historic environments are more likely to support cultural rituals. The authenticity of historic spaces can only be maintained in relation to their cultural significances, which are mostly linked to intangible heritage. Therefore conservation is also a question of spatial atmosphere. It's important to define appropriate uses and appropriate interventions that maintain the "aura" of space. In this respect intangible culture and rituals become very necessary ensuring the continuity of memory (and actual conservation) line. In this sense, the appropriate evaluation of historic buildings through adaptive reuse needs to be regarded as a very important contribution to well-being. One of the most important objectives of reuse in historic buildings is determining their architectural and spatial potentials in order to define a compatible use [38]. This necessitates the exploration of certain aspects including the role of space in its context; spatial restrictions, limitations; spatial properties to be underlined; factors that determine architectural and spatial identity; and values of cultural significance. Architectural or spatial role may refer to the use of a place and its contribution to a social system, the functions of a place, including the activities and traditional and customary practices that may occur at the place [39]. Every building or structure can be evaluated as a part of a bigger spatial organization and it has an individual role in this system. The most important objective of analysing historic buildings is to determine the values that contribute to the cultural significance of the building. According to the Burra Charter [39], cultural significance may change over time with use as a result of new information. Every period, every different use has its signs and effects on the building itself. Therefore in analysing historic buildings, layers from different periods needs to be evaluated with a contemporary point of view. The notion of the architecture in this concentric and holistic approach is to donate spaces with elements that support human activity and enrich cultural experience and rituals. Historic buildings already have the potential to enrich human experience but they need to be adapted to contemporary needs and expectations in order to be integrated into contemporary life. What is critical at this point is the analysis of all underlying issues and spatial values that are part of their cultural significance. Every intervention on historic buildings introduces new spatial elements and materials that can be regarded as new layers of adaptation. In this sense, in heritage buildings, the legibility of old and new layers increases the ability of communication of the building ensuring a meaningful spatial experience which will in turn enrich the quality of social activities in relation to cultural rituals and strengthen community well-being [10].

Although historic environments are of great importance for cultural values, we cannot limit cultural rituals to historic environments as they are and they need to be a part of contemporary living to ensure their continuity. In this sense also contemporary environments need to be thought in a way that can support cultural rituals. Rituals may necessitate contextual, functional, aesthetic arrangements depending on the essence, cultural meaning and background of the ritual. In this respect space needs to be thought as a counterpart of cultural activity responding not only to the spatial requirements but also should create atmosphere, which is necessary to support the sensorial experience. Every ritual is supported by certain objects, furniture, accessories and spatial definitions with specific characteristics. In this case, the well-being framework based on contextual, functional, psychological, social, sensory, aesthetic and ergonomic aspects discussed above [28] can be a road map to consider the requirements that lead to well-being related to space.

3. Conclusion

Cultural heritage as a source of tangible and intangible values need to be valorised and enriched as a powerful tool to preserve "biodiversity" in our lifestyles. Through this paper the importance of intangible heritage has been particularly underlined as they give the possibility to enrich daily activities, routines and make them become cultural rituals often rooted in local territory protecting all the diversities related to cultural context. In this sense eating and drinking rituals play one of the most important role also because they are particularly reported to create possibility to strengthen social ties, feelings of relatedness and trust. This is mostly because people tend to be more open or sincere and are more willing to share ideas, visions and feelings while they share a meal.

The role of cultural heritage and rituals as a promoter of biodiversity needs to be augmented by the power of architecture and spatial design. The atmosphere created by space and spatial properties tends to be the complement of spatial experience related to cultural activities. If space as the tangible counterpart of culture can be woven in harmony with the intangible cultural heritage, the cultural experience can be more complete and support both individual and society well-being which are inevitably linked to each other. There is a very strong connection between values of cultural significance and well-being. The existence of socially appreciated cultural rituals creates a platform to come together and share common values. This can be regarded as a booster of well-being for all levels of the society. Today designers and architects tend to create architectural solutions without a proper examination of ways of living. It is also a reality that the difference between cultures and lifestyles is not as significant as before but they are adapted to the advancements in technology and science. But this way of thinking

make us lose our ties with local values and sources breaking the natural links that preserve biodiversity. On the way to ecological transition the mission of design and architecture is to understand this adaptation process so that cultural values of societies can find their correspondences in new living environments. Future research needs to discuss how new architectural solutions can respond to well-being needs in a natural way as we can see in vernacular examples and how we can develop an updated and contemporary understanding of space in relation to the cultural environment. This is also because our present ways of living is excessively impactful on the environment and living environments are no more extensions of nature. Therefore, conservation of intangible heritage and cultural rituals as a lesson to preserve a sort of “biodiversity” in lifestyles can contribute greatly to contemporary living and well-being, different from society to society, far away from the impacts of “Global” or “International Style” that create similar solutions in different contexts.

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20th World Heritage and Ecological Transition
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NAPLES 16 - CAPRI 17|18 JUNE 2022
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Food Design: Art and Food Culture

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Abstract
One of the consequences of the pandemic concerns a new general awareness in environmental problems and different ways of relating with food arose.
Agriculture has been affected in production and in supply system, so changes have been imposed on our habits.
Undoubtedly, the way of living places and objects have changed; the consumption of food as a colloquial and social act has been disrupted by confinement. The places of catering have been modified to protect health and the house has become the stage of a new way of living. All these factors lead us to review what has been assumed by the world of design in the field of food design. Food certainly remains the closest link with nature, and new ideas are partly linked to the experience of eating and partly to the whole sensory food adventure. The food experience tells the design of the experience for preparation and consumption: how people interact with food, what food is able to communicate. We try to elaborate design ideas, adapted to underline in their image the visible aspect of the changes, giving methodological tools to elaborate appropriate food design. It should be intended to provide adequate capabilities into the fields of creative design, executive detail drawing, both into the built environment in which food arises and into the eating experience itself. In today's contemporaneity, food design is inherent, which must be inextricably linked to the environment and not to waste. The actions that gravitate around food can be rethought and contaminated to innovate. In this sense, food design arouses sensations, gives emotions and becomes the construction of relationships between “the future as an eternal present”, a legacy of the past as an economic, social and environmental value.

Keywords: Food Design, Culture, Art, Nature

1. Re-thinking food design[1]
A distinctive way of thinking about food gradually arose over the past few years and the Pandemic has definitively marked the difference in dietary habits as a consequence of changes in the entire supply system, way of working and living at home. Food, after all, still remains one of the closest links with nature and these changes encourage us to reconsider each aspect into the experience of eating in the whole sensory food adventure. It is so necessary to rethink the fundamental approach in the field of food design.
Food experience involves a series of research topic concerning climate change, nutrition, wellness, agriculture and food creative creation, into the entire process from preparation to consumption. But basically a designer should start from the interaction between people and food basing design approach on what food is capable to communicate with adequate capabilities for characterizing at the same time the environment in which food arises and moving towards the eating experience itself. In

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that way a critical thinking about the strong design connection to be established between food and the physical agriculture environment stresses the focus at the center of an adequate food design.
The experiments can elaborate new project forms, adapted to underline also in their image itself the visible aspect of natural relationship in the food cultural area, through the elaboration of a thinking capable to highlight the sense of belonging of people, while eating, to a place. Professional tools vary into the fields of creative design, executive detail drawing, both into the built environment and into the natural environment.
As a basis of knowledge, the reference is to an old era in which the idea of attachment to a place was a complete homogeneousness between people who consumed and people who produced. Different aspects are influenced as landscape assets, aesthetics of packaging, equipment for eating and preparing food. Everything to be checked into a cohesive approach which tends to establish connection between people and place with the eating experience an useful link.
In the past, food was considered, in a broad sense, as a distinctive sign of historical landscape heritage. It was an integral part of the place, as the sensorial integrity was given by the knowledge of the agricultural practice, the community life, its economy and its landscape bound to the cultivation and this fact created an ideal interconnection among human activity and the natural environment. But, also today, there is a way for reconnecting the entire system with an integrated food design into a territorial dimension. The experience to be studied could be found having acquaintance with the ecomuseum experiences, where community consensus is reached because here are studied well-adjusted strategies for considering tourism and at the same time traditional agricultural preservation. So in geographic areas in which the undertakings of human occupation and the places have created a balanced distribution of types of cultural landscapes, the contrast could converge in coherent perspective, which is apt to realize the process of cohesion among people living in the place.
But the cohesion in the process of food production cannot be experienced only as in the recent experiences into sustainable tourism, in-fact in the Pandemic period we have experienced a more profound attachment to the ground, to the vegetable plants and to the food production for cooking, even in very little dimension of space, as on balconies and into kitchens. Following this line, a return to the direct involvement of people, not only as consumers, has been started and it is important now that a trace of this process could remain. The food experience will never be the same as a return to the past when the cultural rooting of communities has been promoted and at the same time new experimentations are expected.

Some basic principles can be laid as basis for an adequate food design process: firstly, performances are related to sort of “natural law principles ", so the chosen design criteria should be simulated in advance, based on natural evolution in time. Secondly, trying to involve in the food design the personal experience of the users, with respect to the diversities of eating habits and tradition. Thirdly, as the Pandemic experience has made us understand, things are never the same, they change not only in shapes with durability corrosion process, but they can suddenly change their function itself. Food is a changeable habit, as we have learnt during travel periods abroad, so design should consider its “potential utility” in a wide sense, with reconfigurable paradigms.

2. The experience of food combined with design: how people interact with food and its surroundings[2]

In today's contemporaneity there is food design, which must be inextricably linked to the environment. Today, in fact, food is a more and more central temper that pushes companies, businessmen, and chefs to study new ways of consumption and to strengthen the union with design. At the center are the idea, the spaces for consumption, the products that make it possible to assemble a peat. Today it is fundamentally restoring the food distribution space, promoting a sustainable restaurant model that is able to contribute to the lot through food and spread concrete messages to change food intake. The relational exchange and the way of living places and objects changes more and more, also due to the latest circumstances. The consumption of food as a colloquial and social substance is tiring, all to be quantified with regard to the world of the past and to prevent contemporary designers from dominating the change of course. Food resembles the other body in nature, or the reference to this, since the way to find new ideas and experiments is linked to the experience of eating and to all the sensory components that food is in the degree of transmission. Is it the kitchen that creates the food, or is it the products, the gastronomic culture and the tradition that condition the kitchen as an element for the transformation of food? In today's contemporaneity the term "Food Design" is inherent, a term that is taking up more and more space, but which is susceptible to different interpretations. According to a

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recent definition, the planning of the complex set of food acts must therefore be understood. Scientific studies have recognized the value of the impact that the environment within which food is consumed affects our perception of taste. The actions that gravitate around food can in fact be rethought, transformed and contaminated to innovate. In this sense, Food Design arouses sensations and gives emotions and becomes the construction of relationships between the future as an eternal present, a legacy of the past as an economic, social and environmental value. An essential commitment that binds man and nature, society and the environment. Research, sustainability, innovation and technology are therefore the essential requirements to be able to talk about Design, in its true process meaning, to design a product, service or experience. In reality, what does it mean to design innovative and functional solutions for a memorable food experience? In light of the new ways of communicating gastronomy, when do you think it is essential for the chef to interact with the designer? Halfway between classification and gastronomic experimentation, a good example is the projects of the Spanish designer Martí Guixé, who works on the "reductions" of ideas in the food sector, through solutions that try to adapt the kitchen to the reality of our days and propose new ways of relating to food. Another recent concrete example is the work of the Umbrian designer Marta Toni, author of the interior design project of the “Il Frantoio” restaurant in Assisi.
“*More and more customers and the target audience are looking for a complete and immersive experience, from food to the venue*. - declares Marta Toni - *I joined the chef to create an emotion for the Frantoio that went along the same track. It all starts from the "concept", which in this case is the olive tree and extra virgin olive oil. I started from the idea that the experience must be made for all the senses; while I focused on sight and touch, I left hearing, taste and smell to Lorenzo Cantoni, chef of the prestigious Il Frantoio restaurant, located in the splendid setting of the Fontebella Palace Hotel in Assisi, as well as Best Chef of Oil A.I.R.O 2021* ".
For the Il Frantoio restaurant in Assisi, Marta Toni has in fact created a space with a strong personality, playing with materials and colors, an aesthetic alternation between craftsmanship and elegance. Elements that recall nature in its essence and the sensation of entering an olive grove, which is emphasized by the colors of the walls, the play of light and of course by the presence of real olive leaves set in the tables with a special resin, applied by the installer Natalini Grabriele of Design luxury collation. Another element of attraction is the photos of Pier Paolo Metelli, Umbrian photographer, author of images for reportage, publications on architecture, wine and oil. The wonderful shots of Francesco's monumental olive trees alternate on the walls, emotionally involving the guest. (Fig. 1)
All the elements from the space to the furniture, up to the table, bring the emotional tangibility of the outside into the inside.





Fig. 1: @PierPaolo Metelli-La Sala del Ristorante il Frantoio e dettaglio foto degli Ulivi Monumentali.

An immersive dimension resulting from a work of synergies, where the work team is confronted and interfaced directly with the chef and is completed; when you enter the restaurant you have the feeling of being in nature and immerse yourself in this context, you feel free to regain possession of your own feeling. Not only nature, but also the concept of well-being comes into play in the design work, in fact, as the designer says: "*The study started from the observation of olive leaves, their shape and color; hence the choice of colors used for the tables and walls and the choice of exhibiting the photos of Pier Paolo Metelli, which represent Francesco's millenary olive trees. A work of art within the work, which gives an important sign to the place itself. I believe that this game of synergies is fundamental today, also because chefs and designers are now starting from the same point, namely the concept, as the nodal point that allows the customer to live the experience in the round. In addition, inner and physical well-being should not be overlooked, which derives not only from a healthy and careful cuisine such as*

that of chef Lorenzo Cantoni, but also from a healthy environment, where air and health are essential. In fact, I chose to use a particular paint, attentive to cleaning the air and therefore to the person. I used a water-based paint for interiors based on renewable raw materials with packaging made from 100% recycled materials. Thanks to this innovative paint, the formaldehyde accumulated in the indoor air is neutralized ".
The emotion of the touch of the olive leaves under the fingers and the interaction of the courses with the recreated environment makes the experience original and one of a kind; a relationship with the space in which the action takes place, in a complex interaction between food, man and the environment, where all levels concur in defining the consumer's experience. (Fig. 2)



Fig. 2: @PierPaolo Metelli – Dettaglio tavolo del ristorante Il Frantoio

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20th World Heritage and Ecological Transition
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Lens on Landscape. Atlas of the coastal villages of Lake Bolsena (Central Italy).

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Abstract
This contribution summarizes the results of a broader survey focused on the architectural and environmental complex of Lake Bolsena and some of its coastal villages. This piece of Italian territory recognizes a unique heritage of its kind, which has been inhabited since the Etruscan era and saw its most flourishing period during the Renaissance. Recognized in its genius loci by poets and writers, it is an exemplary testimony of a shared, conscious and respectful living. Today the richness of these places is manifest of transitions and cultural, legible in the landscape and in the architectural emergencies and in the ways of living that distinguish the eight villages and the entire basin of the lake. The objective of the study is to map and communicate the evolutions, phases and transitions that characterize these places through the survey of the architectural, environmental and ephemeral qualities. Representation is the privileged means of this narration. In this context, Photography - in its double role of expressive language and documentary medium - through Structure from Motion processes and UAV acquisition methodologies - has allowed an interpretative and documentary reading of landscape and architecture.

Keywords: Photography, Survey, Ephemeral Heritage, Landscape, Lake Bolsena Italy

1. Introduction - For an Atlas of the coastal villages of Lake Bolsena
This contribution summarizes some of the results of a broader survey focused on the architectural and environmental complex of Lake Bolsena and its coastal centers.
This piece of Italian territory recognizes a unique heritage of its kind, which has been inhabited since the Etruscan era and saw its most flourishing period during the Renaissance.
Recognized in its genius loci by poets and writers, it is an exemplary testimony of a shared, conscious and respectful living.
Today the richness of these places is evidence, on the one hand, of legible historical-cultural transitions in the landscape and architectural emergencies; on the other, of the ways of living that distinguish the eight villages of the entire lake basin area.
The goal of the study is to map and communicate the evolutions, phases and transitions that have characterized these places by surveying the environmental, architectural and ephemeral qualities.
Representation is the privileged means of this narration. In this context, Photography - in its dual role of expressive language and documentary medium - through the Structure from Motion processes and UAV acquisition methodologies - has allowed an interpretative and documentary reading of the landscape and architecture which constitutes a first contribution towards the construction of an Atlas of the coastal villages of Lake Bolsena.
The cultural dimension of this asset in its relations with the territory is communicated by comparing heterogeneous documentary sources, in this context the representation is an expressive modality and indispensable medium for the construction of an open investigation.
Among the objectives of these observations - which intend to document the progress of an ongoing cognitive investigation - is to provide new operational ideas for the protection and safeguarding of a complex cultural heritage in the multidisciplinary relationships that it invests for its specificities.

2. Capodimonte, Bolsena Lake, Central Italy

Lake Bolsena, located in the upper Tuscia, Central Italy, at an altitude of about 300 m asl was generated by the collapse of a volcanic caldera, still recognizable today in its geological conformation, the two islands - Bisentina and Martana islands - are still visible trace of the eruptive cones.

Evidence of this geological situation can be traced by observing the shores of the lake: the northern and western ones show a curved shape, typical of a calderic depression; while the eastern side looks like a vertical rocky wall, several tens of meters high, due to the presence of numerous faults; one of which crosses the lake passing through the Bisentina island following a route that goes from Valentano to Bagnoregio. [1] [2]

A clearly traceable geological connotation even in the larger of the two islands, the Bisentina island – which has a polygonal shape and an area of 17 hectares variously articulated in terms of altitude – which has the south-eastern side consisting of an extensive tuff wall overlooking the water, which constitutes one of its main connotations.

A punctual element in a coastal landscape, a marked distinctive feature that characterizes the area of Lake Bolsena and the Vulsini Mountains, the Bisentina island has remained intact over the centuries and has formed the visual and symbolic fulcrum around which clear spatial hierarchies of the historic centers gravitate of the coastal towns

Observing from the sky the "great Tarquinian lake of Italy" with its "floating islands" - according to the definition of Pliny the Elder in the second book of the Naturalis Historia - and following its perimeter counterclockwise, eight centers can be noticed: Capodimonte and Marta to the south; Montefiascone and Bolsena to the east; San Lorenzo Nuovo, Grotte di Castro and Gradoli to the north; Valentano to the east.

The survey campaign is referred to the sangallesco cloister of the convent of the Bisentina island, a sort of spatial and visual fulcrum, that allowed us to mark and retrace the relationship with the eight urban settlements.

The area of Lake Bolsena is characterized by a particular natural scenery of rare beauty, which since the Palaeolithic has given hospitality to various populations who have left evidence of their presence; there are many archaeological areas recognized along the shores of the lake, including Monte Bisenzio in the territory of Capodimonte and the archaeological area of the Gran Carro located along the segment of coast between Montefiascone and Bolsena. [3]

To this day, the original remnants of the Cassia that connected Rome to Etruria and the Via Francigena, a pilgrimage route that crosses Italy from Santa Maria di Leuca to Aosta, passing through Rome and Viterbo, can still be traced in the design of the territory.

During the Renaissance these territories were affected by the enhancement works carried out by the Farnese family who, in the years ranging from 1385 to 1649, affirmed their presence and authority in Val di Lago. The Farnese palace of Gradoli and Grotte Di Castro, the Farnesian Memorial on the Bisentina Island and the Rocca Farnese di Capodimonte testify to this. [4] [5]

It is important to remember that during the pontificate of Clement VI (1342-1352) the Rocca di Montefiascone became the papal seat: the extension project was entrusted to Antonio da Sangallo the Elder (1455-1534).

The ascent to the papal throne of Alessandro Farnese, who took the name of Paul III, further contributed to the intensification of this relationship of patronage which led to the assignment of the works to enhance the architectural heritage of the territories recognized at the time as the Duchy of Castro.

Descending from the scale of the district as a whole to the scale of the eight villages, we turn our attention to the village of Capodimonte.

Capodimonte is located in the south-west quadrant of Lake Bolsena, it develops an area of about 60 square km, part of which with a peninsular trend - it extends into the water for about 300 meters, towards the Bisentina island - in its final part configures like a rocky promontory rises for about 30 meters above the water. Its territory includes Monte Bisenzio and Bisentina Island. [6]

When the possession of the territories of Capodimonte passed to the Farnese, they decided that the original fortress would later become their official residence in the village.

Between 1513 and 1514 Alessandro Farnese commissioned Antonio da Sangallo the Younger the restoration project of the fortress, transforming the pre-existing building with an octagonal plan, with the addition of an advanced body - which would later become the main access to the building - connected to the historic center by a drawbridge, later converted into a two-arched brick bridge.

To this day, the purely Renaissance four-arched score is still visible despite the subsequent interventions of infill.

The increase in power by the Farnese family over the years is evidenced by the increasingly evident need to transform the existing buildings into majestic palaces that celebrated the authority of the family.

3. Phases of the Survey

In a first phase of the research, as mentioned, it was possible to reconstruct the evident relationship between the architectural features that characterize the eight lake villages and the Bisentina island. The latter is characterized by the presence of a late sixteenth-century church, home to the famous Farnese shrine, a convent complex and seven oratories scattered along the jagged perimeter of the island's coastline, oriented towards the coastal villages.
An open-air museum in which they merge water, greenery, and architecture. [7] [8]
The Church of SS. Giacomo and Cristoforo was built on the previous site of S. Giovanni Battista, under the management of the Observant Friars Minor and the auspices of Ranuccio Farnese the Elder (1390-1450), who wanted to build the family Shrine on the island; it is attributed to Giovanni Antonio Garzoni da Viggiù, a pupil of Vignola in the Caprarola shipyard, who was in charge of the shipyard on the island from 1588 to 1591. [9] [10] [11]
The convent complex has an open courtyard plan on two levels. The cell distribution corridor has an open view to the north towards the main oratory. The complex also includes a square cloister porticoed with cross vaults with five arches on each side with a circular basin in the center. As is known, due to its planimetric characteristics, it can be referred to the project by Antonio da Sangallo the Younger, for the complex of S. Maria di Montemoro in Montefiascone; the project is illustrated in Dis.Uffizi 1275 [Giovannoni 1959] The oratory of S. Caterina, called "la Rocchina", is located on the promontory south of the island facing the Rocca di Capodimonte, referring to the same cycle of solutions by Sangallo. [12]
The landmark identified in the Sangallo cloister of the Bisentina island was crucial for tracing the territorial sections that cross the lake. The latter prove to be substantial for the interpretation of the territory and the spatial visual relationships that exist between the anthropic and natural elements typical of the complex system object of this study.
A system of orthogonal Cartesian axes that divide the lake basin into quadrants has been centered with respect to the cloister of the convent, assumed as the center of the system.
Both the representations of the lake centers have been referred to this ideal center, a sort of spatial and visual fulcrum. A real landmark, the Sangallo cloister was chosen as the geometric center for the representation of the spatial and visual relationships between the coastal urban centers and the Bisentina island. (Fig.2)
With the aim of creating an exhaustive story through images, various surveying methods were conducted in an integrated manner, from direct to indirect, in this context photography has made it possible to acquire data with considerable precision, both metric and chromatic, provided from Structure from Motion techniques.
The monitoring project of the first of the eight villages investigated, Capodimonte, is based on the integration of direct and indirect survey methodologies with the aim of building a three-dimensional model of the peninsula and its anthropic and natural connotations.
It was decided to proceed with a UAV aerial photogrammetry campaign, divided into two drone flights, the first with a nadiral camera, pointed downwards, 150m away from the study object; the second, with an oblique camera, inclined at 45 ° according to a circular path around the Rocca Farnese at a distance of 50m.
The combination of these two flights ensured a more complete and effective data acquisition for the determination of a three-dimensional model.
Subsequently, with the help of Agisoft Metashape software, the two-dimensional data of the frames were processed, 220 frames were used in the processing - taken with f / 2.2 1 / 200sec ISO-100 - which through a series of elaborations were converted into georeferenced three-dimensional data.
The software algorithms recognize in the various frames - taken with an overlap of 60-80% - homologous points used for the first alignment of the images – “point cloud” made up of 164,437 points – which constitutes the basic structure of the survey.
A fundamental step to build the three-dimensional model is the processing of the dense cloud - "dense cloud" homologous to the first processing but more full-bodied, consisting of 1,691,188 points - from which all the output export formats, both two-dimensional (orthophoto) and three-dimensional (NURBS model).
The UAS platform employed was a drone Dji Mavic 2 Pro equipped with a Hasselblad camera; builds 20 megapixel frames with 77 ° field of view and electronic shutter capable of varying between 8 and 1/8000 of a second as shutter speeds; possibility to push the ISO up to 12800. The photographic shots, with variable aperture from F2.8 to F11, reach a maximum quality of 5472 x 3648 pixels.

4. Conclusions. The power of aerial photography

Through a sequence of images that runs in parallel to the text, the contribution proposes a reflection on the languages that allow the documentation of both the material and the ephemeral qualities of the landscapes. [13]

The aim of the investigation is to draw the invisible. The vision of places from above allows the eye and then the mind to conceal relationships and relationships. The fundamental support of the photographic medium allows to capture and compose fragments of landscape, to elaborate visions, sequences of the gaze, stopped by the sky, by the water, captured by crossing the places on foot.
The images presented in the text are evidence of distinct areas of research and are referable to interpretative systems that in digital photography identify an irreplaceable medium of expression and investigation, in all phases of knowledge of the architectural and environmental heritage, connected with the procedures of the survey, or of the project.
The role of photography is essential in every phase of research on architecture, especially in the context of investigations connected with the knowledge of complex heritages, both architectural and environmental, characterized by the uniqueness of spatial qualities and the interrelationships between their components. [15] [16]
The synthesis of the surveying experiences, conducted on some exemplary cases of the Italian architectural and environmental heritage, allows to highlight the role and value of photographic shooting, in correlation with the current registers of digital light acquisition.
The convergence of the disciplines of representation and photographic technique at the various scales of the documentary investigation and of the support in all phases of the survey constitutes a fundamental step in the enhancement and protection of this heritage.
The landscape visions elaborated in these notes, in a sort of graphic monitoring, are oriented in support of the open communication of this heritage, in the belief that the representation of the territory and of the architecture for cognitive purposes is strictly connected with any intervention, operational aimed to safeguarding and sharing.
The Lake Bolsena area is an open-air museum, a heritage that is characterized by unique spatial qualities, a unicum that needs to be investigated in order to outline an open cognitive framework, in which the conservation and timely management of its components, it is integrated into a complex mosaic of dynamic and changing relationships.
In this context, the language of photography assumes the double documentary and interpretative role aimed at the 'revelation' of the meaning of the work with respect to the data explored and collected; both by relating the connections between project, survey and drawing, and by explaining the relationship that is established between the operator himself and the work investigated in the specific historical, cultural and perceptive conditions.
With regard to this language, Eugenio Turri (1927-2005), traveling geographer and writer,
introduces the term 'iconeme', which, like the phoneme for language, constitutes the elementary unit of perception of the Italian landscape, a sort of framing that allows us to “choose to frame, as the photographer does (...) The selection through 'frames' sets in motion psychological and representative mechanisms that have to do with historical, geographical, sociological, economic and territorial knowledge”. [16]

Credits
This paper is the result of a common discussion and elaboration between the authors Antonella Salucci (paragraph 1; 2; 4) and Francesca Liberatore (paragraph 3 and graphic elaboration). The original photographic documentation and the elaborations are by the authors.



Fig. 1: Lake Bolsena (VT) Central Italy, Capodimonte- Drone view from Capodimonte towards Bisentina Isle.

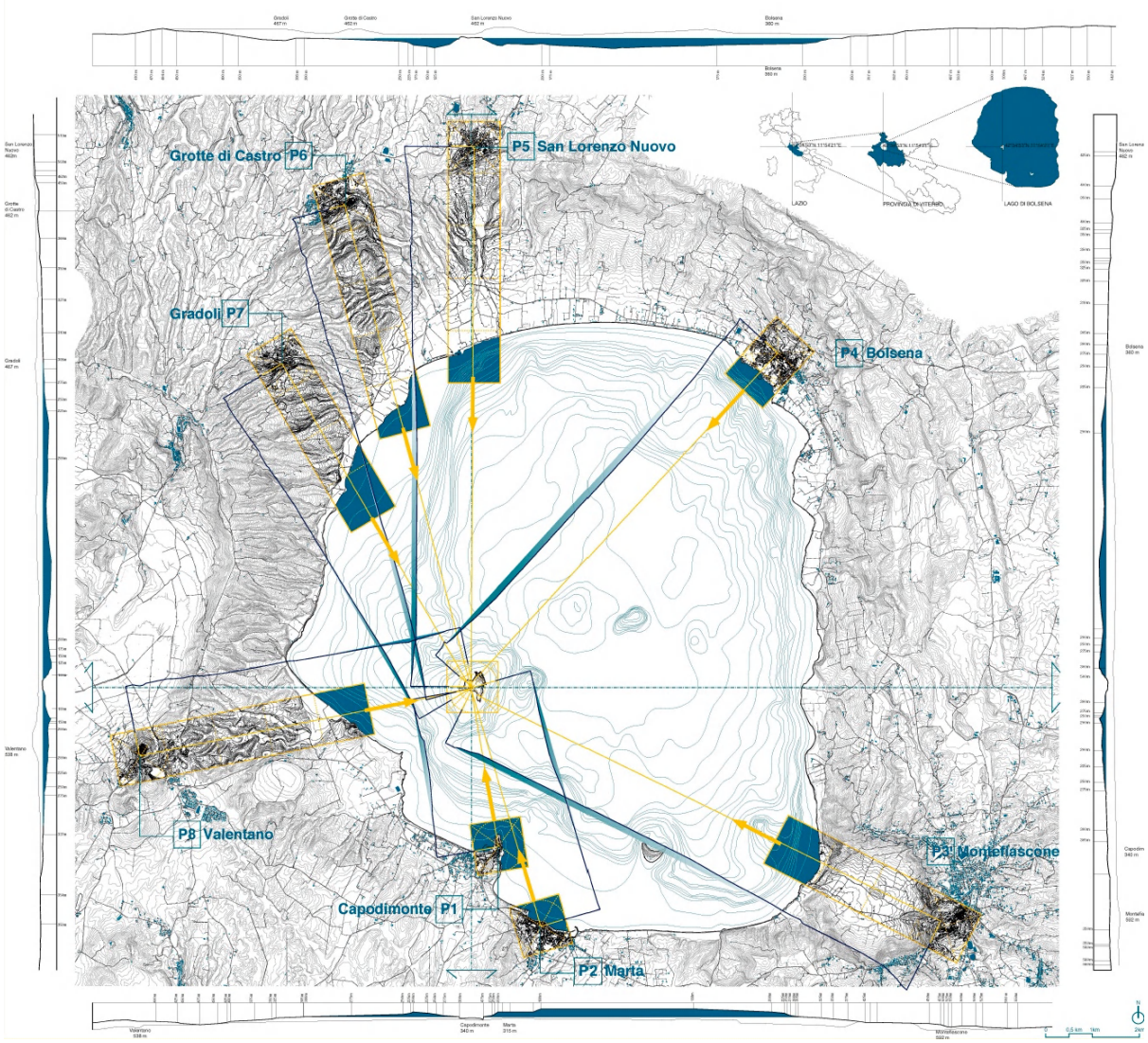


Fig. 2: Lake Bolsena (VT) Central Italy. Visual relationships between the Bisentina Isle and the coastal villages. P1) Capodimonte; P2) Marta; P3) Montefiascone; P4) Bolsena; P5) San Lorenzo Nuovo; P6) Grotte di Castro; P7) Gradoli; P8) Valentano. Drawing by authors.



Fig. 3: Lake Bolsena (VT) Central Italy. Satellite view of the eight coastal villages.

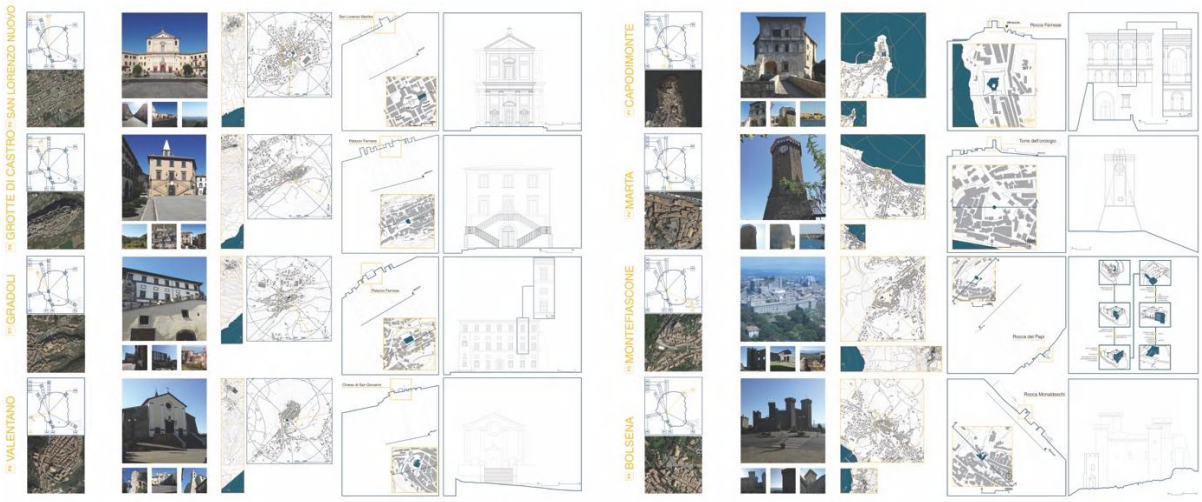


Fig. 4: Lake Bolsena, Viterbo, central Italy. Graphic analysis of the eight coastal villages.

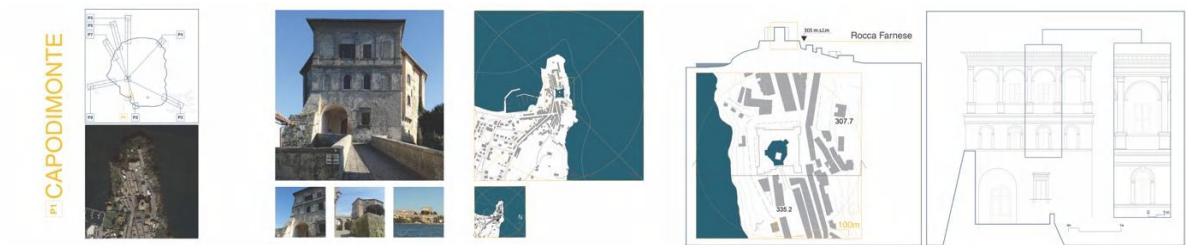


Fig. 5: Lake Bolsena (VT) Central Italy, Capodimonte and the Rocca Farnese. Graphic analysis.



Fig. 6: Capodimonte (VT, Central Italy). Mappa del Catasto Gregoriano 1819 «Stato Ecclesiastico. Provincia del Patrimonio Delegazione di Viterbo. Governo di Valentano Cont. di Capodimonte. VT 103. (Archivio di Stato di Viterbo).

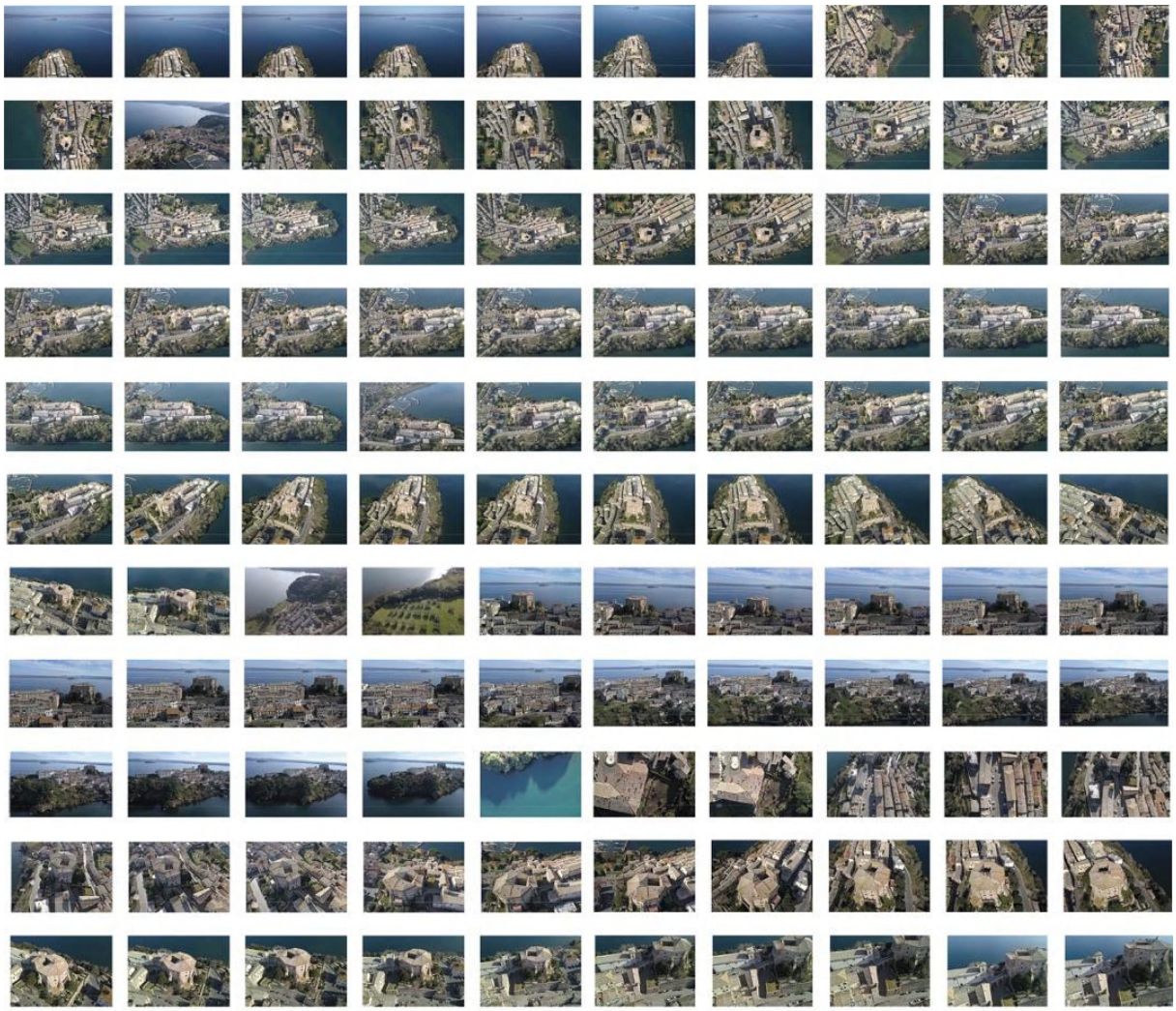


Fig. 7: Lake Bolsena (VT) Central Italy, Capodimonte e la Rocca Farnese. Frames. (Images by authors)



Fig.08: Lake Bolsena (VT) Central Italy, Capodimonte and the Rocca Farnese. Structure from Motion phases; drone view distribution. (Images by authors)



Fig.09: Lake Bolsena (VT) Central Italy, Capodimonte e la Rocca Farnese. Ortophotography generated by SfM methodology based on UAV. (Images by authors)

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Urban Gardens as Drivers of the Ecological Transition in Italy

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Abstract

In the 21st century, intensive urbanisation and climate change have presented urban planners with unprecedented societal challenges. Issues like green deprivation and spirals of gentrification across urban areas have gradually become focal points to address within municipal environmental strategies. As a result, urban green strategies proposed creative solutions, including the introduction of urban gardens, i.e. tracks of land devoted to agricultural production within densely populated neighbourhoods. Communities lacking large lots of land have been resorting to vertical urban gardens. These novel elements in the urban architectural landscape may contribute to a more sustainable ecology, while matching the sustainable development strategy devised by the European Commission. The ecological transition targets established at the EU level indeed refer to: 1) energy transition (energy efficiency, with a focus on renewable energies), 2) industrial transition (local production and recycling, in a circular economy perspective) and 3) agri-food transition (replacement of an industrial agriculture by an organic production). The aim of this work is to assess the role of urban gardens as drivers of the ecological transition in Italy, through the agri-food channel. Using regional data published by Istat over a recent timespan, we aim to unfold a relation between the share of land devoted to urban gardens and the share of organic agriculture.

Keywords: urban gardens; ecological transition; organic farming.

1. Introduction and Literature Background

In the past few years, the phenomenon of urban gardens has gained momentum both in the academic debate and in policymaking activities (Lin et al., 2018; Mbow et al., 2019). An urban garden is a green space owned by a municipality and managed by the citizenship that lies within the municipal territory. Land is entrusted by public authorities, through a tender and upon payment of a slightly more than symbolic rent, for a defined period of time to individual citizens or more often to citizen associations. The beneficiaries, typically non-professional farmers, receive the space in concession with a specific purpose, such as floriculture, production of fruits and vegetables or requalification of the area. Although urban gardens may be located anywhere within a city, peripheral areas represent very often popular solutions. In these areas, municipal authorities find it easier to grant the management of small plots of land because the economic value of land is lower with respect to central neighbourhoods. Thus, urban gardens are seen by the literature as concrete tools in the fight against urban degradation in peripheral municipal areas (Langemeyer et al., 2018).

The literature highlights several advantages arising from the presence of urban gardens. First, the citizenship is allowed to rediscover the value of the land, thus keeping in touch with its historical identity.

Second, working around a common goal, cohesion among citizens increases. Third, awareness is raised on more sustainable and "green" ideas of cities, in favour of the newer generations. Finally, the health of residents may benefit significantly from frequent engagement in outdoors activities and availability of healthy and natural food, whose production does not rely on the use of chemicals and pesticides (Camps-Calvet, et al., 2016; Garcia et al., 2018; Dobson et al., 2020). Although common sentiment holds that urban gardens are a contemporary invention, their presence within cities traces back to rather distant roots. While before the industrial era many European cities did frequently host vegetable gardens within urban areas, the growth of urban agglomerations and the presence of mass migration flows from the countryside to the city eroded the availability of arable land. The share of farming land within urban areas dropped drastically during the 1900s. At the end of the century, the first urban garden projects were born, aiming to reintroduce a somewhat consolidated earlier tradition (Keshavarz & Bell, 2016).

Recent contributions point to the potential for growth featured by urban gardens, that proved to be valid food provision sources (Edmondson et al., 2020; Mcdougall et al., 2020). Moreover, as urban gardens are typically managed by non-professional farmers who tend to employ traditional and 'green' farming methods, they are likely to contribute to increasing organic farming output at the local level. Although this relationship has been often hinted at by the literature (Barthel & Isendahl, 2013; Rusciano et al., 2018), little effort has been made up to present to the best of our knowledge to estimate empirical the impact of urban gardens on organic farming.

Based on the above, this article aims to establish a relationship between urban gardens and organic farming, using NUTS-2 data for Italy, spanning from 2011 to 2019. To do so, we propose a panel data regression. In particular, the hypothesis we seek to test is the following:

H_1: The diffusion of Urban Gardens increases the share of Organic Farming output

Should H_1 be confirmed by the data, the role of urban gardens in driving the ecological transition through the agri-food transition would have to be acknowledged. The rest of this article is organised as follows: Section 2 introduces the empirical strategies employed, Section 3 describes the main features of our dataset, Section 4 lays out and comments our results and Section 5 offers our final considerations and concluding remarks.

2. Methods

To provide an empirical assessment of the research question, panel data regression is employed. If the data available cover several individual units across multiple periods, panel data estimation techniques represent the most suitable approach to establishing causal relationships. In the presence of panel data, two main models may be employed, depending on the assumptions made on the characteristics of the error term.

$$y_{it} = \beta_0 + \beta_1 x_{1it} + \beta_2 x_{2it} + \cdots + \beta_K x_{Kit} + u_{it} \quad (1)$$

$$u_{it} = \alpha_i + \varepsilon_{it} \quad (2)$$

Where the dependent variable y_{it}, measured for unit $i = 1,2,\dots,N$ and period $t = 1,2,\dots,T$ is explained by a set of K covariates x_{kit} and by a composite error term u_{it}. The error term contains an individual effect α_i and an idiosyncratic component ε_{it}. Either fixed or random individual effects may be assumed.

The main hypothesis that guarantees the consistency of the estimators for $\beta_k,\ k = 1,2,\dots,K$ is (weak) exogeneity. In the panel data context, this assumption translates into $cov(x_{kit}, u_{it}) = 0$ for each $k = 1,2,\dots,K$. Given the composite nature of u_{it}, this hypothesis implies two equalities, namely: 1) $cov(x_{kit}, \alpha_i) = 0$, meaning that observable individual characteristics are uncorrelated with induvial effects and 2) $cov(x_{kit}, \varepsilon_{it}) = 0$, meaning individual characteristics are uncorrelated with the idiosyncratic component. While hypothesis (2) is very similar to the main assumption of the cross-sectional case, falling back into the category of standard weak exogeneity, hypothesis (1) is more demanding, in that it requires the individual effects to be independent of the characteristics.

The Fixed Effects estimator requires only hypothesis (2), since it removes the individual effects (assumed fixed) by demeaning all the variables in the model. Conversely, the Random Effects estimator requires both assumptions. While the Fixed Effects estimator is more robust (since it imposes fewer restrictions on the data), the Random Effects estimator is more efficient, as it uses the information available at full (without having to remove any piece of information). In econometric practice, the choice between the two estimators is based on the Hausman test. Under the null hypothesis of the test, the two estimators return very similar results. If hypothesis (1) fails to hold however, the Fixed Effects estimator will still be consistent, while the Random Effects estimator will not, producing a difference between the estimates produced by the two estimators.

Empirically speaking, the Hausman test is based on the following statistic:

$$H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' V[\hat{\beta}_{FE} - \hat{\beta}_{RE}]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE}) \quad (3)$$

Which is distributed as a χ^2, with a number of degrees of freedom equal to the number of observations minus the covariates used in the model. If H exceeds the threshold value of the χ^2 distribution, the null hypothesis is rejected, meaning that the Fixed Effects estimator should be preferred.

3. Data

In order to tackle the research question proposed in this work, we use Istat data disaggregated at the NUTS-2 level, covering the 2011-2019 timespan. The period of analysis was selected based on data availability. The regions considered cover the entire national territory and amount to 21, since the two autonomous provinces of Trento and Bolzano are considered separately, thanks to the availability of fine-grained data. The main characteristics of the dataset are displayed in **Table 1**.

Variable	Obs	Mean	Std. Dev.	Min	Max	Source
Organic Farming	189	0.04411	0.03871	0.00446	0.1654	Sinab
Urban Gardens	189	0.000407	0.000445	0.00000	0.00161	ISTAT
GDP	189	24916.16	6898.086	14507.81	41268.01	ISTAT

Tab. 1: Descriptive Statistics

The variables used are defined as follows:

- *Organic Farming*, which constitutes the dependent variable of this work, is measured as the share of organic products in monetary terms over total agricultural output at the regional level. This information was obtained from Sinab (Sistema Alimentare dell'Agricoltura Biologica).
- *Urban Gardens*, which represents the covariate of interest in this study, is calculated as the share of the municipal territory devoted to urban gardens, either traditional or vertical. This information was drawn from either the "Verde Urbano" yearly reports or the "Ambiente Urbano" reports.
- *GDP*, a key control included in order to avoid omitted variable bias, is defined as the natural logarithm of per capita GDP at prices of 2015. This variable captures both the size of the regional market and the availability of resources at the local level. Data on GDP were drawn from Istat.

From a qualitative point of view, plotting the series of Organic Farming and Urban Gardens at the aggregate national level, a clear positive co-movement emerges (see **Figure 1**), potentially suggesting a positive association between the two variables. Empirical estimation techniques however must be used in order to disentangle correlation from causal relationships.

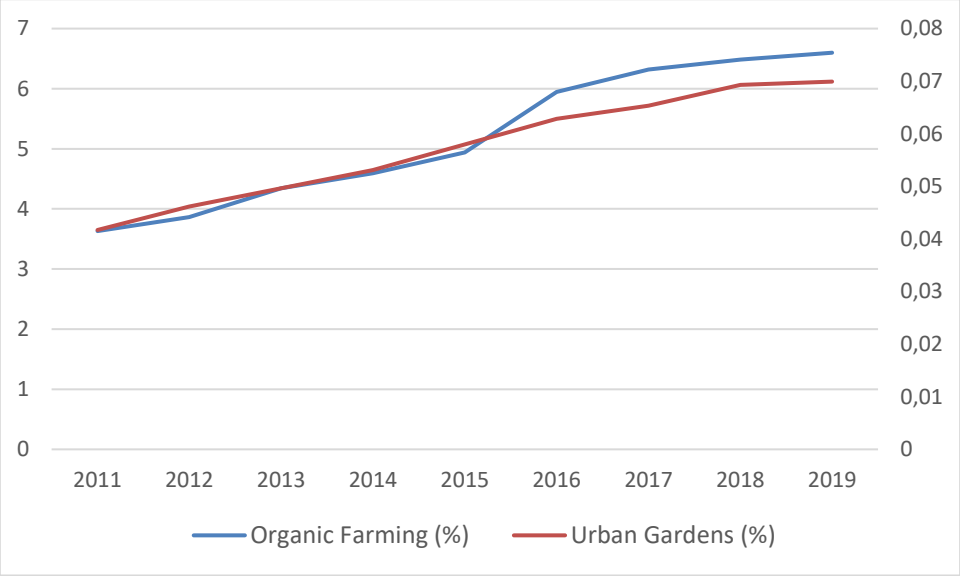


Fig. 1: Organic Farming and Urban Gardens in Italy (2011-2019, percentages). *Source: original elaborations on data provided by ISTAT and Sinab*

A clear regional heterogeneity emerges across the years in terms of diffusion of Urban Gardens. The spatial distribution of the phenomenon is mapped in **Figure 2.**

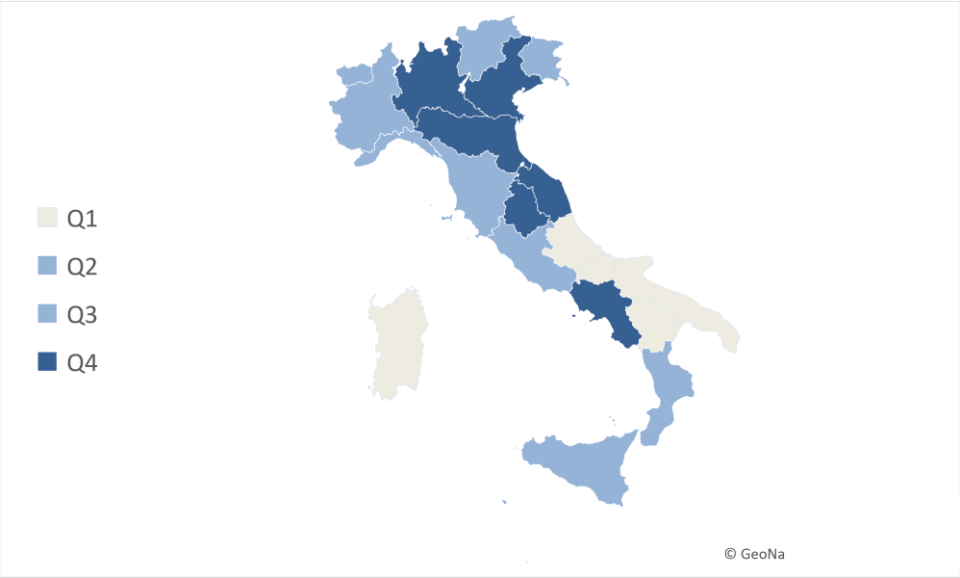


Fig. 2: Urban Gardens in Italian Regions (Quartiles, 2019). *Source: original elaboration on Sinab Data*

4. Results

The results of the empirical analysis are displayed in **Table 2**. The Fixed Effects and the Random Effects estimators both return a positive and significant coefficient for the *Urban Gardens* variable. In other words, clear evidence emerges in favour of the idea that increases in the share of urban land devoted to urban gardens contribute to smoothing the ecological transition across Italian regions, through an increase in the share of organic farming over total farming output. This result is significant at the 1% level whatever the specification assumed. Both models then confirm research hypothesis H_1.

While the main finding is the same across specifications, it is important to highlight that the coefficient associated with the *GDP* variable is positive and significant only in the Fixed Effects model. A positive coefficient indicates that the wealthier the region, the larger the share of organic farming, possible through an Environmental Kuznets Curve Effect (Sarkodie & Strezov, 2019). Moreover, the adjusted R^2

of the two models is very different, with the Fixed Effects model exhibiting a much larger value, approximately equal to one third. In other word, about one third of the variability of the dependent variable is explained by the model. This value is especially high, given the very small amount of covariates considered.

Dep Var: Organic Farming	Fixed Effects	Random Effects
Urban Gardens	2,297.807	2,472.169
	(653.895)***	(657.313)***
GDP	14.058	-3.456
	(3.650)***	(2.112)
Time Dummies	Yes	Yes
_cons	-138.284	38.252
	(36.738)***	(21.235)*
R^2	0.33	0.13
N	189	189

Tab. 2: Estimation Results. Note: * *p*<0.1; ** *p*<0.05; *** *p*<0.01

While these considerations point to the Fixed Effects estimator as the better choice, it is still necessary to run the Hausman test, in order to decide between the two alternatives. The result of the test is shown in **Table 3**. The test rejects the null hypothesis, under which the Random Effects estimator is consistent. As a result, the Fixed Effects estimator must be preferred.

Distribution	$\chi^2(2)$
Test Statistic	34.67
P-value	0.000

Tab. 3: Hausman Test

5. Conclusions

Urban Gardens are a growing phenomenon, whose diffusion has accelerated considerably across European cities over the last two decades. Using recent data, this work has proposed an empirical assessment of the effects of the diffusion of urban gardens on the share of organic farming across Italian regions. The results of the regression analysis proposed clearly indicate a strong link between the two variables, even controlling for GDP and time dummies.

These findings imply that the agricultural production activities that take place within urban gardens should not be seen as an antithesis of the city, yet as a full-blown segment of urban life. Urban food systems are thus fully entitled to recognition and policy emphasis, especially in a period where the themes of the ecological transition have made their way to the policy agenda of the European Commission and of national governments within the EU.

Urban gardens constitute contemporary examples of urban “memory workers,” which help connect citizens with local ecosystems, contributing to creating and reinforcing community identity. Thus, urban gardens add value to the municipal social fabric in three ways: 1) they produce food, carrying out an economic function, 2) they strengthen relational ties among citizens, providing social value and, as proved by this work, 3) they contribute to the ecological transition, which means they entail a positive environmental effect. Overall, these considerations indicate that urban gardens improve sustainability at the municipal level.

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Towards long-term sustainability: design priorities for outdoor green spaces

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Abstract
Within the New Urban Agenda framework, the contribution is in line with Goal 11, making cities and human settlements not only inclusive, safe, and sustainable, but most of all, durable. The paper deals with the adaptive reuse design process for abandoned and degraded outdoor spaces in contemporary cities. Twofold sustainability concepts mark the reactivation of long-term care relationships between settled communities and green spaces: converting urban waste into a community resource and engaging local stakeholders in care. The paper refers to the Play_ACT project (FRA, funding from the University of Naples Federico II). It proposes questionnaire build-tables to realign the UNI EN design requirements with the Goal 11 targets. Focusing on the UNI 1176-1:2018 standard, questionnaires are organised and distributed to semi-expert stakeholders involved in the adaptive reuse process for green outdoor educative entertaining facilities in the Sanità district of Naples. Finally, the paper outlines design priorities, combining users' needs and sustainability targets, lengthening the green spaces' lifecycle through the design process.

Keywords: outdoor green spaces, built environment, design priorities, participatory design, sustainability.

1. Introduction

Released in 2016, the New Urban Agenda [1] is a key instrument for cities' and human settlements' planning and management. By keeping people and spaces within a unitary strategy, the New Urban Agenda supports local governments and all the involved stakeholders to achieve environmental sustainability and social justice [1]. Within Goal 11, the Agenda promotes the creation and maintenance of well-connected and well-distributed networks of outdoor public spaces, multipurpose, safe, inclusive, and accessible. In addition, through 10 Targets and 15 indicators, Goal 11 recognises green and quality outdoor spaces as drivers of social cohesion, inclusion, and safety in peaceful and pluralistic societies (art. 67).
In continuity with the work carried out by United Nations, the European Union is implementing a renewal process for the Urban Agenda. Transferring within an action plan supported by financial measures and technical assistance, the need to overcome conflicts between the built environment and nature is the core of the European Commission Green Deal [2]. Furthermore, the transformative power of cities has been recently emphasised with the Ljubljana Agreement adopted on 26 November 2021 by EU Ministers responsible for Urban Matters [3].
Renaturing urban areas and interweaving green infrastructures within degraded and abandoned outdoor green spaces are emerging demands for planning and managing approaches to dissociate growth from waste and create a just and prosperous society. Design is expected to affect the ecological footprint of cities and their communities, which are responsible for 75% of global emissions, occupying only 3% of the earth's surface while consuming ¾ of global resources [4].
According to international strategies, the paper aims to support local governments and designers with planning tools that can drive the adaptive reuse process for outdoor public spaces. The project

"Play_ACT Playgrounds and Art for Communities in Transition: pact of care for cities", conducted in the Rione Sanità of Naples, explores the potentialities of aligning Goal 11 contents to the EN UNI standards for public spaces adaptive reuse. Furthermore, the research explores design challenges and sustainability impacts in creating well-connected and well-distributed networks of outdoor playgrounds. Long term sustainability depends on a creative and engaging design process that does not end with the realisation but flows into shared maintenance actions [4]. The design concept is summarised in the image below: the Sanità district can be equipped with a network of green playgrounds to educate and engage its younger community in aware care processes (Figure 1).



Fig. 1: The Play_ACT concept. Potential reuse of Rione Sanità outdoor green spaces in Naples

The paper focuses on stakeholders' latent needs, outlining their demands, engagement and empowerment through play. The innovation of the approach lies in inputting into a system the European guidelines referred to urban spaces' sustainability performances and the definition of design requirements supported by the EN UNI standards. A validation is proposed focusing on the EN UNI 1176-1: 2018 standard for outdoor playgrounds. A sample of 100 young semi-experts has been involved in prioritising the contents of the Agenda in terms of requirements for outdoor green educative entertaining facilities.

2. Methods and Materials

The paper adopts the requirements-performance approach [6] to set the design priorities according to the international commitment to sustainability [7]. The methodology is based on discretising and setting up the latest European sustainability guidelines, as expected performances, with international standards for recreational facilities with UNI technological requirements (Figure 2). Questionnaire build-tables support the comparison between requirements and performances; they return design priorities and combine users' needs and sustainability targets to lengthen the outdoor, educative entertaining facilities' lifecycle.

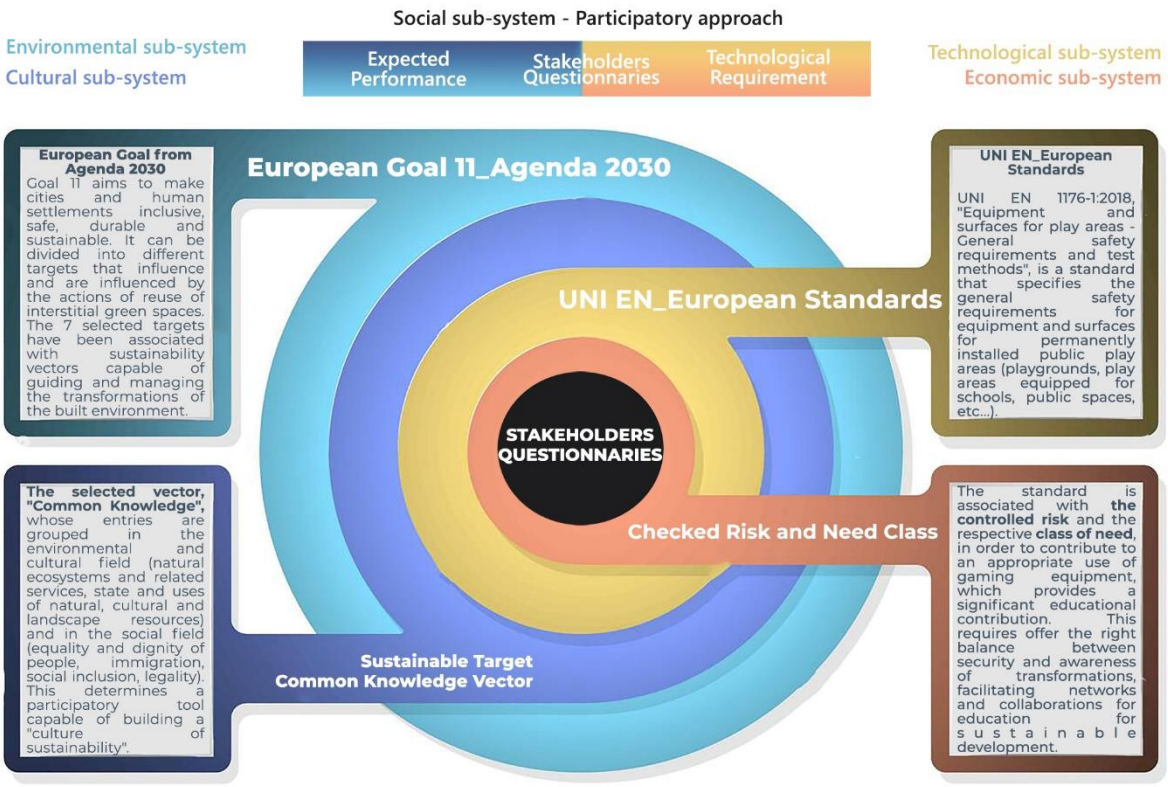


Fig. 2: The methodological approach

The Questionnaire build-tables are pivotal to identifying visions and expectations from a dual transition perspective, comparing the expected environmental and cultural performances with the technological and economic requirements. They aim at promoting the culture of sustainability through participatory approaches devoted to “Education, Awareness, Communication” [8] at all levels (business, civil society, institutions, research) and in all educational venues, formal and non-formal, with a view to life-long learning [9]. Furthermore, the formulation of the questions raises awareness of the transformations, knowledge, skills, lifestyles and virtuous tools of reuse of the built environment, facilitating networks and collaborations between those involved in sustainable development and education for the latter [10;11].

3. Discussion and Results: Architectural Technology between European Goal (Agenda 2030) and European Standards (UNI EN)

3.1 European Goal 11 and Common Knowledge Vector

The New Urban Agenda discretised Goal 11 to make cities and human settlements inclusive, safe, and durable into specific targets. Each of them influences and is influenced by outdoor spaces and educative entertaining facilities. The research focuses on seven targets investigating the most significant environmental, cultural, and social sustainability aspects. The selected targets are: 11.1 (By 2030, ensure access for all to adequate, safe and affordable housing and basic services and redevelop poor neighbourhoods), 11.2 (By 2030, ensure access for all to a safe, affordable, accessible and sustainable transport system, improving road safety, with particular attention to the needs of those who are most vulnerable, women, children, people with disabilities and the elderly), 11. 3 (By 2030, enhance inclusive and sustainable urbanisation and the capacity to plan and manage participatory, integrated and sustainable human settlement in all countries), 11.4 (Strengthen efforts to protect and safeguard the world’s cultural and natural heritage), 11. 5 (By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease direct economic losses relative to a global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and most vulnerable), 11. 6 (By 2030, reduce the negative per capita environmental impact of cities, paying particular attention to air quality and the management of municipal and other wastes), 11.7 (By 2030, provide universal access to safe, inclusive and accessible green and public spaces, in particular for women, children, the elderly and persons with disabilities be associated with a specific vector).

From a participatory perspective, these targets can be associated with “sustainability vectors”, objectives capable of directing transversal fields of action. They can be considered fundamental levers to initiate, guide, manage and monitor the integration of sustainability in policies, plans and projects, in line with the transformative process triggered at the international level by the 2030 Agenda.
Among the five categories of vectors present in the literature, the research works on the most significant one for outdoor green space reuse, i.e. the vector “Common Knowledge” [1]. By linking tools and areas of action and appropriate indicators for monitoring, the latter intercepts objectives to improve the state of knowledge, with particular attention to areas in which a more significant effort is needed to complete the information framework. In particular, the research associates the selected goal targets with the vector items grouped in the environmental and cultural field (natural ecosystems and related services, status and uses of natural, cultural and landscape resources) and in the social area (equality and dignity of persons, immigration, social inclusion, legality). This approach allows the research to reconnect the built environment adaptive reuse issues to the impacts on environmental, cultural, and social sustainability (Tab. 1).

Education, Awareness, Communication			
Environmental and Cultural sub-system			
Expected Performances			Stakeholder Need
Goal 11	Target	Vector “Common Knowledge”.	(Questions?)
On making cities and human settlements inclusive, safe, durable and sustainable	Target 11.1 (By 2030, ensure access for all to adequate, safe and affordable housing and essential services and redevelop poor neighbourhoods)	Social knowledge (equality and dignity of persons, immigration, social inclusion, legality).	Are you satisfied with the recreational facilities in your neighbourhood? Do you think that reusing the outdoor green spaces in your neighbourhood with recreational facilities can impact and alleviate poverty in the area?
	Target 11.2 (By 2030, ensure access for all to a safe, affordable, accessible and sustainable transport system, improving road safety, with particular attention to the needs of those who are most vulnerable, women, children, people with disabilities and the elderly)		Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can increase the area's safety? Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can provide a valuable leisure space for children, women and older people?
	11.3 (By 2030, enhance inclusive and sustainable urbanisation and the capacity to plan and manage participatory, integrated and sustainable human settlement in all countries)		Would you engage with planning the reuse of outdoor green spaces in your neighbourhood? Would you participate in managing outdoor green spaces in your neighbourhood after they have been reused as sites of creativity?
	11.4 (By 2030, Strengthen efforts to protect and safeguard the world’s cultural and natural heritage)	Environmental and cultural knowledge (natural ecosystems and their services, status and uses of natural and cultural resources and landscapes)	Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can help protect the built environment and cultural heritage from degradation? Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can help reduce environmental impacts through outdoor educational functions?
	11.5 (By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease direct economic losses relative to the global gross domestic product caused by disasters, including water-related disasters,		Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can help vulnerable people integrate into the community where they live? Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can help increase the quality of life by providing new areas for economically fragile people?

	with a focus on protecting the poor and most vulnerable)		
	11.6 (By 2030, reduce the negative per capita environmental impact of cities, paying particular attention to air quality and the management of municipal and other wastes)		Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can improve waste management in the implementation area? Do you think that reusing outdoor green spaces in your neighbourhood with recreational facilities can improve air quality in the development area?
	11.7 (By 2030, provide universal access to safe, inclusive and accessible green and public spaces, in particular for women, children, the elderly and persons with disabilities be associated with a specific vector)		Do you think that outdoor green spaces in your neighbourhood, reused with recreational facilities, should become a facility accessible to all? Do you think that outdoor green spaces in your neighbourhood, reused with recreational facilities, could be used by everyone?

Tab. 1: Questionnaire build tables for the development of design priorities (part I)

3.2 European Standards (UNI EN) into creative reuse

UNI EN 1176-1:2018 standard, called “Equipment and surfaces for playgrounds - General safety requirements and test methods”, specifies the general safety requirements for permanently installed equipment and surfaces for public playgrounds (playgrounds, equipped play areas for schools, public spaces, etc...). The standard came into force on 25 January 2018 and is derived from EN 1176-1:2017 (ICS: 97.200.40). This standard was launched by the Technical Committee dedicated to “Sports and recreational facilities and equipment, Playground equipment” and describes the additional safety requirements for playground equipment for all children. It has been developed to fully recognise the need for supervision of young children and less able or less competent children. The requirements of this standard are intended to contribute to the appropriate use and management of playground equipment, which provides significant educational input to child development and/or plays. Therefore it is necessary to identify existing safety issues using different criteria since the ability to deal with a risk depends on the skill level of individual users and not on age. Risk-taking is a characteristic of playgrounds and all environments where children legitimately spend time playing. Providing playgrounds aims to offer children the opportunity to encounter acceptable risks in a stimulating environment of challenge and controlled learning. Playgrounds should strike the right balance between providing risks and keeping children safe from serious hazards.
The principles of safety management apply to workplaces in general and playgrounds. However, the balance between safety and benefits is likely different in the two environments. For example, exposure to some degree of risk in playgrounds may be beneficial because it fulfils a basic human need and allows children to learn about risk and consequences in a controlled environment.
By respecting the characteristics of children’s play and how children benefit from recreation in developmentally appropriate areas, this standard aims to prevent accidents with disabling or fatal consequences. Secondly, it aims to diminish the severe effects caused by an occasional accident that might inevitably occur in children’s attempts to expand their level of competence, whether social, intellectual or physical.
Requirements of significant importance are drawn up, recognising a growing need for play areas accessible to disabled users. It requires play areas to offer the right balance between safety and the necessary level of challenge and incitement to all possible user groups. In addition to the short-term risks associated with playgrounds, there is the risk that the child playing will be overexposed to ultraviolet light. Too much ultraviolet radiation and sunburn during childhood increases the risk of contracting skin cancer. Therefore, playgrounds should be arranged considering the availability of shaded areas.
EN 1176 standard specifies the general safety requirements for permanently installed public playground equipment and surfaces. It addresses playground equipment for all children, young and less able or less competent, to ensure adequate safety when playing in, on or around playground equipment. In addition, the standard considers activities and features known to be beneficial to the well-being of children because they provide valuable experiences that enable them to cope with situations outside playgrounds. This part of EN 1176 applies to playground equipment for individual and collective use by children and to items installed as playground equipment, although not

manufactured for this purpose. The use of electricity in playground equipment, both as a play activity and as a driving force, exposure to UV levels, and playground equipment placed in water, where water can be considered an impact mitigation surface, are not addressed by the standard referred to international considerations. (EN 335 Durability¸EN 350:2016 biological agents and materials; EN 351-1:2007 Classification of preservative penetration and retention; EN 636; EN 818-2:1996+A1:2008) (Tab. 2).

Education, Awareness, Communication			
Technological and Economic sub-system			
Technological Requirements			Stakeholder Need
UNI EN	Controlled risk	Class of Requirement	(Questions?)
UNI EN 1176 -1: 2018 Equipment and surfaces for playgrounds - General safety requirements and test methods (derived from UNI EN 1176 -1: 2017 Sports and recreational facilities and equipment, Playground equipment)	Mechanical resistance to static and dynamic actions	Security	Do you believe the playground should resist the weight and shocks of children's actions?
	Adequacy of the falling space		Do you think the playground should be provided with a children's fall space?
	Absence of emissions of odours and harmful substances		In your experience, have you noticed that the playground may have released abnormal substances and/or odours over time?
	Safe sitting, climbing and descending		Do you believe that playgrounds should ensure interaction between the child and the work of creation through sitting, climbing up and down?
	Limitation of fire spread		Do you think it is essential that the material used to make the playground should not be burnable? Would you, therefore, exclude materials such as wood, cardboard and/or plastic?
	Adequate protection from dangerous situations		Do you think the playground should be designed for hypothetical dangerous situations?
	Integrity for individual or collective use of handcrafted games		Would you be willing to monitor the integrity of the playground should it be handcrafted?
	Surface temperature control	Wellness	In your experience, have you ever been burned, or has a child been burned by a hot playground surface (e.g. slide seat)?
	Controlling colour changes from radiation		In your experience, has the playground discolouration resulted in the child losing interest in playing with it?
	Ease of use and manoeuvring	Usability	Do you think it is essential to be able to move the playground over time and not anchor it to the ground?
	Watertightness and liquid impermeability		In your experience, have you ever been unable to use a playground because it was not waterproof and could not withstand water or other liquids?
	Do not create an obstacle or stumbling condition		Do you think the playground should be placed in a space where there is no passage of people?
	Resistance to biological attacks		Do you think the playground should be made of materials that inhibit the growth of moulds and mosses?
	Ease of intervention	Management	Do you think the playground should be built so that even non-specialised personnel can work on it over time?

	Replaceability		Do you think the playground should be built by assembling several possibly replaceable parts?
	Resistance		Do you think the playground must be built to withstand long-term use and weathering?
	Cleanability		If the playground was easy to clean, would you be willing to take care of it if necessary together with the community?
	Repairability		If the playground was easily repairable, would you be willing to take care of it if necessary together with the community?
	The roughness of surfaces check	Appearance	Would you be willing to point out any problems with the playground surface if they were easily recognisable?

Tab. 2: Questionnaire build-tables for the development of design priorities (part II)

The questions were submitted to a significant sample of 100 stakeholders aware of the Sanità district specificities and involved in the “Play_ACT Playgrounds and Art for Communities in Transition: pact of care for cities”, a project of the FRA research programme of the University of Naples Federico II. They are a selection of a semi-expert sample that was able to simultaneously return the expression of a need based on the expected performance/ requisite downstream of their own experience of playing while living in the neighbourhood. This choice empowers questionnaires dissemination, establishing community engagement for built environment qualities. Below is a graph containing an extract of the questions and answers obtained, stating for each one the relative answers and the percentages and the number of respondents associated with them. Each response was analysed by constructing a pie chart, differentiating the different types of answers by colour. The typology of the answer was based on the choice of a range of 5 possibilities, typical of the Likert scale, which allowed the sample to express an opinion of "certainly, Yes, Enough, No, Absolutely not" (Figure 3).

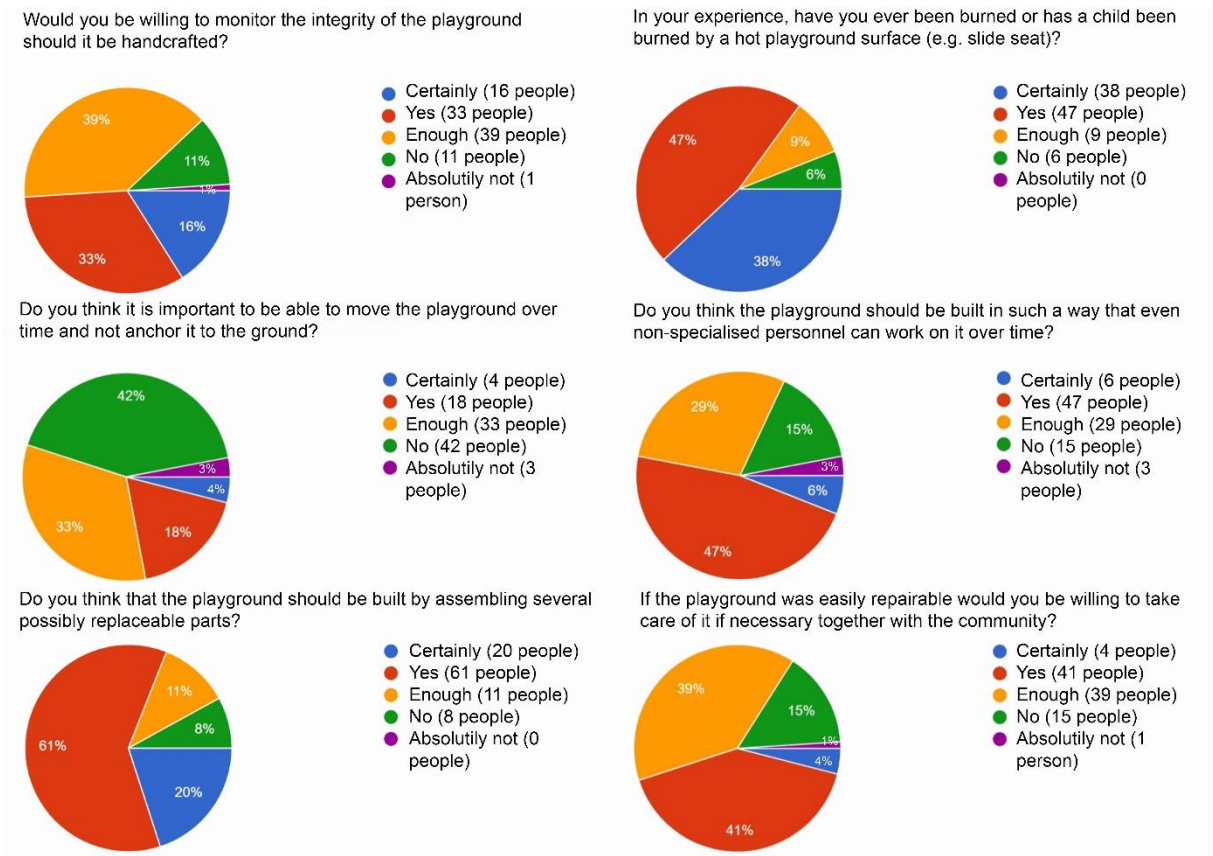


Fig. 3: Extract of questionnaires answers (sample of 100 semi-expert stakeholders)

The results reveal a high degree of dissatisfaction with the creative facilities existing in the neighbourhood (81%), the need to regenerate them to affect the state of poverty (69%) and the safety (85%) of spaces useful for the leisure time of children and the elderly (85%). The need for intervention is also revealed by the stakeholders' readiness to participate in the regenerated space's planning (96%) and management (59%). The sample would be willing to monitor the integrity of the playground if it were handcrafted (88%), preferring assemblable games (81%) on which they could intervene in case of failure (80%) as non-specialised personnel (53%). It stems from considering the reuse operation as a potential tool to protect the built heritage from degradation (76%) and environmental impacts (63%), improving waste management (64%), offering an improvement in the quality of life of the neighbourhood (68%) and the air (51%), as well as an opportunity for integration for the most vulnerable residents (67%). The playground is designed as a facility that is accessible (86%) and usable (77%) by all. Based on their experiences, the sample considers that the playground must have specific characteristics prioritised over others. In particular, the playground that will be built must be resistant to the weight, the impact of the children (91%), liquids (74%), as well as having a space for sitting, climbing, descending (75%), falling (90%) with a controlled surface temperature (85%) that inhibits the growth of mould (77%).

The elaboration of the questionnaire submitted to the stakeholders makes it possible to decode the needs of the answers received, making explicit the orders of priority of the issues recognised as important concerning their own experience. Consequently, the priorities identified by the different stakeholders involved in the decision-making process may give different weights, recognising a separate order of satisfaction of the specificities of the context.

The most significant responses reveal how questionnaires can return a system of priority themes capable of influencing the built environment governance and transformation. In particular, the diagram shows the main concepts on which the sample was asked to express themselves. Each idea is associated with a number that refers to the percentage of the sample that said their order of priority in answering the questions. In red are highlighted the topics that reached a significant focus. Assuming this core set of responses as a priority, which considers both the requirements and performance declared by the experts and the communities' preferences, the contribution identifies the relevant issues that can guide designers towards appropriate implementation choices. Furthermore, this analysis allows the response of the dominant sample to be associated with a particular meaning with a different priority, attentive to the manifest specificities of the context and its inhabitants.

The order of priority has been established on the percentage of respondents who express more than 80% in unison on that particular issue. It suggests that community participation in the planning decision-making process is necessary and that the community is willing to monitor and intervene if the space is built according to specific priority characteristics: the possibility of creating a leisure space accessible to all, especially to the economically weaker communities, which guarantees assemblable games (i.e. composed of parts that can be easily replaced in case of breakage), with surfaces capable of dissipating temperature and fall spaces, resistant to the weight and impact of children (Figure 4).

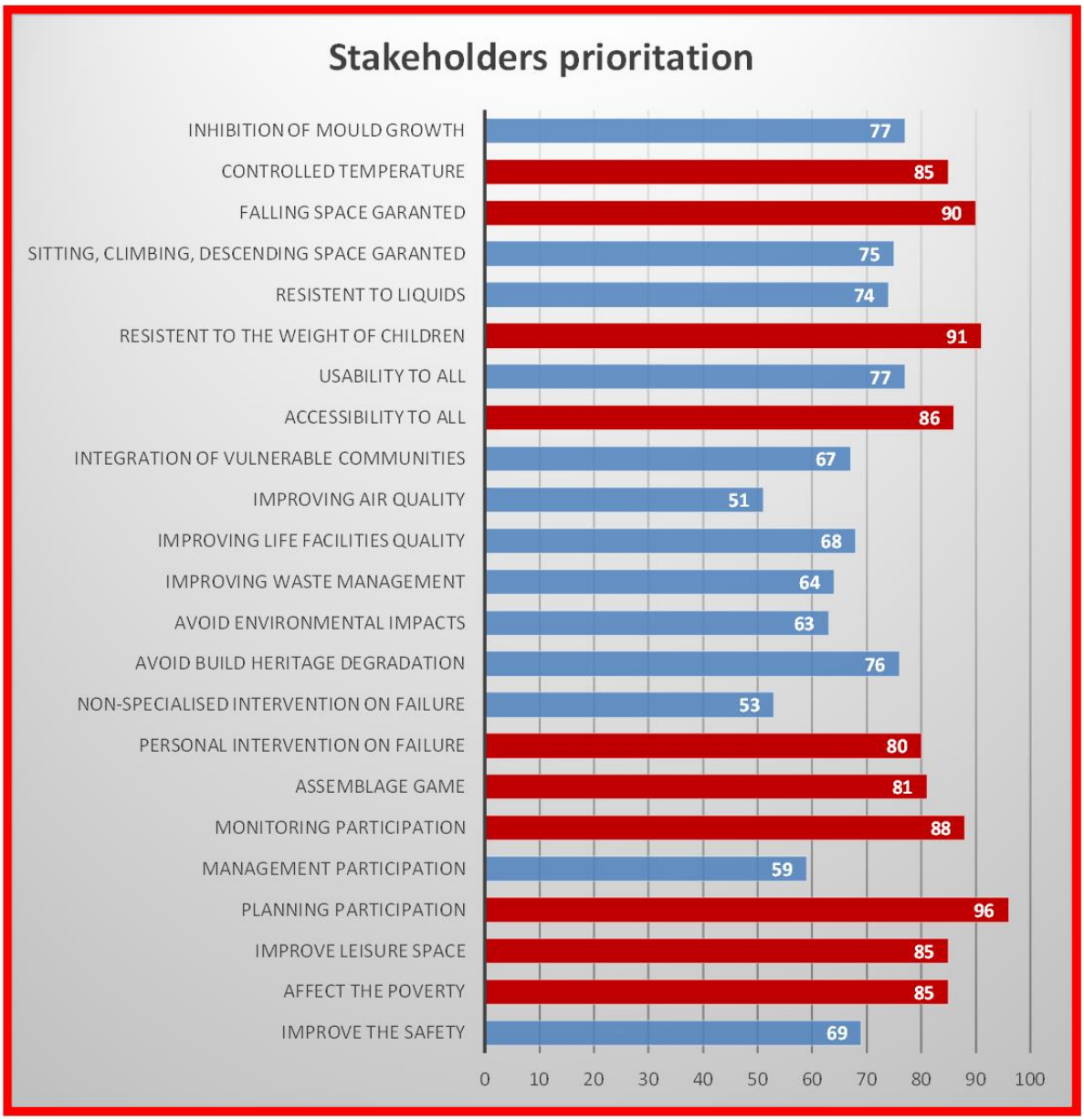


Fig. 4: Elaboration of participatory approach results (sample of 100 semi-expert stakeholders)

Conclusions

The adaptive reuse of outdoor abandoned spaces can make settlement systems attractive, inclusive, and sustainable. Within the Play_ACT research, the paper investigates design priorities for creating and maintaining well-connected and well-distributed networks of outdoor public spaces, multipurpose and accessible. The disused areas of the Sanità district in Naples are the subject of a design approach to verify the engaging potential of outdoor playgrounds for children's growth.

By combining the latest European sustainability guidelines with the technical standards for outdoor spaces, questionnaires are proposed as planning tools that support the definition of stakeholders' priorities. Questionnaires capture and enhance the predisposition of people towards appropriate use of outdoor areas in the long term. Exploring users' opinions improves the comprehension of common mistakes preventing and mitigating degradation and abandonment processes. A key finding from the experimentation is that communities' priorities intersect architectural and urban dynamics with social and cultural sustainability. The performance-requirements approach adopted for the Sanità district can be transferred to other contexts with congruent vulnerabilities and potentials. Empowering the citizenship ethic of responsibility through a shared maintenance process contributes to long-term sustainable development.

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Is Transition Design an alternative way to create sustainable futures? Starting from the differences between recycling and overcycling

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Abstract
Over the past few decades, the academic literature has proposed a vast set of theoretical and applied contributions on the transformations that socio-technical systems need to undergo in order to achieve sustainability. More recently, a new area of study has been emerging, i.e. Transition Design for sustainability, which integrates the current knowledge on sustainable transformations with design theory, education and practice. Transition Design has the potential to address the sustainability agenda more effectively than previous approaches, due to the integration of the ecological dimension into its perspective. Transition Design harnesses ideas and discoveries from a variety of fields, such as physics, biology, mathematics, philosophy, sociology, and organizational development, to catalyze socio-technological change. The ecological perspective provides the insights necessary to conjugate design within complex systems, as a foundation for Transition Design. Based on the above, this paper takes stock of the concepts of recycling and overcycling in order to favor a new design framework based on the concept of zero waste and reuse of materials.

Keywords: circular economy, recycling, reuse, overshooting.

1. Introduction
In 1972 the report 'The limits to growth' (Meadows al., 1972) defined for the first time through simulation models the effects of human production and consumption activities systems on the Earth (Ceschin, 2014). The report sparked a paradigm shift towards sustainable thinking, influencing modern thinking today (Ashby, 2016). Climate change, desertification, loss of biodiversity, global population growth, increased demand for materials (Heiskanen, 2014), growing energy consumption (Ashby, 2016), material price volatility and dependence on raw materials, energy and food, (McKinsey & Company 2013) are just some of the predictions made in 1972 that are gradually coming true.
In this scenario, it is necessary to ask radical questions about the foundations of our way of producing, consuming and living to "satisfy the needs of the present without compromising the ability of future generations to satisfy their own needs" (Meadows et al., 1972). Circular Economy has recently emerged as an economic, environmental and social promise: an innovative, revitalizing and regenerating concept that bases its principles on strategies to decouple growth from resource constraints (Ellen MacArthur Foundation, 2010). In this new economic vision, a crucial role is attributed to design, aiming to prevent, through careful and targeted planning, the waste of resources (McDonough et al., 2002; Elle MacArthur Foundation, 2010; Badalucco, 2013). Novel artifacts which include the concept of service product need to be devised (Manzini et al., 2007; Stahel, 2010). Circular Economy groups together notions such as Industrial Ecology (Frosch & Gallopoulos, 1989), Natural Capitalism (Hawken et al., 2013), Industrial Symbiosis (Frosch, 1992), Bioeconomy, Cradle to Cradle (McDonough & Braungart, 2003), Systemic Design (Wurster et al., 1962) and Blue Economy (Pauli, 2010). Although these theories have been widely discussed by the scientific community, many terms and relationships have not been fully explored

(Kyungeun, 2015). Specifically, the concepts of recycling and overcycling are often placed before each other.
Based on the above, this work aims to fill the gap in the literature. The rest of this paper is organized as follows: section 2 provides a definition of recycling and overcycling. Section 3 presents the similarities between the two concepts. Section 4 discusses the relationship between circular economy and over laundering. Section 5 concludes.

2. Recycling and Overcycling: shedding some light

In this research, recycling refers to the set of operations for the recovery of dissimilar waste materials which ultimately results into the attainment of a hybrid material. Overcycling instead is meant as the set of operations for the recovery of similar waste materials which ultimately results into the attainment of a material equal to the initial one. This section provides a small historical introduction and a comparison between the two terms, before then delving into the relationship between overcycling and Circular Economy.
Recycling implies the recovery of materials at the end of the product's life, reinserting them in the production chain (Heiskanen, 2014), aiming to use them for new industrial products. Recycling activities have been practiced for centuries, especially in periods when raw materials are difficult to find, e.g. during wartime (Peck, 2016). While in developing countries it is still common practice today to reuse materials, especially packaging, in more advanced economies, infrastructures capable of managing huge flows of materials have been created, fueling unsustainable growth. Discarded materials are collected in landfills, usually regulated by bodies that take care of the materials to be recycled on behalf of municipal authorities, before reselling them to organizations that process them to transform them into recycled materials and resell them to producers. Generally, the quality of recycled materials is altered due to various factors, such as the degree of cleanliness of the recycled materials (Heiskanen, 2014), impurities and the combination of materials of the same type but with different technical characteristics (McDonough et al., 2003). The loss of value is almost always caused by inefficiency in the recovery process (Chen et al., 2015) and by unsuitable design.
The notion of recycling is close to that of reuse and the two terms are often confused. Reuse consists in the use of products or components without prior industrially processing aimed at providing them with a new life. Usually reuse occurs in the domestic or in the artistic domain. In the circular economy perspective, reuse is one of the most virtuous cycles for saving energy, materials, labor, emissions and water. On the other hand, talking about recycling is essential, especially at an industrial level, where reuse is not a feasible option, such as in the case of disposable materials, bulky appliances or materials hazardous for human health. Recycling is a complex matter because it can treat materials ranging from the simplest products such as paper up to the most complex, such as mechanical and electronic equipment. For example, a car can be made up of a hundred materials assembled together and each of them can be recycled, while they can hardly be reused. This kind of products are more complex to manage when compared to a simple plastic bottle, usually made using 96% plastic and 4% paper for the label (Yam, 2009). Historically, recycling has been considered a problem related to the management of product waste, while today it is increasingly connected to design. Design for recycling is a design model that favors the facilitation of end-of-life operations of products to contain the ever-increasing demand for materials (Badalucco, 2013). Some tools that the designer uses to take on this commitment are Life Cycle Assessment and Material Flow Analysis and more recently the Material Circular Indicator. The was latter developed by Ellen MacArthur Foundation and aims to maximize the "circulation extension" or the time of each cycle of materials in a circular economy perspective (Ellen MacArthur Foundation, 2012).
The concept of overcycling gained popularity after the publication of the book "From the Cradle to the Cradle: How to Reconcile Environmental Protection, Social Equity and Development" by McDonough and Braungart (2002). In the book the authors refer to *over-laundering* as the process whereby materials are kept within a closed technical cycle to preserve their characteristics and quality over time (McDonough et al., 2003). *Overshooting* instead was used in the context recycling for the first time by Reiner Pilz (Kay, 1994; Kyungeun, 2015), who in an interview in the 1994 Salvo Monthly newspaper states: “Recycling, I call it down-cycling. They smash bricks, they smash everything. What we need is upcycling, where old products are given more value, not less ".
The Ellen MacArthur Foundation calls overshooting ‘pure cycle’ and describes it as "that power to keep the flows of materials pristine, increasing the efficiency of collection and redistribution while maintaining the quality, particularly of technical materials, which, in turn, extends the longevity of the products and increases the productivity of the material "(Ellen MacArthur Foundation, 2012). McDonough and Braungart (2002) identify overshooting as follows: "biological nutrients are useful for the biosphere, while technical nutrients are useful for what we call the technosphere, industrial process systems. [...] Products can be made either of materials that biodegrade and become food for biological cycles, or of technical materials that remain in the closed-circuit technical cycle, in which valuable nutrients for industry continuously circulate. […] A technical nutrient is a material or product that has been designed

to go back into the technical cycle, into the industrial metabolism from which it comes. [...] Some of them are toxic, but others are valuable nutrients for industry that are wasted [...] in landfills. Isolating them from biological nutrients allows them to be overcycling rather than recycled - maintain their high quality in a closed-loop industrial cycle".
Overcycling processes aggregated to functional service models, where producers or retailers always retain ownership of their products and, where possible, act as service providers by selling the use of products and not their consumption (Manzini & Vezzoli, 1998) represents a key solution for circular economy models. Walter R. Stahel in his book "The Performance Economy" also states that in the future, thanks to smart materials, it will be easy to recover materials, allowing companies to easily switch business towards service products, thus maintaining functional profit for the entire useful life of materials (Stahel, 2010).

3. Recycling and Overcycling: similarities and differences

Recycling and overcycling aim to recover materials that would otherwise be lost, causing social and environmental degradation. Recycling and overcycling are multisectoral concepts, and a design of the entire supply chain and the prediction of the various transformations that the material undergoes, must be considered from the beginning (McDonough et al., 2003; Stahel, 2010; Badalucco, 2013; Ellen MacArthur Foundation, 2013; Ashby, 2016). To maximize recovery, this transformation must embrace systemic design, allowing for easy upgrade, product disassembly and product reassembly. The substantial difference between the two concepts lies in the quality of the output. In fact, overcycling, unlike recycling, aims to preserve the initial quality by processing similar waste materials that generate a material with the same technical characteristics originally possessed. As overcycling is not a practice widely implemented at the industrial level, designers have little practical experience in this field. Defining a strategy for products that can be overcycled requires notions that cover the entire production chain and that span beyond the simple choice of shapes and materials. Smart materials represent a concrete possibility to recognize materials and to reduce dispersion through embedded sensors, allowing service providers to better plan collection and selection, avoiding waste (Ellen MacArthur Foundation, 2016). Other aspects, such as economic and ecological considerations, are of essential value to outline the differences between recycling and overcycling. The economic benefits of both approaches depend mainly on the comparison of the economic and environmental cost of the extraction, processing and transport of the virgin material (Heiskanen, 2014). However, since overcycling does not reduce quality over time, it can be considered more advantageous than recycling or usage of raw materials.

4. Relations between circular economy and overcycling

Some contributions firmly argue that the overshooting is one of the essential aspects for a true circular economy (Ellen MacArthur Foundation, 2013; McDonough and Braungart, 2003). Chen et al. (2015) on the other hand claim that it is only an ideology and that today it is not possible to carry out the overcycling of materials due to transformations and decreases of quality imposed by the workmanship. Today it is difficult to implement a process that aims at the overcycling of all materials. Undoubtedly, however, policies for the recovery of materials through functional service models could facilitate this concept. Furthermore, such strategies would facilitate users, no longer being in charge of dealing with materials they are unable to manage and on the other hand, companies could recover useful materials for reuse while maintaining possession of the materials (McDonough et al., 2003; Manzini et al., 2007). In this way, companies would be able to decouple growth from resource constraints (EMF, 2010).

5. Conclusions

This study contributes to an initial analysis for the concepts of recycling and overcycling. Further research for a broader understanding of these two concepts and their application is needed. The results indicate that for the realization of a circular economy, both concepts are valid. The knowledge of these issues by designers and decision-making groups could positively influence the operating system of companies, territories and social contexts. A virtuous design is based on reuse, redistribution and regeneration of products but to get closer to the absolute reduction of waste, a design that considers some variables is also necessary, such as the use of materials unsuitable for the health of users for consecutive cycles of use (Chen, 2015). Project tools such as Life Cycle Assessment, Material Flow Analysis and Material Circular Indicator can facilitate systematic planning. Indicators or indices that also consider other factors such as the creative reuse of the product user, or the reuse of waste materials by recovery communities for social as well as economic reintegration should be considered and deepened.

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The Grand Tour UNESCO in the Piedmont region. A slow travel route across "in between" territories, to improve the accessibility of places in cultural landscapes

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Abstract
In the time of the ecological transition, special attention should be focused on the fruition and accessibility of the landscape and cultural heritage for sustainable touristic purposes, which require new approaches and new strategies for inner and marginal places and their often forgotten landscapes. This paper introduces the initiative of the Grand Tour UNESCO in the Piedmont region, inserted in a broader project of connecting the Italian UNESCO sites by slow routes (in collaboration with the Italian National Commission for UNESCO), that aims at enhancing slow connections through the landscape focusing in particular to the territories "in-between" the UNESCO sites, as a sustainable travel mode to access also the less travelled tracks in the inner places. This paper shows how the Grand Tour has been defined on the basis of a complex territorial strategy, which relies on the rediscovery of remote and minor places, which are the most extraordinary and somehow less exploited, widespread, components in the Italian landscapes. The Grand Tour in Piedmont is a 660 km long route, completely drawn within the existing road/bike network of existing roads. It enables more efficient slow connections among the sites of the World Heritage List (WHL), Man and Biosphere (MAB), Geopark and Creative cities localized in the Piedmont Region. The strategy also considers accessibility and mobility issues, by promoting intermodal connections with railway stations, through which many centers and also villages are reachable, with benefit not only for tourists but also to inhabitants and with specific reference to the UN Sustainable Development Goals (SDG 3, 9 and 11).

Keywords: slow tourism, bicycle route, UNESCO, Piedmont, mapping.

1. Introduction
The slow-travel experience through the landscape, from a tourism perspective, has gained increasing interest across Italy in the last decade, due to the development of new forms of tourism, such as the experiential one, that put the direct experience of places at the center of the tourist products, but also in relation to a major and spread sensitivity related to the environmental issues which today affect our planet [1] [2]. In the ecological transition period, special attention should be focused on the fruition and accessibility of the landscape and cultural heritage for sustainable touristic purposes, which require the development of new territorial strategies for the enhancement of inner and marginal places and their often forgotten landscapes.
The current research aims at showing the initiative of the "Grand Tour UNESCO in Piedmont region", inserted in a broader project of connecting the Italian UNESCO sites by slow routes (in collaboration with the Italian National Commission for UNESCO), that aims at enhancing slow connections through the landscape focusing in particular to the territories "in-between" the UNESCO sites, as a sustainable travel mode to access also the less travelled tracks in the inner and often fragile places [3]. The paper will first introduce the territorial strategy that led the initiative and then will show how that strategy fits the real consistency of the places.

2. The Grand Tour UNESCO in Piedmont: a territorial strategy for enhancing in-between territories

The project is centred on the Piedmont Region, where many places of extraordinary historical, environmental and landscape value have been recognized by UNESCO in the World Heritage List (WHL), Man and Biosphere (MAB), Global Geopark (UGG) and Creative Cities Network (UCCN). The extraordinary richness of heterogeneous places which are located in this territory has led to the creation of a whole slow mobility route, named “Grand Tour”, that, on the one hand, allows to link the UNESCO sites and, on the other hand, can foster the enhancement of the so-called “in-between” places, which are the distinctive feature of the Italian landscape.

2.1 The territorial strategy

The territorial strategy, which has led the project, has been defined according to three main points;
the first aspect concerns the role of the slow-mobility route, as a linear element that enables the linking of heterogeneous places in a comprehensive territorial vision. Indeed, on the one hand, there are the UNESCO sites, which have a high popularity and are frequented by most visitors; on the other hand, there are places that are less known, but equally beautiful, which need to increase their level of attractiveness, in terms of tourism.

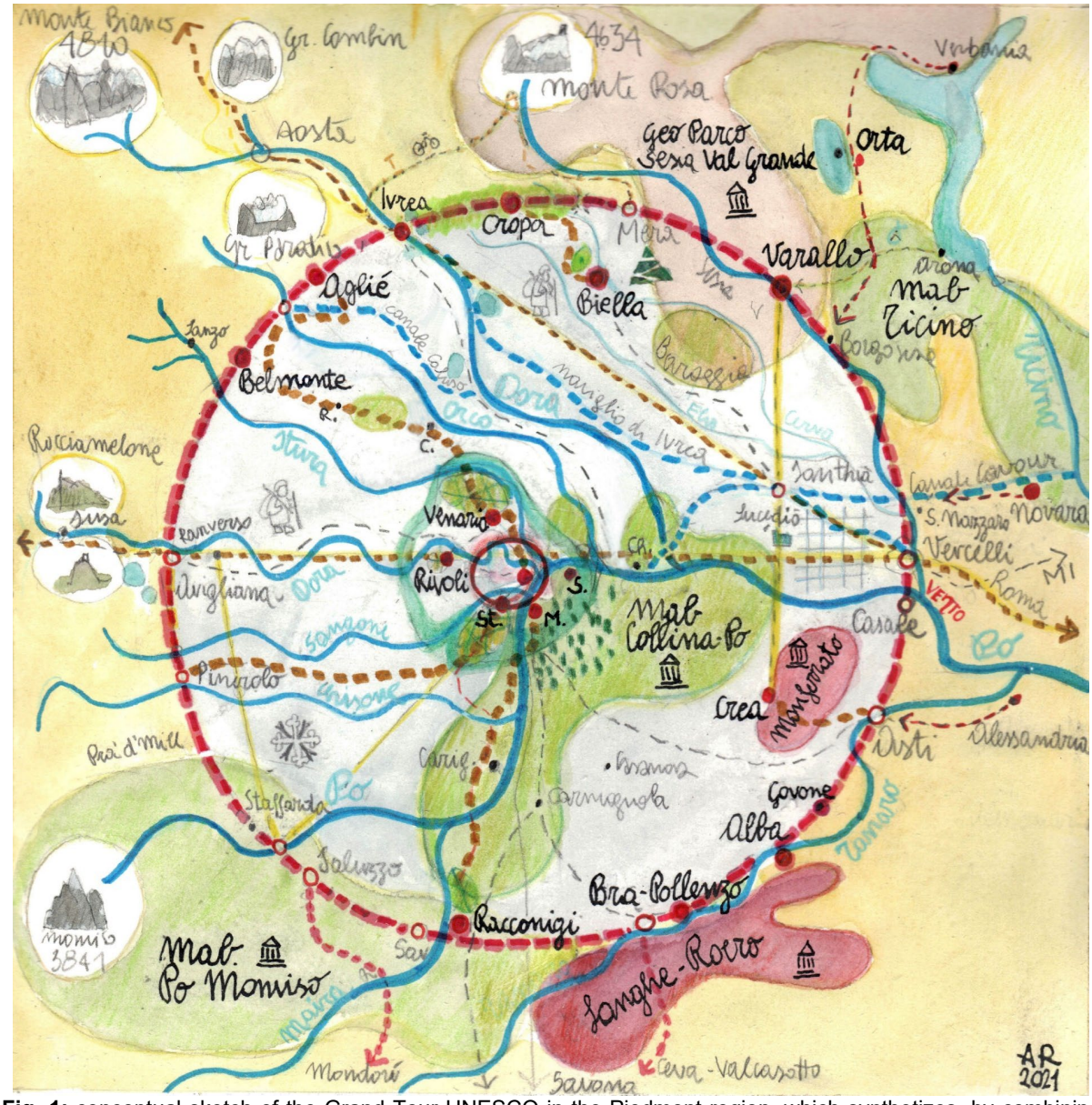


Fig. 1: conceptual sketch of the Grand Tour UNESCO in the Piedmont region, which synthetizes, by combining iconic and symbolic language, the territorial strategy which concerns a ring connecting places across the Piedmont region. Drawing by Andrea Rolando.

The second aspect concerns the strengthening of the network of the different UNESCO sites (WHL, MAB, UGG and UCCN), with the main aim of reducing the overpressures in the most frequented places and promoting more balanced use of the places across the entire territory [4]. In this sense, the slow route between the UNESCO sites put the travel experience at the centre of the whole project.
The third point concerns the potential of sustainable tourism, which can play a fundamental role in the enhancement of inner and fragile territories of the country, particularly referring to the UN SDGs 3, 9 and 11 [5]. Those territories, which are rich in natural and cultural resources, according to the national strategy for inner areas of the country [6], deserve to be enhanced from a touristic point of view, which can take advantage of both inhabitants and tourists.

2.2 Key design principles

According to the main territorial strategy, some key design principles have been taken into account to define the route. First of all, it is important to underline that the route was conceived with the aim of creating a unique territorial figure, in order to make it recognizable as a tourist product, inserted in a wider project of territorial development. The route was conceived as a “ring”, which provides a cross-section of the landscape, which allows experiencing different places related to nature, history, culture, food, arts and literature, as it has been conceptualized by the sketch (Fig.1). Furthermore, the route, as a way to access places by bicycle or on foot, was conceived to be a scenic route, with special attention to the quality of the space, particularly referring both to the natural and built heritage, but also to the open spaces.
At the territorial scale, the existing components of the landscape, which can be discretized in the form of points, lines and surfaces, have led to the definition of the route. Punctual entities, such as an architecture, a monumental tree or industrial archaeology, but also linear components of the landscape, such as waterways (rivers and canals), tree-lined roads, and areal entities, such as protected areas, woodlands, vineyards, paddy-rice fields, have been taken into consideration as reference entities to increase the level of the pleasantness of the route. In terms of accessibility, the route exploits the existing widespread network of minor and low-traffic roads and the connections with railway stations, in order to foster intermodality between train and bike, encouraging sustainable travel mode. In this perspective, with the aim to get wider accessibility to the main route, bicycle connections from/to the airports localized in the area, and from/to rest areas and motorway exits, which are in the surrounding of the route, have been taken into account.

2.3 The route features

This section concerns the main features of the Grand Tour UNESCO in Piedmont. The route consists of a ring, 660 km long, that extends over the entire Piedmont region. The main route can be divided into four arches starting from the cities of Avigliana, Biella, Casale Monferrato and Racconigi, which are conceived as gates to access to the route. The ideal center of the ring is in the city of Turin, from where it is possible to reach various locations along the route. The widespread network of the regional railways, that innervates this territory, enables the connections from the city of Turin to minor towns, such as Avigliana, Venaria, Rivarolo Canavese, Ivrea, Biella, Santhià, Vercelli, Casale Monferrato, Asti, Alba, Bra, Racconigi, Savigliano, Pinerolo, which are hotspots located along the ring.
The whole ring touches 25 sites/themes, recognized by UNESCO in the WHL, MAB, UGG, and UCCN, distributed across the region of Piedmont, and reachable mainly along the existing minor road network, river banks and canals. The map shows the whole route across the region and the UNESCO network in Piedmont (Fig.2).
The capitals of the provinces, such as Verbania, Novara, Alessandria and Cuneo, are not directly touched by the Grand Tour, but they are connected with dedicated routes, passing through significant places, respectively in Varallo or Borgosesia, San Nazzaro Sesia, Casale Monferrato or Asti, Bra or Saluzzo. As mentioned before, one of the main goals of the project is to ensure intermodal accessibility of the ring through the main gates, which are connected with the railway network and with the nodes of the motorway network (rest areas and motorway exits). They are located along the A32 Turin - Bardonecchia Susa (Avigliana, Rivoli), along the A5 Turin-Aosta (Ivrea, Scarmagno), along the A4 Turin-Milan (Santhià, Villarboit) at the intersection between Turin-Milan and the A26 Voltri-Sempione (Vicolungo), along the A26 (Vercelli, Ghemme - Romagnano Sesia, Alessandria), the A33 Asti-Cuneo (Bra), the A55 Turin-Pinerolo.
Beyond the UNESCO sites, the route allows the experience of different landscapes and many heterogeneous places across the region [7]. Many cities, small towns and historical hamlets, which are of great importance from the historical and artistic point of view, are intercepted by the route; even many places, scattered in the territory, recognized by the Fondo Ambiente Italiano (FAI) are reachable by the main route, such as the castle of Masino and the Manta di Saluzzo. Numerous castles, historic villas and abbeys of great interest are along the route (e.g. the castles of Miradolo, Rivara, Montalto Dora, Guarene, San Martino Alfieri, Lagnasco and Buronzo, the abbayes of Lucedio, Staffarda, S. Nazzaro Sesia and the preceptory of S. Antonio di Ranverso).

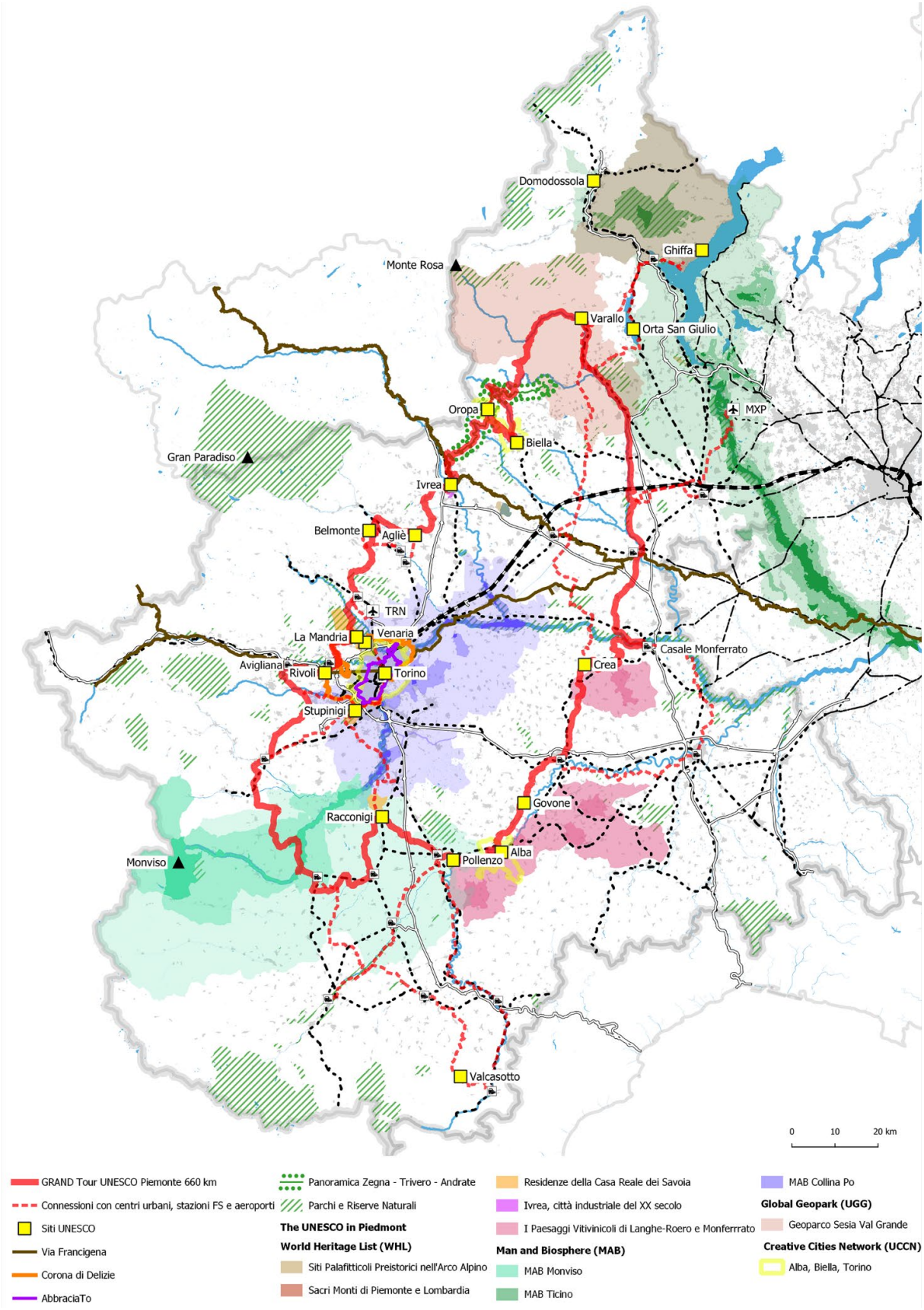


Fig. 2: Map of the Grand Tour UNESCO in the Piedmont region. The map highlights the main route, the UNESCO sites, the protected areas and the connections to the main infrastructural nodes. The Map was drawn by selecting specific geographic data from QGIS software by Andrea Rolando and Alessandro Scandiffio.

The route also intercepts historical routes, such as the Via Francigena coming down from the Susa valley and Aosta valley, but also other slow routes which cross the metropolitan area of Turin, such as VenTo, Corona di Delizie and Corona Verde. The main route also intercepts many different protected areas such as the park of La Mandria, the natural reserve of Vauda, the Oasi Zegna with its panoramic road, the natural reserve of Baragge, the park of Lame del Sesia, the woodlands of Partecipanza di Trino, the park of Po and the lands of the Mauritian Order (Stupinigi and S. Antonio di Ranverso).
From a landscape point of view, starting from Avigliana, the route touches some important nodes generated by the intersections between landscape linear elements (rivers and canals, boulevards, historic routes, railways and other infrastructures) and the route itself. In a similar way, the intersections between the visual perspectives and the route have been taken into account, especially when a point of view over some landmarks is more evident and is worthy of specific attention and valorization. Some important landmarks led the travelling through the Grand Tour. The views on the main peaks of the western alps, such as the Monviso and Monte Rosa, are perceivable from the plain, but also some architectural references such as the Sacra of San Michele and the basilica of Superga which are perceivable from the Reggia di Venaria Reale, the dome of San Gaudenzio in Novara, visible from the plain along the Cavour canal.

3. Thematization of the route

The route is defined according to a specific methodology, which aims at connecting the main highlights of each territory, selected on the basis of their belonging to specific categories (nature, history, architecture, etc.). At the same time, it considers the importance of thematic and transversal readings, which allow for the definition of areas and network like connections among each site, that acquire a broader interest.



Fig. 3: a) Picture in the Oasi Zegna (BI), over the autumn season. The autumn coloring foliage is one of the most attractive stages of the year. b) Picture in the area of Rovasenda (VC), over the flooding of the paddy-rice field in the spring season. c) Picture of the park of contemporary art Sandretto Re Rebaudengo, localized in Guarene (CN). d) industrial archaeology settlement of former Milanese and Azzi factory of concrete, located in Casale Monferrato (AL).

These elements make the itinerary attractive even with respect to specific interests and to define innovative and original paths that intercept different themes throughout different territories, even relatively distant from each other. This are, for instance, thematic itineraries of modern and contemporary architecture (Turin, Ivrea), to see the architectures of Alessandro Antonelli (localized in Castellamonte, Romagnano Sesia, Turin and Novara), of Bernardo Antonio Vittone (localized in Grignasco, Bra and Rivarolo), of Gabetti and Isola (Ivrea and Alba). These connections refer to the presence of tangible memories of the history, but it is also important to consider how some landscapes acquire a particular meaning, thanks to their immaterial presence, through the stories written in the works of writers such the one by Sabastiano Vassalli, for the valleys along the Sesia river, Beppe

Fenoglio and Cesare Pavese which are related to territories of Langhe, Giovanni Arpino in Bra and Silvia Avallone in the Biellese area.

In the same way, the events of the history and culture of industry have defined the shape of the places, building original landscapes that can be named, in a broad sense, productive, with significant examples of the agricultural and industrial landscape. Consider in this key the landscapes of paddy-rice fields, fruit growing, wine and food, now fully recognized also by UNESCO and which are often wisely integrated with the landscapes of the history of the industry (historic canals, railways, hydroelectric plants) by now which have become a heritage of architecture and industrial archeology.

Another key to reading and interrelation of the landscapes crossed by the Grand Tour is that of the agrarian landscapes of food and care, such as those that are still evident today in the great triangle between the preceptory of Sant'Antonio di Ranverso, the entire territory of the farmhouses around the Stupinigi Hunting Lodge and the Staffarda abbey, still belonging to the Order of the Mauritian Hospital in Turin.

The imprints of the territorial transformations produced by some events in the history of industrial culture are also relevant, with actors who have assumed the role of real place makers, capable of generating new landscapes of work and industry: Adriano Olivetti and the Canavese, Camillo Benso di Cavour and the paddy-rice fields, Riccardo Gualino and the factories of concrete; the industrial dynasties of Sella, Piacenza, Zegna, Cerruti and Fila, for the area of Biella related to the textile industry; the marks of Lagostina, Bialetti and Alessi for the home design district in the lower Sesia valley and in the Vercelli area; Ferrero and the food industry in Alba, the whole gastronomic district diffused in the whole Region.

A further element that marks its presence as a real territorial network is that linked to the presence of key figures in the field of contemporary art, through the presence of artists strongly linked to the territory (Michelangelo Pistoletto, Giuseppe Penone, Gilberto Zorio and many others), able to directly mark and define the territory, but also through the presence of important collections visible in the museums, at the foundations and in the open spaces (Gardens of the Reggia di Venaria, Castello di Rivoli, Castello di Rivara, Oasi and Casa Zegna, Fondazione Pistoletto, Sandretto Re Rebaudengo Foundation in Turin and Guarene, Ferrero and Ceretto in Alba and Barolo, Materima in Casalbeltrame etc.).

Finally, the presence of numerous significant places in the history of the built landscape, such as important gardens and parks, is the result of the historical tradition and of contemporary interventions (Miradolo, Agliè, Racconigi, Venaria and Burcina) [8].

4. Conclusion

The contribution has shown the project of the Grand Tour UNESCO in Piedmont, as a territorial strategy to reduce overtourism phenomena on the most frequented places and promote more balanced use of the places distributed across the region, with the aim to support the creation of a widespread tourist-destination offer, year-round. Some points are relevant for a comprehensive understanding of the initiative, particularly in relation to the use of route for different purposes over the year.

First, the whole route, being conceived as a scenic route, enables an overview of the beauties of the Piedmont region: a territorial transect that intersects and merges highlights and minor places, which are relevant from the natural, historical, cultural and landscape points of view. The Grand Tour ring, in this sense, can be considered as sort of sequence shot across the landscapes of the Piedmont Region.

Second, the route has been conceived also with the idea to be ridden with a more specific purpose. As is shown in the previous section, it is possible to apply a sort of “filter” to the reading of the places that are localized along the ring, with the aim to customize the experience through the landscape. In this perspective, the thematic reading can be applied to different fields such as nature, contemporary art, historical or modern architecture, industrial archaeology, literature and film locations, productive districts and landscapes, historical gardens and parks, historical figures and many others.

Third, the great heterogeneity of the landscapes allows using the route according to the seasonality. In the last years, the scenic phenomena related to the seasonal landscapes, such as the spring blooming and autumn coloring in the woodlands, are becoming major of interest in the tourism sector. From this perspective, the Grand Tour touches many environments where these phenomena are more evident. For example, the spring-blooming occurs in some historic parks and gardens touched by the Grand Tour, such as the gardens of Reggia di Venaria Reale, the Rododendron bowl and the park of Burcina, in the province of Biella, the park of the Govone castle, as well as in the productive landscapes of the fruit orchards in the plain between Savigliano and Saluzzo. Even the phenomenon of the flooding of the paddy-rice fields in the plain between the provinces of Biella, Novara and Vercelli is also of high scenic value. In autumn, both the phenomenon of foliage in the woodlands at Oasi Zegna and the coloring of the vineyards, in the Monferrato and Langhe areas, are highly attractive. The knowledge, analysis and parametric mapping of these features of the landscape, also including just in time and geo referred data (precision farming, hydro-geologic management) is of great interest to develop multidisciplinary research and concrete applications of the concept of smartness on a regional scale [9].

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More information are available at: https://www.visitpiemonte.com/it/arte-cultura-e-unesco/tesori-unesco/grand-tour-unesco-bicicletta

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Experiencing places of worship

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Abstract
In three conferences held between ’19 and ’24 (textures, contrasts, colors), the Danish architect Carl Petersen highlighted the connection between the building’s features and the people inside it, but white and pure materials dominated the period. Almost thirty years later, in Experiencing Architecture (1957), Steen Eiler Rasmussen describes several spaces where light, color, shape, and superficial effects directly influence our perception; in this case, the architecture looks hollow and massive. This situation is quite evident in some projects of museums or, even more, in churches. Places of worship represent one of the main typologies during the Twentieth century, first in the sculptural spaces of Le Corbusier, Luigi Moretti, and Jørn Utzon, then in the volumes of Steven Holl or Peter Zumthor.
The wall and the roof play a fundamental role in isolating the internal environment from the context, and today, due to different conditions, public space must become part of the architectural project. From all these references, several ideas and considerations can be drawn, which find their synthesis in a proposal designed for the monumental cemetery of Caltagirone in Sicily, where the public space and the place of meditation become an indivisible unit.

Keywords: experience, place of worship, church, light, cavity.

1. Places of worship in the ‘900
Henry Plummer highlights how light is one of the main constants in architecture[1], an element that transforms any environment into an active experience. Light can hide or highlight, give weight or dematerialize the mass of the building. In religious buildings, this idea has played an essential role throughout the history of architecture; this typology is mainly characterized by structure, mass, form, and materials.
Le Corbusier gives an essential contribution to this topic, especially about the volumes excavated in the 1960s rather than in his first purist works. In the first-period homes, the light has the exclusive task of highlighting the pure volumes, the cuts inside the walls, or the suspended ground floor. In the 1960s, on the other hand, in the Chapelle de Ronchamp (1950-55) and the Monastery of Saint Marie de La Tourette (1959), lighting and mass prevail over everything. He conceives a void in which light generates superficial and emotional effects through its intensity, colors, and mass; it is no coincidence that this period sees the joint work with Costantino Nivola.
It is precisely from the artistic world that architecture draws the ability to influence the observer, thanks to the rediscovery of primitive art. In this period, considerable optimism toward technology prevails. This interest is promoted by the economic boom of the second post-war period and by the success of Mies’s American works. Several authors simultaneously left aside the tectonic concept and worked on plastic forms, generating a renovated language.
Today, the church typology continues in this direction. Light is the first material to build places of worship. The ‘glass church’ (1956-57) by Mangiarotti and Morassutti, the church of the motorway (1960-64) by Michelucci, and the church in Fratte (1968-74) by Paolo Portoghesi and Vittorio Gigliotti all represent a different declination of the same concept: working with light. This article focuses on stereometry and the meanings of geometries excavated in places of worship, tracing their origin and developments in the twentieth century. The images in the paper show a project for a new ecumenical space inside the monumental cemetery of Caltagirone in Sicily (2021), where these concepts are replicated.

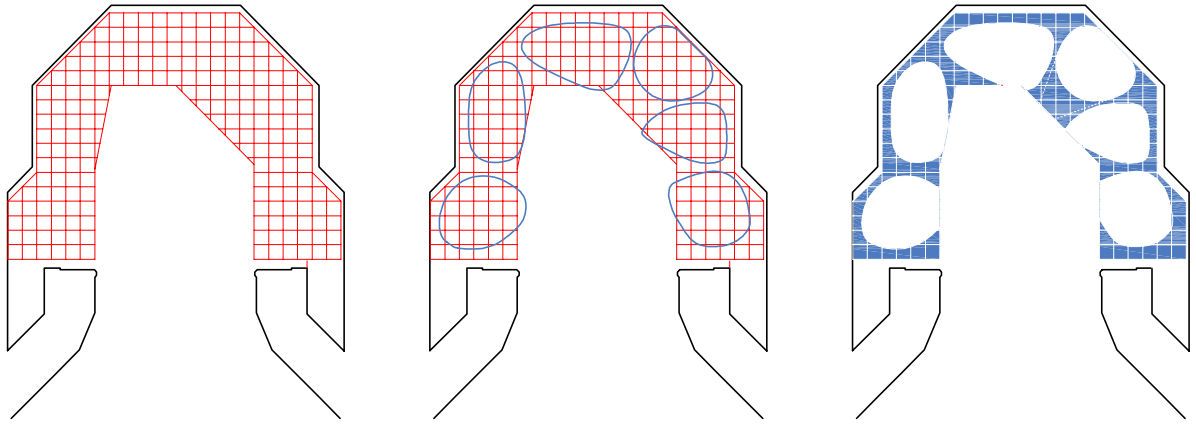


Fig. 1: Construction schemes (Marco Russo, Gilda Antoniello, 2021).

2. Volume and mass erosion. The archetype of the cave

The wall thickness increase inevitably leads us to perceive architecture based on mass and excavation. While the void is elusive in the pavilion buildings, in the excavated architecture, it is dynamic.

This principle is evident in Roman architecture, using thick walls to support domes or vaults. The Pantheon has repeatedly become the primary reference for this way of conceiving space, and Christian Norberg-Schulz indicates it as the foundation of the genius loci in Rome[2]. It is shaped to obtain an "existential space" and represents the image of an archaic Rome linked to the cavities in the hinterland. This iconic construction, comparable to a tholos, transmitted the idea of a space derived from the primitive cave reinterpreted several times over the twentieth century.

Primitive art is at the origin of everything. Sigfried Giedion speaks of a well-defined spatial conception rather than architecture[3]. A space free from a preordained horizontal or vertical axiality will be introduced only with Egyptian architecture. It is interesting to note how Giedion describes the space of the cave as an empty where a 'perpetual darkness reigns'[4]. It was not a dwelling but rather a sacred location where a ritual took place[5]. Within these cavities, we find those 'special active forces' that characterize the void as a place to live an experience that involves all the senses.

The same concept will find great diffusion in the second part of the twentieth century, generating an alternative aesthetic to classical canons. The rediscovery of primitive or aboriginal art, made of rough materials and irregular shapes, radically influenced architecture. Le Corbusier's churches are built on these concepts, thanks to the rediscovery of African art and the artistic partnership with Nivola.

The sixties represent a crossroads in world architectural culture. It corresponds with the resumption of an 'autochthonous' aesthetic and the beginning of an era of great optimism toward technology; both strands will produce their language projecting the focus on stereometric/tectonic dualism; in these two schemes, we can say that the light has a different propagation.

Ernesto N. Rogers identifies the church of Notre-Dame-du-Raincy by Auguste Perret (1922-23) and the Chapelle de Ronchamp by Le Corbusier, both 'unbelievers', the most beautiful Catholic churches of the twentieth century[6]. The first highlights a traditional three-nave layout, where natural light makes the reinforced concrete structure even more slender. In structural frame schemes, the light is almost always diaphanous as in Our Lady of Mercy (1956-57) in Baranzate or static as in the Carr Memorial Chapel in Mies (1952). In Le Corbusier's oeuvre, natural light always plays a fundamental role, but the walls and roof mass affect the light entrance and surface effects. In both churches, it is possible to try a specific experience, but only in the second typology the crossing of the void becomes an experience that is always different and actively dialogues with the outside world. The continuous concavity and convexity allow the visitor to participate wherever he is, both inside and outside. Again, Ernesto N. Rogers, in the description of the work, affirms the affinity of these mechanisms to the Baroque[7], although in this reference the environment remains bound 'analytically in its directions'[8]. In the Chapelle de Ronchamp, the context and 'acoustic' geometries eliminate any directionality or hierarchy. Elements' weight will remain a constant in the last production of the Swiss master, as demonstrated by the works of Chandigarh and in the church in Firminy. Le Corbusier himself provides the link with Roman architecture. If we compare the drawings of Villa Adriana in Tivoli made in October 1910, we find the same spatial expedients of Ronchamp[9].

Le Corbusier takes up these ideas first in the schemes for the Sainte-Baume (1948) and later in the Chapelle de Ronchamp, but, in the Basilique, he works only on the inner space. In the chapel, the experience starts outside thanks to the unexpected concave and convex shapes; the same feeling occurs inside, where the colored light inflames specific settings. Concave and convex geometries modify every element of the construction.

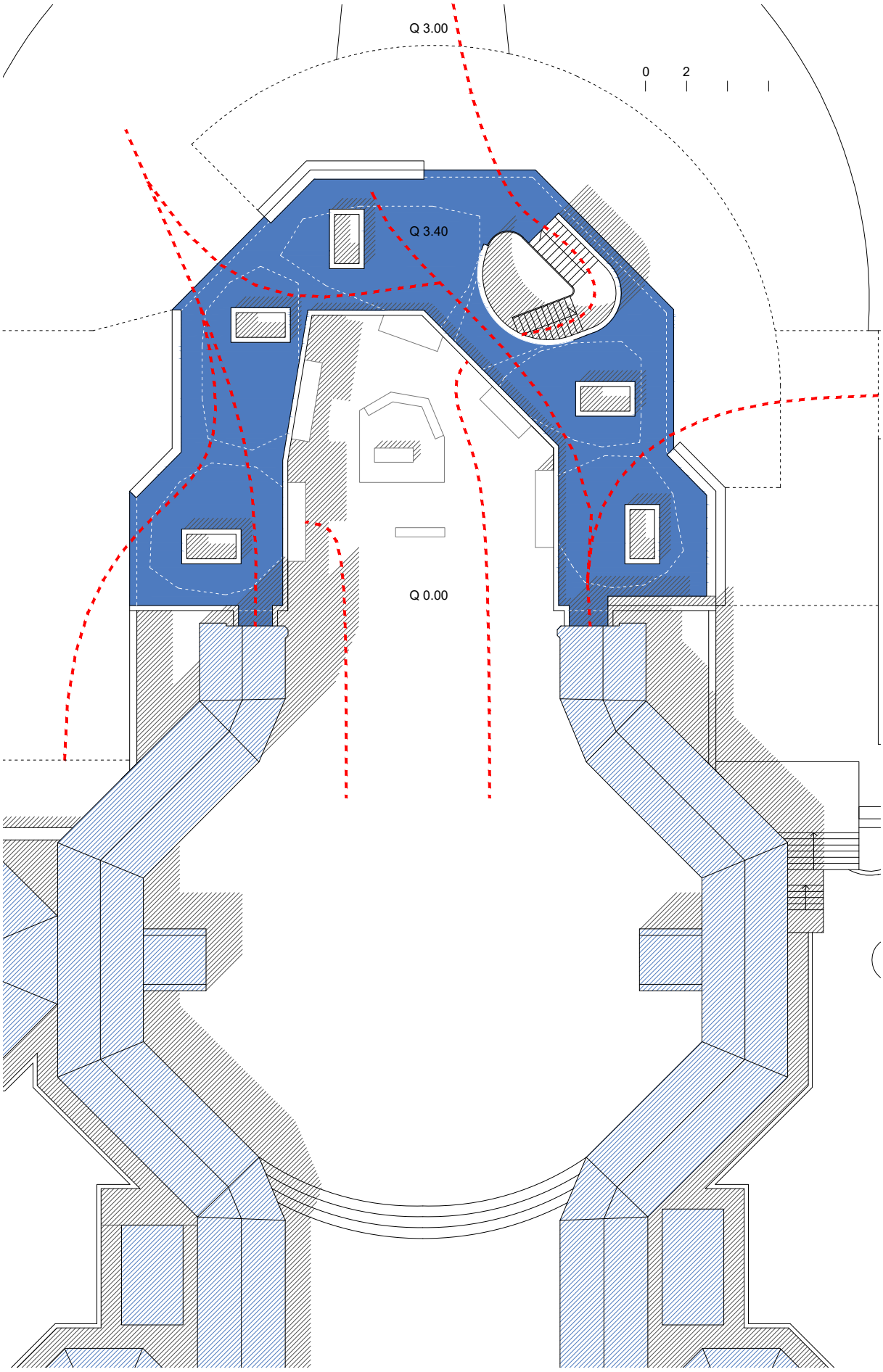


Fig. 2: New addition and new fluxes (Marco Russo, Gilda Antoniello, 2021).

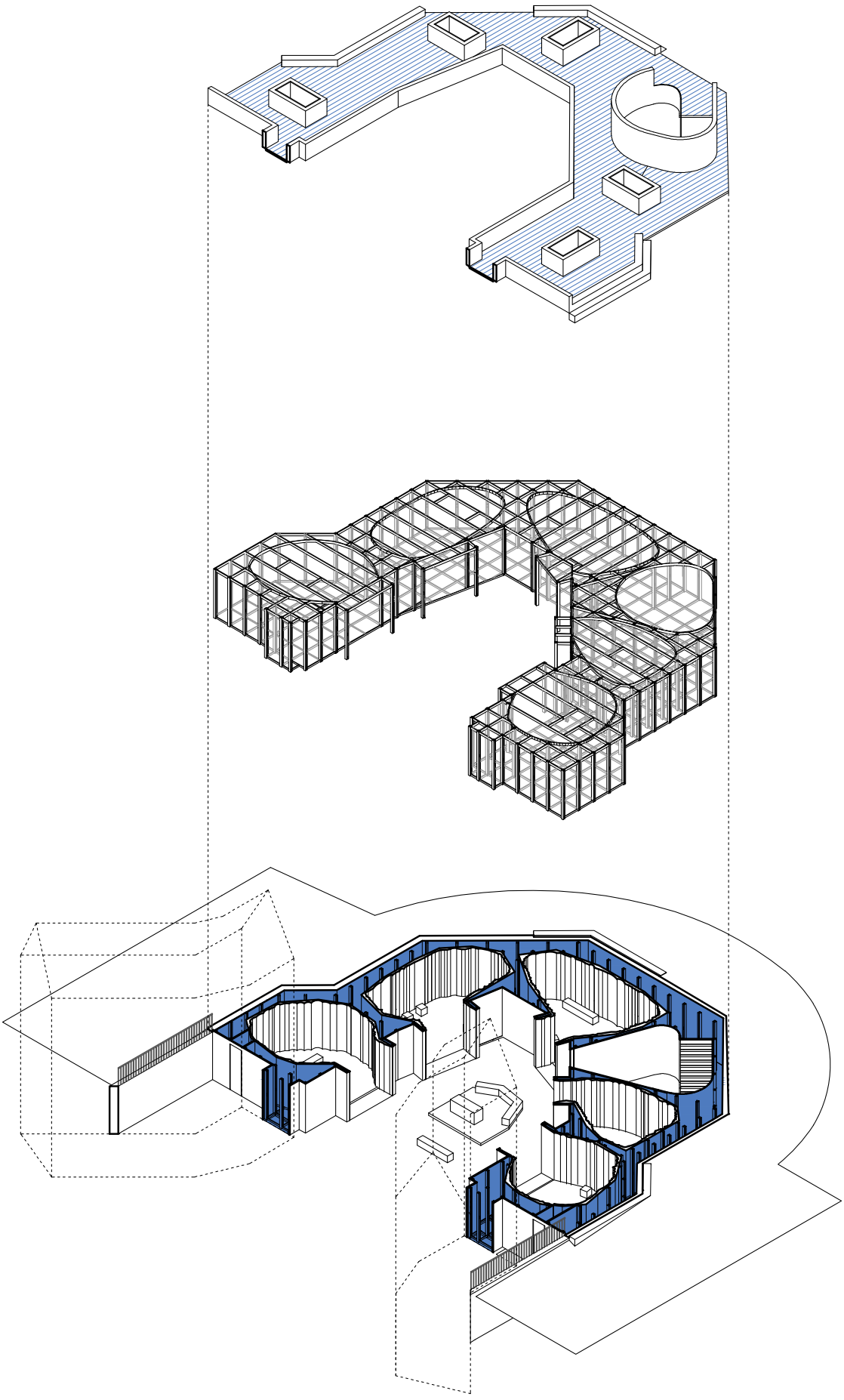


Fig. 3: Wooden inner structure (Marco Russo, Gilda Antoniello, 2021).

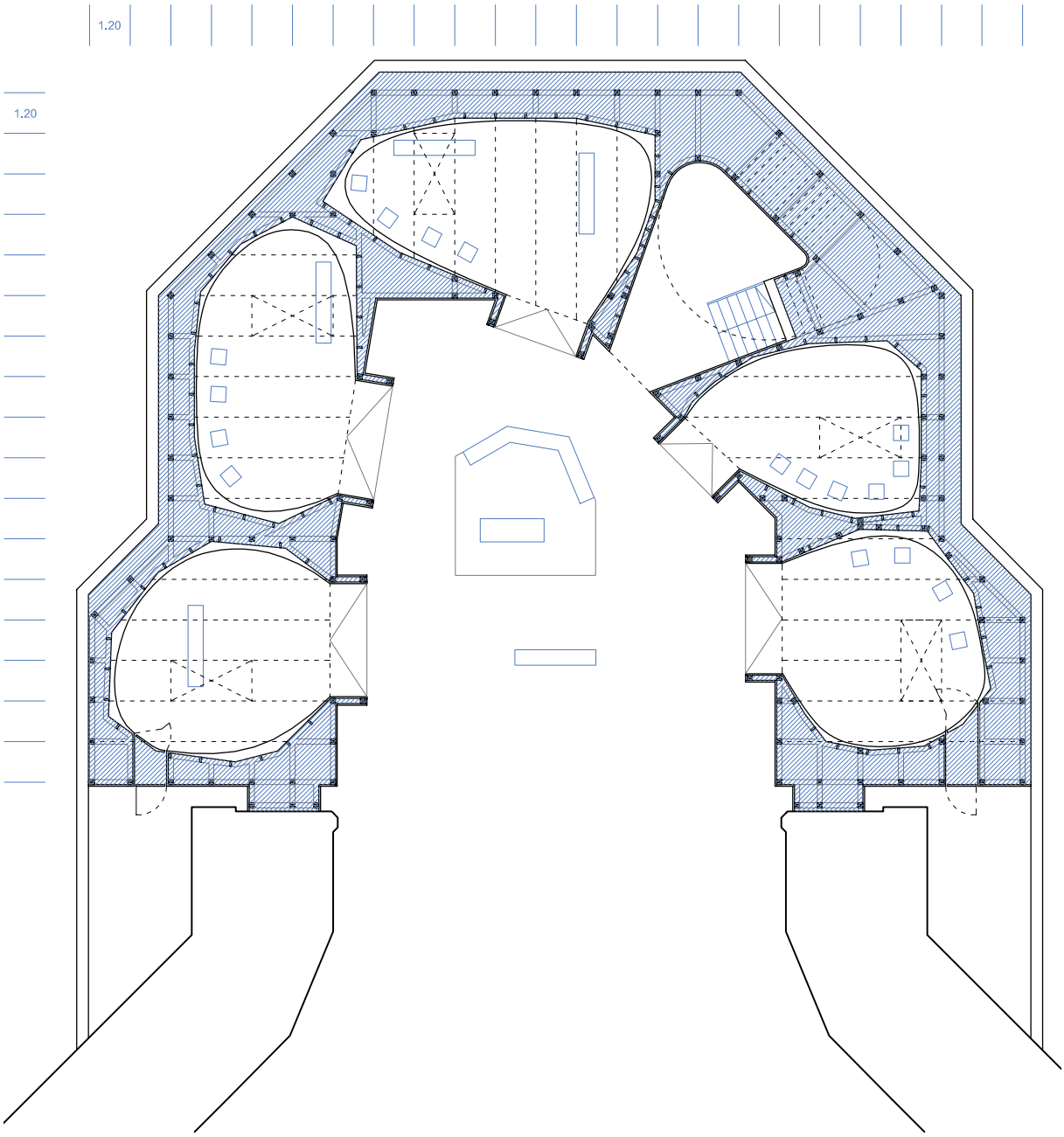


Fig. 4: Cavities (Marco Russo, Gilda Antoniello, 2021).

The roof and the main wall are deformed according to a double curvature geometry and, consequently, their figurative weight and gravity increase. The windows carved into the megalithic wall emphasize the depth of the envelope and the sense of excavation, while a thin slot of light breaks the connection between the roof and the underlying walls.

In the same period, Louis Kahn gave a different vision of Roman architecture starting from the Roman baths schemes; he built an excavated environment starting from precise geometries. In his architecture, the walls always have the same thickness, and their detachment allows us to understand the basic additive logic. He subtracted a perfect sphere from the four reinforced concrete walls inside the Philips Exeter Academy Library (1965-72). The same approach is adopted in the National Assembly Building of Dhaka (1962-83), where the solids are sliced by elementary shapes (circle, triangle, rectangle). A different sensation can be ascribed to the subsequent Kimbell Art Museum (1966-72), where the repetitive space suggests the volumes of the Roman cisterns or the Pompeian shops[10]. In this project, natural light is never direct and becomes an element capable of animating environments in an ever-changing way. However, in his religious buildings, the curved shapes are abandoned in favor of compact geometries, almost eroded by natural light. It directly references Wright's Unity Temple (1905-08). This particular condition occurs in the First Unitarian Church of Rochester (1959-69) and the Synagogue of Hurva (1967). We cannot speak of a perimeter wall or shell since the building is made of mass only because the solid part prevails over the void; this dynamic geometry is obtained from the large gap between the solids. The room's geometry is



Fig. 5: Walkable roof and connection to the existing monument (Marco Russo, Gilda Antoniello, 2021).

always square in the plan, and the light always comes from the four top corners[11].
We find the same work on form and light in contemporary religious buildings. We do not arrive at the monumental dimension of the projects from the sixties, but they demonstrate the possibility to report these concepts to a smaller scale until the pavilion dimension. The space of worship resulting from a manipulation of pure volumes also finds an essential reference in the Church of Saint-Jacques de la Lande by Alvaro Siza (2018). The curved volumes, already used in the Santa Maria Church de Canaveses (1996), compose a complex tridimensional shape that hides a single-nave church. Light is the main element of the interiors, where the monochromatic space is animated only by skylights hidden in the suspended ceiling.
In the Chapel of St. Ignatius (1997), Steven Holl traps seven “bottles of light” on a platform and builds a spatial experience made of form and light. Inside the building, the directionality of the classic buildings disappears, recalling the Piranesian prisons. The sudden volumetric shots make the interior always different, while the light changes the church’s appearance during days and seasons.
In conclusion, Peter Zumthor’s Bruder Klaus Field Chapel (2007) is built in the same direction. The exterior looks like an anonymous monolith in the German countryside, while the interior presents a roughed geometry open to the sky. The visitor enters through a triangular opening and reaches the main space after a few meters; everything is marked by rough concrete created with disposable formwork. Light, plastic forms, and rough surfaces return in a small architecture in which we recognize the influence of the previously described references.



Fig. 6: Closed/Open system. Two solutions from the same initial scheme (Marco Russo, Gilda Antoniello, 2021).

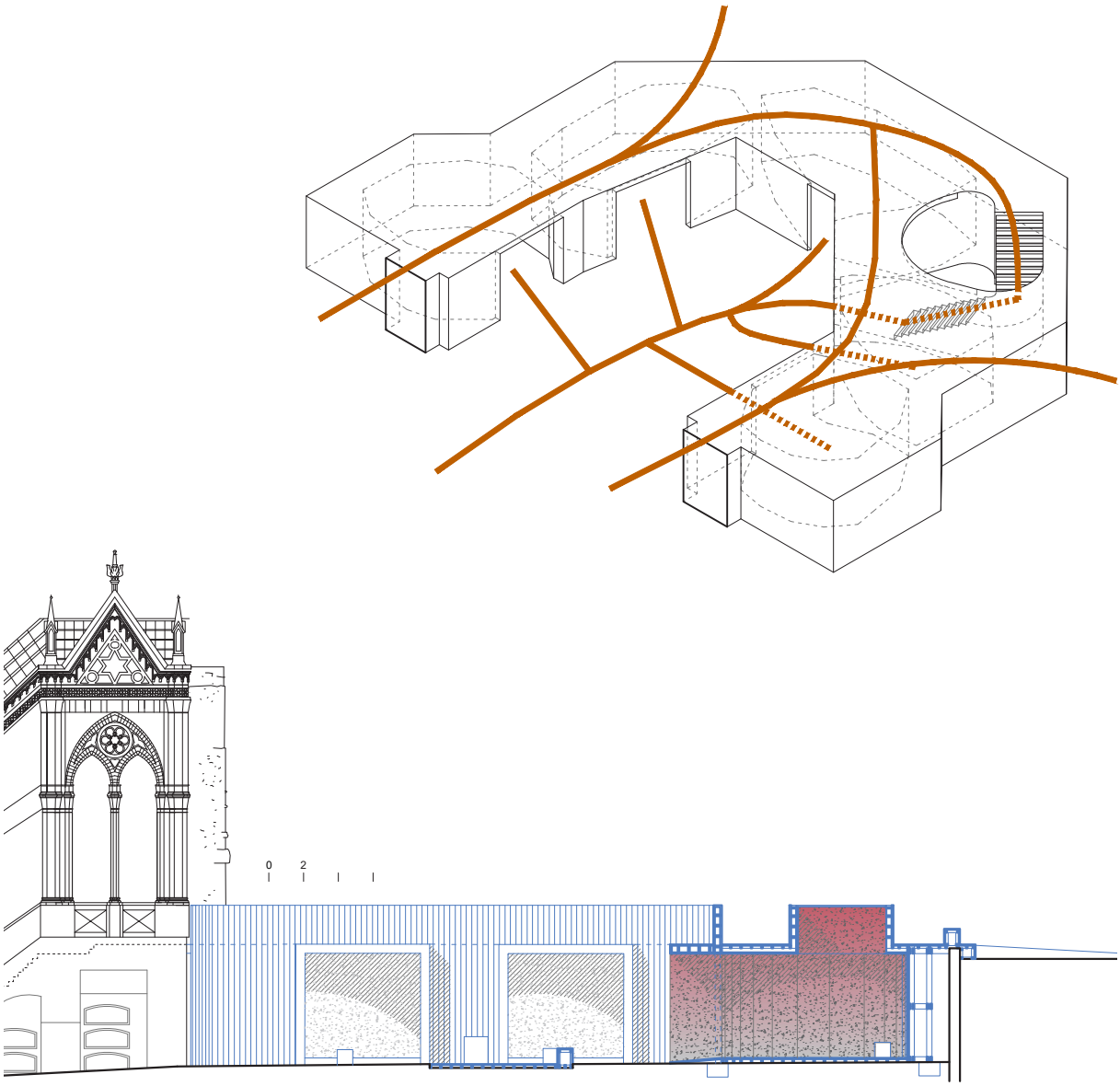


Fig. 7: Cavity (Marco Russo, Gilda Antoniello, 2021).

3. Continuous public space

When we design in an already consolidated context, we need to face two main themes: the existing flows and the image of our project in the context.

In the case of the Monumental Cemetery of Caltagirone, the existing building consists of an elevated path with several levels up to +2.75 m. The cross scheme was designed by the architect Giambattista Nicastro in 1866 but is partially incompleted. The area where the construction of the new ecumenical space is suggested is a void surrounded by high reinforced concrete walls that separate two levels of the cemetery. The main goal was to think of a system that could easily connect the two floors of the complex without altering it.

The design starts from the existing cross-scheme with a 'C' volume inserted in the void, recreating a new walkable surface between the two wings. The new floor becomes a meeting and relational place, on which we find a series of benches that hide colored skylights for the rooms below, accessible by a curved staircase. Once on the lower floor, we can continue through the rest of the monumental complex or linger in the new chapels shaped like a cave. In this regard, two opposing schemes have been developed (open/closed), and only in the end, the closed scheme was preferred to have more private areas and powerful lighting effects. The discarded scheme, fig. 6b, would have allowed a more significant opening but would have reduced the light effects in the excavated parts. The idea behind this scheme is to recall the church's image that was to be built in this void and its traditional ambulatory. The spaces obtained on the ground floor are places to stop and isolate from the outside.

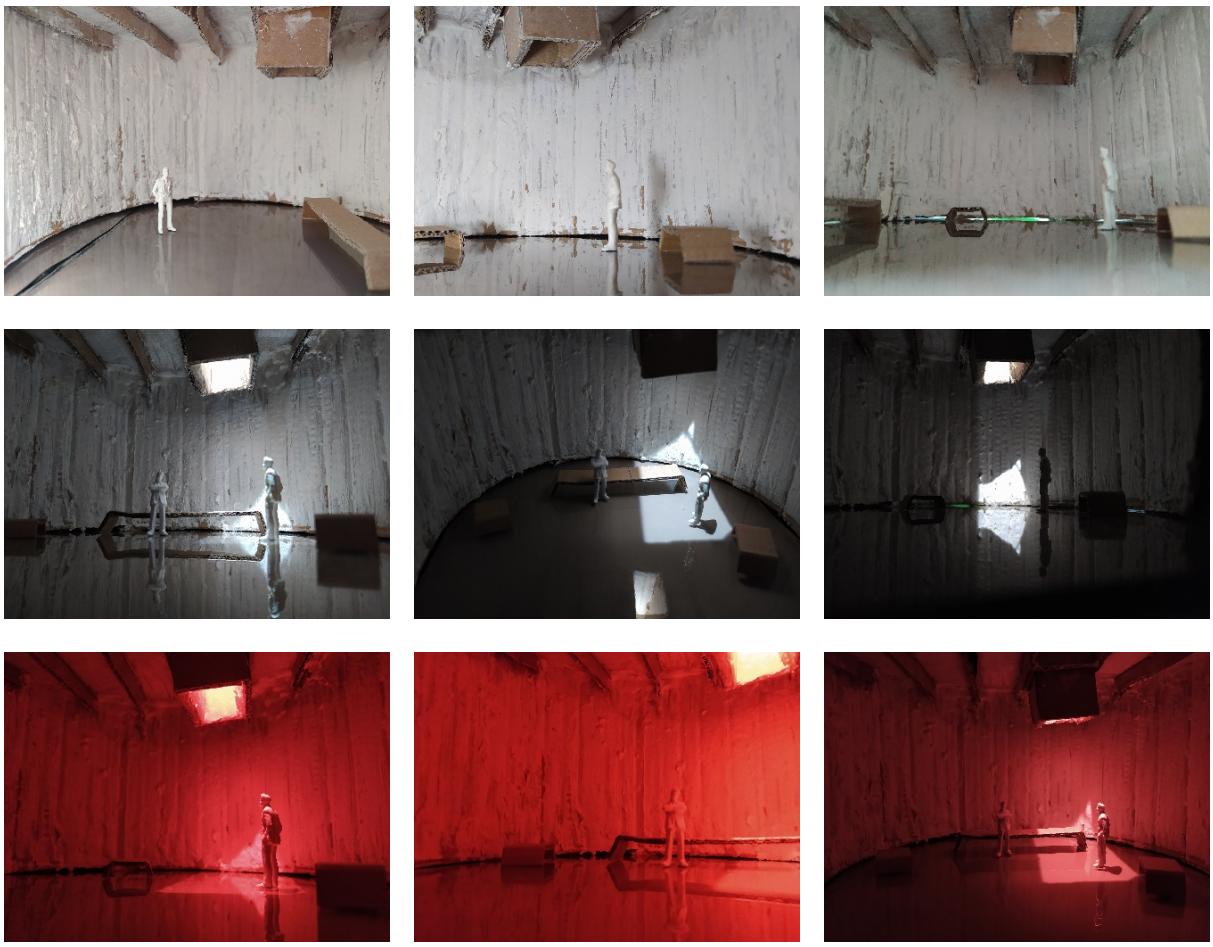


Fig. 8: Textures, Contrasts, Colors (Marco Russo, Gilda Antoniello, 2021).

4. Textures, Contrasts, Colors

Ludovico Quaroni, in a text from the sixties, underlines how superfluous it is to take refuge in a technological aesthetic to resolve issues related to places of worship[12]. He cites Frank Lloyd Wright and Le Corbusier as authors who marked the path towards an experiential space, a direct consequence of the 'plastic freedoms that the theme of the church' offers[13].

It is interesting to note how the masters of Italian architecture essentially propose two spatial models: the longitudinal or circular plan. In the first model, a regular language leads to significant internal volumetric shots, as in the Church of the Madonna dei Poveri in Milan (1952-54) by Figini and Pollini or the Holy Family church in Genoa (1956-59) by Quaroni. On the other hand, the circular typology brings to light other mechanisms, such as in the church in the QT8 district (1947-55) by Ludovico Magistretti and Mario Tedeschi or the Cathedral of La Spezia (1956) by Adalberto Libera[14].

Whatever configuration is used for the theme of the places of worship, the constant seems to be the light and its effects on the internal surfaces. Natural light is used as a living material, capable of animating the 'great hall'. Walking in these spaces becomes an experience due to the involvement of all the senses rather than just sight. The effects are amplified in a space modeled with curved geometries because the light propagates homogeneously. The absence of edges or vertices helps to perceive a continuous environment where the space is constantly modified and always different.

Carl Petersen is one of the first architects to trace a modern theory of experiencing architecture, tracing back to his three conferences held between '19 and '24. The titles of the interventions are 'textures' (1919), 'contrasts' (1920), and 'colors' (1924). In these three lessons, he reflects on Nordic Neoclassicism[15], but he intends to direct architects towards sincere art, capable of thrilling sensitive visitors through specific characteristics of the architectural space. The study of surfaces and how light is reflected or absorbed by different materials are addressed and reported in urban and architectural contexts. Concepts such as the idea of crossing space, how the human body receives all these stimuli and relates 'unconsciously' with the outside world are the main focuses of the lectures[16]. He demonstrates the possibility of translating it from ancient buildings to modern spaces. All the expedients discussed in the three conferences are an essential contribution to subsequent considerations by Rasmussen and a milestone for the '60s and contemporary architecture.

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[13] Ivi, p. 35.

[14] In this period, the Church of the Concilio Sancta Maria Mater Ecclesiae (1965) by Luigi Moretti represents an unique case of plastic manipulation of the space. Along the line of these baroques compositions there is the later work by Paolo Portoghesi in 1971.

[15] A current active between 1850 and 1927, among whose exponents we can mention Hansen, Hakmann, Petersen, Fisker, Rafn, and partly Asplund.

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The interactive condition of the wall: between world heritage and ecological transition. The Storefront Gallery in New York by Steven Holl and Vito Acconci

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Abstract
The Storefront for Art and Architecture Gallery, specialised in the work of young artists and architects in Manhattan, New York, hosted a project by Steven Holl in cooperation with Vito Acconci. In it, we are shown the value of the "participating interface wall" in architecture, in the *civitas*/urban life and existence, where place, living and creativity convene in an intrinsic and interactive spatial and ecological relationship between culture and nature, and among humans, their *modus operandi* and the environment. Insofar as it is a wall, threshold, bench, table, lamp and exhibition window/façade, it is an architectural and an artistic element with an interactive condition. It is at the same time both static and dynamic, formal and spatial, limiting and non-limiting, interstitial and borderline, full and empty, generating floating spatial areas, multiple reflexes of light and images, and different experiential dynamics that imprint formal, functional and environmental aesthetic and ethical possibilities on the location. Designed to be the protagonist, the "participating interface façade" of the gallery is, according to Holl, an "inside-out-facade". There where the idea of architecture is materialised as an "in-between place of creativity", among the street, the gallery and the event, or among life, architecture, art and the environment. It is a place between meaning and the imponderable, which as Norberg-Schulz advocates, helps man give meaning to existence. It is a place achieved through a poetic operation that displaces an idea of consolidated or confined architecture, through the opening or breaking of the architectural box, by generating imprecise/*figural* interstitial spatialities that are more permeable, more flexible, more adjustable and more ambiguous, evoking the ecological value of the "relation", the "transition" and the "interaction" among form, space, use, creativity and the natural environment.

Keywords: Interactive-Architecture, Participating-Wall, Interstitial-Spatialities, World-Heritage, Ecological-Transition



Fig.1: Storefront Gallery, Manhattan, New York, USA, 1992-93, Steven Holl and Vito Acconci.



Fig.2: Storefront Gallery, Manhattan, New York, USA, 1992-93, Steven Holl and Vito Acconci.

1. Introduction

Designed in 1992-93 by Steven Holl in cooperation with Vito Acconci, the *Storefront for Art and Architecture Gallery* in Manhattan, specialised in the work of young artists and architects, show the value of the "participating interface wall" in architecture, and in the relation among architecture and the *civitas*/urban life and existence, there where place, living and creativity convene in an intrinsic and interactive spatial and ecological relationship between culture and nature, and among humans, their *modus operandi* and the environment.

2. The inside-out-façade

The "participating interface wall" of the Storefront gallery, whilst a static and dynamic element, both formal and spatial, limit and non-limit, interstitial and borderline, full and empty, is constituted in this architecture as a *figural in-between element* (imprecise, movable, manipulable) [1] [2], capable of generating floating spatial areas/ambits between the dynamics, uses and moments of the gallery, and between the gallery and the street, neighbourhood or city.

Designed to be at same time an architectonic and artistic element with an interactive condition, this is a wall that can be manoeuvred, in this case, by opening and closing in a pivoting manner, vertically

and horizontally, serving as a plane and a wall, a threshold, bench, table, lamp and exhibition window/façade, all at the same time. It is an architectural and an artistic element that generates floating spatial areas (in their interior/interior and interior/exterior relations), multiple reflexes of light and images, and different experiential dynamics that imprint formal, functional and environmental aesthetic and ethical possibilities on the location.

If the wall (the more or less dense, fixed and bordering) and the threshold (the empty, spatial and transferable), are the two most primary or elementary figurative in-between formal elements of the architectural space, the "movable wall", among many other possibilities, is the most elemental and primary *figural in-between*, due to the mobility and involvement it that represents, and the resulting spatial flexibility and greater valence of use. And if their materiality is translucent, or if is a wall composed of movable parts (sections, tears, etc.), articulated and "participating," such as this gallery façade, it is possible through its manipulation to generate multiple light and mirror images that record in the space ambient aesthetic possibilities, that are both functional and contingent, which will strengthen the *figural* condition of the place. During the day or at night, openings, fissures or tears in the façade (closed or open) illuminate and compose the areas of the entire space, both indoors and nearby outdoors, which are opened to the possibility of communication and interaction with those who might be there or passing by. The movable wall, so popular with modernist-functionalists architects in the 60s, leads to the participating wall interface, the star of almost all Steven Holl's works, and a hybrid of the foregoing, because it is permanent and articulated at the same time, as Holl puts it: "Beyond the independent area, room to room, is the interactive space in which the "participating walls" reorganise the home environments. The adjustable space comes alive, especially in homes in Manhattan or Tokyo, where each square metre is a universe. Unlike heavy systems of "movable partitions" from the 1960s, participating walls are a hybrid of fixed and articulated walls. The space becomes dynamic and contingent" [3].

In the gallery, this participating interface wall, designed to be the protagonist, it what promotes the interaction between the programme/use, the space and the place. It is at the same time façade, limit and threshold, advertisement, showcase, screen, bench, table, support, light protection, public streetlight at night (because the light crosses through the joints and reaches the remaining parts) or it is simply the organising and structuring element of the space. Here, in an unprecedented manner, Holl's participating interface wall becomes a "participating façade" or, as Holl himself calls it, an "inside-out façade", an interactive hinge, between the inside-outside, passersby-visitors, exhibition-performance, with the function of "gallery" and any other function, body-space (to the extent that, as Holl says, the body is required, or only a shoulder, to modify the space by expanding or contracting it); it is an interactive hinge between the part and the whole, architecture and art, gallery and city, or rather, between humans, creative communication and community.

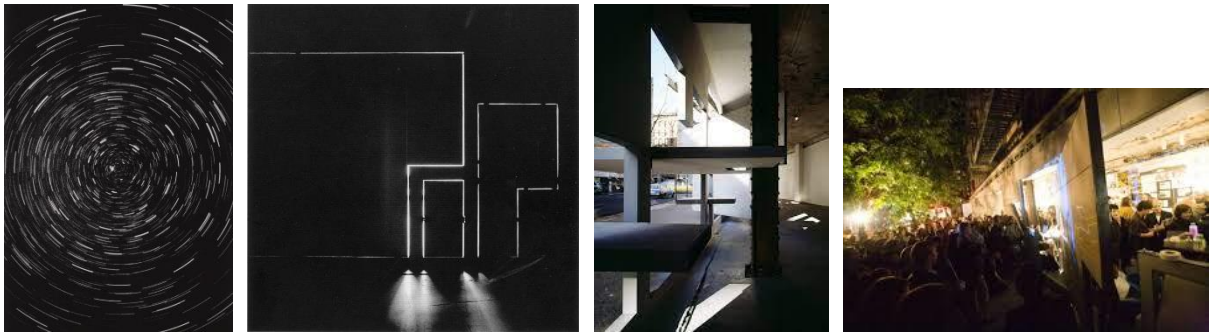


Fig. 3: Hinged Space: "From autonomy to the interactive, time elapsed showing the natural rotation of the Earth around the fixed point of the North Star," Bernard Tschumi [2]. Storefront Gallery, Manhattan, New York, USA, 1992-93, Steven Holl and Vito Acconci.

The programme and the space (form, light, ambiances, etc.) change depending on the interaction with the façade. Therefore, the wall, that element which is borderline, yet formally well-defined (figurative in-between area) is in the work the vector towards an idea of improbability, ambiguity, dynamism, adaptation and participation, all of which are key concepts in a large part of contemporary architecture, which began in 90s. In other words, it is the operating vector towards the *figural* condition: it is borderline, ambivalent and imprecise. The function of this new façade is no longer to simply "divide" or "limit" the inside space from the outside, but rather to propose for the architectural place another more interactive and communicative condition between space, form, programme, life and event. As the director of Kyong Park (next to the gallery) said, this new façade "is neither a wall nor a barrier; neither

inside nor outside; neither space nor building, nor place, nor institution, nor art, nor architecture; neither Acconci nor Holl, nor Storefront".
All the space and functional dynamics of the gallery are implicitly and explicitly subordinated to the position and form of this façade. The façade, the space, the visitor, the passerby and the event are dynamically intercepted in this place-gallery. As Holl states, the intention was not to create a minimalist or static space for a set or conventional programme, rather a formal and functionally hybrid space, a "dynamic combinational space" (Steven Holl's concept of a "hinged space" [2]); an interactive, articulated space that is adjustable to each moment, condition or expository programmme; an announced place and an announcer place that invite any citizen to participate in their event, dethroning the socially instituted exclusivity of the art world. It's a matter of taking art to the street.

3. In between world heritage and ecological transition

Here, everything is interstitial and borderline: day and night, open or closed. The crack is always there. As a consequence of the intentional tension and the formal-spatial-cultural-environmental interaction, through a well-defined figurative in-between element such as the wall-façade, an in-between space of *figural* modality is generated, a dynamic space of transition and communion (*common-union*): relational, participative, communicative, and "ecological" (domestic, environmental, and resonating), between a world heritage and a more creative, expressive and holistic culture.
In addition to the dynamic in-between space that is created between the inside and the outside, there is the fact that the gallery is located on the corner of a block in Manhattan where three urban and socially different neighborhoods come together, namely Chinatown, Little Italy and Soho, which intensifies the tense and borderline condition of being an "in-between place" of this space, due to its interface façade, located on a corner in a socially diverse zone, and one that is often under tension.
On the other hand, the material used for this wall-façade is a mixed composite of concrete and recycled fibres (paper, newspapers, etc.), to make them light-weight to permit the handling of the different pivoting panels, which interact with each other like puzzle pieces in this place in the city: the façade dissolves and the exhibition is projected towards the street.

"(…) [It] can be exact and then suddenly transformed into a combinational and dynamic space. It can be severe or relaxed. When the façade is closed, it has the typical form of triangular a Manhattan storefront. When it is open, it is drawn-absorbed-attracted-immersed in the city outside it. The three-dimensional volume can be made four-dimensional with changes in time. With this façade, Storefront created a new type of dynamic, urban and interactive space." Steven Holl [4].

In the Storefront, the idea of architecture is materialised as a place for public events, of tension and intentional interaction, which is physically expanded towards the outside, and conceptually goes beyond the idea of a traditional gallery. We are talking literally about a space-limit, a floating ambit/environment, an *in-between place* with imprecise limits that suggests another type of façade and entrance; another type of occupancy and use (participative, interactive: between indoors and outdoors, public and private); another way of understanding programmes (multifunctional, multiple uses); another user/occupant (both visitor and passerby), and another idea of architecture (*figural*, between art, architecture and the community, both culturally and naturally).It is a *figural in-between place* (imprecise/dynamic/participative), achieved through the participating interface wall.



Fig. 4 :"(G) host in the (S) hell" installation at the Storefront Gallery, New York, 2008, Didier Fiúza Faustino – Bureau des Mésarchitectures.

4. Final Considerations

In this gallery by Holl, the poetic operation was that of “dislocating” an idea of architecture consolidated or formed through the opening or breaking of the architectural box, and not through operations of transparency or emptying, as suggested by modernism. The aim was to generate *figural interstitial spaces*, where the conceptual, which suggests another way of understanding space (in a way that is more permeable, more flexible, more adjustable, more ambiguous; the value of the “relationship” and the “interaction”), the formal (between the inside and outside, between inside and inside; the value of the “interstitial” and the “borderline”) and the functional (new ways of understanding programmes, use and occupiable space; the value of the “occupiable,” which as it is more versatile, includes the “inhabitable”) intersect and can interact creatively and dynamically.

Designed to be the protagonist, the “participating interface façade” of the gallery, according to Holl, is an “inside-out-façade” and a hybrid of the fixed and articulated wall. Insofar as it is hinged, it promotes interstitial spatialities that are interactive and adjustable and come alive in the experience/use/occupancy/action, in the communication/exhibition and in the interrelation among form-space-time, proposing an architectural place that is dynamic, contingent and creative, with imprecise limits and in permanent transition between the part and the whole, culture and nature, tradition/heritage and the future, autonomous and interactive. There where the idea of architecture is materialised as an “in-between place of creativity”, among the street, the gallery and the event, or among life, architecture, art and the environment. It is a place between meaning and the imponderable, which as Norberg-Schulz advocates, helps man give meaning to existence. It is a place achieved through a poetic operation that displaces an idea of consolidated or confined architecture, through the opening or breaking of the architectural box, but not with operations of transparency or emptying as suggested by modernism, rather by generating imprecise/*figural* interstitial spatialities that are more permeable, more flexible, more adjustable and more ambiguous, evoking the ecological value of the “relation”, the “transition” and the “interaction” among form, space, use, creativity and the natural environment.

The Storefront is a place of transition, both community and ecological, that manifests and exalts the operating, poetic, aesthetic and ethical vector towards the *figural* in a well-defined manner, through the interactive condition of its “inside-out-façade,” formalised by the movable/participative wall interface, the interstitial relationship between full and empty and the interactive dynamics between culture, nature and community.

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The transformation of the contemporary city. Exercises of retrofit and improvement of architectural and urban heritage.

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Abstract
The city and the building stock of the XX century require a reinterpretation and new design visions capable of interpreting the needs of contemporaneity.
Among the various approaches for the transformation of the existing cities there is the attention to the redevelopment of the urban building stock and the social housing, through architectural retrofitting actions and the redesign of public spaces. Interdisciplinary models include projects from the urban landscape scale to the building scale, also looking at environmental issues. Retrofitting and its practical methodologies analyze and develop technological and energy aspects. The design decisions take into consideration the transformation of building, its context and the entire urban area.
The regeneration of the existing building and urban area, through 'microsurgery' operations to replace 'demolition and replacement' practices of large portions of buildings, emphasize an operating mode that is respectful of the social and urban identity of the consolidated city, even more sustainable.
These very topical themes represent an opportunity for reading, analyzing and reinterpreting existing buildings and the cities.

Keywords: Urban heritage, Architecture heritage, Re-design, Retrofitting, Regeneration

1. Introduction
The twentieth century, the century of modernity and technical evolution, marked the urban development of the city with new settlement models that looked to the monumental scale for the construction of buildings dedicated to social housing.
In the period between the two World Wars, in the era of reconstruction, the socio-economic conditions, characterised by the great demand for housing, the urgency of the situation and the need to build more and more housing while minimising the economic resources to be used, led to the construction of buildings without good architectural quality.
The demographic growth and the consequent urban growth, with the expansion of collective housing, saw in the 1960s and 1970s a trivialisation of the modern conception of living. This trivialisation can be traced in the effects produced by the " Grande Numero " (Great Number), themes identified by the XVI Triennale di Milano in 1968, curated by Giancarlo de Carlo [1].
The city inherited today is fragmented, and often distributed within the territory in a non-homogeneous manner, unlike the historical city and the consolidated fabric of the city developed with projects that followed the principles of state welfare, defining parts of cities that function and reflect the principles dictated by the concept of modern architecture. Alongside these, however, there is a city that does not follow precise forms and criteria, but pursues an ethic belonging to economic issues and consequently

leads to the formation of portions of the city defined as 'dormitory'. These architectures have developed in the suburbs, in often marginal fabrics formed by minor architectures that follow the logic of standardisation and prefabrication.
This heritage that we inherit today needs a reinterpretation, a redesign, capable of interpreting the new needs of the contemporary world, exploiting its resilience to be reintegrated within the urban and social fabric of the consolidated city. This is also underlined by the housing and real estate market issues that have resulted from the social, economic and product effects of COVID-19.
Also the environmental issue becomes a starting point for the definition of an interdisciplinary model that can consider the different aspects that concern professionals, enterprises, public administrations and stakeholders, as well as the inhabitants of the places. The focus on several fronts can lead to the concrete implementation of architectural recovery programs for the redevelopment of urban areas. Interventions on the built heritage, such as architectural retrofitting - an intervention of building requalification with the aim of updating comfort conditions, technological and typological aspects -, become an opportunity to think about a redesign of architecture and the urban context, considering the need to regenerate public spaces, often considered as interstitial spaces between buildings.

2. Context

Intervention in this fragile built heritage must follow attitudes and design choices that are critical of the experience of modern construction [2]. The solution is not demolition, but a series of actions aimed at giving new qualities to existing buildings, radically transforming them with intelligent additions, integrations and subtractions. Starting from these assumptions, the initial weaknesses of the building and of the urban areas, taken into account for the redesign, are evaluated as starting points and opportunities to regenerate the heritage and not as volumes to be deleted.
The reinterpretation of the modern is therefore necessary for the recovery of entire portions of the fabric of European cities. Starting from the characteristics of modern residential construction, new housing, spatial and social qualities can be defined. There is thus a "re-writing", a "re-design", of the built environment that is able to represent the beginning of a new architectural identity, thus triggering positive effects on a social level and on the real estate market.
Not of secondary importance are the current studies that start from the real estate market and outline the future of design and demand by inhabitants and stakeholders. This is underlined by the recent CasaDoxa 2021 study (4th edition of the National Observatory on Italians and the Home by Bva Doxa): the impact of the pandemic has consequences on the priorities of housing selection criteria. In fact, 65% (+17% compared to 2019) of the sample analysed prefer to choose based on the proximity of their home to green spaces, and having private gardens and terraces (67%, +9% compared to 2019)[1].
At the same level, the research on the theme of housing carried out in 2021 by Tecnoborsa shows that for 62.7% of the sample analysed, their home is inadequate for working or following distance learning activities. The aspect that emerges most is the inadequacy of small houses, and 76.8% would make major changes to their homes, such as a redistribution of internal spaces, if they could. Also from this survey the desire to have private and public green spaces is preponderant, underlining the importance of social relations and public spaces[2].
Even from the design sector (home design), there is a re-evaluation of living and domestic spaces: the need for a change in the concept of living has emerged strongly, looking at the home not in terms of its size, but in terms of the quality of relationships and the ability of a space to meet the needs of its inhabitants[3].
The adaptation of the existing building stock to contemporary living, therefore, achieves several different goals which may include perceptual issues of the city, issues related to the inadequacy of living, issues related to climate and environmental changes and issues related to the sociality of public spaces. All these issues have been understood and resolved in the 'Urban renovation' project in the Génicart neighborhood, near the centre of Lormont, by LAN Architecture, which mainly concerned the urban and social redevelopment of the collective use spaces and residential units of the neighborhood’s four housing estates, built between 1960 and 1975.

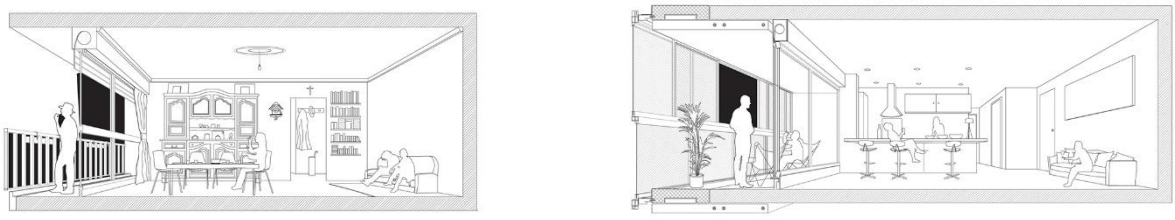


Fig. 1: Section of typical flat before and after the façade renewal; (credit: LAN Architecture, www.lan-paris.com).



Fig. 2: Building before and after the façade renewal; (credit: LAN Architecture, www.lan-paris.com).

3. Case studies of 'redesign' for community living and urban heritage

In Europe, for some decades now, recovery actions of this kind have been carried out in which the rehabilitation of social housing buildings and urban spaces gives rise, over time, to revitalisation processes at a social level and at the scale of the neighbourhood. The methods of intervention can take place at different levels: on the quality of public and private spaces, inserting new common areas and services for the neighbourhood, on the functional level increasing the number of dwellings or updating the distribution or intervening on the building envelope. This is the action that allows an update on the energy level and on the aesthetic level of the building.

National and international architecture awards are also increasingly including retrofitting projects in their short list of candidates.

This is the case of the famous Park Hill project [3] in Sheffield, England, one of the six nominated projects for the 2013 RIBA Stirling Prize, and winner of numerous national architectural awards. This residential complex, built between 1957 and 1961, has seen years of under-investment that have left it in a state of decline, despite the fact that it is part of the protected heritage ensemble due to its special historical and architectural interest.



Fig. 3: The original complex and façade designed by architects Jack Lynn and Ivor Smith in 1953; (credit: Hawkins Brown Architecture, www.hawkinsbrown.com).

The project arose from Sheffield City Council's need to regenerate a notoriously neglected estate into a place where people wanted to live. With developers Urban Splash, Hawkins and Brown Architects and Studio Egret West, have succeeded in making the building interact with the surrounding landscape. The building and the apartments have been given a thorough face-lift and renovated to 21st century standards, whose most visible transformation is the replacement of the original façade, brick panels and wooden windows added a new façade made of simple glazing and colored panels. There

have been over 5,000 repairs to the concrete frame, from patches to structural work. Aesthetically, the complex is updated in terms of colour and distribution with new external vertical connections.

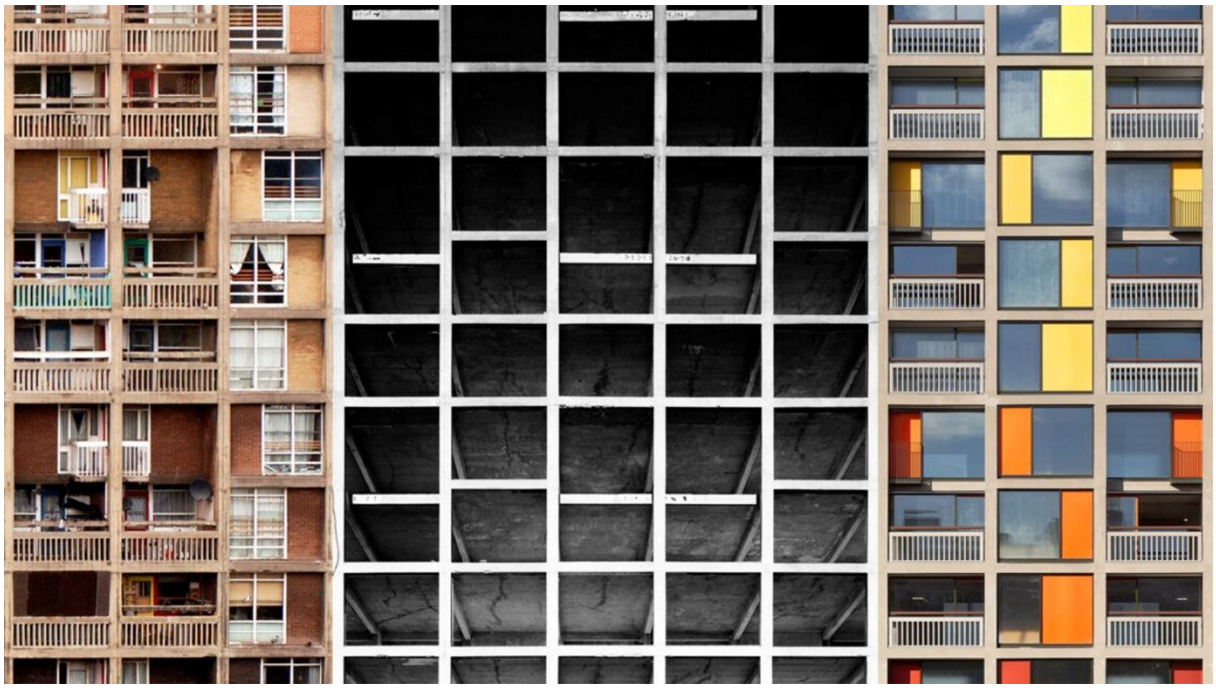


Fig. 4: Before, during and after regeneration action of Park Hill complex in Sheffield by Hawkins/Brown Architecture and Studio Egret West; (credit: Hawkins Brown Architecture, www.hawkinsbrown.com).

The transformation has also involved the flats, which have been reinvented and renewed in their internal distribution.
The Park Hill building has always had an uncomfortable relationship with its landscape, alienated from the main city. A reconfiguration of the services in this neighborhood included the inclusion of a community of services such as shops, bars, cafes and restaurants on the ground floor, revitalising the public areas for residents and becoming points of attraction from outside.
The public areas are also being redesigned in collaboration with landscape architects Grant Associates. The green space, thanks to the regeneration project, reconnects to the nearby Peak District, and every part of it is designed for the community.
The desire of Urban Splash and the designers was to manifest change to the city and the rest of the Sheffield community in a powerful way, manifesting the strength of transformation and renewal.



Fig. 5: Green space and new façade of Park Hill; Hawkins/Brown Architecture and Studio Egret West; (credit: Hawkins Brown Architecture, www.hawkinsbrown.com).

The Work of this project started in 2009 and in 2013 the first new residents and commercial tenants moved in to the building, a defining moment in the start of a new phase of its life. Urban Splash and Sheffield City Council have demonstrated how with the appropriate planning a complete regeneration of the Modern's residential stock is possible. Proof of this is that transformation is still taking place, although with a ‘light touch’ approach: in a second phase new flats are being recovered, as well as connections to the first building already redeveloped in 2011; in the third phase, already completed in

2020, there has been the transformation of housing modules into student accommodation, consisting of 356 rooms in 74 townhouse style units as well as communal spaces and a convenience shop; the fourth phase, currently in progress, involves the redevelopment of 95 residential units, artists' accommodation and a contemporary art gallery.
Another project that responds to the need for transformation of the built heritage is the project, part of the 'Cité du Grand Parc' programme, by Anne Lacaton & Jean-Philippe Vassal, Frèdèric Druot and Christophe Hutin in Bordeaux, completed in 2016 and winner of the *EU Mies Award 2019*.
Thanks to their "democratic", social, technological and sustainable vision of transforming and renovating large building volumes, opposing demolition practices, Lacaton & Vassal have been declared winners of the 2021 *Pritzker Architecture Prize*. Their selected works include the transformation of the G,H,I buildings in Grand Parc (Bordeaux), with a total of 530 residential units. The estate can be considered a city within a city, with 25,000 inhabitants, conceived in the 1960s by planners Jean Royer and Claude Leloup, inspired by the urban projects of Le Corbusier. The project, promoted by the Aquitanis O.P.H. de la Communauté Urbaine de Bordeaux, is part of a larger regeneration project involving the Grand Essembles. It is commissioned to French architects who have been working on housing and its regeneration for more than 20 years. [4] The heritage of the Cité du Parc reflects the characteristics of modern architecture, with its standardised design elements and industrial prefabrication techniques.



Fig. 6: Façade Building G, before/after transformation; (credit: © Philippe Ruault, www.lacatonvassal.com).

The project of retrofitting starts from the addition of winter gardens and balconies, with a prefabricated self-supporting structure, in extension to the building, giving, for each apartment, a large luminous space and more living area. The same typology, already experimented by the same designers in the renovation of Tour Bois le Prêtre, has made it possible to increase the comfort and internal distribution of the flats and improve their sustainable quality.

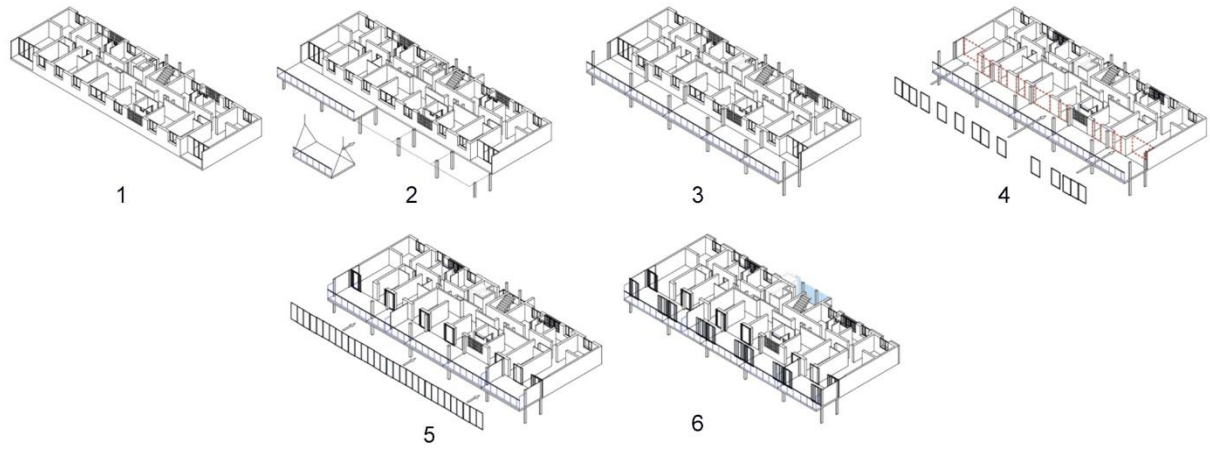


Fig. 7: Axonometric cross-section of construction phases; (credit: © Philippe Ruault, www.lacatonvassal.com).

Works are also planned in interiors space, with the renovation of the bathrooms and new electrical installation, and to improve the vertical circulation, a supplement new elevators and on ground floor, new access from green space under the buildings. One of the strengths of the project was to plan the

installation of the new façade in such a way that it could be installed without the residents moving from their homes during the construction process.



Fig. 8: Construction phases; (credit: © Philippe Ruault, www.lacatonvassal.com).

The architects demonstrate through this project how social housing, a heritage often judged low quality and criticized, can be transformed economically and with a 'simple operation' giving “generous , pleasant and performing dwellings, that renew the typologies and the living conditions, comfort and pleasure, and improve the urban dwelling image”. [5]

4. Case studies to ‘redesign’ local social housing heritage

Architectural retrofitting and urban regeneration are topics that are also investigated in the academic and educational context, during the training of designers, starting with themes related to the survey and analysis of the city and its component parts [6]. Thanks to the agreements between the University of Basilicata and local Institutions such as the Region and the Azienda Territoriale per l'Edilizia Residenziale (ATER), there is the opportunity to work on projects on concrete case studies that need to be transformed. This is the case of a design experimentation carried out on a public building from the 1960s, located on the outskirts of the city of Potenza, in Via dell’Edera, and the urban space adjacent to it. One of the aims of the project was to establish a new balance between the built and the green space. The architectural retrofitting operation consists in the addition of a volume on the façade that allows the creation of loggias and terraces, in order to improve the internal distribution, increasing the living space and improving the energy efficiency of the building and its functional parts.[4]





Fig. 9: Transformation of the façade and green space of a building in Via dell' Edera in Potenza (credit: Marialuisa Zozzaro)

In other university research, two other buildings were identified: the first, located in Rione Tre Galli in Potenza, and the second, in a town near Potenza, in Lavello, both of which were social housing projects at the turn of the 1970s/80s.
The first building, located in the Cocuzzo district, in Piazza Adriatico, consists of 80 flats with three different types of distribution and three sizes. This responds to constructive and compositional criteria of an industrial design, readable in the facades, anonymous and disconnected from the context. The retrofitting work mainly involves the shell, improving energy performance and guaranteeing new appropriate conditions of comfort in terms of function and distribution. This is made possible by an extension of the volume juxtaposed to the north façade, with the definition of balconies and loggias that offer each flat new functional conditions, with the opportunity to have a private outdoor space, especially for the flats with smaller sizes.
The second building, located on the outskirts of Lavello, was built in the 1980s to provide housing for industrial workers. Here too, the elevations, with few balconies and therefore few private open spaces, make the building anonymous and an ideal basis for redesigning the architecture. The intervention, after providing a new skin for an energy upgrade, was designed with a self-supporting prefabricated steel structure, which at the same time gives a new look to the building's envelope and allows it to meet functional problems related to new contemporary needs.
In both cases, the spatial reconfiguration with private open spaces and the inclusion of services on the ground floor underline the desire to adapt the building and its context to current comfort, while maintaining the typological and dimensional diversification of the flats to adapt to demand and needs.

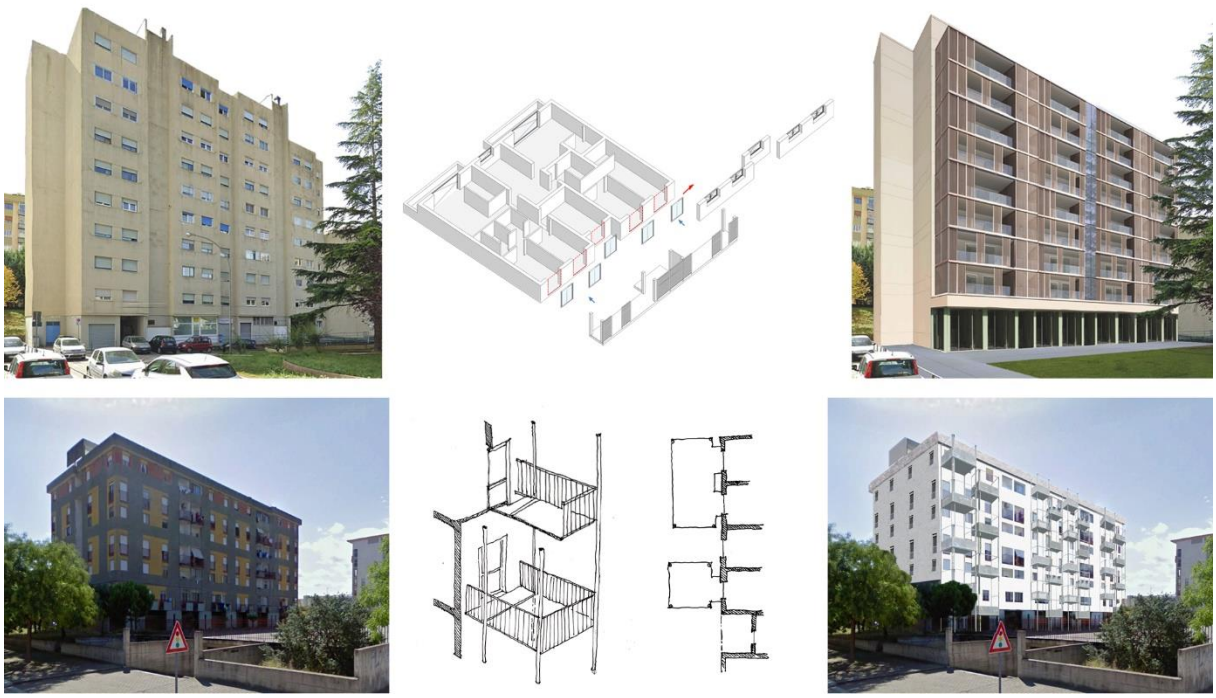


Fig. 10: Architectural Retrofitting of the building in Piazza Adriatico in Potenza and the building in Lavello (credit: Authors)

5. Conclusions

The urban context of our cities, inherited from the theory of the Modern Movement, whose central theme was "a roof for all" [7], underlines the need to deal with a building heritage that is not only concentrated in the sprawl of the suburbs, but also constitutes part of the urban territory of the consolidated city. Architectural retrofitting and related methodologies analyse and develop performance issues in terms of energy, seismic and therefore technological aspects and design choices that produce functional adjustments that affect the building and its context, up to and including the entire urban environment. The transformation of the existing building through 'microsurgery' operations instead of 'demolition and replacement' actions of large portions of the building shows an operating method that is respectful of the identity, including the social identity, of a consolidated building fabric. This type of transformation is more sustainable as it allows to limit new land consumption with new building [8].

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Heritage performance realignment for contemporary community: a maintenance strategy for the historical built environment

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In contemporary cities, the sustainable redevelopment of the built environment aims to rehabilitate the existing cultural heritage, building a regenerative link between past and present.
Identifying cultural heritage as a driver of sustainable redevelopment, the paper recognizes the maintenance of the historical axes system as a strategy for the management of existing resources and the re-distribution of tourist weights.
The paper concerns the framework of actions for the redevelopment and enhancement of the Buffer Zone of the UNESCO Site N.829 "Archaeological Areas of Pompeii, Herculaneum, Torre Annunziata". Acting on the Historic Urban Landscape (HUL), the methodological approach is based on a multidimensional analysis of the historical infrastructures in a systemic key. The construction of a correspondence matrix between the vulnerabilities of the cultural heritage infrastructures (city of the past), the contemporary community's needs (city of the present) and the requirements necessary for their performance realignment (city of the future).
The case study concerns the archaeological site of Pompeii and the axis from "Royal Palace to Royal Palace" identified within the Strategic Plan for the redevelopment of the areas included in the UNESCO Site Management Plan, characterized by the system of Vesuvian villas. The results provide a maintenance strategy, flexible and replicable, for the redevelopment of the historical built environment.

Keywords: Cultural heritage, built environment, redevelopment, maintenance.

1. Introduction

The contemporary cities axis can be interpreted as complex systems, which is, determined by more or less strong relationships between pre-existence and advenience while not being able to renew or reproduce primary resources [1]. Therefore, the city assumes three main dimensions: dynamic, that is, performing the territory in which it is located; adaptive, that is, capable of reacting to impacts of various kinds; open, that is, interested in exchange of various kinds. These impacts and exchanges often carry material and immaterial threats [2]. The first are related to the destruction or implementation of inappropriate interventions that generate phenomena of abandonment and increased natural risk; the latter are linked to social transformations that generate the disappearance of traditional crafts, the inability to transmit values or material knowledge [3]. In this scenario of urgency and vulnerability, the strategies for the sustainable redevelopment of the built environment are placed, which aim to rehabilitate the existing cultural heritage, building a regenerative link between past and present. The protection of the ancient city starts from the recovery of the existing building heritage, as a basis for promoting a new model of redevelopment on an urban scale. Interventions that should be carried out on the existing buildings should relate the physical system and the cultural heritage to the system social (reducing housing hardship and maintaining the popular settlement in the central areas), economic (committing fewer resources and appropriately reusing the built environment), cultural (preserving the building heritage with historical and environmental characteristics). Identifying cultural heritage as an engine of sustainable redevelopment, the document recognizes the maintenance of the system of historical axes as a strategy for the management of existing resources and the redistribution of tourist burdens. This purpose is based on the need to mediate between conservation and transformation actions to which the ancient city is subjected, thus investigating the ability of the latter to maintain its culture and characteristics unchanged while being subjected to a technological renewal. The paper consists of four main sections. The first is attentive to the need to pursue both social and environmental

sustainability in the recovery of the built environment, a heritage considered as a direct expression of the relationship between places, citizens and institutions. The second section on the strategy for the enhancement of the Buffer Zone of the UNESCO Site N.829 "Archaeological Areas of Pompeii, Herculaneum, Torre Annunziata". The case study is the archaeological site of Pompeii and the axis from "Royal Palace to Royal Palace"(an itinerary that starts from the Bourbon royal palace of Portici, through excavations, views and landscapes, and reaches the Quisisana royal palace in Castellammare di Stabia) identified within the Strategic Development Plan of the areas included in the UNESCO Site Management Plan. It characterized the system of Vesuvian villas of the Agenda on the Historical Urban Landscape (HUL), as well as descriptive of a multidimensional methodological approach of historical infrastructures, discrete in a systemic key. The third section relates to the discussion of the results and therefore to the construction of a matrix of correspondence between the vulnerabilities of cultural heritage infrastructures (cities of the past), the needs of contemporary communities (cities of the present) and the requirements necessary for their performance realignment (cities of the future). A fourth section on the possibility of elaborating these outcomes within a flexible and replicable maintenance strategy for the redevelopment of the historic built environment.

2. Historical built environment as driver of sustainable redevelopment

The heritage of ancient cities represents the set of material and immaterial elements in which the community recognizes and identifies itself as a direct expression of the relationship between places, citizens and institutions. The consolidation of a vision that links the future of the city to sustainability does nothing but bring new arguments and reflections on the relationship between conservation and transformation. Therefore, the methods of administration of the built environment can be redesigned to meet the needs of citizen involvement, giving new attractiveness and distribution of tourist weights. The management of the built environment focuses on overcoming internal imbalances by ensuring a maintenance strategy that invests in the conservation and growth of the remaining natural capital, as well as in investing in new anthropogenic instances by improving the conditions of use of the space and the components that build it. Local sustainability involves a two-faced strategy that aims, on the one hand, to safeguard available resources, and on the other, to the compatibility between the design strategies and local identities. The technological innovation is able to introduce new services and methods representing the transformation of an idea into a new and improved process and / or product, in our specific within the maintenance strategies of the built environment. This affects both in social processes, in which technology must be accepted and shared by end users; and in scientific processes, in which it is able to create conditions of well-being equally distributed for classes and populations constituting end users [4]. In addition, in processes of conservation and enhancement, in which it protects traditions, heritage, landscape and cultural identity in its sustainable sense. This determines a "culture of sustainability" linked to a redevelopment of urban competitiveness representative of the ability of ancient cities to attract new forms of tourism and the predisposition to improve the quality of life of the communities. This competitiveness, with a view to sustainable redevelopment, takes on a connotation of empowerment towards recovery actions in the built environment, for which the protection of heritage, economic growth and social integration combine prospects of sharing [5]. Interpret the evolution of the needs of the community by identifying the alignment of the performance of the built environment expected for the satisfaction of what has been identified. In this sense, the exigent-performance realignment returns a form of flexible recovery, capable of determining places of collective use appropriate to the return of performance levels of maintenance and complementarity of supervision, activities and experiences necessary to face the change [3].

3. Methods and Materials

The Operational Guidelines for the implementation of the World Heritage Convention UNESCO (1977), describe the buffer zone as an area to provide an additional level of protection to areas. The site, recognised as World Heritage and configured as a buffer zone for the specific site nominated within the World Heritage List (WHL), protects heritage values from the direct effects of impacts because of use and resource use outside the identified area [6].

In 1997, the archaeological areas of Pompeii, Herculaneum and Torre Annunziata were inscribed within the WHL, also identifying the buffer zone. In 2016, the area was re-perimetered to cover 77 sq. km and borders the Vesuvius National Park, includes five archaeological sites (Pompeii excavations, Herculaneum excavations, Villa Imperiale di Oplonti in Torre Annunziata, Antiquarium and archaeological area of Boscoreale, Stabiae excavations in Castellammare di Stabia) and nine municipalities of the Vesuvius area, grouped into two territorial systems:

- The sea side (overlooked by the municipalities of Portici, Ercolano, Torre del Greco, Torre Annunziata and Castellammare di Stabia)
- The inland side (Pompeii, Boscoreale, Boscotrecase, Trecase)



Fig. 1 The picture shows examples of the vesuvian villas examinated within the urban context of Corso Resina, on the left a villa before intervention and on the right a villa after the intervention - but both equally needed of applying the proposed maintenance strategy.

The city of Pompeii, a hinge between the Vesuvian coastal system, the Sorrento-Stabia system and the Agro Nocerino Sarnese, and a crossroads between different infrastructural and landscape systems, is a complex urban system where the archaeological city enclosed within its boundaries, the consolidated city, the religious city and the historic countryside coexist and feed off each other. The Archaeological Park, represented a complex system of elements of extreme importance, is the main pole of attraction for the city and for the surrounding urban areas. The Archaeological Park in fact, polarises 84% of tourist flows calculated on the total number of visitors in the year 2021 in the museums of d'Orsi, Oplontis, Boscoreale Museum, Stabia Villas and Herculaneum.
The buffer zone has complex urban system, both from a geographical and administrative point of view, characterised by strong contradictions: there are numerous cultural, religious and natural attraattractions contrasting with the urban system, which seems to have lost its identity, especially due to the continuous and disorganised overlapping of buildings. Widespread forms of decay that affect the residents' quality of life and therefore the socio-economic system characterize the entire area. In addition, the progressive reduction of free areas and green spaces and an inadequate road system make also difficult the allocation of urban services. Moreover, in most cases the major attractions do not interact and have to be reconnected to safeguard the landscape, environmental and cultural values and the economic redevelopment of the entire area. The goal is to obtain, through an appropriate maintenance strategy, an increasing of the quality of the built environment that also promotes the tourists' redistribution throughout the area.

The planning and management tool of the archaeological site and the buffer zone act on three different scales: the archaeological building heritage linked to the Pompeii Master Plan; the urban scales linked to use of and accessibility improvement actions to the site; and an innovative tourism system linked to the potential territorial networks, aimed at decongesting tourism on the Pompeii site. These strategies and actions are part of the two main management instruments: *the UNESCO Site Management Plan No. 829. Archaeological Areas of Pompeii, Herculaneum and Torre Annunziata*, and *the Strategic Plan for the redevelopment of the areas included in the UNESCO Site Management Plan "Archaeological Areas of Pompeii, Herculaneum and Torre Annunziata"*, of 2017.



Fig. 2 The picture shows Villa Durante within the urban context of Corso Resina, an example of the restored vesuvian villas examinated and needed of applying the proposed maintenance strategy.

These tools recognise in the programmed maintenance plan the nodal and connecting element that can guarantee redevelopment and support conservation. The maintenance plan has the purpose of slowing down the failure processes, guaranteeing the protection and conservation of the intrinsic and extrinsic values [3] of the Historical built environment, as well as for the users safety in the use and enjoyment of the assets and areas. This is fundamental to reduce the causes of decay, manage the use and enjoyment, face risk management and constructive role in the sustainable redevelopment of the wider Vesuvian area [7]. Beside the above, the Great Pompeii Project (GPP) represented a general rethinking start of the managing and using archaeological sites models, In the case of archaeological heritage, because of the values present, it is strategic to activate specific maintenance plans able to prevent the loss of elements and materials. [8]. As already demonstrated in previous studies [9], the maintenance plan designed for the system of buildings supporting the fruition of a fragile system such as the Archaeological Park of Pompeii, can be configured as a strategy of indirect conservation of the protected system itself, where the choice and scheduling of inspections and interventions depends on the relationships that this type of building has with the protected context.
The strategic plan in Chapter 7 provides for the redevelopment of the “From Royal Palace to Royal Palace” route: an itinerary that starts from the Bourbon royal palace of Portici, through excavations, views and landscapes, and reaches the Quisisana royal palace in Castellammare di Stabia. It concerns three parts which link the two aforementioned royal residences and the Sanctuary of Pompeii. Starting from the Royal Palace of Portici, it runs along the Miglio d'Oro and the SS18 state road to Torre Annunziata, from where it branches off. On one hand, towards the city of Pompeii to reconnect its

cultural and religious attractions to the system, and, on the other, towards the archaeological area of Stabia and the Royal Palace of Quisisana.
This requires the redevelopment of a maintenance strategy that considers together the route and the buildings that delimit it, in order to reduce the loss of matter and to preserve the architectural and environmental values, in line with the strategic planning guidelines.
The route from Royal Palace to Royal Palace has three sections with different characteristics, the research dealt with the first section characterised by the presence of the so-called "Vesuvian Villas". It extends from the Royal Palace of Portici to Torre Annunziata and includes the entire Miglio d'Oro up to Torre Annunziata, networking the significant cultural heritage of the area.
In particular, the road axis of the Miglio d'Oro is characterised by the presence of eighteenth-century buildings known as 'Ville Vesuviane' (Figg. 1, 2), 26 of which are to be found in Ercolano and 18 in Torre del Greco, the prevalent type of which is a country residence. The façades of the buildings are arranged along the main roads and the gardens, full of ponds, greenhouses, pavilions and aviaries, offer striking views of Vesuvius and the sea. All of these buildings are listed according to the provisions of Part Two of Legislative Decree 42/04, and in most of them, the original colours of the buildings' external surfaces (ochre, ash grey, peach, red and havana yellow).

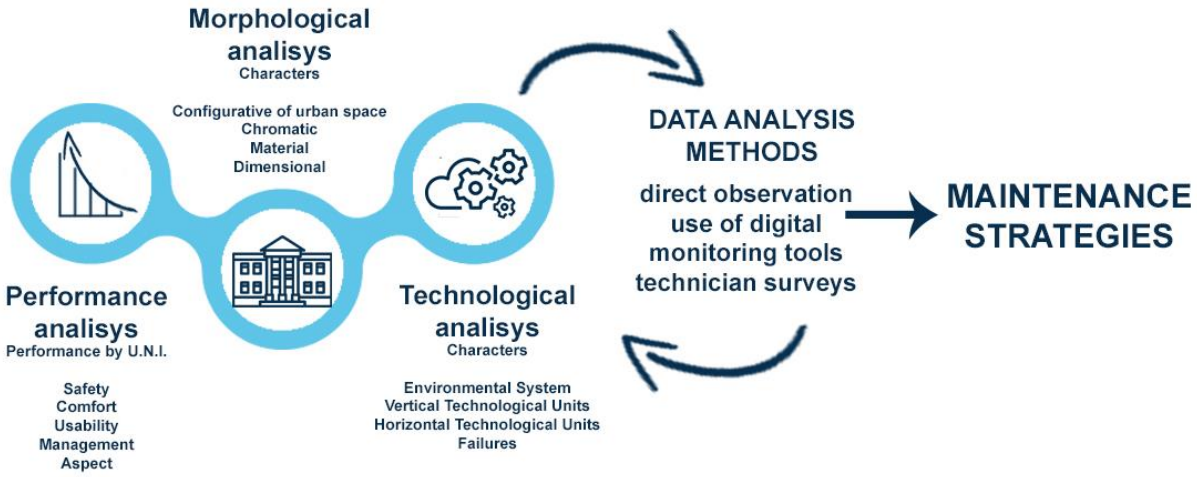


Fig. 3: Methodological path

The first methodological step was the identification of the elements of the technological system that will be the subject of the analysis preparatory to the identification of maintenance strategies to be implemented. In line with the reference literature [10], the route was broken down into vertical technological units and horizontal technological units, borrowing from UNI 8290 [13] the grouping of the elements of the sub-systems into technological units and classes of technical elements.
The historical and cultural value of the route and of the architectures that characterise it required a morphological analysis of the chosen segment in order to identify its peculiar characteristics, values and therefore constraints to the transformation. The technological analysis has flanked the decomposition of the technological system with the identification of the failure processes, identifying the impacts that these processes have on performance and therefore the maintenance strategies to be implemented [11] (Fig. 3).

4. Results and discussion

For this purpose, relating to the cultural heritage, recognising the failure chain becomes strategic above all when the frequency of non-systematic failures is high, and this is because several events combine with each other leading to an evolution that is not always predictable. Therefore, it becomes essential to prevent the failure that leads to the loss of matter to which the values of the built are connected. Further insight to evaluate a fault is the correlation between it and the expected performance of the investigated system: the effect of faults on the conditions and performance of a building depends on the functional requirements of it [12].
Failures in construction depend on the characteristics of a component, on defects in its installation, but most are the result of natural forms of obsolescence, which, in the absence of maintenance, lead to a lowering of the performance of a component to such an extent that its resistance to the action of degradation agents is compromised. To counteract the effects that follow the onset of a failure phenomenon, it is therefore essential to analyse it in order to understand their causes, monitoring the state of the technical elements and avoiding intervention "after the failure has occurred". That is, after a

failure condition that has compromised, for a period of time more or less, the functionality and in some cases even the safety of the building and consequently of the urban system, with decay of cultural values in the historical building.
The main factors that determine the occurrence of faults are mostly due to the action of atmospheric effects, but also to the occurrence of accidental events, activities of users who may unintentionally damage or cause damage to components and finishing materials. In relation to atmospheric and accidental agents, the intensity of the pathologies, as well as the frequency with which they occur, depend on the environmental conditions to which the materials are exposed and the operating conditions for which they are intended. To this end, for each class of technical element, the recurring types have been identified, distinguished by technological characteristics and level of vulnerability, and the recurring failures and inspection and maintenance priority levels have been associated with them in relation to the risk classes (Tab. 1).

TECHNOLOGICAL UNITS	CLASSES OF TECHNOLOGICAL UNITS	TECHNOLOGICAL UNITS
Roadway	Track.	Pavement
	Sidewalk	Pavement
	Protection elements	Bollards
Elevation structures	Vertical elevation structures	Masonry
Vertical Closure	Exterior vertical window	Main gate
		Secondary gate
		Window
		Oculus
Horizontal exterior partition	Balconies and Loggias	Balcony
Inclined exterior partition	Exsternal stairs	Stairs
Liquid Disposal System	Rainwater drainage networks - Street	Sump
	Rainwater drainage networks-Building	Inlet
		Pluvial

Tab. 1: Technological system composition

The analysis of the failure processes that affect the technical elements identified related to each of the technological units as reported in Table 1 cannot disregard a knowledge phase that leads to the identification of the constraints to the transformation of the system under examination. In order to identify the faults of the buildings, the facade is divided into basement, facing and crowning.
The constraints identified are perceptive-cultural, morphological-dimensional, material-constructive, and are linked to the characteristics of the Vesuvian villas along the route:

- Tuff masonry bearing structure
- Traditional lime plaster with brightly colored paintwork
- Symmetry in the openings
- Presence of stone entrance portals
- Lava stone basement
- Stucco decorations as cornices and stringcourses
- Paving in lava stone paving stones

Incorrect plan integration and inadequate water channeling systems contribute to the acceleration of the failure processes. It generates a lack of performance in terms of appearance and safety if we consider the façades of the buildings; furthermore, at some points, along the route there is a stark contrast between some of the villas undergoing reuse and those buildings, which remain in residential use or in disuse (Tab. 2).

TECHNOGICAL CHARACTERIZATION AND RECURRENT FAILURES					
Technological Units	Classes of Technological Units	Technical element	Technological features	Localization	Recurrent Failure
Roadway	Track	Pavement	Paving in lava stones	Corso Resina, Purgatorio Street	lack pothole surface deterioration of the walking surface disconnection
	Sidewalk	Pavement	Paving in basalt slabs or stone blocks, and concrete curbs	Corso Resina, Purgatorio Street	lack pothole surface deterioration of the walking surface disconnection presence of vegetation
	Protection elements	Bollards	Metallic bollards	Corso Resina	chromatic alteration shape variation break disintegration of joints
Elevation structures	Vertical elevation structures	Masonry	masonry in tuff blocks	First part of “Royal Palace to Royal Palace”	decoesion of plaster lack surface cracking exfoliation efflorescence biological patina through cracks
			mixed masonry in tuff blocks and bricks		
			coating with smooth plaster, painting		biological patina runoff detachment efflorescence lack of parts plaster swelling chromatic alteration presence of humidity
			cladding with fake ashlar plaster, painting		
			basement sections in shaped plaster		
			plaster stringcourse cornices		
			plaster frames of apertures		
			plaster crowning cornices		
			stucco decorative elements		

Tab. 2: An example of the technological characterization and recurrent failures of the Technological Units identified

The identification of inspection and intervention priorities allows the route maintenance manager programming the implemented maintenance strategies, the subdivision of the route system into vertical and horizontal planes allows instead planning the interventions in relation to the maintenance sets identified for vertical and horizontal planes. The division of the horizontal and vertical planes, in the case of the urban system, becomes functional to the organization of the maintenance site and of the instruments necessary to carry out the programmed activities. The urban space system, in its technological units roadway and facades, concerns into similar segments for which to plan inspection or maintenance activities carried at the same time. For instance, it could be possible using, in the case of the vertical plane, a single scaffolding being moved along the road axis to carry out the activities in the next segment. At the same time, a part of the horizontal plane can undergo the necessary interventions, always ensuring that the practicability and accessibility are not compromised and without ever failing to meet the need for user safety. This way of operating would bring benefits in terms of ease of intervention, as well as economic benefits.

The maintenance plan structured on the decomposition of the road space system into horizontal and vertical planes aims to meet the needs:

- conservation and protection of the architectural heritage;
- direction and control of urban quality;
- control of the appropriateness of intervention projects with respect to the requirements of reliability, durability and maintainability;
- non-stop accessibility and usability of the area, especially during the periods of greatest tourist flow;
- decongestion of tourist flows in the Pompeii Archaeological Park.

The maintenance plan provides for the following types of intervention:

- Performance realignment interventions;
- Inspection works;
- Maintenance interventions.

The purpose of the process just described is the management of coordinated interventions for the conservation of the values of the historic buildings of the "royal palace-to-palace" itinerary and for realigning and maintaining constant over time the performance levels of the elements of the sub-systems, so as to meet the contemporary needs of the community, which have been recognized in:

1. Reduce the loss and discard of valuable architectural heritage
2. To offer a new form of enhancement of the cultural identity of the site
3. Offering sustainable forms of use of the city
4. To offer new employment opportunities

The strength of the research is the systemic approach to the urban scale [14] that is led to a reinterpretation of the maintenance plan for urban area, starting from the decomposition of the elements of the urban system, analyzed in relation to the spatial element of the street. This approach, through diagnostic techniques, vulnerability variables and maintenance actions, defines the maintenance plan of the urban segment, improving the services offered by the manager of the area to the community that benefits in economic terms, through an increase in the number of tourists visiting, and in social terms because the level of degradation decreases. The maintenance plan, as defined, can be considered an important tool to support the strategies of the Strategic Plan for the redevelopment of the areas included in the UNESCO Site Management Plan "Archaeological Areas of Pompeii, Herculaneum and Torre Annunziata", of 2017.

Conclusion

The results return a maintenance strategy capable of enhancing the existing heritage for socio-cultural and economic-tourist purposes. The replicability of results in similar contexts encourages the activation of a public and private investment policy aimed at activating local redevelopment. This strategy influences quality of life levels while safeguarding available resources and mitigating the exploitation of existing buffer zone areas. The maintenance strategy generates a cascade of the defense of the cultural identity of a place and the redevelopment of the network of connections and distributions that characterize the adaptation of tourist weights and flows. The results open the research towards new scenarios based on the critical rethinking of the ways of using cultural heritage and aimed at the prosperity of ancient cities adapted to the needs and correspondence of contemporary attractiveness. The maintenance strategy, from the enucleation of the constraint conditions to the realignment of the performance of the ancient cities, is the guarantor of the specific identity and historical invariants constant in innovation and technological adaptation, as well as capable of orienting appropriate design actions.

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Living in future cities: from overbuilding to ecological transition

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Abstract
In contemporary cities the levels of livability and urban quality are less and less optimal. There are various causes: climate and demographic changes, reduction of natural resources, health risks, excessive consumption of soil, increased pollution, impoverishment of populations, lack of employment, transformation of urban space, etc. Evolving cities, increasingly vulnerable, characterized by insecurity, uncertainty and unpredictability, the result of mistakes made in the past. In this context, in planning future scenarios it is necessary to re-examine the *governance*, the strategies of urban expansion and transformation through new approaches capable of declining innovative concepts such as participation, transparency, creativity and resilience. Thanks to the application of new organizational and management models, with at the base of the indicators, it is possible to build more livable and sustainable cities capable of coping with the changes taking place. Several international and national environmental sustainability programs aim at the "*green revolution*" so that, through investments and reforms, the ecological and digital transition of cities is favored, as indicated in the 2030 Agenda or in the Assisi 2020 Manifesto for an economy on a human scale against the climate crisis. In this study, through a multidisciplinary approach, we will analyze the gap between some cities in the north and south of the Country, with particular reference to the Sicily region.

Keywords: climate crisis, soil consumption, green revolution

1. Introduction
The uncontrolled expansion of the cities, the wild cementification, the lack of respect for urban regulations have caused, over the years, considerable damage to our territories and biodiversity.
Already starting from the Industrial Revolution, a historical period in which the evolution of production processes and the birth of new companies have favored the movement of the population from the countryside to the cities, together with the spread of new and efficient infrastructures - such as highways, bridges, new buildings, factories etc. - the first forms of pollution and demographic increase are beginning to be seen. The phenomenon of urbanization (1) determines a serious and substantial change in land use as well as excessive consumption of agricultural land to make room for industries and buildings in general. In Italy, the development of new industrial activities and the spread of mass consumer goods accentuated the gap between north and south, causing an internal migration of inhabitants from the southern countryside to the industrialised cities of the north, profoundly changing their demography. During almost a century, in fact, residents in urban areas went from 2.906.267 in 1861 to 11.046.485 in 1951 (2). It is the Italy of progress, consumerism, abandonment of the countryside, air pollution, accelerated land use, despite the National Urban Planning Law, no. 1150 of 1942, requires municipalities to equip themselves with an urban planning tool, in order to regulate urban development. This is the phase in which cities are growing abnormally, vast suburbs are consuming ever greater quantities of natural resources and energy, producing an unprecedented anthropic pressure that has put the balance of urban centres and the environment at serious risk. It is the period of uncontrolled residential construction, which began with the economic boom of the 50s of the 900s - the so-called period of the "*economic miracle*" - when it is built aggressively and without proper planning. Among the most striking cases we remember the Sicilian ones, the “sack” of Palermo (1950 - 1960) and the landslide of Agrigento (19 July 1966). Real looting of the territory. In the first case the Palermo land

was impoverished, in particular, the plain of the *Conca d'Oro* with its marvelous orchards and citrus groves and the Libertà street with the Liberty style villas, both subjected to indiscriminate overbuilding. In the second case, the multi-storey buildings built in the late 1950s along the southern edge of the historic center of Agrigento caused the landslide of the *Rabato/Santa Croce* district, creating serious inconvenience to the victims as well as having irreparably changed the skyline of the city. It is the period in which in many municipalities, from one day to the next, agricultural areas are transformed into building zones, building buildings and houses without the indispensable primary urbanization works or, even worse, building abuses are carried out on the coast with buildings at less than 300 meters away from the sea, indelibly disfiguring the landscape. According to a survey by ISPRA (*Higher Institute for Environmental Protection and Research*), the soil consumed from 1950 to 2021 amounted to 7.1% of the Italian surface, despite a slight slowdown between 2008 and 2013, and between 2014 and 2020. In 2021, after two years of pandemic that blocked most of the activities for months during the lockdown, another 56.7 km^2 are cemented, over 16 hectares per day, that is the loss of 2.4 sq. m. of soil per second (3). Land consumption has led to the loss of over 4 million agricultural products, with the reduction of more than 360 million cubic meters of water absorption capacity of the soil. In addition, over the last decade alone, we have lost a CO2-absorbing capacity of 3 million tonnes of carbon. Unfortunately, the consequences of the anthropic effect and the bad habits of modern civilization do not stop only at land consumption. Every day, cities and our territories are undergoing more and more transformations and changes due to:

- phenomena of hydrogeological instability, more and more landslides and overflows of rivers (4);
- changes in habitats and climate, which are putting a strain on species and ecosystems (5);
- global warming and consequent air pollution (6).

These data confront us with a sad truth: the progress of civilization has not gone hand in hand with respect for the environment. This is why it is necessary to make the most of the reforms and economic resources coming from the PNRR - National Recovery and Resilience Plan - which would allow our country to achieve the objectives of the EU 2030 Strategy, for a greener, more innovative and inclusive.

2. Land consumption and urban decay. An unstoppable phenomenon from north to south of the Country.

The transformations of the territory at the hands of man highlight a significant urban decay and a substantial loss of biodiversity, essential elements for our existence and for our well-being. The degradation of the Italian territory - due to the loss of productivity and organic carbon, erosion, fragmentation and deterioration of habitats, with the consequent loss of ecosystem services - is concentrated in some parts of the Country.

In particular, in the northern plain areas, in the metropolitan areas of Turin, Milan, Venice, Naples, Rome, Bari and Bologna, in the Adriatic coastal strip - from the Romagna coasts to Salento - in the South and South-East of Sicily (fig. 1a). The changes occurred mainly in the plains, in the valley floors and in the belt areas around the large urban poles.

The soils affected are those with an agricultural vocation, those in urban areas and not only.

In the last year, almost 3,150 hectares have been cemented in rural areas, about 2,550 hectares in urban and productive areas, 87 hectares in river and lake areas, about 53 hectares in the coastal belt (fig.1b). Soil loss is advancing even in the areas most at risk, the artificial soil now covers almost 10% of the areas with medium hydraulic danger, and almost 7% of those classified as high dangerous. Unfortunately, natural and agricultural areas continue to be covered with asphalt and cement. It is estimated that in just seven years land consumption has led to higher costs, about 3 billion euros per year, due to ecosystem services no longer provided by an artificial territory. Considering also other threats to soil and biodiversity, such as the loss of productivity and organic carbon, erosion, fires and other forms of land degradation, in the same period there were 1,600 km^2 of new, highly degraded areas, while those with more limited forms of degradation have spread over an additional 14,000 km^2, almost 5% of the national surface (fig. 2). In the ISPRA annual report of 2021, the highest percentages of land consumed are recorded in Lombardy 12.08%, Veneto 11.87%, and Campania 10.39%. While in Emilia-Romagna, Puglia, Lazio, Friuli-Venezia Giulia and Liguria the values are between 7 and 9%. Valle d'Aosta is the region with the lowest percentage 2.14% (table 1). The data confirm the advance of phenomena such as diffusion, dispersion, urban decentralization on the one hand and, on the other, the strong push to the densification of urban areas, which causes the loss of natural surfaces within our cities, valuable areas to ensure adaptation to climate change. These processes mainly concern coastal areas and lowland areas, while in marginal areas we witness the abandonment of land and the fragmentation of natural areas. To counteract the advance of cement, therefore, we must start from the cities, from a renewed relationship with nature, we must restore quality to urban contexts. We need to look at the themes of urban regeneration, which are well reconciled with other themes such as good urban practice, living spaces and sustainable development. Focusing on the recovery of abandoned spaces, redeveloping the districts in the throes of decay, can be some solutions to reduce the environmental and landscape impact created by overbuilding. There are many examples that we can

take as a reference. The interventions carried out in some European cities, such as Toulouse, Madrid or Lisbon - which aim at the rehabilitation of disused buildings, the conversion of public open spaces as models for research on architecture, the redevelopment of abandoned urban areas to be used for urban gardens - are the demonstration of how it is possible to avoid financial waste and building speculation. Interventions that aim to remodel disused buildings into new opportunities, live in harmony with nature and the environment, have a better quality of life, as required by the United Nations Sustainable Development Goals. Even in Italy we record some virtuous examples, such as in the city of Turin which following the Winter Olympics in 2006 has converted the old buildings of the Olympic village in places intended to produce exchanges and social and cultural services. Thanks to an increasingly green culture, the community has gradually become more aware of the need to protect and safeguard the environment. Today this has become a fundamental prerogative for the economy of European countries and for national companies. In fact, more and more companies decide to operate in the market in a conscious and sustainable way, creating quality products with a minimum environmental impact, towards an ecological and digital transition. And it is precisely these companies that we will deal with in the next paragraph.

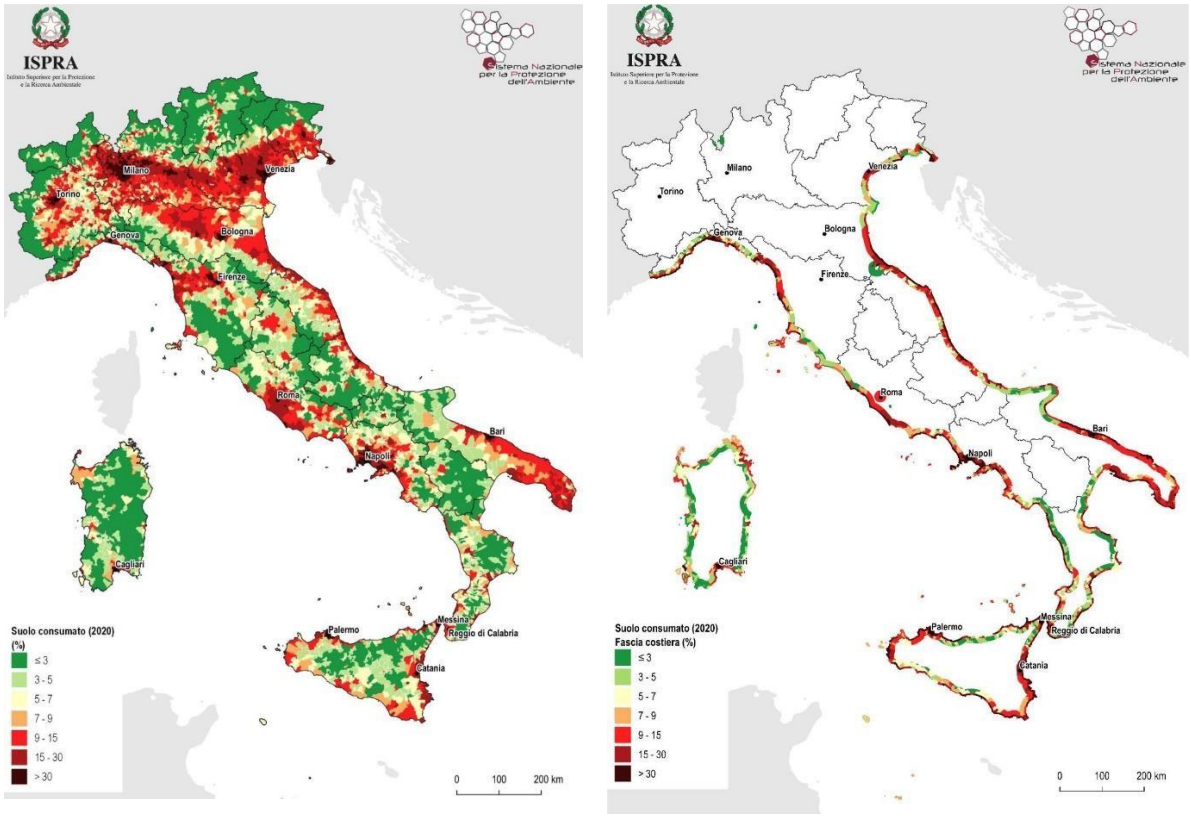


Fig. 1 - a) Soil consumed at municipal level; b) soil consumed in the coastal belt.

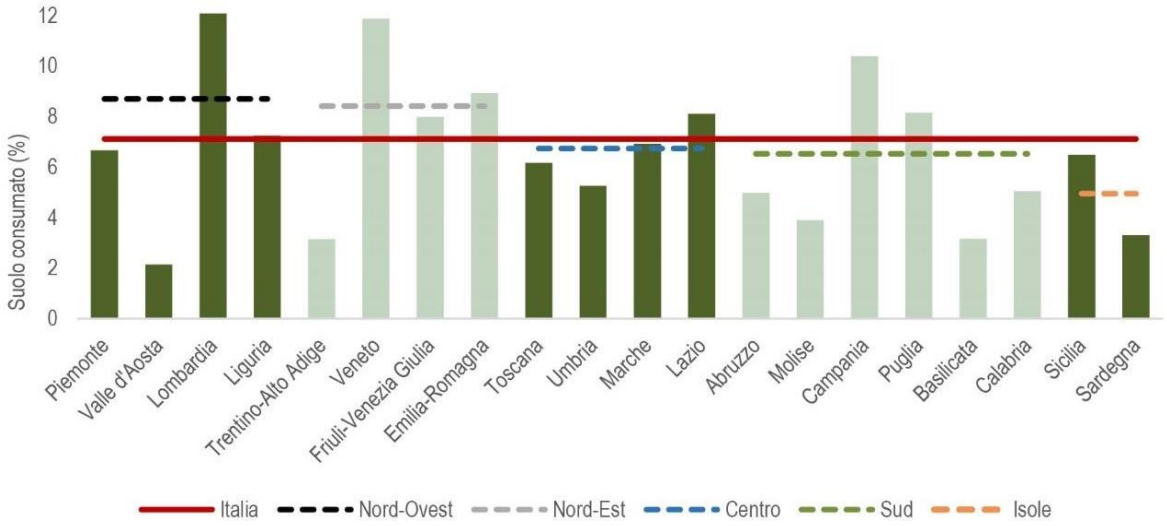


Fig. 2 - Soil consumed at regional level and by geographical breakdown. In red the national %.

Regione	Suolo consumato 2020 (ha)	Altre coperture non considerate e aree con superficie <1.000 m² (km²)	Suolo consumato 2020 (%)	Altre coperture non considerate e aree con superficie <1.000 m² (%)	Consumo di suolo netto 2019-2020 (ha)	Consumo di suolo netto 2019-2020 (%)	Densità consumo di suolo netto 2019-2020 (m²/ha)
Piemonte	169.393	78	6,67	0,03	439,36	0,26	1,73
Valle d'Aosta	6.993	3	2,14	0,00	13,87	0,20	0,43
Lombardia	288.504	176	12,08	0,06	765,45	0,27	3,21
Liguria	39.260	28	7,24	0,01	33,25	0,08	0,61
Nord-Ovest	**504.151**	***286***	**8,70**	**0,09**	**1.251,93**	**0,25**	**2,16**
Friuli-Venezia Giulia	63.267	31	7,99	0,01	65,27	0,10	0,82
Trentino-Alto Adige	42.772	20	3,14	0,01	75,97	0,18	0,56
Emilia-Romagna	200.404	96	8,93	0,03	425,33	0,21	1,89
Veneto	217.744	125	11,87	0,04	681,95	0,31	3,72
Nord-Est	**524.187**	***272***	**8,41**	**0,09**	**1.248,52**	**0,24**	**2,00**
Umbria	44.427	16	5,26	0,01	48,26	0,11	0,57
Marche	64.887	21	6,92	0,01	145,29	0,22	1,55
Toscana	141.722	62	6,17	0,02	214,33	0,15	0,93
Lazio	139.508	130	8,11	0,04	431,43	0,31	2,51
Centro	**390.545**	***229***	**6,73**	**0,08**	**839,31**	**0,22**	**1,45**
Basilicata	31.600	24	3,16	0,01	83,39	0,26	0,83
Molise	17.317	5	3,90	0,00	64,49	0,37	1,45
Abruzzo	53.768	19	4,98	0,01	246,58	0,46	2,28
Calabria	76.116	65	5,05	0,02	85,97	0,11	0,57
Puglia	157.718	63	8,15	0,02	493,11	0,31	2,55
Campania	141.343	161	10,39	0,05	210,55	0,15	1,55
Sud	**477.861**	***338***	**6,52**	**0,11**	**1.184,09**	**0,25**	**1,62**
Sardegna	79.545	57	3,30	0,02	251,24	0,32	1,04
Sicilia	166.920	189	6,49	0,06	399,62	0,24	1,55
Isole	**246.466**	***246***	**4,95**	**0,08**	**650,86**	**0,26**	**1,31**
ITALIA	**2.143.209**	**1.370**	**7,11**	**0,45**	**5.174,71**	**0,24**	**1,72**

Table 1 – Soil consumption indicators at regional level, source by ISPRA and SNPA.

3. Sicily towards the ecological and digital transition

Sicily has started its process of ecological and digital transition by equipping itself with two very important tools for the future planning of cities: the Triennial Digital Transition Plan (PTTD) and the Environmental Energy Plan (PEARS) with which it aims to achieve the objectives of the *Green Deal* and the 2030 Agenda. The PPTD is based on community, national and regional strategies adopted on the theme of the Digital Agenda starting from 2010. The aim of the PPTD is to foster and/or complete the digital transformation processes that have already begun in the public administration, civil society, businesses and, consequently, in the interactions between their ecosystems in terms of efficiency, effectiveness and cost cheapness. In particular, it aims to increase the degree of digitisation of public services, especially online public administration and online healthcare providing citizens with an advantage in terms of ease of access and improvement of existing digital services.

The PEARS, approved on February 3, 2009, is a useful tool to ensure innovation and energy autonomy, thanks to the use of renewable energy sources such as photovoltaic, solar thermal, wind and wave motion. The objective of the Plan is to transform Sicily into the most important energy hub in the Mediterranean, reaching 70% of renewable sources by 2030. The strengths of PEARS are basically three:

1 - The upgrade of existing plants to reach the target of 300 MW of additional energy;

2 - the installation of new photovoltaic systems on abandoned areas of quarries, mines, exhausted landfills and agricultural land that is no longer productive;

3 - the maximum adoption of renewable sources on the smaller islands of the Sicilian territory.

The guidelines of the new energy-environmental planning are mainly based on:

- *Active participation of the community*, as the use of renewable sources has direct social and economic consequences, as well as environmental. The quality of air and water, work, mobility, tourism and economic activity are positively affected by the green impact.

- *Development of energy from renewable sources* and use of *new technologies* will guarantee tangible economic benefits for Sicily, both in terms of new skilled jobs and lower energy supply costs.
- *Protection* of the artistic and historical heritage of the area through innovative technologies, based on the use of renewables and able to functionally integrate with the architecture and beautiful landscapes of the Sicilian territory.

In particular, for 2030 it is expected:

- a 10% reduction in consumption in the industrial sector;
- a 15% reduction in consumption in the civil and agricultural sectors;
- a 10% reduction in consumption in the transport sector.

For the private sector, the efficiency measures will mainly concern:

- the promotion and incentive of interventions to redevelop private real estate assets for residential use, with particular reference to condominiums;
- the reduction of energy consumption and gas emissions of companies and production areas.

Thanks to these tools, the island is launching a new phase of development towards the ecological and digital transition by promoting sustainable development capable of promoting participatory and integral regeneration processes of territories and communities.
In this regard, we recall below the models of sustainability, innovation, use of renewable energy sources, *green agricultural* production implemented in some municipalities: Salemi, Mazara del Vallo, Paternò, Santa Cristina Gela, Naro.

3.1 A Sicilian maxi park for renewables

In the territory of Salemi (fig. 3), in the province of Trapani, one of the windiest areas of Italy, a maxi park for renewable energy is being built. This is the largest photovoltaic plant in the country - with innovative turbines that allow, against 38MW of installed power, the production of 115 GWh per year - and a large wind farm with 135-meter diameter blades. A green and innovative choice by the Region which together with the *ENGIE* company decided to invest 140 million euros. Thanks to this initiative - which has already brought a series of benefits to the population and the environment - important compensation works have been started for the territory for 7 million euros, a landslide area has been made safe, the coverage of the municipal stadium with photovoltaic panels, refurbished two purifiers, renovated the former Santa Chiara convent and provided for the energy efficiency of a school to ensure green and sustainable energy. In addition to the wind farm in Salemi, the ENGIE company is engaged in the construction of two agro-photovoltaic parks, in the territory of Mazara del Vallo (Trapani) for an extension of 115 hectares, and in the municipality of Paternò (in the province of Catania), for 75 hectares. These plants will have a production capacity of 1040 MW peak. 80% of production will go to Amazon, or 66MW, to power its factories; the rest will be placed on the market to meet the needs of 20,000 Sicilian domestic users. A saving of 62 thousand tons of Co2 is expected. For the technologies used, these are the most innovative systems designed in Italy, with panels with double-sided technology and large size. This type of energy aims at a hybrid use of the land, alternating fields and photovoltaic panels. In other words, the large sunny spaces are used in the same territory for photovoltaic systems without giving up cultivation: the sun continues to make the raw materials grow and mature and at the same time offers us renewable and sustainable energy.
In the municipality of Santa Cristina Gela (Palermo), near Agghiastro is the most powerful hydroelectric plant in Sicily. Taking advantage of the physical characteristics of the existing aqueduct, the company Amap S.p.A., manager of the integrated water service in 35 Municipalities of the Metropolitan City of Palermo, has started - after an important modernization and functional efficiency intervention - the restoration of the hydroelectric plant. The hydroelectric plant has a power that is the largest on the island after those managed by Enel S.p.A.. In fact, compared to the hydroelectric plants registered in Sicily, which produce a power greater than one megawatt, the one built by AMAP S.p.A. has a potential of 2.5 Megawatts, thus resulting in the power plant with the greatest potential managed by a fully public-owned company, capable of producing about 10 kWh of energy, and meeting the energy needs of companies in the entire province of Palermo. In addition, the energy produced is such that it can be sold to the service manager, with an estimated saving of 40%. With this project, Sicily has shown that it is able to exploit in a responsible and sustainable way a resource that already exists in the area (fig. 4).

3.2 Farms and biodiversity

The innovation and sustainability of the Sicilian challenge is achieved not only through the production of renewable energy but, also, in the choice of an increasingly sustainable and green agricultural production. This is the case of some farms that are investing heavily in recovering biodiversity, past traditions and aiming for the future thanks to environmental sustainability.
In this regard, we recall the *Bagol'Area* EcoFarm (fig. 5), located on the stretch of the sicilian coast between Catania and Messina, 24 hectares of biodiversity with vegetable garden, citrus grove, orchards, vineyards and woods, all strictly organic. *Bagol'Area* is the eco-village project that was born from a group

of enterprising and passionate friends who bought a farm in 2008, which took the name Bagolaro of the "*sentinel*" tree at the entrance to the fund.
"The challenge is to prove that an alternative human settlement to urban aggregation is possible both in economic and social terms, rediscovering human values and finding harmony and balance with the surrounding environment".
An avant-garde reality that develops on the eastern side of Etna, whose foundations are rooted in tradition and in the recovery of the territory, but largely projected into the future thanks to the massive use of renewable sources such as biomass heating systems and solar panels.
The enhancement and recovery of the territory have as their main objective that of restoring biodiversity and indigenous cultures through a replanting project that requires, among other things, ancient knowledge and workers.
The renovation of the buildings, uninhabited for over 30 years, took place following the principles of green building and energy saving that reuse pruning waste and the remains of forest maintenance. A phytodepuration plant and a bio-lake has been built, and the ancient rainwater collection and recovery tanks have been recovered.
The positioning of the crops and the irrigation system takes into account the slope of the soil by exploiting the fall irrigation and reducing the use of energy. Phytodepuration and a pond for the collection of rainwater from the roofs of buildings support the irrigation of ornamental areas. The philosophy of renovations has always been directed towards environmental sustainability; from the use of eco-friendly materials to the choice of local collaborations for the rediscovery and revaluation of ancient techniques (dry stone walls, earthenware technique, etc.). In addition, Permaculture (7) and biodynamics are also being experimented.
When sustainability meets the excellence of the territory, however, the result is a farm that has revolutionized all olive oil production, from flowering to bottling. We are talking about the Val Paradiso farm, in Naro, in the province of Agrigento.
The choice of a totally organic agriculture that relies only on the use of natural pesticides goes hand in hand with the choice of eliminating CO2 emissions associated with the production of the product and bottling. In fact, the power supply of the traditional oil mill has now been replaced by the green energy produced by a photovoltaic and wind power plant. The company also enhances food waste by exploiting the kernel olive for internal heating of the same.
And again, in the list of virtuous and sustainable models we remember the *Boniviri* project (people of value), founded by three entrepreneurs under 30 who have united under a single brand the small Sicilian companies that work in a sustainable way, producing quality products.
The innovation of the project stems from the sensitivity of young entrepreneurs who have understood the difficulties of small olive oil producing companies to enter the increasingly saturated market of large companies and multinationals.
The company supports these small businesses on the market on condition that they meet the criteria of sustainability and quality.
The project rethinks the supply chain and product *packaging* from an *eco-friendly* and responsible perspective, eliminating the carbon footprint of products through emissions offsetting projects.
Furthermore, thanks to a partnership agreement with Linkem S.p.A., Italy's leading 5G telecommunications operator in the wireless ultra-broadband sector, the growers who join the project are offered innovative 4.0 agriculture services. Linkem4Farm intelligent agriculture services - developed in collaboration with XFarm and Farm Technologies - involve the use of an integrated digital platform for farm management connected to a system of sensors that communicate with the mobile application, all through the cloud.
Through smartphones and tablets, growers will be able to manage and coordinate corporate administrative activities digitally, automate activities such as stock control, machinery maintenance and export the specific documentation required for companies operating under organic farming, including export. specific documents for members of the *GlobalGap*.
Thanks to forecasting models based on artificial intelligence it will be possible to consult in real time the data coming from the field - such as soil humidity and temperature, salinity, conductivity, leaf wetness - and receive precise agronomic advice, for example on when and how to irrigate, improving thus the quality of production and management and effectively plan field work.
This is the Sicily we like to tell, not that of illegal building and overbuilding.
A region founded on ancient traditions, with an extraordinary tangible and intangible heritage that looks constructively at the challenges of the future.
Technology, sustainability and the richness of the territory become co-protagonists of a history rich in value for the economic realities and for the communities that participate in it.



Fig. 3 - View of the renewable energy park in the territory of Salemi (Trapani).



Fig. 4 – Hydroelectric plant Agghiastro, Santa Cristina Gela (Palermo).



Fig. 5 - *Bagol'Area* Farm (Catania).



Fig. 6 -*Val paradiso* Farm, Naro.

Conclusion

Today we are faced with a great challenge. It is the challenge of a civilisation which, in order to survive, must go beyond. A substantial reduction in land consumption, in order to soon reach the European objective of zero soil use, is the prerequisite for ensuring a sustainable recovery of our territories through the promotion of natural capital and the landscape, urban regeneration and quality construction, as well as the reuse of contaminated or abandoned areas. For this purpose, it will be essential to provide Municipalities and Metropolitan Cities with clear indications and useful tools to also review the forecasts of new buildings present within the urban and territorial plans already approved. The European Union has announced the objectives to zero land consumption by 2050, avoiding any increase in environmental degradation after 2030. This is an essential commitment to protect the landscape and soil by focusing on the circular economy and qualitative urbanization through redevelopment.

Preserving the environment means increasing its ability to absorb rainwater, greenhouse gas emissions and provide quality food through sustainable agriculture. Stopping wild overbuilding requires the participation of the whole society, from citizens to institutions to businesses, to live *green* and support the green revolution. In this way it is possible on the one hand to protect the soil and the environment, and on the other hand to reduce the carbon footprint by using renewable energy for light and gas.

Time to take action!

Notes

(1) Urbanization is the process of development and organization that leads an inhabited center to assume the typical characteristics of a city.

(2) SVIMEZ Report 2011.

(3) ISPRA Report (Higher Institute for Environmental Research) 2021, the data reported indicates 20 soccer fields covered with artificial surfaces a day.

(4) As in Sicily, on 11 December 2021, due to bad weather there was a new flooding of the Magazzolo and Verdura rivers in the territory of Ribera (Agrigento).

(5) One million species of plants, insects, birds and mammals around the world are currently threatened with extinction. And up to 200 species go extinct every day.

(6) The two richest countries in the world that pollute the most are the United States and China. However, China has increased public investment in clean energy since 2010. In Europe the most polluted city is Timisoara (in Romania), home to several industrial groups and factories. In the world Cairo, capital of Egypt, is the city with the most polluted air. According to the latest report of Eco Expert the level of PM10 amounts to 284 ug / m3. Contrary to what you might think, even in Africa pollution is high and causes deaths across the continent. Ghana is one of the countries with the most pollution-related diseases. In Agbogbloshie, a suburb of the capital Accra, there is the largest open-air dump in the world, where large waste (such as electronic waste) is burned, damaging the atmosphere and the waterways. A report by the World Bank and the Institute for Health Metrics and Evaluation (IHME) states that pollution diseases have killed 5.5 million people. Losses were also found in countries in Southeast Asia such as Vietnam (malformations and skin diseases) and Laos (many pesticide poisonings). Although the damage caused by urban pollution is severe, solutions can be adopted that combine modernity and sustainability. According to the UN, we could save up to half the resources of our planet if the transport and infrastructure sectors were managed efficiently. By focusing on the diffusion of vehicles with electric propulsion, even for short journeys, it is possible to reduce the amount of CO2. As well as encouraging car-sharing and building traction public transport such as trolleybuses and trams. Meanwhile, many states are making commitments to a cleaner world: by 2045 California will use only renewable energy and Sweden is increasing the construction of wind turbines. Italy, which is third in Europe for the use of energy renew.

(7) Permaculture is a set of pseudoscientific agricultural practices aimed at designing and managing humanised landscapes that meet people's needs for food, fibre and energy while exhibiting the resilience, richness and stability of natural ecosystems.

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Stone facades and curtain walls

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Abstract
Inspired by the quality and aesthetics of the marble stone as well as the residual marble stone and challenged by the current paradigm of sustainability and circular economy, we created several architectural applications, projects and prototypes such as modular grids for curtain walls that take advantage of the local bioclimatic conditions, as well as its application on urban equipment and the use of waste marble as visible element of the building envelope. Then we studied the ecological benchmarks of the use of waste marble in the mentioned applications.
Among the examples, the kiosk of Vila Viçosa stands out - built from laminated marble plates alternately overlapped in full/empty composition - destined for the tourist info point and also functioning as an urban lantern at night time. Another form of hybrid architectural application is the combination of green-grid stone facades and structural masonry with residual marble cyclopic blocks, as in the case of the building project for the Vinery of Vidigueira or the experimental wall designs.

Keywords: residual marble, marble skin facade, bioclimatic facade and ecological benchmarks

1. Environmental friendly structures

The connection of Global Warming to these matters divides opinions, but the necessity of improvement in pollution caused by gas emissions and energy usage is generally accepted as a necessity. International targets have been set during the last decades through worldwide endeavour and the United Nations promoting annual conferences. The last more important is the Paris Agreement of 2015, where governments accordingly establish national goals to meet the targets they themselves authored and conducted. This fact promotes and encourages research to contribute and support this endeavour. It is not an objective of this work to give an account of the conferences and goals of the various countries, but as an imperative example it has to be mentioned that the European Commission has set a 30% energy efficiency target for 2030. [1]
Certainly the main field to contribute for these goals is the research for innovations on an efficient production and use of renewable energy. On the other hand the consumption of energy has also to be reduced even by use of renewable energy for protecting the environment and avoiding excess of land occupied by power plants. Considering this point, the housing sector is known as a major consumer of energy. The Department of Energy & Climate Change of the United Kingdom states in 2013:

> *"The energy used in homes accounts for more than a quarter of energy use and carbon dioxide emissions in the United Kingdom. More energy is used in housing than either road transport or industry, and housing represents a major opportunity to cut energy use and CO_2 emissions."* [2]

The German Federal Bureau for Environment writes in a statement of 23.2.2018

> *"The private households consumed in the year 2016 as much as energy as in the year 1990 and so far a quarter of the hole final energy consumption of Germany. They used more than 2/3 of final energy consumption for heating of rooms."* [3]

In southern European countries and regions the energy consumption of households is slightly lower than for transport or industry, as in average less heating is necessary, but instead the necessity for cooling avoids a significant reduction in comparison with northern countries, according to the Final Report, Analysis of the energy consumption of the household sector in Spain of 2011, elaborated by the Government of Spain.
Generally spoken, this gives us an idea about the importance of discovering ways how to reduce energy consumption in households, having in mind that by appropriate measures the gas emissions will be reduced adequately.
The above figures include also the electricity consumption for lightening and other devices, but the heating or cooling during the household's life cycle is dominant and can efficiently be reduced. As said before the usage of renewable energy plays an eminent role, but a matter less known is the construction material that can contribute significantly to the reduction of energy consumption. Even the embodied energy of construction materials, which includes the energy consumed for extraction of raw materials up to manufacturing, transport and construction, is a significant value of interest. The total energy consumption of a building during life cycle is composed of embodied energy and the energy consumption during the operation of the building. In previous studies it had been proven that the embodied energy makes up to 30 to 35% of the total energy consumption. Therefore the choice of materials and construction solutions do have an important role in the environmental friendliness of a building.
As small houses constitute the majority of the building park of many countries, this research focuses o this type of buildings. Considering that concrete is the most widely used construction material in the world; it can serve as a reference to discover by comparison how much other structural construction solutions contribute to the reduction of energy consumption, gas emissions and economy in comparison with concrete structures.

2. Method for determining benchmarks

To achieve the objectives and to be able to compare fairly and scientifically a digital three-dimensional building model is developed that is capable to harbour the conditions necessary for this study. As the household is one of the greatest consumers of energy, the model is more related to habitat than administration and represents small housing units up to four floors. The wall spans used are the common spans in every housing, 4 to 7 meters. The created conditions for this study are the minimum necessary structural strength, to guarantee minimum use of constructional materials and to design similar thermal comfort for having the same habitat quality for each construction solution. The comparison analyses the embodied energy, the carbon dioxide emissions and the macro- and micro economy of the construction materials from cradle to delivery at construction site, considering extraction, transportation, transformation and the production.
The three-dimensional model is at the beginning in its integrity studied for the construction solutions Concrete Model (CM) and Masonry Model (MM). Thus, the minimum quantity of necessary construction material is established and the study can proceed with the quantification of the materials. The quantification can be limited to the structural construction materials as the other materials like plaster, finishing, windows, doors, interior division walls etc. can be used for any kind of constructive solution.
The environmental benchmarks like embodied energy and gas emissions of the materials have to be supplied by the industry and research centres, as the *INVENTORY OF CARBON AND ENERGY*, from the two researchers Prof. Geoff Hammond and Craig Jones of the Sustainable Energy Research Team (SERT), Department of Mechanical Engineering of the University of Bath from 2011, have listed. [4]
With these indicators and the material quantities calculated the embodied energy and gas emissions for production and realization of the project could be analysed and compared in both constructive solutions, likewise variations of these solutions can be considered for better analysis. Furthermore, the lifecycle of the project should be taken into account for all solutions concerning the energy consumption (energy consumption is the sum of embodied energy and the energy consumed during operation of the project), which improves the understanding of the energy consumptions differences and gives a realistic picture of the environmental friendliness of the project concerning materials choice.
Finally the costs have to be compared on the same bases of comparison as described and if applicable the impact of a constructive solution on the macro economy of a region or nation can be analysed concerning Labour Cost Per Unit and employment.
After this start gradually other construction solutions are studied always in comparison to the CM. This way a cross comparison between other construction solution can be examined always having the CM as a reference figure.

3. Masonry of bricks and stones

3.1 Brick masonry

We present at this point the first attempt and than the widening of the research.
As explained above the indicators for gas emissions GE and embodied energy EE are presented in the following table.

Table 1. Recommended average GE and Embodied EE values for the selected construction materials

Construction material	CO_2 ($kgCO_2/kg$)	EE (MJ/kg)
Clay brick	0,100	1,02
Concrete	0,100	0,81
Steel	1,400	17,40
Mortar with a compressive strength of 5 -10 MPa	0,213	1,40

The building model is once considered with a reinforced concrete structure, consisting of columns, beams and slabs, with brick walls in between the columns in the periphery and interior of the building. Then, structural masonry with clay blocks in the exterior and interior walls is studied. Both models are analysed in two versions. In the first version the slabs are of reinforced concrete and in the second version the slabs are built in pre stressed concrete beams and clay blocks. The building model represents for all solutions equal conditions.[]
For both models, we must achieve minimum normative stability and equal environmental comfort to render the comparison a scientific and meaningful component. The comfort characteristic is a conditioner to choose the right materials, knowing that thermal insulation is not very environmentally friendly in production but still necessary in construction. For exterior walls an insulation of 3 cm, with a thermal conductivity of 0,035 W/mK, is applied in both models. This will result in a similar thermal transmittance of 0,456 W/m^2K for the Concrete Model and 0,422 W/m^2K for the Masonry. [5]
The comparison is limited to the quantification of the most important environmental parameters, the embodied energy and CO_2 emissions including equivalents and to the macro/micro economical impact on the society.
The following tables show the results.

Table 2. Comparison of masses in kg, CM – MM Version 1

Construction Material	CM1	MM1	Difference (CM-MM) (%)
Brick (exterior)	99.849	219.866	-120
Brick (interior)	23.793	45.211	-90
Concrete	457.691	284.836	+38
Steel, rods	26.838	19.712	+27
Mortar	25.844	27.282	-6
TOTAL	634.015	596.907	+6

CM: Concrete Model; MM: Masonry Model, Version 1: Masonry Model with concrete slab

In the Masonry Model it can be identified a reduction of 172855 kg of concrete due to the lack of columns and bars, on the other hand, a rise of 120037 and 21418 kg of bricks because of the more dense thermal and the clinker brick for the interior walls. Considering also the little differences of steel and mortar, in general the Masonry Model Version 1 uses 37108 kg less material for the structure, which is a very moderate reduction of the masses, compared with the Concrete Model with reinforced concrete slabs.
In case of Masonry Model Version 2 the reduction of concrete with 312341 kg is much more notable due to additional lack of concrete slabs compared with Masonry Model Version 1. The brick ceiling, composed of bricks, cement and rods, is much lighter as concrete slab and substitutes the slab of Version 1 with only 48871 kg. Consequently the total reduction of materials in Version 2 is 140673 kg compared to the Concrete Model with solid slabs.
Comparing both Versions 1 and 2 of the Masonry Model, it can be verified that Version 2 reduces the total weight 17,35 %, specifically 49 % in concrete and 65,7 % in steel.

In the next table we compare the masses of all versions with each other and prepare for the comparison of the benchmarks.[5]

Table 3. Comparison of masses in kg, CM – MM Version 2

Construction Material	CM1	MM2	Difference (CM-MM) (%)
Brick (exterior)	99.849	219.866	-120
Brick (interior)	23.793	45.211	-90
Ceiling brick	0	48.871	-
Concrete	457.691	145.350	+68
Steel, rods	26.838	6.762	+75
Mortar	25.844	27.282	-5,6
TOTAL	634.015	493.342	+22

Version 2: Prefabricated beams and clay blocks slab

Table 4. Comparison of masses in kg in all versions

Construction Material	CM1	CM2	MM1	MM2
Brick (exterior)	99.849	99.849	219.866	219.866
Brick (interior)	23.793	23.793	45.211	45.211
Ceiling brick	0	48.871	0	48.871
Concrete	457.691	284.864	284.836	145.350
Steel, rods	26.838	13.888	19.712	6.762
Mortar	25.844	25.844	27.282	27.282
TOTAL	634.015	497.109	596.907	493.342

Tables 5 and 6 show that in case of the CM1 the primary materials, concrete and steel, contribute with a majority of 45% and 37% of CO_2 emissions of all materials used for the construction, and respectively with 37% and 47% of embodied energy. In version 2 of the Concrete Model the CO_2 emissions for concrete are reduced to 40%, close to the clay material, and steel to 27%. Concerning embodied energy, concrete is reduced to 34% of contribution, clay material to 25% and steel to 35%. Likewise MM2, the main materials brick and concrete contribute with 51 and 24% in CO_2 emissions, and 54% and 20% in embodied energy.
MM1 is a little bit environmentally friendlier than CM1, because the reduction of masses is low. As mentioned before, the carbon dioxide emission of clay brick is equal to concrete and the embodied energy is even higher. The production of clay bricks consumes more energy for backing and causes also the high emissions. It can be verified in Tables 5 and 6, if CM2 is compared with MM2, although CM2 has a far higher amount of steel, but MM2 with much more clay bricks cannot perform much better than CM2.[5]

Table 5. Comparison of CO_2 emissions ($kgCO_2$)

CO_2 emissions	CM1	CM2	MM1	MM2
Concrete	45.769	28.846	28.484	14.535
Brick	12.364	17.251	26.508	31.395
Mortar	5.505	5.505	5.811	5.811
Steel, rods	37.573	19.443	27.597	9.467
Total at fabric gate	101.211	70.686	88.399	61.208
Transport	5.577	4.044	5950	4.044
TOTAL	106.788	74.729	94.349	65.251

Table 6. Comparison of embodied energy (MJ)

Embodied Energy	CM1	CM2	MM1	MM2
Concrete	370.730	230.740	230.717	117.734
Brick	126.114	175.963	270.379	320.227
Mortar	36.182	36.182	38.195	38.195
Steel, rods	466.981	241.651	342.989	117.659
Total at fabric gate	1.000.007	684.536	882.279	593.815
Transport	27.989	17.553	23.851	16.168
TOTAL	1.027.996	702.089	906.131	609.982

3.2 Stone masonry

The marble quarries of Portugal have a high number of waste marble, as only between 5 to 25% are considered for use and marketing. The rest is considered waste stone rejected and dumped into the landscape around the quarries by the industries of extraction and transformation of marble. This led to the idea of using the waste marble for construction of small houses.

The comparison of the environmental performance of reinforced concrete and white marble blocks follows the same pattern as shown above. For saving space and time the presentation of the quantification of material is skipped and the results below demonstrate the results of embodied energy and carbon dioxide emissions of the construction materials from cradle to delivery at a construction site, considering extraction, transportation, transformation and production. One model is constructed with a structure in reinforced concrete, columns, beams and slabs, with exterior and interior walls in bricks, which is designated as Concrete Model CM, equal as before; the other in non-reinforced stone masonry, designated as Stone Masonry Model SMM. Both models have reinforced concrete slabs.

In the case of the SMM the stability requirements are also overpassed by having 50 cm width of stone bricks, which are necessary by experience for the building of the walls. Regarding the comfort conditioner, the choice falls to cork that has the lowest benchmarks concerning gas emissions GE and energy consumption EC, 0,19 kgCO_2e/kg, 4 MJ/kg, other insulation materials are at least four times higher. Knowing this fact, the brick chosen for CM is a thermal brick with excellent thermal performance that has a width of 29 cm. This leads to choosing 30 cm square columns for the CM to match with bricks, simplifying the construction process. As a result, the stability of the CM with 20 cm slabs for a three-floor building is given, which overpasses the minimum requirements. For the CM a 3cm cork insulation is considered and for the SMM 6,5 cm. For both cases, the same thermic plaster of 2,5 cm is considered for outside and an interior common revetment of 1,5 cm only for the CM as the surface of the marble is smooth and comfortable. This configuration results in a similar thermal transmittance of 0,44 W/m^{2}K for the CM and 0,441 W/m^{2}K for the SMM. Hereby, both models are well designed for a justified comparison. [6]

It has to be noted that the stone blocks receive only 5 cuts to reduce costs, GE and EC. The slightly irregular face is turned to the exterior where it will be covered by the heat insulation and plaster.

Table 7: Materials benchmarks

Materials	CO_2 emissions kgCO_2e/kg	Energy Consumption MJ/kg
Concrete	0,12	0,81
Marble white	0,11	1,70
Mortar	0,213	1,40
Steel, rods	1,40	17,40
Cork	0,19	4,00
Clay brick	0,24	3,00

The tables show that concerning GE we have a rise of 12% in total for the SMM compared with CM and a more unfavourable result of 29% regarding EC, Tables 8 and 9; the negative sign indicates an unfavourable progress. This is due to the quantity of EC for the blocks and their higher weight, more than double and, on the contrary, a significantly lower reduction of the steel quantity, which is a strong polluter and energy consumer. Therefore, to reduce the use of steel, the SMM is considered in a second version SMM2 substituting the concrete slabs with light slabs, beam and block ceilings, which means a drastic reduction of steel.

Table 8: Comparison of GE in kgCO_2e/kg, CM – SMM

CO_2 emissions	CM	SMM	%
Concrete	54.923	38.182	30
Block	25.914	66.330	-156
Mortar	6.961	4.722	32
Steel, rods	37.573	28.892	23
Cork	310	671	-117
Total at fabric gate	125.681	138.797	-10
Transport	5.250	7.259	-38
TOTAL	130.931	146.056	-12

Table 9: Comparison of Energy Consumption EC in MJ/kg, CM – SMM

Energy consumption	CM	SMM	%
Concrete	370.730	257.723	30
Block	265.433	823.753	-210
Mortar	45.751	31.037	32
Steel, rods	466.961	359.084	23
Cork	6.521	14.128	-117
Total at fabric gate	1.155.415	1.485.725	-29
Transport	23.998	32.776	-37
TOTAL	1.179.413	1.518.502	-29

This comparison proves that the reduction of steel is a real game-changer, taking into account that the weight and quantity of steel is much lower compared to concrete or masonry, Tables 10 and 11. The SMM2 is now 12% better concerning GE, and regarding EC, the SMM2 is still 8% below the CM, but it should be considered that the use of debris marble is a benefit to the environment. Valuing this credit goes far beyond this research; if the energy consumption for storage and handling of the debris is calculated and the environmental benefit of the use of debris is valuated, it may justify the excess of the EC and promote its use.
In this research, the debris of marble is considered, but it has to be said that the debris of limestone can also be considered and as it is a softer stone, the indicators will be more beneficial and on the contrary, granite is a much harder stone and therefore more energy-consuming and gas emitting in extraction and in the transformation process.[6]

Table 10: Comparison of Gas Emissions GE kgCO_2e/kg, CM – SMM2

CO_2 emissions	CM	SMM2	%
Concrete	54.923	17.442	68
Block	25.914	78.059	-201
Mortar	6.961	4.722	32
Steel, rods	37.573	9.467	75
Cork	310	671	-117
Total at fabric gate	125.681	110.361	12
Transport	5.250	5259	0
TOTAL	130.931	115.620	12

Table 11: Comparison of Energy Consumption EC in MJ/kg, CM – SMM2

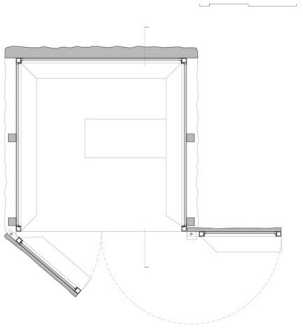
Energy consumption	CM	SMM2	%
Concrete	370.730	117.734	68
Block	265.433	970.366	-265
Mortar	45.751	31.037	32
Steel, rods	466.961	117.659	75
Cork	6.521	14.128	-117
Total at fabric gate	1.155.415	1.250.924	-8
Transport	23.998	25.658	-7
TOTAL	1.179.413	1.276.581	-8

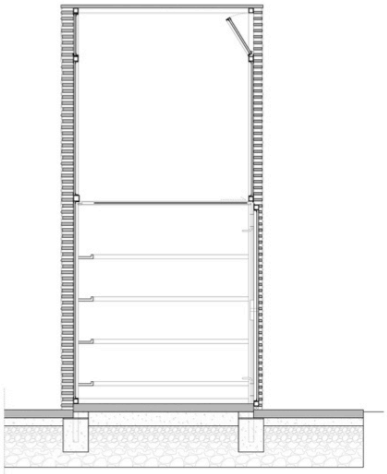
4. Some applications

4.1 The Kiosk Lantern

After showing the environmental benefits of marble, we wish to present some applications of our experience for the use of waste marble.

This urban furniture piece arises from an ecological use of residual marble stone plates and blocks, trying to make the most of the aesthetical, functional and economic value. Through its geometrical forms, the stone kiosk acquires a hybrid condition between a design piece of furniture, an urban lantern and a minimalist sculpture that we coined “para-architecture”, an inhabitable space in between architecture and sculpture.

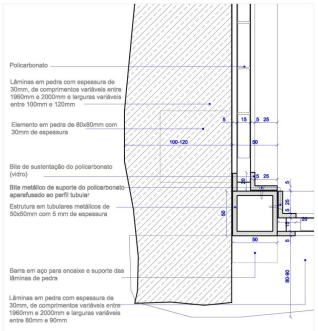


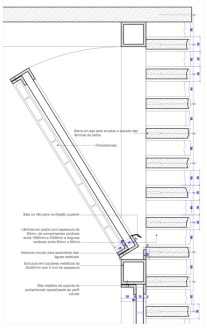


Figures 1 and 2: Kiosk, plan and section



Figure 3: Kiosk opened





Figures 4 and 5: Plan and Section details

By night, when closed and lightened, the kiosk takes the form of a big lantern, on the scale of the urban image, in which light can, gradually, change colour. A skin facade made of overlapping stone slabs, creating an alternating play between full/empty that allows natural ventilation and shading composes the kiosk construction. The plates are overlapped at the corners, surrounding a tubular metallic structure that supports the interior surface, comprised of transparent or trans lucid

polycarbonate sheets. This construction seeks to enhance the aesthetic value of Marble Stone, using grotesque cracked cut slabs to take the most advantage of the rough textures and crystalline grain. Simultaneously, it looks to safeguard and resists vandalism and ageing. To create a compact form, the doors are disguised, and hinges are hidden. The doors, when open, work as a support to display touristic information, magazines, craftwork stands, with 2 x 2m in width and 4m in height, is reinforced in its interior by the stainless-steel structure. The roofing can support a photovoltaic panel.




Figure 6 and 7: Kiosk in Vila Viçosa, at daylight and night. Design: Jorge Cruz Pinto and Cristina Mantas, architects, structure: Soheyl Sazedj



Figure 8: Cracked stone plates



Figure 9: Corner solution

Technical characteristics:

- Exterior walls with overlapping marble stone plates, from Estremoz/Vila Viçosa (or other local stone from the place of integration), with full/empty plates composition
- Stainless Steel interior structure, with transparent or translucid polycarbonate sheets 12mm thick
- Polycarbonate interior shelves.
- 180º opening doors, expositive shelves and security lock
- Two superior tilting openings for ventilation
- Polycarbonate extendable sliding exterior protection, protecting from the rain and sun
- Interior lighting with polychromatic led
- Possibility of energy autonomy through the placement of photovoltaic panels on the roofing
- Dimensions can change according to demand and the intended function



Figure 10: Kiosk forms and skin façades variations, Jorge Cruz Pinto and Cristina Mantas, Arch.

4.2 The Patio of the Vinery of Vidigueira

The Vinery of Vidigueira is a project designed with exterior walls in stone masonry stiffened by an inner steel structure that also supports the ceiling. Outstanding is the exterior wall design and the patio where visitors can see the production line through a glass facade and enter the administration department. A double-skin facade that takes advantage of the bioclimatic conditions protects the administrative part in two floors connected to the patio. It is equipped with a ventilation system and ornamental panels like stone *mashrabiyas* that allows shadowing and natural ventilation. “Vinery of Vidigueira” is a non-executed project whose prototype was made for the sake of the research. [7]



Figure 11: The Vinery



Figure 12: Patio Stone Laminar Skin Façade
Architecture Design Jorge Cruz Pinto and Cristina Mantas, Arch; structure Soheyl Sazedj

4.3 Experimental Wall Designs

Among different morph-typologies developed, we illustrate this experimental design using residual marble blocks for two structural walls in contrast with the laminar stone skin façade for natural ventilation and shading in experimental composition, with variations of angles, vertical and horizontal rhythms, and transparency effects.



Figure 13: Experimental Building, Architectural Design: Jorge Cruz Pinto

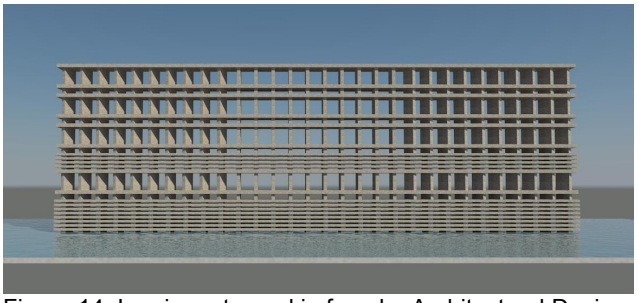


Figure 14: Laminar stone skin façade, Architectural Design: Jorge Cruz Pinto

4.4 An Applied Example of Experimental Wall Designs, Carcavelos, Portugal

Based on the previous experimental project, we have designed an extension for an existing house in Carcavelos (Portugal), where we have proposed a patio typology and a laminar stone skin facade confronting southwest orientation in order to have an integrated solution of shading, avoiding the sun rays to touch the glass doors behind; natural ventilation, creating air stream convection through the patio; and providing privacy by filtering the views from the garden and street. The limestone plates were used to combine with the existing windows and door stone frames.

By transforming the scale of the experimental grid into a smaller one, we also have reduced the complexity of horizontal levels. In terms of structure, the stone plates compression system is reinforced with a traction system through stainless steel suspenders horizontally braced and tied to the concrete aside pillars. [8]

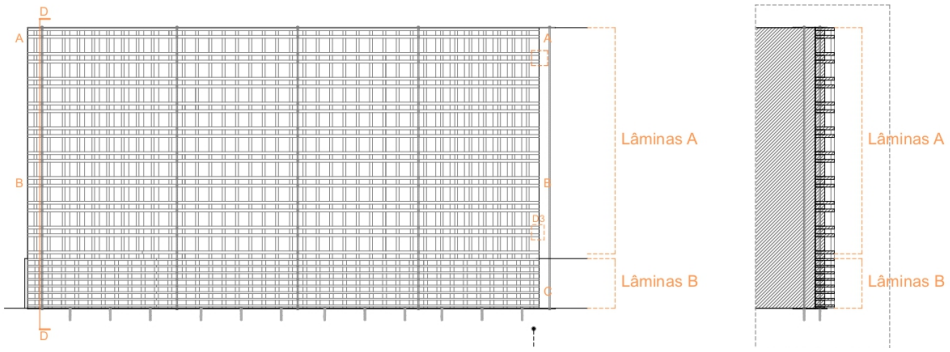


Figure 15: Laminar stone skin facade and section. Architectural Design: Jorge Cruz Pinto

Conclusion

The use of stone as a construction material is an ancient technique that can be observed in old heritage construction worldwide. This research intends to promote the reuse of debris stone as a structural material and ornamental material in ventilated facades by taking advantage of bioclimatic conditions to enhance the effects of shadowing combined with natural vertical ventilation, thereby improving the environmental conditions of the building. First, it can be concluded that using the debris stone is an obvious benefit to nature and natural resources. Second, the research also showed that compared to a reticulated concrete structure with thermal clay bricks for typical habitats, the marble masonry is not much behind regarding environmental indicators. Furthermore, it must be expressed that the use of limestone debris instead of marble will improve the indicators and if for comparison a three-floor office building totally in concrete is considered, we can argue that the same in stone with double skin façade will be more environmentally friendly. [6]

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Digital manufacturing systems and smart materials for a sustainable anastylosis process

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Abstract

One of the most discussed themes in the archaeological restoration field is concerned with the necessity to use efficient methodologies of intervention for the conservation of ancient monuments of relevant historical interest, able to ensure a total reversibility of the intervention, preserving the characteristics and materials of the original structure.
The university research with expertise in ancient architecture and stone, since 2010 leads a multidisciplinary research on anastylosis.
The collaboration with different specialized Apulian companies has allowed to improve the relationship between the digital systems in use (3D laser scanner,CAD/CAM and CNC-AM) and to validate innovative materials in Archaeological Restoration. The attention is focused on the use of metallic non-ferrous materials, such as Shape Memory Alloys (SMA). They are defined as "smart" materials, exhibiting unique properties in respect of traditional metallic alloys. The associated reconstruction technique uses biocompatible fastening systems with low invasiveness and positive repercussions on monuments and the environment.
The contribution - through the case study of the restoration of the Roman temple of Agrigento - aims to trace the main stages that led to the validation of this methodology aimed at making the anastylosis of ancient monuments sustainable, also through the construction of new relationships between the research and the production system (Smart Factory).

Keywords: restoration, anastylosis, digital manufacturing, smart materials, Agrigento

The anastylosis' intent is to preserve the monuments in ruins, guaranteeing the repositioning of their collapsed fragments onto their original positions [5]. The first Restoration Charters, respectively dated in 1931 and 1964, represent the expression of this practice, widely spread in the Mediterranean area during the 20th century, mainly focusing on the criterion of distinguishability. This criterion, legitimizing the integration of the ancient artworks, mostly resulted in the generalized use of reinforced concrete; irreversible damages on the artworks were produced, mainly for materials' incompatibility issues and for serious structural alterations due to the erroneous integration of different static systems.
Recalling restoration and conservation issues over time in Italy, during the 19th-century, the integrations for restoration interventions were mainly in brick and hydraulic mortar and they had been able to maintain an adequate compatibility with the building systems used in the past. The spread of concrete in the postwar period and its use in restorations exhibited, instead, a structural incompatibility between ancient and new structural systems. In addition, starting from the second half of 20th century, the method of insertion of metal bars and glass fibers in the ancient stone material, similar to the one used for reinforced concrete, brought to the same consequent alteration of the original trilithic system in many ancient structures [18]. As a result, a critical state of preservation is today observed, especially in the archaeological sites of Southern Italy and Sicily, where the ancient Greek monuments were compromised by invasive restorations with reinforced concrete made by '30s, and even by the most recent employment of fixing resin and synthetic fibers. The critical conservative framework is matched by a methodological delay in Italy, compared to progresses achieved in Greece in the last 50 years: here, interdisciplinary research institutes such as the YSMA (The Acropolis Restoration Service), defined dedicated methods for de-restoration and anastylosis procedures, to ensure high quality results

for both in situ interventions and Museum's expositions. Currently, the Athenians Acropolis' restorations constitute the only scientific references and enriched the Venice Charter (1964) with two new criteria, namely: the materials' physical-chemical compatibility and the intervention reversibility, with the absolute prohibition of tampering the artwork ancient materials and altering their original static systems. In addition, special attention was paid to preserve the original static system, the only one which guarantees the conservation of the structural autonomy of architectural elements, in order to ensure that the original parts and the restored ones act equally, also in case of seismic event [17]. Despite the clarifications in art. 9 of the Restoration Italian Chart, up to the most recent work, in most of the restorations works a total absence of structural projects has been observed, mostly supported by the experience of the same workers in the construction site. The cause is mainly connected to a lack of methodology, both in the management of this demanding architectural heritage and in the method of calculation used in the static consolidation, often resolved according to a theoretical approximation that equates the stone, with its peculiar morphological characteristics, to the reinforced concrete.

[LD,VS]

1.The case-study of the Hellenistic-Roman sanctuary e of Agrigentum

1.1 New investigation on the site of Agrigentum[1]

Since 2012, the Department of Science of Civil Engineering and Architecture (DICAR) team of the Polytechnic of Bari - in agreement with the Archaeological Park of the Valley of the Temples - started a critical revision of the previous investigations on the monumental areas adjacent to the northern Agorà of Agrigentum, in order to valorize them [0].
The recent investigations have shown that the area of Poggio San Nicola had been the subject, since the Archaic period, of a constant building program that had its peak in the Hellenistic period and continued until the early imperial age, without neglecting the transformations and reoccupations of the post ancient age. The long frequencies of the area also directly affected the Hellenistic-Roman sanctuary, whose first architectural evidence dates back to the second century BC, when it was made the first impressive terrace, over which the first structures of a sanctuary were built. The so-created artificial embankment involved a new organization of the public area, so a narrowing of the track of the plateia E-F, one of the great arteries in an east-west direction characterizing the topography of the ancient city, that from m 13,00 was brought to only m 6,50 of length. The large square acquired considerable dimensions, the width of an entire insula (m 36,00 x 60,00).
The study of the northern sector continued until 2017 clarifying the configuration of the above-mentioned monument. As later explained, the archaeological excavations provided the first information for the anastylosis intervention of the porticoes of the Tiberian phase . Infact, at the end of the first campaign in 2014, numerous architectural fragments emerged in the north portico to which the cornices of the north wall in the primary collapse location were added.
The architectural complex of the Hellenistic-Roman sanctuary is a temple on a podium, surrounded by porticoes on three sides and well inserted into the urban grid. It was located on the northern edge of the large square, from which it was separated by the plateia E-F. This building seems to be inspired to the nearby monument known as the Oratory of Falaride.
In situ some rows of the podium from an original temple can be recognized, which were never finished, probably because of the servile wars.
As attested by the excavation data, the construction activity was resumed later in Tiberian age, when the porticoes and the tribune in front of the temple were built, according to the typology of the templum rostratum and, in line with the ideological and political needs, the monument assumed the aspect of the so-called templa cum porticibus.

[VS]

1.2 The architecture of the North Porch[2]

Numerous anomalies have been found in the Hellenistic-Roman architecture of Agrigento. However, this datum cannot prevent an anastylosis project, depending only on the philological and methodological rigor, not on the "aesthetic quality" of an architecture. As stated by Giovanni Carbonara, the Restoration is a set of technical and methodological interventions, carried out with historical awareness, critical spirit and planning skills. The restoration process must always have the preservation of the monument as its ultimate goal. A good anastylosis, in fact, should aim first of all at the conservation of the fragments

[1] about the archaeological excavations cf: Caliò et al. 2017 and attached bibliography.

[2] on the Hellenistic architecture of Agrigentum cf: Livadiotti M. , Fino A. in Caliò et al. 2017, pp. 97-110 and attached bibliography.

found and repositioned, to restore their total readability even to the ruin, to transmit its memory value to subsequent generations. Hence the double function of "conservative" and "revealing" restoration in the 1974 Venice Charter and first in the 1932 Italian Restoration Charter.
From the archaeological investigations new data emerged, clarifying the phases of the Hellenistic-Roman sanctuary, the numerous restorations and subsequent renovations.

Back wall: at the end of the first campaign of 2014, numerous well-preserved architectural fragments emerged from the excavations in the northern sector. By this occasion, they were all detected in their primary collapse position. Later, the autopsy studies of the recovered fragments and the 3D detailed relief provided further architectural data for a concrete anastylosis proposal for a portion of the northern portico, where the conservation of the Tiberian facies over time can be recognized.
The data obtained from the reliefs of the wall blocks and the crowning cornices made it possible to rebuild the elevations on the northern street whose isodomic walls consist of ten rows of square blocks, about 50 cm high. The upper wall is delimited by a single element, acting both as a Doric architrave, characterized by taenia, regulae and guttae, and as a Ionic frame, ending with a double sima with an inverted groove, resting on an ovolo.

Colonnade: numerous irregularities were found in the northern portico, both in the compositional details and in the construction solutions. For example, its stylobate has the carvings to insert the column drums in some sections, while in other ones it shows the starting of the shaft integral with the support surface itself.
Further, the order's expressive characters are very different from the syntax of the more strict Greek Doric models: the columns of the Sanctuary are devoid of grooves and they are made up of three limestone drums with a fairly elongated shaft; the capitals also show a strongly verticalized echinus; finally, the entablature, of which an intact example is preserved with frieze and epistyle worked in a single block, shows in the triglyph-metope succession, the presence of an unusual smooth triglyph.

Roof: the new data allowed us to define the facade along the north street and to make a new hypothesis about the covering system of the porches. Specifically, the presence of the eaves channel and of the recesses on the back and on the waiting beds of the cornice (both of the colonnaded front and of the wall) led to the hypothesis of a double-sloped roof. This hypothesis is confirmed by the presence, on some elements, of quadrangular holes related to a system of gargoyles for the disposal of water, separately realized and then applied to the cornice blocks.

[VS]

1.3 Anastylosis of the North Porch: reasons and principles

The anastylosis is a specific practice of restoration, commonly applied in the archaeological field (but not only), which provides the assembly of original "dry" elements (without the application of mortar), allowing new additions limited to the achievement of the objective.
Often, the "contiguity" of the fragments is an important required condition for anastylosis, which is not so much valued as "**completeness**". The legitimacy of this technique lies in the fact that the mechanical relocation of the elements has an objective basis, like the mandatory recomposition of the fragments of an ancient vase [1,5,6].
In the case of the northern portico, in the phase of feasibility verification of the intervention, the assembled cornices pertinent to the crowning of the wall, in addition to showing completeness, answered to this particular condition of "**contiguity**" (Fig. 2 - 1,3).
One of the most discussed issues in the field of archaeological restoration concerns the need to use efficient methods of intervention for the anastylosis, able to ensure a total "reversibility", preserving the characteristics and materials of the original structure.
Compliance with the **criterion of reversibility**, suggested by the Greek experience, becomes necessary at all stages of the restoration project, which certainly aims to the "conservation of the historical monument", beyond any "educational" and informative instance.
In general, the damages produced on monuments by past restorations are often attributable to theoretical and ideological speculations that have operated to the detriment of conservation. The consequences of these actions lead to an undiscussed methodological reflection, re-evaluating, case by case, some positions and principles, in the light of a more multidisciplinary and scientific approach.
Already during the 1930s, Gustavo Giovannoni expressed himself in favor of this thought, contemplating the possibility of using industrial and modern materials only after adequate experimentation.
Lastly, this "**interdisciplinary**" proposal wants to take into account a specific conservation problem related to cultural heritage: anastylosis sometimes uses materials that can damage the ancient stone; reinforced concrete, used in restorations, exposes old structures to stress levels they were not

designed for and non-reversible restoration techniques cause further damage to the ancient material; besides, specific references regarding the use of **innovative anastylosis** procedures on calcarenite architectural fragments are currently very few [17,19].

The proposal of anastylosis starts from the fundamental principle of the **"reversibility of the interventions**", coherently with the recent restorations of the Acropolis that, as already mentioned, constitute the methodological reference of this experimentation:"It is forbidden to cut ancient fragments to facilitate the placement of new fragments, or to rasp ancient material", a stratagem frequently adopted in the past to facilitate the integration of fragmentary elements. Moreover, thanks to the use of new materials later described, the criterion of reversibility in this experiment aims at the purest concept, i.e. the possibility to bring back every single element, on which we intervene, to its ex-ante state, being able to take it off whenever required [3,4].
These objectives, in line with the principles set out in the 1964 Venice Charter, are also accepted by the new MIBACT guidelines[6].
Always for purposes of conservation, together with the already known ability to replicate complex architectural elements, and sculptural groups too, through electronic processing and numerical Cad/Cam execution, in range of the in-progress researches, particular interest is devoted to the development of a methodological procedure for stone additions to incomplete elements, using stone material conform to the original one and in continuity with the processing techniques used in ancient times. The attempt is to verify the real support that advanced technologies, like 3D laser scanner and CNC CAD / CAM, can give to the design of the prototypes of the integrative elements [14,15].
All the original fragments have been scanned and repositioned in the 3D model.(Fig. 2 - 3,4). From the 3D model a part realized as a maquette scaled 1:10 was extrapolated, with the help of 3D rapid prototyping systems[(Fig. 2 -2].
The deep knowledge of the monument led to the anastylosis project of a section of the northern portico and its realization, corresponding to the 3rd and 4th intercolumn from the east, in order to give the visitor a suggestion of the proportions of the porticoed piazza (Fig. 2 - 4,8)..
The back wall, preserved for a height of 2.20 m, was restored at its original height of 4.9 m, for a linear section of 8.93 m length, using new squared blocks, reproducing the original ones (Fig. 2 - 5). The integration of the wall was necessary to relocate on its top in situ the crowning fragments found in the collapsed excavation(Fig. 2 - 3,1). Therefore, each frame was relocated in its original position or homologous, according to the exact positioning of the beams, obtained from the analysis of the housing recesses on the bed and on the back of each fragment, also taking into account the sequence of the regulae. The data set has allowed repositioning, in contiguous succession, five original elements, corresponding in reality to a total length of about m 5,00 (Fig. 2- 1).
It is interesting to observe that the elements realized with contemporary robotic means can be easily distinguished by an expert, who will certainly recognize the signs deriving from an industrial working process from those of a traditional handicraft work, performed by a stonemason. These signs will contribute to the definition of a specific communicative language, with diacritical function - foreseen in the integration techniques - and will contribute to ensure the "distinguishability" between new and ancient, thus avoiding to generate interpretative misunderstandings, especially when the patina of time will have uniformed the most superficial layers of the stone.
The 3D reconstruction of the portico was useful to investigate the "**original building system**", verifying the roof truss hypothesis (Fig. 1 - 1; Fig. 2 - 2). In the project proposal it has excluded the possibility to realize a congruous portion of cover, because of the principle of the "**minimum intervention**". As an alternative to the truss, to ensure solidity between the front and the back wall, it was useful to proceed with the positioning of two horizontal beams of the carpentry, in chestnut wood, always taking into account the succession of the recesses on the frames. The relocation operation for the fragments found in a collapsed position and pertaining to the Tiberian facies of the porticoes, through an act of anastylosis, has had as a priority objective to ensure the conservation of these elements.
Another goal of the anastylosis project is the preservation of the **"original static system**". The porticoes of the Hellenistic-Roman sanctuary were made of local limestone.
All wall elements and the colonnade are composed of squared blocks of cut stone, placed without mortar. For this reason, the use of cement and iron reinforcements for integrations and consolidations has been excluded. The lithic integrations have been realized with the aid of advanced systems of 3D survey and CNC stone prototyping . For the integration has been used material from Sabucina, the most compatible with ancient one among the stones analyzed (Fig. 2 - 5)
The integration realized with the use of "**traditional materials and techniques"**, in analogy to the original ones, is itself a desirable operation, because it ensures compatibility, in both chemical and mechanical terms. Reinforcement devices should be made of a material compatible with the stone. However, even if traditional materials are used, in restoration work the introduction of new anchoring devices is often required, also to ensure static response (Fig. 2 - a,c). In the Acropolis restorations the use of titanium's fasteners compatible with stone was observed [4]. Consequently, their positioning in

order not to damage, irreversibly, the ancient material should be studied. In general, calculating exact sizing, the new devices should be limited to necessity, i.e. to integrate or replace ancient grafts and tenons, in order not to alter but preserve the original artwork static system.
The respect of all the above-mentioned theoretical references requests a "**multidisciplinary approach".** The restoration project of the North Porch [19] was based on the collaboration of figures with operational experience in the field, possessing knowledge of historical buildings, materials and construction techniques used in antiquity.
In the case of the northern Portico of the Roman Temple a scrupulous experimentation has been carried out, in order to deepen the methodological issue (Figg. 1,2).
The positioning of tenons and grafts in compatible alloys was evaluated by numerical analyses, analyzing the behavioral effects, in the short and long term, in both standard and exceptional climatic conditions.

[VS]

2. The design process: reassembly devices development

As described above, the developed design proposal starts by one of the most critical issues in the restoration field [1], concerning the need to implement new technologies that can guarantee an easy restoration process, able to respect the functional characteristics of the original structures, but which are also fully reversible and compatible with the ancient materials .
In order to ensure an intervention respecting the aforementioned characteristics of little intrusiveness and materials compatibility, the use of Titanium based non-ferrous alloys on the reversible restoration of ancient stone monuments has been explored here, in line with the research of the last years in the field.

2.1 Materials and methods identification

The studies on the Agrigentinum archaeological site carried out and the high quantity of data collected, led to the possibility to find a dedicated feasible solution and, at the same time, to explore the possibility to develop an experimental procedure, based on the use of innovative materials. Therefore, the following parallel paths were followed:

- On one side, the use of Titanium alloys was properly implemented in the Anastylosis of the whole arcade complex, instead of classical steel alloys, after a dedicated structural analysis of the different compositional elements (Fig. 1 - a,b).
- Contextually, the use of innovative advanced materials, known as shape memory alloys, was explored, by defining an experimental procedure which starts from the environmental analysis of the Agrigentum site and ends with the prototypal realization of a fully reversible reassembly device (Fig. 1 - c).

2.2 Experimental phase: design of a SMA prototypal device for the reassembly of fragmentary monuments

Focusing on the experimental procedure before-mentioned, the realization of interconnection structural elements for the reassembly of monumental stone components made of Shape Memory Alloys (SMA) has been proposed [3].
SMA materials are non-ferrous metal alloys whose main peculiarity consists in "recovering" their original shape (lost after a mechanical deformation) under the effect of a thermal and/or mechanical action. This is due to a reversible solid to solid phase transformation, thermally and/or mechanically induced, with a consequent rearrangement of their microcrystalline structure []. Their wide use in different technological fields, ranging from aerospace and biomedical applications to vibration damping in the civil engineering sector [2,7,8,10,11], led the research in the restoration field to evaluate their potential applicability in reintegration operations of fragmented artworks, paving the way for solutions of great interest [13]. The binary composition of nickel-titanium for the SMA materials is particularly appreciated for their strong corrosion resistance attitude and their relative high compatibility with ancient materials, increasing their potential use in this sector.
The technology here developed wants to guarantee an easy restoration process and define a reassembly device fully compatible with the ancient materials and totally reversible. As well, from a numerical point of view, the research aims at defining valid computational methodologies, able to consider the high complexity of the material phenomenology.
The research highlights the use of the SMA prototype in the reassembly of monuments' compositional elements with secondary structural function, such as capitals, cornices, friezes or supplementary fragments of columns and architraves.

After having identified the operating archaeological site of Agrigento, a dedicated environmental study was carried out to identify the most suitable alloy to be used, considering the related peculiar thermomechanical behavior. Then, different types of devices were pre-designed through 3D modeling and FE analyses. The subsequent prototype realization was developed in different phases, starting from the material thermomechanical characterization, followed by the effective prototype realization and the related verification of both its superelastic behavior and its shape memory effect. The experimental phase allowed further considerations about the process of fragments' assembly and disassembly reversible operations.
The final work's phase involved the realization of a dedicated numerical thermomechanical FE model and its related calibration by comparison with experimental results. The FE model proved to be a valid predictive tool to design SMA devices for the reassembly of monumental ancient fragmentary elements. Here below, a brief detail of all above-mentioned phases is given.

2.3 Environmental thermal analysis

A thermal analysis of the Agrigentum environment was fundamental for a proper employ of the SMA materials, since the components to be restored are exposed to the different daily and annual site thermal excursions. The city is characterized by a mild climate, with thermal excursions ranging between 0°C in winter and 40°C in summer. Simulations with a dedicated fluid-dynamic analysis software (WUFIpro - Fraunhofer) were carried out, defining a typical "masonry package" including in its inside a lamina made of shape memory material. The analysis showed that, for reassembly applications, a reduced thermal excursion between 5°C and 30°C on an annual scale could be considered for the alloy.

2.3.1 Prototype description

To guarantee a reversible and minimally invasive restoring operation, both the SMA shape memory effect and superelasticity properties are intended to be used [9,10]. The prototypal device has an elementary C shape, and it is intended to be inserted between the parts to be re-joined.
The insertion and the extraction phases foresee the possibility to exploit the material shape memory effect. In exercise, instead, to support the structural loads, the SMA superelasticity properties must be guaranteed.
The installation phases shall consist of:

- Housing/holes creation inside the two fragments to be re-joined by means of drills with diamond tips or hole saws (Fig. 1 - c.1, c.2, c.3).
- Device cooling until the reaching of the material martensitic phase[3] and related mechanical deformation for its insertion into one of the two fragments' housings and optional filling with compatible fluid mortar (Fig. 1 - c.4).
- Parts assembly (Fig. 1 - c.5) and device shape recovery phase (Fig. 1 - c.6).

2.3.2 Prototype characterization and testing

After a preliminary device dimensioning, a semi-processed Ni-Ti wire with a diameter of 2.08 mm was chosen, rarely applied in the most common SMA applications [2,7,8,10,11].
Then, the first experimental phase consisted in the material forming and in its constrained heat treatment, for the definition of the transformation temperatures. Being unknown the values of temperature and timing of the heat treatment to obtain the ideal thermomechanical characteristics, six heat treatments were carried out, at temperatures of respectively 450 °C and 500 °C for the related timing of 5, 10 and 15 minutes.
For each heat treatment two pairs of specimens were set up consisting of a wire 11 cm long for the alloy thermo-mechanical characterization and a C-shaped element with flanges of 5 cm long and a central core of 10 cm.
At first, pseudo-elastic uniaxial traction tests were carried out at room temperature on the wire specimens. They were brought first at a deformation of 6%, to which the material was able to completely recover the stored deformation, subsequently up to a deformation greater than 12%, inducing permanent plasticization phenomena (Fig. 1 - d).
For the thermomechanical characterization completion, DSC (Differential Scanning Calorimetry) calorimetric scans were carried out, to evaluate the influence of heat treatments on the alloy's transformation temperatures, by restoring numerical data about these temperatures and the stored

[3] For the cooling techniques, depending on the alloy characteristics and on the extension of the surface to be cooled, liquid nitrogen jets can be used, able to guarantee cooling temperatures between -180 °C and -210 °C, or dry ice, whose cooling temperatures are around -78 °C.

transformation latent heat. In general, in the design phase, this step allows us to evaluate the range of the material's transformation temperatures, which depends on the heat treatments, and to verify its compatibility with the expected application of the SMA alloy, therefore, to compare the experimental data with the thermal and mechanical operating conditions of the device.
The DSC analysis showed that the phase transformation for the treated material starts at relatively high temperatures (in respect of the average environmental temperatures of Agrigento), so further mechanical characterization tests at higher controlled temperatures have been carried out in a thermal chamber, to verify the effective superelasticity of the specimens at temperatures sufficiently far from the critical transformation temperatures (which result to be close to environment temperature values).
The last experimental step consisted in the verification of the superelasticity property and the shape memory effect of the representative samples of the prototype device. All the C-shaped samples have been first tested, simulating a loading similar to a hypothetical real condition, to verify their superelastic behavior in recovering their original shape after the unloading phase. Subsequently, the same devices have been immersed in liquid nitrogen, going down the minimum desired cooling, and the shape memory effect has been verified by inducing a mechanical deformation after the extraction from the fluid and waiting for the recovering of the undeformed configuration by natural heating up to room temperature.

2.3.3 Numerical simulation and FE model validation

The final research phase consisted in the validation of an equivalent numerical prototype, using the thermodynamic constitutive model of Lagoudas, Bo and Qidwai [9]. The numerical FE simulations, carried out by ABAQUS code, were compared with the experimental data showing a good correlation (Fig. 1 - e).

Experimentation results

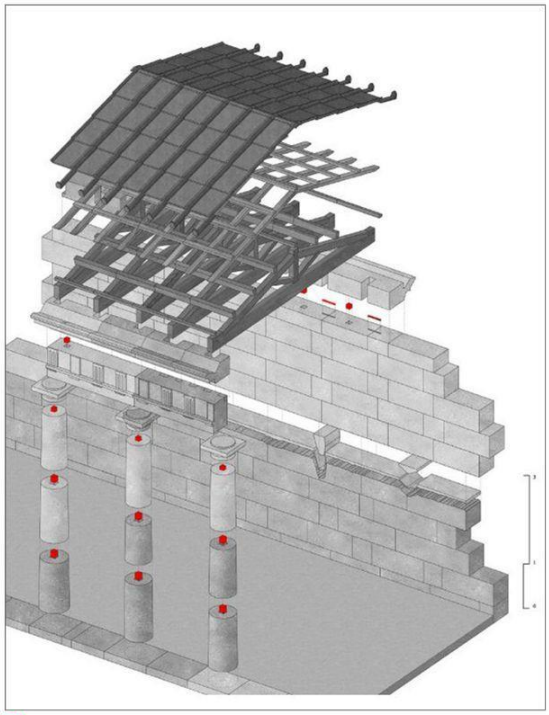
The prototypal device is potentially useful for different applications, even if the SMA peculiarities contemplate different variables to be involved in the design process. The thermomechanical characterization and the subsequent testing phases, in fact, show all the criticalities related to the determination of the mechanical and physics alloy characteristics, which must be carefully defined in order to obtain an efficient and reliable device. The final numerical simulations revealed how a good FE model is a valid predictive instrument for the dimensioning and design of SMA reassembly devices, under the premise of having a clear understanding of the material design and characterization.

[LD]

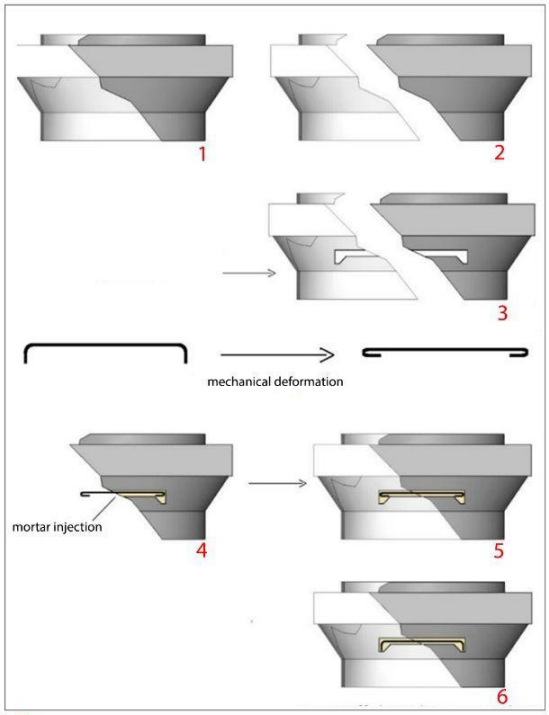
3. Conclusions

In conclusion, in the archaeological field the same principles elaborated for the architectural restoration are still valid; however, the vulnerability of these contexts, too much exposed to degradation, not only requires the presence of cadres of specialized figures, but also needs a greater critical sensibility by all the professional figures, such as architects and engineers, which should have a multidisciplinary attitude to suggest, case by case, the most appropriate operational methods. The experimental research contextually carried out on SMA materials confirms the need of such an approach for a successful intervention. Proceeding in this direction, each design choice can be optimized with a view to guaranteeing the general principle of "minimum intervention". The integrations foreseen by the project in respect of the well-known principles of reversibility, authenticity and material's compatibility must be finalized to preserve the cultural content of the monument and its historical stratification, in the awareness that a restoration cannot "avoid" but only "slow down" the unstoppable processes of degradation.

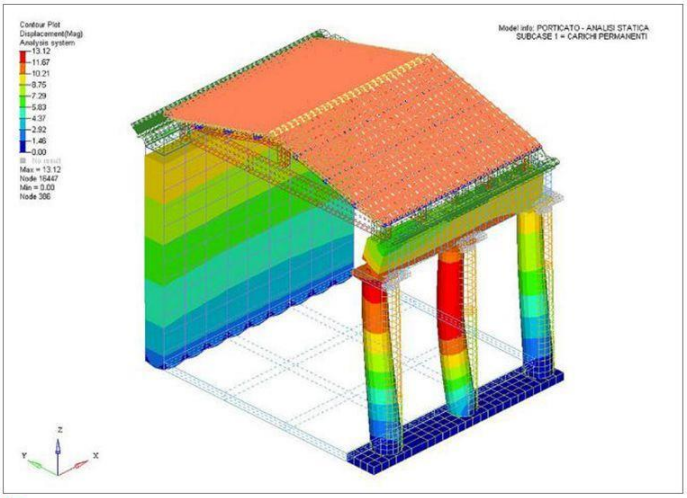
[LD, VS]



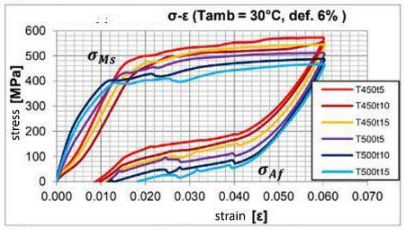
a



c

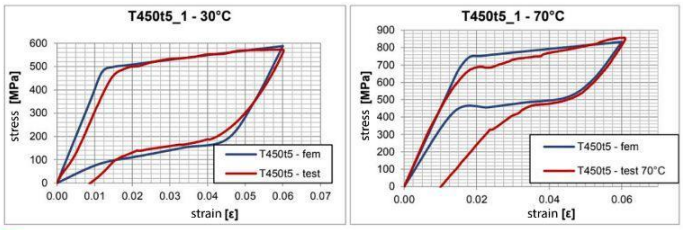


b



d

Test	E_A	σ_{Ms}	σ_{Af}
	[MPa]	[MPa]	[MPa]
T450t5	40000	500	200
T450t10	40000	500	190
T450t15	40000	480	160
T500t5	42000	460	100
T500t10	50000	400	80
T500t15	50000	400	60



e

Fig. 1: **a.** Porch reconstruction hypothesis by use of titanium alloy; **b.** Porch reconstruction FE Analysis; **c.** SMA device insertion in a Porch fragmented capitals; **d.** SMA thermomechanical characterization results; **e.** FEM results and correlation with experimental data.

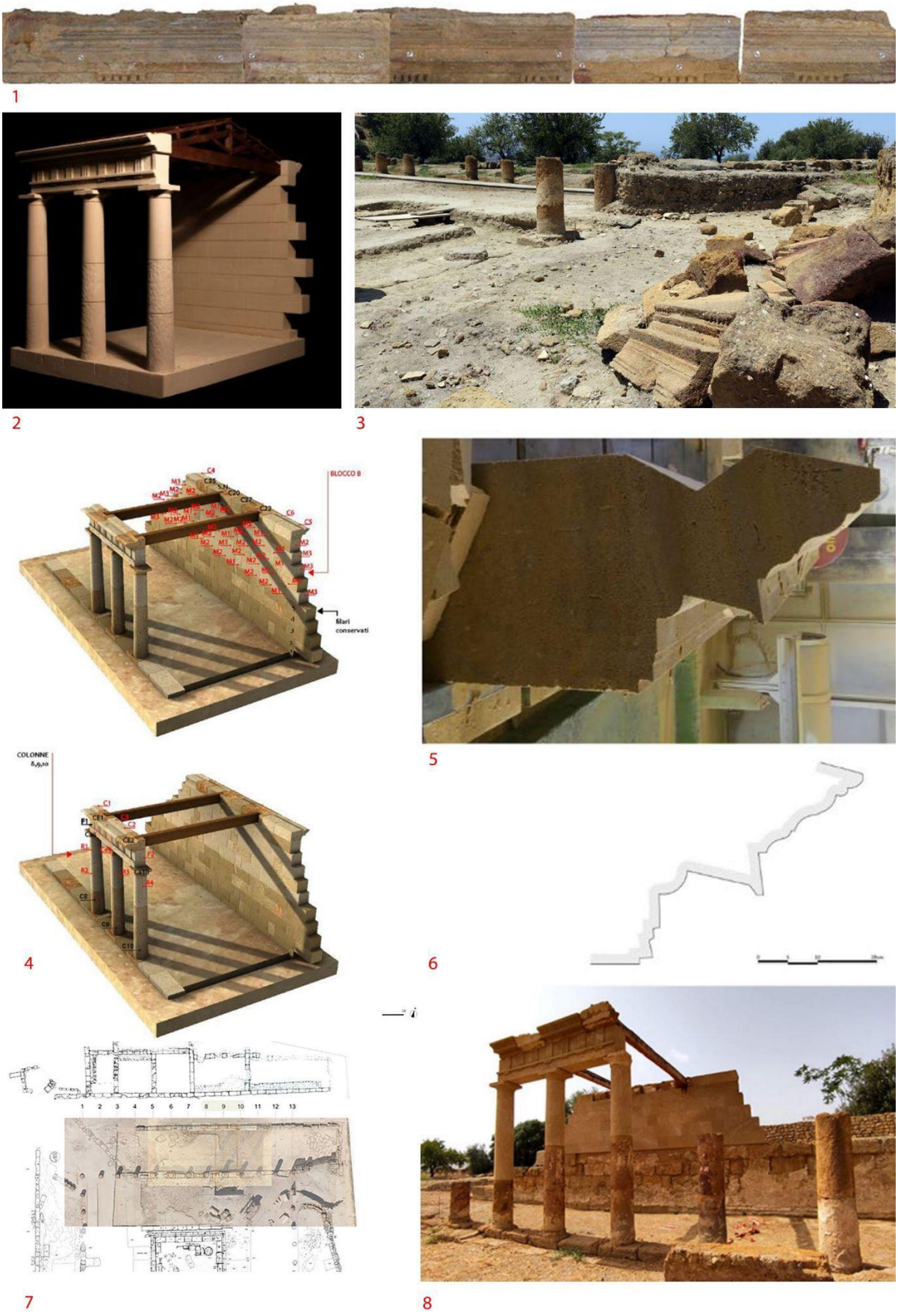


Fig. 2: **1.** 3d cornices assembly pertinent to the crowning of the wall; **2.** *maquette* of Porch; **3.** Collapsing cornices in the north Porch; **4.** anastylosis project: in red the new integration stones; **5.** a new cornice made with scanner 3D and CNC robotic machining used in the anastylosis; **6.**outline relief; **7.** Survey of the north Porch; **8.** portico anastylosis (author's ph., 2020).

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The visual identity of wine landscapes through the Piedmont wine posters

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Abstract
As a form of intuitive and immediate communication, the poster is characterised in its informative guise towards the end of the eighteenth century, still stimulated by industrialisation and the literacy of the population from the second half of the nineteenth century; quickly, it became a new dynamic element of European cities. Through unique design and graphic languages, it reflects and represents the avant-garde both at the commercial level and at the political and cultural level of the moment.
The poster, as a mode of communicative and identity expression, has always had to deal with the problematic recognition and insertion in the artistic area by critics; criticism that specifically proposed a clear distinction between artistic posters, considered a minor art, because they are linked to an industrial client, and commercial ones that with serial reproductions for practical purposes were not worthy of critical analysis.
In this sense, the paper wants to disseminate the outcome of the research project among the dAD Department of the Polytechnic School in Genova and the Club for UNESCO of Canelli (AT), aiming to catalogue and disseminate the first "professional oenological advertisements" at the Italian level.
The project, financed by the Piedmont Region's Call for the Promotion of Book and Archival Heritage, Publishing and Cultural Institutes, provides a first general census of advertising posters of wine cellars produced between the XIX and XX centuries through the filing and digitisation of these works.

Keywords: Representation, landscapes, heritage, wine

1. The manifest as a way of expressing the graphic representation

The poster is found worldwide and is an artistic creation of awareness of individual and collective problems, changes in society due to industrialisation, new technologies, etc. The poster can inform, challenge, indicate, explain, move, innovate, denounce, influence, compare and make your dream. However, its primary objective remains to communicate.
It isn't easy to know precisely when the poster was born. However, it went through several critical stages in its history before arriving at the form we know today due to the evolution of computers and printing techniques.
In ancient times, notices were already posted in public places to communicate messages: the Romans used posters as propaganda for emperors or to announce gladiator fights. The invention of printing (1439-1444) by Johannes Gutenberg revolutionised the billboard, allowing a poster to be reproduced quickly and in multiple copies.

The industrial boom of the nineteenth century, the beginnings of mechanisation, and production organisation opened a new era for the poster; in this period, the bill took off, thanks to the advent of lithography in 1799. Jules Chéret[1] took the poster to another level by helping to change its aesthetics, giving it a much more illustrative form. At the end of the century, the cultural and advertising poster, thanks to the work of Toulouse-Lautrec, Chéret and Steinlen, attracted the interest of collectors and lived a golden age.
From 1910 to 1930, the bill was influenced by various artistic movements: Futurism, Dadaism, Russian Constructivism, the De Stijl movement and the Bauhaus, while the first photographic posters appeared in the 20s. The wars led to the creation of propaganda posters, which became a tool to denounce the enemy and exalt the war effort, among other things, through designs that encouraged the recruitment of soldiers. Since then, the poster has continued to multiply, entering shops, offices, private places and museums.
One of the responsibilities of the graphic designer is to translate messages into visual signs. Suppose the means of representation used do not consider the context of dissemination, the cultural or social context, the communication objective or the target audience. In that case, any visual message may open up to involuntary or unforeseen interpretations. As a result of these observations, a question was identified at the beginning of the research: how does the combination of different means of visual representation guide the interpretation of a message?
The definition of the poster, its role and its classification according to the specificities of each content are the three elements addressed to proceed with the analysis of the theoretical framework.
The bill developed mainly in the nineteenth century thanks to reproduction.[2] It belongs to the category of graphic arts whose function can be to present, express and promote an event, a current of thought, information, a campaign, an ideology, a product, etc. The image and the word, reduced to a small number of words, can be used as a means of communication because the latter, reduced to the essentials, must convey a single message, clear enough to be kept by its recipients[3]. The poster must be simple, presenting a synthesis of elements because the viewer will often have little time to decode it. According to Philippe Apeloig[4], designer of numerous posters, "a graphic designer's virtuosity consists of finding a visual concept that is obvious, original and easy to remember".[5]



Fig. 1 Philippe Apeloig, “Affiche Philippe Apeloig” Studio Philippe Apeloig 118 × 175 cm Silkscreen (Dubois Imagerie) 2003; Philippe Apeloig, “An American in Paris”, Châtelet, Théâtre Musical de Paris, 100 × 150 cm, Silkscreen (Lézard Graphique) 2014; Philippe Apeloig, Le Havre, Patrimoine mondial de l’humanité (2006), screenprint, 175 × 118.5 cm. Printed by Sérica, Nancy, France. Typeface: Helvetica Neue.

[1] http://www.designplayground.it/2013/09/jules-cheret-il-padre-del-manifesto-moderno/
[2] Secondo SOURIAU, Etienne, Op. cit, p.59.
[3] As defined da HOLLIS, Richard. Graphic Design from 1890 to the Present, Revised and Expanded Edition, London, Thames & Hudson Publishers, 2002, "The Art World Collection", p.11.
[4] https://apeloig.com/apropos/biographie/
[5] APELOIG, Philippe, op. cit., p.8.

Anyone can refer to a poster and name one that they liked. Behind its connotation of ephemeral and commercial mass production, popular art par excellence centred on the present moment can hide an entirely different nature: that of a work of art. Hence the need to question the very basis of the bill and its dichotomy. Anne Meyer, a professor of applied arts in France, raises the question: "What makes a poster not a work of art and art? Some posters will never find their way into a museum, while others are naturally there. A poster, unlike a sculpture or a painting, is not unique.
Mass reproduction can therefore be a factor in discrediting its artistic power. A comparison with photography, lithography, printing or screen printing is possible since these means of expression can also be reproduced in quantity. Etienne Souriau wrote about lithography: "Being able to join the photographic processes, the art of lithography allows the creation of prints and a historical document and a representative sample of an era and a society. It reflects the production of multiples that achieve the dignity of works of art." These means are therefore considered works. Etienne Souriau[6] points out that the very nature of the poster places it in two domains, subjecting it to two orders of requirements: that of art and that of advertising, as most the posters serve to sell a product, and if a poster that sells a product is brilliantly aesthetic and artistic, it will always be connected to the product it sponsors. However, some factors make it possible to recognise the poster as a work of art: the subject of the poster, the space-time relationship, and as Etienne Souriau argues, the poster can spread to the general public art forms that would otherwise only be known by a limited audience. Therefore, the poster is a work of art when referring to an image that makes sense of its plastic qualities. Josef and Shizuko Miiller-Brockmann tried to establish six rules of poster design that contribute to the effectiveness of the same:
1. The poster must be readable and its message easily understood;
2. The poster must be attractive and innovative; it must offer something new and unknown in form or text;
3. The poster must be designed on a good scale; its message must produce maximum effect with a minimum of graphic means;
4. The poster must be composed of large shapes, which remain effective at a great distance;
5. Up close, the poster should give impulses through easy perception and the sum of details;
6. the poster must be memorable, establishing a new relationship between the viewer and a theme or product.[7]
As part of the research on the visual identity of wine landscapes through wine posters, there is precisely the intent to enhance the enormous artistic heritage held by the historic cellars of Piedmont that have determined the birth of advertising linked to this sector.
With the last years of the 800, the need to expand the number of consumers persisted, and so a new propaganda tool appeared: the illustrated wall poster.
The authors compete in the search for the particular intuition for the presentation of the product. The advertising of sparkling wine is entirely part of that first advertising epic, with the signatures of the most famous artists of the time such as, for example, the Gancia company created one of the very first posters of Italian wine, from 1895, the work of the painter Alberto Rossi, for the Bosca company, Marcello Dudovich[8], he created his only poster in the Wines and Sparkling Wines sector, for the company Contratto, Leonetto Cappiello, proposing the image that replaces the product. Thus a period of his production is characterised by creating posters that, on a dark background, reproduce the product to be promoted together with images of animated subjects and characters that become the heritage of public opinion, triggering identification processes typical of advertising. The task of the poster is to communicate a message and make it accessible clearly and directly that can be assimilated in a short time. The poster is part of history, illustrates the significant events of the years, and is a symbol of a people and its culture. The poster is direct: it captures attention and quickly establishes contact with the public by its very nature. Marie-José Mondzain wrote on this topic:
"The poster can do more than move people and make them believe. Most often, it has the task of informing about a state of affairs, a state of the world, and a subjective desire or a joint project. Therefore one can speak of a relationship with truth and reality since it makes known something that makes visible, whose existence teaches us or asks us to make exist."
In addition, Josef and Shizuko Muller-Brockmann insist that "posters are a barometer of social, economic, political and cultural events and relationships; they are a mirror that reflects the intellectual and spiritual activities of man" because they must take into account the culture and social environment in which they are spread if they want to have an impact and a charm; in fact, the message reaches the viewer only through the relationship he has with his experience of daily life.

[6] SOURIAU, Etienne, op. cit. , p.59.
[7] MÙLLER-BROCKMANN, Josef e Shizuko op. cit., p.16.
[8] https://marcellodudovich.it



Fig. 2 Poster for the Gancia company, made by Alberto Rossi, 1895, Poster for the Bosca company made by Marcello Dudovich, 1904, Poster for the Contratto company, created by Leonetto Cappiello, 1922

Books on posters often present them according to artistic trends: Bauhaus, Constructivism, Dadaism, etc. or according to the dates of their creation. In the book History of the Poster, Josef and Shizuko Muller-Brockmann propose a classification according to chronological order and five main types of posters: the illustrative, informative, constructivist, experimental and serial posters. The perfect poster aims to represent situations, characters or objects using drawings or photographs to sell a product or announce an event. The information poster tries to convey information by means that are as objective as possible, thereby refraining from expressing its opinion. The constructivist poster is always based on the principle of order given by the layout. The experimental poster uses surprising forms because they remain far from the modern formal vocabulary. Finally, the serial poster consists of at least three posters, and their shapes, colours and texts have predominantly common aspects that allow them to be perceived as a whole.
In this context of communicative design, where an independent and personal creation of stimulating ideas and content is realised, the poster plays an essential role as an informative, cultural, social, engaged or propaganda medium. In addition, exploring contrast categories in graphic design has proven to be an excellent aesthetic and functional way of translating a duality. The semiological and rhetorical analysis grids made it possible to validate the choice of visual means of representation at the end of the creative phase.
The poster has lost none of its relevance over the years and is still part of our daily lives. Its enormous evolution through eras and styles, from cartel to illustrative advertising, to propaganda and experimental posters, gives it an invaluable historical richness. In a period in which knowledge and technology continually evolve, forcing the bill to constantly renew itself and explore different media and forms of expression, it is increasingly accessible thanks to publishing and the Internet. In a world where everything is globalised, where there are more and more global advertising campaigns, the author's poster stands out by proposing creations where direct contact between the sender and the recipient is possible thanks to the effect of the proximity it provides. Finally, the poster will always be alive because it is the art of the moment, of the present. Therefore, it will be interesting to look at the poster as a means of social integration in a crisis in a future project.

2. Objectives of the research

The site THE WINE LANDSCAPES OF LANGHE ROERO AND MONFERRATO obtained UNESCO recognition in 2014, becoming the 50th Italian site to receive this recognition and the first for the characteristics of a cultural wine landscape.
Among the reasons for this victory is underlined the importance of these landscapes as "the exceptional result of a "wine tradition" that has been transmitted and evolved from antiquity until today, constituting the fulcrum of the socio-economic structure of the territory. This cultural tradition is manifested through a consolidated heritage of knowledge and techniques of cultivation and winemaking based on the deep knowledge of historically cultivated vines and their ability to adapt to particular environmental conditions. This experience evolves through the continuous search for

improvement of the production cycle in absolute respect of tradition and has led to the production of wines of international excellence. The millenary tradition of wine is reflected in the structure of the landscape, which represents the palimpsest of the places where the wine supply chain takes place, among which the vineyards emerge, divided into small plots deriving from the medieval land parcel; the wineries of historical foundation, connected to the events of the noble dynasties or the intuition of enlightened entrepreneurs; vernacular architectures, which arose "spontaneously" to meet the needs of the production cycle; the commercial urban poles, already merchant nodes in the late Middle Ages, which today represent the capitals of the export of Piedmontese wines of excellence."[9]
The site is serial, that is, composed of six components (Langa del Barolo; Barbaresco hills; Castle of Grinzane Cavour; Canelli and Asti Spumante; Nizza Monferrato and Barbera; Monferrato degli Infernot) which extend over three provinces (Cuneo, Asti and Alessandria) for a total of about 10,000 hectares of excellent areas.
The cultivation of the vine has strongly carpeted the territory not only from the landscape site but also from a socio-economic point of view, creating a unique reality where the populations that live there recognise themselves in the values and traditions linked to the production of wine, and architectural, through the creation of high performing specialised buildings.



Fig. 3: Collage images of the areas component of the UNESCO site: La Langa del Barolo (La Morra); the Castle of Grinzane Cavour (The Castle); Canelli and Asti spumante (Canelli); the Monferrato of the Infernot (Vignale Monferrato) ; The Barbaresco Hills (Barberesco); Nizza Monferrato and Barbera (Calamandrana).

Among the many records of the wineries of southern Piedmont, we also find that of having produced the first "professional oenological advertising" at the Italian level. Various posters and advertising cartons have made their products known worldwide.
This exciting material often bears the signature of great artists of Cesare Saccaggi, Marcello Dudovich, Leopoldo Metlicovitz, Leonetto Cappiello, Aleardo Terzi and others who have worked for many Piedmontese companies; some now disappeared, but whose name survives thanks to their works. This incredible heritage has never been surveyed or adequately valued.
The project THE VISUAL IDENTITY OF WINE LANDSCAPES THROUGH THE POSTERS OF THE WINE OF PIEDMONT provides for a first general census of advertising posters produced between the end of the nineteenth century and the early 60s of the last century of the wine cellars present in the Piedmontese territory UNESCO heritage: through the filing and digitisation of these works, we want to create a first flexible database of data and images that can serve as an initial basis for a future cataloguing project also of the other products of the wine production chain (machinery, liqueurs, fairs,...) and expandable to the entire Piedmontese territory.
In addition to their artistic value, these posters are testimony to the thought and methods of communication that have characterised this historical period and can provide interesting information to

[9] UNESCO World Heritage List THE WINE LANDSCAPES OF PIEDMONT: LANGHE-ROERO AND MONFERRATO Management Plan, Criterion(iii) To be a unique or exceptional testimony of a cultural tradition or a living or disappeared civilization, p. 13

analyse the unique and particular relationship that has been established between the local landscape and wine production in this area of Piedmont.
The research is carried out in collaboration with the Department of Architecture and Design of the Polytechnic School of Genoa, which will elaborate through a scientific research project on the analysis sheets and will digitise the registered posters: the investigation is aimed at the realisation of a project with scientific bases that can act as a first step for a broader cataloguing campaign of all the images related to the wine supply chain.
The project, in addition to being the first in this specific area with the desire to gather in a single database material currently located in various parts of the region between archives and private collections, wants to pursue an investigation on the methods of communication of the product in the ability to help us understand the particular dynamics between wine production and landscape that have been established in this area of Piedmont.



Fig. 4: Poster of the company F.lli Gancia & C. di Canelli by Rodolfo Paoletti about 1910, Poster of Luigi Bosca and Figli Ximenes about 1910, Poster of the Award-winning Narice Plant by Rapetti of about 1900

3. Research methodology and phase of the investigations aimed at filing the collected material

The Wine Landscapes of Piedmont is a geographical area strongly characterised, from an environmental and cultural point of view, by the millennial modelling of the territory for the cultivation of the vine and the production of wine. It is a unique landscape characterised and reflects its beauty in the community's historical, cultural, and economic testimonies. Cultural, landscape and environmental heritage that since 2014 has been included in the World Heritage List and therefore protected by UNESCO. There have been many opportunities to defend the values of uniqueness that represent the wine supply chain in recent years. This survey is another fundamental tool to pass on to future generations the knowledge and deep roots of this heritage.
The contemporary interpretation, which supports the theoretical debate and rekindles critical interest in the promotion of these values of historical socio-cultural and landscape uniqueness of the wine landscapes of Piedmont, also includes the study and documentation of graphic testimonies, which have played a determining role in the economy and interpretation of the wine sector.
The research in this sense aims to digitise, document and file the advertising posters of the Piedmontese wine cellars, produced between the end of XIX and the 60s of the last century, as evidence of the first professional oenological advertisements at the Italian level. This study shows the methodology used and the different phases conducted for research purposes.
The research investigation consists of five distinct phases: the first phase, dedicated to the collection of material and information related to the wine sector, was conducted through direct on-site surveys between the companies still present in the area and private collectors and indirect investigations in the private and public archives of the Ministry of Culture and the museums of the site. Given the diversity of posters, covers, bills and illustrations still existing, the second phase was dedicated to the study and

recording of all the material collected as an archival basis for subsequent investigations. The census of the works, considered by the Central Institute for catalogue and documentation at the inventory level for the basic information provided, took place by scanning the graphic elements and transcribing the data collected. All the details for the information's completeness and to provide a database that can support further investigations in this field of research have been considered and surveyed.
The third phase was dedicated to selecting the material in the archive to restrict the field of investigation to only Piedmontese oenological posters, which today include a collection of about three hundred graphic elements. Of the selected posters and the minimum mandatory information, additional information was recorded, which can be deduced from the direct observation of the asset and its inclusion in the context as indicated in the ministerial norms for the definition of pre-catalogue.
The fourth phase, entirely dedicated to filing the selected posters, has been developed to define a proper filing for a future printed publication and a timely filing for a consultation in a web environment.
The fifth and final phase concerned disseminating this research, made available through the website of the Langhe-Roero and Monferrato Wine Landscapes [10] and within the Documentation Center based in Asti, where copies of advertising posters and descriptive cards will be collected, archived and exhibited. The methodology used will also allow the inclusion of this unique heritage and not yet usable within the SIGECweb Catalog.[11]
Specific research was also conducted to identify the Oenological Posters currently included in the SIGECweb Catalogue. The survey showed only twelve bills concerning this particular research field. (Fig 5).
In this research, we propose a digital filing methodology in which the necessary and fundamental information for the contextualisation of the asset from a historical, cultural and geographical point of view is highlighted and which allows not only its enhancement but, in particular, the relationships between the different components of the heritage and its territory. The data, accompanied by the poster's image, will contain basic information such as the title of the subject, historical era, author, and dimensional characteristics. It's technical/stylistic description given by the iconographic reading, but also the identification of the territory of the winery still present for a continuous connection of the historical heritage with the entire process of the wine supply chain. For an orderly and coordinated management of information, scans and cartographic data, the catalogue graphic standards for the registration of goods issued by the Central Institute for Catalog and Documentation (ICCD) have been taken as a reference (Fig 6).
Digital filing is defined by three distinct but interconnected information levels that allow the widespread and continuous use of the data collected: Descriptive, Iconographic and Cartographic. The Descriptive level, in which the descriptive and technical-scientific information inherent in the asset itself is transcribed, is the "open" part of the card that can be implemented from time to time by additional information. The Iconographic layer in which other multimedia files can also integrate the photographic images of the posters. The use of advanced techniques in the acquisition phase of the posters has allowed the generation of very high definition raster files in terms of pixels / mm and colour profile in RGB. The raster images were saved in a double format: an uncompressed raw file to maintain the quality characteristics of the image and a compressed file in "lossless" mode for its use on the web.
The photographic transcription of the posters was also fundamental for identifying and describing the stylistic, geometric and compositional characteristics of the poster under investigation.
At the cartographic level, geographical information and location of the asset on the territory of reference are given; through its georeferencing and the information contained in the filing, the connections and relationships that connect the existing cultural heritage with its environment are initiated.
This type of cataloguing allows the identification of the data characterising a work. Still, it could enable the next phase of possible inclusion in the General Information System of the Catalog, a single ministerial platform for the management, cataloguing and publication of the assets (archaeological, architectural and landscape, demo-ethno-anthropological, photographic, musical, naturalistic, numismatic, scientific and technological, historical and artistic).
The cards are designed as descriptive models in which news about goods are collected in an organised way according to cataloguing standards for their reproduction in print and as a "path of guided knowledge" for its dissemination and enhancement in a web environment. The reader will have the opportunity to consult and have information on the personal poster and obtain additional information on the territory of origin, the wineries, and their production history.
The document consultation methodology in a web environment will have the same characteristics. Still, it will include an additional Alphanumeric level for managing files through search filters, importing and exporting data, and all information and updates regarding the territory being searched.

[10] https://www.paesaggivitivinicoliunesco.it/
[11] http://www.iccd.beniculturali.it/it/sigec-web



Fig. 5: Posters in the SIGECweb Catalogue selected through an advanced search through filters: Category: Movable property; Sector: Historical and artistic heritage; Type: Prints; Cultural field: Italian area; Region: All; Data source: All.

The web environment will be structured according to three sections in which the user can carry out his search: Authors, Cellars, and Browse. In the specific Navigate section, you can search the locations and itineraries present in the regional territory.
The Catalogue structure has been designed to be subsequently implemented with the material and information obtained during the collection phase. It will be possible to conduct an advanced search by selecting the filters by category, sector, type, cultural area, region, and data source. The printable digital card differs from the one that can be viewed in the web environment only in the information and reference catalogues of reference for the identification and recognition of the good such as the catalogue codes or the geographical area because they are considered useless for use by the end-user.
The filing is fundamental for preserving and protecting this heritage precisely because of the variety of derivations of the posters, many of these of a private nature that, without its digital cataloguing, would be lost and not disclosed.
In this sense, it is intended to address the issue of cataloguing as an essential element for the management and enhancement of cultural heritage and as a support for the promotion and implementation of educational, dissemination and research activities, as well as an incentive to the

production of open data in which to convey the information derived from the different administrative levels.
This study is part of a broader line of research that wants to lead, through the historical cognitive memory on an archival basis, to the community's involvement in protecting its continuous implementation and extension of the study. In this sense, the photographic and documentary cataloguing of the posters is a fundamental element of connection and sharing of the Piedmonts' cultural heritage.

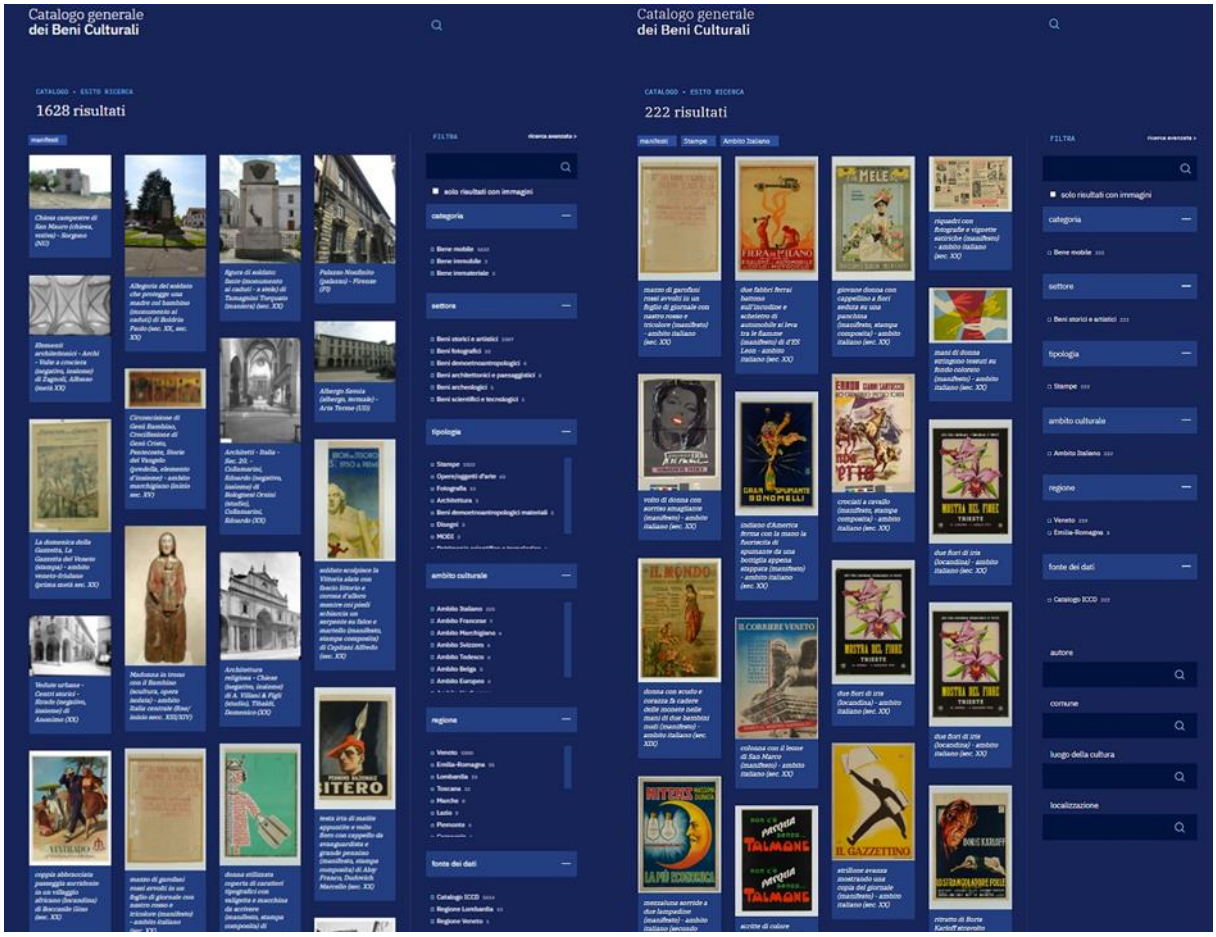


Fig. 6: Structure of the General Information System of the SiGECweb Catalogue of Cultural Heritage

4. Conclusions

The research has identified more than 100 posters of Piedmontese wineries, some of which are still active in the area: the result is a varied panorama of images that have evolved, following the fashions and artistic trends of the period.
The first professional wine posters identified in Canelli and Moscato d'Asti, dating back to the late nineteenth century, focused a lot on the image of the local landscape as a vehicle for product communication: architectures and recognisable views of the city of Canelli are present in numerous examples. They are the background to the harvest activities described as a moment of celebration, the joyful conclusion of a year of work in the vineyard and the beginning of the transformation of the vine's fruit into wine. The magic of the vineyard is also evoked through the use of female figures who, in traditional clothes, work and toast to the generosity of the harvest in progress.
With the emergence of the product in the world market, the need to represent the local landscape is replaced by highly evocative images where the product is not communicated with its representation but through images capable of transmitting the sensations of joy and celebration associated with wine.
The research carried out so far is only the first step in more ambitious cataloguing of posters related to the Piedmontese wine world and has given us how the image of the product, for a specific historical period, has been linked to the idea of the landscape that produced it.
In addition to the cataloguing and dissemination of the images themselves, the future developments of this research may also affect the current appearance of wine landscapes that develops in an articulated way through social media and posters and traditional advertisements. How is the image of the landscape and wineries of Piedmont conveyed in the current century?

Although in the general sharing of the ideas expressed in this article, the paragraph *The manifest as a way of expressing the graphic representation* is to be attributed to Sara Eriche, *Research methodology and phase of the investigations aimed at filing the collected material* is to be attributed to Francesca Salvetti and Objectives of the research and Conclusions to Michela Scaglione.

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The wild garden inside: the universal everlasting dream of capturing nature and bringing it into our lives

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Abstract
In the Enlightenment period, the *natura naturans* concept was a value in the lifestyle of aristocracy. Jean-Jacques Rousseau, after his theory on the good savage, has written an epistolary novel *Julie ou la Nouvelle Héloïse* where there is the description of an enclosed wild garden, the Elysée, where the main character, Julie, does not allow any gardener to enter the precinct and touch the natural evolution of the vegetation and animal species.
Since the 18th century, Humankind has endangered the planet due to many consequences of industrialization, creating an effect in the atmosphere through the acumulation of carbon dioxide, and other greenhouse gases that has led to a inequivocal climate change that is unbalancing the planet itself and putting into risk all the living species.
Nowadays, everyone seems to aspire to that same nostalgic return to nature, under a paradisiac scope of view, in a time when the planet is in utter danger, due to climate change phenomena or other impending menaces. There is the utopian search for the last redoubts of “untouched” nature, the biophilic desire to live in contact with nature. The Elysée only exists in our minds and hearts, for we have lost its key.

Keywords: Natura naturans; Biophilia; Climate change.

1. Pursuing *natura naturans*

The latin term *natura naturans* invented in the Middle Ages, refers to "nature naturing" or, interpreted in a more freely way, "nature doing what nature does". It is commonly associated with the philosophic construct of Spinoza (1632-1677). *Natura naturans* refers to the self-causing activity of nature, while *natura naturata* – “nature already created” - refers to nature considered as a passive product of an infinite causal chain. In Modern Age, Man has always aspired to a state of integration and fusion with nature, with this same *natura naturans*.
Jean-Jacques Rousseau’s (1712-1778) thought was very much concerned with the issues related to the interpretation of human nature and the relation between the mere concept of *natura naturans* and the human subject himself. His works, - either the *Discourse on the Origin of Inequality* and *On the Social Contract* - constitute important landmarks in the political and social modern thought, contributing to define the values of democracy and social empowerment. His autobiographical writings, - *Confessions* and *Rêveries of a Solitary Walker* - along with the two novels (*Emile* and *Julie*), were quite relevant to establish a hermeneutics about the *principia* of the philosophical thought of Rousseau on Nature.
Rousseau wrote the epistolary novel “Julie, ou La Nouvelle Héloïse” and published it for the first time in 1761, at Marc_Michel Rey, in Amsterdam. The Elysée a sentimental and wild garden included in the epistolary novel becomes a subject of interest for Saint-Preux, one of the main characters in the plot, when he travels to pay a visit to his former pupil, Julie, finding her in a different age and personal status. Experiencing the garden is one of the most significant aesthetic experiences of the work as in a letter he describes an afternoon spent in the private space of the Wolmar family.
The alpine landscape, attaining the sublime, is also present in some parts of the implicit narrative, demonstrating a contrast with the garden related to a multiplicity of Saint-Preux’s emotional states.

"On entering this so-called orchard, I was struck with a pleasant sensation of freshness which dark shades, animated and lively greenery, flowers scattered on all sides, the glurging of running water, and the song of a thousand birds, appealed to my imagination at least as much as to my senses: but at the same time I thought I saw the wildest, most solitary place in nature, and it seemed to me that I was the first mortal who had ever entered this desert." (free translation from french by the author*, Julie ou La Nouvelle Héloïse*, Quatrième Partie, Lettre XI, De Saint-Preux à M. Édouard, p. 171)



Fig. 1: Julie et Saint-Preux, Julie ou La Nouvelle Héloïse, Lettre XVII. Source: Bibliothèque de Genève, Iconographie. Drawing by Francis Wheatley, etching by Francis Jukes.

Let us go back to the descriptions of the *Élysée*, very close to the main house at Clarens. It was concealed by a covered alley and could not be perceived from any exterior viewpoint. It was closed by the means of a door that only a key could unlock, protected by thick trees such as ells and hazels, surrounding it. Finally, it did not allow the eye to penetrate the place and the door gave way to some kind of reality that one would accede as if falling *"down from the clouds"*.
The spatiality described was so "extraterrestrial", that the entering visitor seems to have attained some kind of heavenly condition. The initiation to this *locus,* its access, is symbolized by the key that Saint-Preux, as he regrets in the letter, pertains to the present owner - the husband - and not to the former lover, himself.
Thus, this wild garden bears many symbolical values. Saint-Preux cries, after entering the orchard, *"Julie, the end of the world is at your own door!"* He is there referring to this unique representation of the universe, some kind of metaphorical Eden to which he associates Julie and all that she represents to him.
Once having entered the orchard, Saint-Preux had been struck with an invading sensation of freshness produced by umbrages, scattered flowers and a gurgling of current water, as well as the twitter of a thousand birds. His imagination made him believe he was in the remotest, wildest natural place, as the first mortal to enter that same deserted *locus.*
According to the descriptive lines, the place was charming but looked quite abandoned and wild so that Saint-Preux enquired why he could not see the traces of human labor. Once the door was closed, water came from wherever one would not know and nature itself arranged for the rest to happen. The garden's denomination is referring to the Elysium or Elysean Fields that greek mythology separated from the Hades, an underworld afterlife realm. Only mortals related to the gods and heroes would be admitted beyond the river Styx to reach it.

2. Climate change and the early experiences

The planet has been facing a major crisis for its average surface temperature has been risen by at least 1,1 º C, since the levels related to the period of 1850 to 1900. Industries, along with the activities relating to recent western lifestyle, have been responsible for the transformation of the atmosphere. It is currently overloaded with gases that retain heat as a result of the combustion of fossil fuels, namely coal and gas. It is also a result of forest gradual elimination throughout the world.
This increase of temperature is enough to transform the mere flow of energy in the planet and has been accelerating. Its consequences are generalized as icesheets in Greenland and Antarctica are melting, causing the raising of sea levels and the flooding of maritime cities.
On another hand, drought is also affecting agricultural lands and the course of the rivers that used to feed them are disappearing. Wildfires are frequently raging everywhere and rains are becoming more intense. All of this is happening as weather patterns are shifting.
The origin of this climate emergency began more than a century and a half ago. In the 1950's, scientists began to proceed to detailed measurements of atmospheric carbon dioxide that would put into evidence how much carbon resulted from human activities. Ten years later they started to develop comprehensive computer models that explain the harshness of the changes we are now experiencing.
In the 1850's, an amateur scientist and sufragette Eunice Newton Foote (1819-1888), from New Your, put two glass jars both containing thermometers in the sunlight: one containing just air (a mix of nitrogen, oxygen and other gases including carbon dioxide); the other containing just carbon dioxide. As the sun's rays struck the jars, she observed that the second jar alone heated up more quickly, and was slower to cool down. The results of this experiment allowed Foote in 1856 to conclude on the relationship between carbon dioxide, the planet and heat.
Three years later, apparently unaware of her findings, John Tyndall (1820-1893), an Irish physicist, elaborated the same basic concept with more detail. He found that carbon dioxide as well as water vapor, absorbed more heat than air alone. He found that such gases would trap heat in Earth's atmosphere, like panes of glass trap heat in a greenhouse. Tyndall explained the heat in the Earth's atmosphere in terms of the capacities of the various gases in the air to absorb radiant heat, in the form of infrared radiation. He was the first to correctly measure the relative infrared absorptive powers of the gases such as nitrogen, oxygen, water vapor, carbon dioxide, ozone, methane, along with other trace gases and vapors. He concluded that water vapor is the strongest absorber of radiant heat in the atmosphere and is the principal gas controlling air temperature. Absorption by the other gases is relatively reduced. Prior to Tyndall it was widely surmise that the Earth's atmosphere warms the surface in what was later called a greenhouse effect, but he was the first to prove it.

3. Industrial Revolution and Modern Climate Science

Humans began substantially affecting the atmosphere around the turn of the 19th century, when Industrial Revolution began in England and factories consumed coal in large quantities. Using fossil fuels, the steam engine revolutionized transportation systems as well as other industries. As is common knowledge Fossil fuels, including oil and natural gas, are driving our global economy.
Svante Arrhenius (1859-1927), a Swedish physical chemist was concerned about ice ages, including whether a decrease in volcanic eruptions, which can put carbon dioxide into the atmosphere, would lead to a future ice age. He proceded to complex calculations involving moisture and heat transport in the atmosphere at different latitudes. In 1896, he reported that halving the amount of carbon dioxide in the atmosphere could provoke an ice age, and that doubling it would raise global temperatures by around 5 to 6 degrees C. Even if he had simplified Earth's complex climate system considering just a few variables, it did not impress scientists of his time.
Guy Stewart Callendar (1898-1964), a British engineer and amateur meteorologist, wrote a paper in 1938 where he linked the temperature rise to the burning of fossil fuels. He did not consider global warming as a problem. According to him extra carbon dioxide would surely stimulate plants to grow and allow crops to be cultivated in new regions. World War II brought nations together with questions of global reach and this allowed modern climate science to emerge.
Between 1957 and 1958 there was a period of eighteenth months when the International Geophysical Year (IGY) organised field campaigns including exploration in the Arctic and Antarctica. The priority was not Climate but Roger Revelle (1909-1991) (Scripps Institution of Oceanography) leading some scientists in California started a project which objective would be to measure carbon dioxide levels at different locations around the world. Charles David Keeling (1928-2005), a geochemist, put ultraprecise carbon dioxide monitors in Antarctica and on the volcano of Maona Loa. This fact originated one of the most iconic datasets , the "Keeling curve," representing the rise ofcarbon dioxide in the atmosphere.

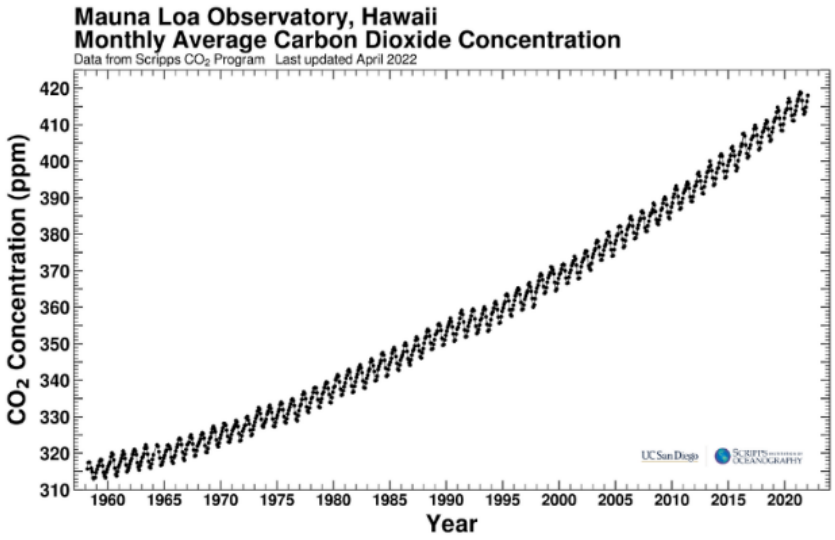


Fig. 2: this chart shows the rise in CO_2 levels as measured at the Mauna Loa Observatory in Hawaii due to human activities. Source: C. D. Keeling, S. C. Piper, R. B. Bacastow, M. Wahlen, T. P. Whorf, M. Heimann, and H. A. Meijer, Exchanges of atmospheric CO_2 and $^{13}CO_2$ with the terrestrial biosphere and oceans from 1978 to 2000. I. Global aspects, SIO Reference Series, No. 01-06, Scripps Institution of Oceanography, San Diego, 88 pages, 2001.

When he began the measurements in 1958, carbon dioxide was 315 parts per million of the global atmosphere. Within just a few years the number was increasing year by year. Because plants take up carbon dioxide as they grow in spring and summer and release it as they decompose in fall and winter,its concentrations rose and fell each year in a sawtooth pattern. Nevertheless the tendency is to go upward as the Keeling curve has been referred by countless scientific sources on earth science. In 2016, it surmounted 400 ppm of carbon dioxide in the atmosphere as measured during its typical annual minimum in September and today it is at 413 ppm. Just to have a notion it is estimated that before the Industrial Revolution, the levels in the atmosphere had been stable for centuries and were around 280 ppm.

In 1957, Revelle and Hans Suess (1909-1993), published a paper that traced the flow of radioactive carbon through the oceans and the atmosphere. They showed that the oceans were not capable of absorbing as much carbon dioxide as it was previously considered, so the gas must be going into the atmosphere instead.

Data collected from observations throughout the second half of the 20th century helped researchers gradually build their understanding of how human activities were transforming the planet.

Climate change in the past can be studied from cores extracted from icesheets. The quantities of isotopes, of oxygen and hydrogen present inside allow for the study of the temperature when they were formed, Air bubbles also can revelate how much carbon dioxide and other greenhouse gases were in the atmosphere at that same period of time. Those ice cores allowed scientists to reconstruct past temperature changes in extraordinary detail.

Earth-observing satellites, having measured the rise in global sea level as well as the rapid decline in ice left floating on the Arctic Ocean each summer. The ten warmest years since 1880 have occurred since 2005 and nine of those ten have come since 2010.

Since the 1960's, looking into the future depended on computer simulations based on complex calculations of how energy flows through the planetary system. Climate models, linked to weather observations, can contribute to predicting future climate.

By 1950, a team led by Jule Charney (1917-1981), a meteorologist at the Institute for Advanced Study in Princeton, New Jersey, used a programmable, electronic computer, to produce the first computer-driven regional weather forecast. Six years later, a member of this team, Norman Phillips, had produced the first general circulation model, which captured how energy flows between the oceans, atmosphere and land, thus initiating climate modelling. In 1967, a huge advance in science took place when meteorologists Syukuro Manabe (b. 1931) and Richard Wetherald (1936-2011), both pertaining to the Geophysical Fluid Dynamics Laboratory in Princeton, discovered connections between Earth's surface and atmosphere and calculated how changes in carbon dioxide would affect the planet's temperature.

In 1979, a scientific meeting got to a conclusion on what increasing levels of carbon dioxide would mean for the planet (Charney Report). In the following decades, climate change became mostly a matter of political issue.

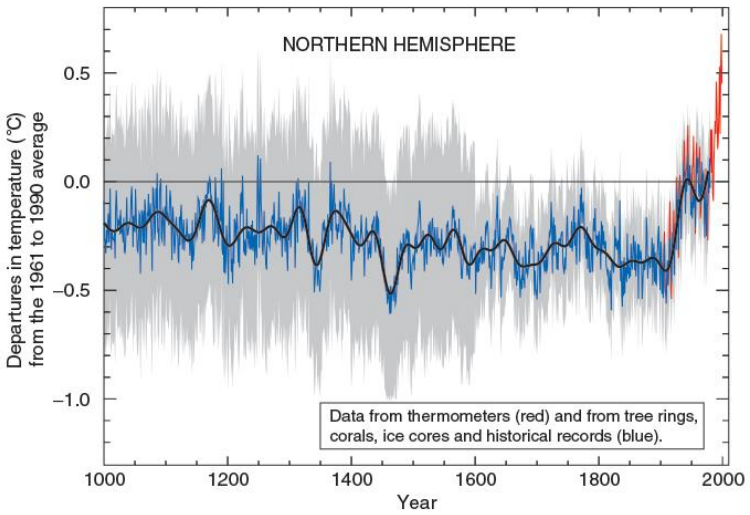


Fig. 3: Climate Change 2001: The Scientific Basis. Contribution Of Working Group I To The Third Assessment Report Of The Intergovernmental Panel On Climate Change.

In the 1960s and '70s, there were other ecological issues raising public interest. Rachel Carson's *Silent Spring* (1962) which condemned the pesticide DDT for its ecological impacts provoked a wave of environmental activism in the United States and led to the celebration of first Earth Day in 1970.
In 1974, Chemists Mario Molina (1943-2020) and F. Sherwood Rowland (1927-2012), from the University of California, Irvine, reported that chlorofluorocarbon chemicals, used in products such as spray cans and refrigerants, caused a chain of reactions that damaged the atmosphere's protective ozone layer. The resulting ozone hole, which forms over Antarctica every spring, allows more ultraviolet radiation from the sun to penetrate atmosphere and reach the earth's surface, causing damages to the health of humans. The 1987 Montreal Protocol, under the aegis of the U.N. limited the manufacture of chlorofluorocarbons.
The present impeding menace of climate change is more difficult to overcome implying the elimination of carbon emissions.

4. Trying to achieve commitments at the United Nations

In 1988, a United Nations body called the Intergovernmental Panel on Climate Change, the IPCC. Its role is to synthesize the vast literature of climate science for policy makers to consider. The first report, (1990) predicted that the planet's global mean temperature would rise more quickly in the following century than at any point in the last 10 000 years, due to the increasing greenhouse gases in the atmosphere.
Discussions on how to stabilize greenhouse gases concentrations started with the Rio Earth Summit in 1992, which resulted in the U.N. Framework Convention on Climate Change. The Kyoto Protocol of 1997 was the result of the first international commitments to reduce emissions, where developed countries committed to reduce emissions of carbon dioxide and other greenhouse gases. By 2007, the IPCC received the Nobel Peace Prize that year, along with Al Gore, for their work on climate change. During the first decade of this century, international climate meetings discussed less issues of equity. Countries such as China and India pointed out that they needed energy to develop their economies whereas nations such as the United States should give the example on cutting greenhouse gases.
By 2015, a relevant U.N. climate conference in Paris produced an international agreement to try to limit global warming to 2º C, and preferably 1,5º C, above preindustrial levels.
Various scenarios for how greenhouse gas emissions might change going forward help scientists predict future climate change. This graph shows the simulated historical temperature trend along with future projections of rising temperatures based on five scenarios from the Intergovernmental Panel on Climate Change. Temperature change is the difference from the 1850–1900 average.
United States President George W. Bush withdrew the country from the Kyoto Protocol in 2001 and Donald Trump similarly rejected the Paris accord in 2017. Nevertheless, other nations have moved

forward, as some European countries like Germany have pursued renewable energies, including wind and solar.

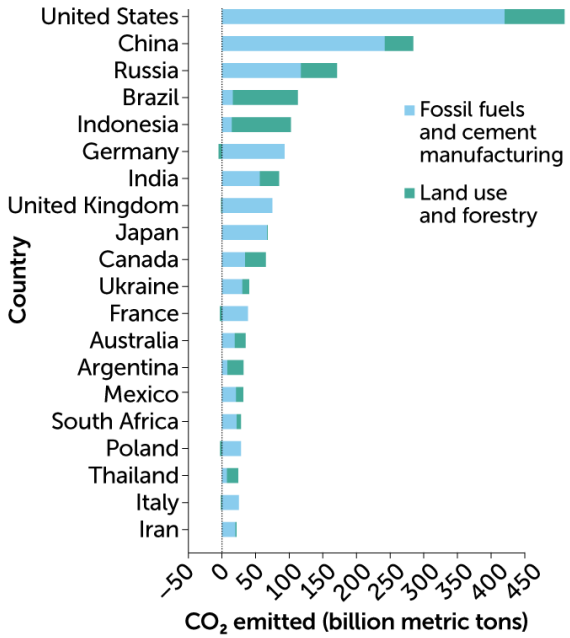


Fig. 3: Total carbon dioxide emissions by country 1850-2021. Source: Carbon Brief Analysis of figures from the Global Carbon Project, CDIAC, Our World in Data, Carbon Monitor, Houghton and Nassikas (2017) and Hansis et Al (2015).

At Glagow's Climate Change Conference in 2021, India was criticised for not committing to a complete elimination of coal, like China and the United States. In many cases, changes are coming faster than scientists had envisioned a few decades ago.

Climate justice is a kind of environmental justice originated by the conviction that climate change do not have equitable effects over world's populations as it contributes to the growth of poverty, starvation and malnutrition, risk of disease or migrations among the most fragile and vulnerable. Besides being a concept, it is also a social and political movement that focuses on social justice, distributive justice, intergenerational justice, originated by climate change.

There are three main reasons that contribute to climate change being an ethical problem based on asymmetries or inequalities: on human causes of the problem and the effects over human communities all over the planet, on the capacity to solve the problem and the increasing severity of the impacts over successive future generations.

5. We have lost the key to the garden of the Elysée

In the Arctic, where temperatures are rising at more than twice the global average, communities are the main victims of change, as permafrost is thawing, there is the destabilizing of buildings and infrastructures.

There is no place in the planet that does not suffer from the recent alterations of climate. Higher temperatures have led to considerable droughts, which dry out vegetation and cause prominent events such the wildfires that have recently ravaged the Mediterranean, western North America and Australia.

The oceans are becoming more acidic as they absorb carbon dioxide, damaging the development of tiny marine organisms that build protective calcium carbonate shells and are the base of the marine food chain. Warmer temperature of waters are bleaching coral reefs. Higher temperatures are driving animal and plant species into areas in which they previously did not live, increasing the risk of extinction for many. The origin of life was the water and we have been compromising, with no return, the entire biosphere.

The Biophilia concept resulted from the dissemination of theories by Edward Osborne Wilson (1929-2021), a biologist who published a first book on the subject in 1984 by the Harvard University Press

and later continued his research. He describes Biophilia as a natural tendency of focusing attention on living things. Another author a German philosopher and psychoanalist Erich Fromm (1900-1980) opposes the concept of Biophilia no Necrophylia, whereas others oppose it to Biofobia. Biophilia comprehends Man's psychological need for nature or life itself. It is a most relevant question in a time when we are facing a question of survival of the whole ecosystem, as opposed to the issues of progress in our hands perhaps to a point of no return.

Awareness of the path we have chosen is not going to save us from the imminent consequences. Nostalgia for the "paradeisos" is just a utopian mood, as dystopia has already installed in the settings we have chosen.

Yuval Noah Harari (b. 1976), an Israeli Historian asserts that Homo Sapiens Sapiens is the only species that is able to implement cooperation between individuals without the necessity of knowing each other because there is a common interest generated by some sort of "narrative" that makes individuals gregarious. Maybe we are facing the time when nations have to find objectives that are higher than the narrative of profit in a capitalist model society, creating the opportunity to justify the term globalization in the context of survival:

Alea iacta est.

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METAVERSE: THE ARCHITECTURAL SPEECH OF DIGITAL REPRESENTATION

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Abstract
In 1997 Nirvana, a film by Gabriele Salvatore, imagines a world parallel to real life, completely digital, in which the characters of the film moved, alternating between virtual and real life.
The first real MUVE (multi-user virtual environment), was *Second Life*, created in 2003, by the American company Linden Lab. It consists of a digital platform, equipped with a virtual currency, with applications for entertainment, art, education, music, architecture etc., in which to lead a life parallel to the real one.
In 2020, Mark Zuckerberg wants Facebook to become a Metaverse company. On this platform, land is being sold to create virtual buildings, urban environments and meeting places between users are planned, digital representation will certainly play an important role in the Metaverse, given that the creators of the most powerful virtual reality engine, Unreal, has decided to invest one billion dollars in this platform and experiment with new technologies for the three-dimensional digital representation of living environments.
Therefore, all the space of the Metaverse must be designed.
Will architects and urban planners be ready to represent their virtual architectural creations in the Metaverse?
In this paper we want to investigate the state of the art of digital representation as a bridge between the virtual world of the Metaverse and the physical world of reality, analyzing solutions that interface the possible virtual architectural scenarios in the Metaverse to “test drive” unbuilt buildings.

Keywords: MUVE; Virtual World; Digital representation; Digital Twins; Architectural layout.

1. What is the metaverse?
The word means "beyond the universe". To describe it, one must think of the growing permeability of the borders between different digital environments and the physical world. A space where it is possible to interact with virtual objects and information in real time [1].
It is the convergence of augmented and virtual physical reality in a shared online space, a virtual reality space in which users can interact with a computer-generated environment. For many it is the future version of what the internet will be.
The word first appears in a 1992 science fiction novel "Snowcrash" by Neal Stephenson, and indicated the futuristic view of the modern internet, how a digital world could evolve in the future.
The first fully digital MUVE (multi-user virtual environment) virtual world was *Second Life*, dating back to 2003, created by the US company Linden Lab from an idea of the latter's founder Philip Rosedale [2].
It is a platform where you can lead a life similar to the real one, users are free to explore the virtual world made up of thousands of regions organized in grids, instantly move from one point to another in this virtual world, socialize with other residents, participate in the most varied activities that take place on the platform, such as events, concerts, courses, purchase virtual goods and services by spending virtual currency.
These features make *Second Life* different from a video game, in which you have to pursue a predetermined goal to move to the next level and finish the game [3].



Fig. 1: Zaha Hadid Architets: Layout of Liberland.

Furthermore, *Second Life* differs from other 3D multi-user environments or games because the content of the entire virtual world is generated by the residents [4].
The world of cinema has explored virtual environments such as the metaverse several times, among the first there was Salvatores with movie Nirvana, more recently, the movies "Matrix" and "Ready Player One". Presence within these virtual worlds appears as real, and human interactions occur through the figurative mediation of avatars. Therefore, within *Second Life* numerous subcultures were born, object of studies in the fields of sociology and communication sciences as a virtual model of human interaction [5]. To the first question, "what is the metaverse", the well-known Zaha Hadid Architets studio responds in style, which announced the project of an autonomous virtual city within the Metaverse.
The virtual city, which will present the unmistakable style of ZHA in the form of a town hall, with collaborative workspaces and even galleries selling NFT (non-fingible token), is not entirely based on the unstoppable imagination of creatives but on the real experience of micronation of the Free Republic of Liberland, which is located between Serbia and Croatia.
The principal architect of ZHA's, Patrik Schumacher, explain, "The time is ripe, technologically, economically and socially, for shifting more and more of our productive lives into the metaverse. The metaverse is just starting to show its potential to empower true global collaboration with global borderless participation."
Schumacher is hoping that the future buildings will resemble the structures which reference the brutalist movement popping up throughout the virtual city.
Unlike those real structures, though, the ones the firm is designing for the metaverse are even more creative, which makes sense considering there are hardly any limitations when it comes to the freedoms of virtual reality.
"The main thrust of the design is to utilize the congeniality of our architecture with the user experience, and adapt our design ethos and methods to address the specific opportunities and constraints offered by the virtual realm," Schumacher says. "Metaverse provided their innovative and proprietary V.R. interaction technology that enables the virtual use of the spaces." Some of the out-of-this-world features of the Zaha Hadid Architects' metaverse include hovering rooftops, enormous interiors with no need to consider energy efficiency, and auditoriums that can expand and shrink based on the number of users in them.
Though the metaverse is still in the planning stage of development, Schumacher is convinced that these virtual cities will become more commonplace as the world continues to adapt to the digital environment into which the pandemic essentially threw everyone.

2. Which Metaverse

For many years, the Internet was mainly a 2D catalog with hyperlinks, now it is finally starting to look interesting thanks to the increase in speed, new possibilities for virtual 3D experiences have opened up. This will change the way we work, buy, live the web of virtual worlds that are emerging.

First of all, it is important to clarify one thing: there is no single world of immersive virtual reality, in which we can work, play, attend concerts and move without restrictions of any kind, imagined and described, among others, by Mark Zuckerberg. Instead, there are various individual digital environments, created before the Metaverse, each with its own specific functions. Some, like Fortnite, give particular emphasis to the game; others, such as VRChat or Zepeto, are immersive social networks; still others, like Horizon Workrooms or Microsoft Mesh, are designed for the job. And then there are those like Decentraland or The Sandbox, which allow you to buy (and sell) land in cryptocurrency, to build all kinds of buildings on these lots: art galleries where you can exhibit your most prestigious NFTs [6], clothes, shops, or digital places to invite your friends' avatars.

In the Metaverse, what has already happened in Downtown Manhattan, when there was only countryside, is repeating itself and buying land in the SoHo area was certainly not a bad investment. In the Metaverse we are having the same pioneering phase, buying blockchain-based lots, in relatively uninhabited digital worlds and where we think we will increasingly move our daily lives in the future.

This real business model also works perfectly in virtual worlds, plots of building "land" are going up in price. One of the reasons why prices are rising so fast is that these plots of land are not unlimited. Scarcity, as always, creates value and pushes people to invest their money.

A company like Tokens.com bought a plot of land in Decentraland and built a digital tower there: the goal is to earn money by renting spaces to brands that want to organize events in the Metaverse.

The social model that is emerging will create a real economy, with new jobs. Among these, one of the most promising seems to be that of the "metaverse architect". Lately there has been an explosion of architectural firms that work exclusively on the design of structures to be built in the various digital worlds.

"We work mainly with companies, brands, investors and art collectors to give them a digital presence in the Metaverse through the buildings we create," says George Bileca, CEO of VoxelArchitects, a studio very active in the digital design of environments in the Metaverse [7].

3. Who will draw the Metaverse?

How can Architects and Designers play a role in shaping and enriching the great Metaverse? The virtual worlds that have been created up to now, have been conceived and designed by graphic designers, for the Metaverse and its derivatives, we want the architects to define the architectural volumes that will fill these new virtual spaces [8].

Metaverse needs massive content to entertain the users. We need experiences like virtual amusement parks, virtual movie theatres, virtual concerts, virtual casinos, virtual schools, virtual conferences, anything you can name it. For Architects, the metaverse is a virgin territory full of possibilities, and a utopia without the constraints of the physical world. Architects can create unique designs backed with NFT for people who like to collect one-of-a-kind assets. Architects can also build digital assets like cities,

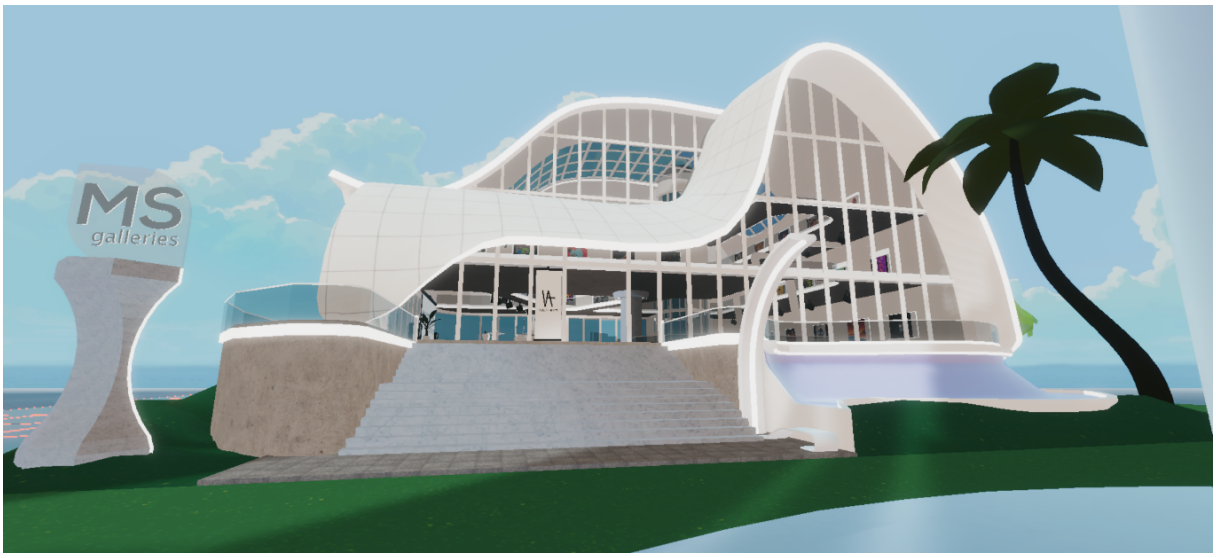


Fig. 2: Vox Architect: Max Stealth Gallery.

buildings, furniture, sculptures, point clouds, textures etc., and sell them multiples times to virtual worlds, games, and movies. This is very similar to the work environment artists do for a game or a movie. Besides static designs, Architects can also develop design “formulas” that users can tweak the parameters to generate various outcomes, like grasshopper script or Houdini digital assets. [9]
Thanks to the diffusion of the Metaverse, Architects and Designers can provide design services all over the world. Finding customers in your city might be difficult, but in a world where potential customers are millions, it might be much easier to find fans of your creations.
On this front, large companies are already moving and studying the potential offered by the Metaverse and the virtual worlds that are emerging.
From one perspective, designing for the metaverse seems like every architect’s dream. No physical constraints, no safety regulations, no construction sites, no engineers and builders to deal with. Pure creativity. “The architect of the metaverse must have knowledge of traditional architecture, but also of conceptual art. Because you are free from the limitations of the real world, creativity is emphasised more than the technical execution”, confirms Bileca [10].
In fact, in the Metaverse, having no structural and legislative constraints, the structural designers have been replaced by programmers who must make the interactions with the designed environment livable and real. Opening the doors, moving the elevator, in the real world are natural actions, but in the digital world everything must be programmed by the software. All these small details give life to the building and create that interaction similar to the real world.
In the Metaverse the bricks are replaced by voxels (three-dimensional polygons) and specific skills are needed to build with these "materials".
But we might ask ourselves what is the need to turn on the light or open a door in a fully digital world? Psychologists believe that virtual environments that reflect material reality are reassuring for those who populate the Metaverse, for this reason, in the buildings of the Metaverse, there are bathrooms, kitchens and bedrooms, to reproduce a reassuring reality but that no avatar will ever use.
The architecture that is created in the Metaverse is mainly public, to meet the need for aggregation. Private structures can be thought of as representative, to affirm their presence in the virtual world. These public spaces are the 3D evolution of the social networks that we all use on our smartphones.

4. A bridge Between the Physical and Virtual World

In digital worlds, as in reality, the business model used is the model of the world of video games, which are considered the best commercial vector of the Metaverse, some games such as Sandbox, Minecraft, Fortnite, offer a high degree of freedom of experience by providing tools for the production of goods to be sold on these platforms.
Due to the recent COVID-19 pandemic, Balenciaga launched its clothing and accessories line in a digital event within a video game platform. Samsung unveiled its phones in a Metaverse theater, Cupra unveiled new car models in its Metaverse showroom. These events had great success and a notable advertising return, creating a great curiosity for the platforms that hosted the event.
Ultimately the way of approaching the life of interpersonal relationships is changing, which are increasingly moving into virtual environments. In these last two years, we have all worked remotely, trying to move our interpersonal relationships to the virtual world and rediscover the freedom repressed by the pandemic. In the new cities of the Metaverse, such as that of ZHA's, there are hyper-realistic neighborhoods that encourage urban self-government and areas where the absence of urban planning allows for spontaneous order through a process of discovery. In this way, you will have a virtual city made by many and not created



Fig. 3: Presentation of the new car in CUPRA Metaverso Showroom.

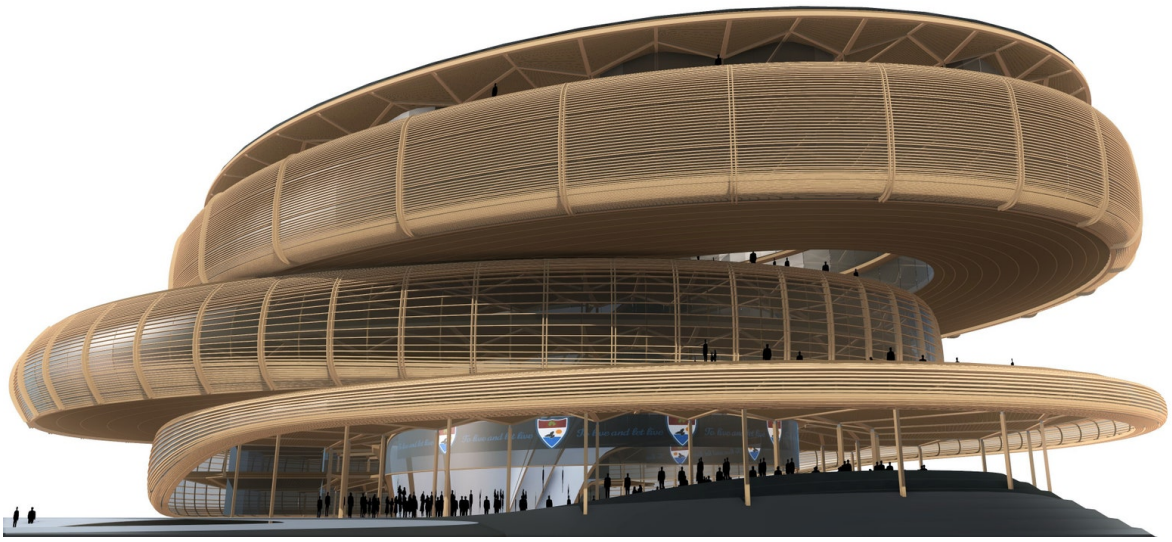


Fig. 4: Zaha Hadid Architets: Liberland Metaverse City Hall.

by a single programmer. This will enrich the virtual Architecture, because Metaverse users will want to live in pleasant environments, more captivating than the real ones.
Although, virtual and physical environments are ideally designed alike, the advantages of creating virtual environments are their global accessibility and adaptive malleability, two key influences behind the design of ZHA's Metaverse, where knowledge and experience has been used, in spatial design, in particular in the general aesthetics of social atmospheres, to design the environments where the socialization of virtual residents is to be carried out and developed.
Another great opportunity given by the Metaverse is to create virtual copies of the real world, called Digital Twins, to acquire information from the virtual model and modify the real model.
The Metaverse is the ideal environment for the creation of Digital Twins, virtual replicas of physical buildings that provide a photograph of the state of the architecture, in real time, the Digital Twins allow - thanks to predictive models elaborated by Artificial Intelligence (AI) - to predict the future performance of the physical asset and to test improvements without having to test them on the product itself [11].
With the creation of Digital Twins, architects can act as a bridge between the physical and virtual worlds. According to Autodesk: "A digital twin in construction, engineering, and architecture is a dynamic, up-to-date replica of a physical asset or set of assets, be it a building, campus, city or railroad, which brings together design, construction and operational data in real time. Digital Twins simulate, predict and inform decisions. "Architects could run simulations to create real-world scenarios for virtually test-drive unbuilt buildings. A Digital Twin uses data from connected sensors to tell the story of a building throughout its life cycle. From testing to real-world use. With IoT data, we can measure specific indicators of building health and performance, such as temperature and humidity. A Digital Twin can also increase the physical experience, let's imagine we have a stadium that can only accommodate 20,000 spectators for a live concert, but you can allow millions of users to attend that event via the digital twin while having a dynamic interaction between the two" [12].

5. Conclusion

We are seeing a new interaction of the internet, which will have huge implications for real society. This new era of the Metaverse will develop creativity by creating new opportunities for brands and companies. For people who undertake a business in the Metaverse, opportunities will be created globally [13].
Certainly, the recent pandemic has changed everyone's way of life. This forced everyone to stay at home, not to travel and find an alternative outlet. The creation of virtual and ideal worlds has prompted many people to leave reality to take refuge in virtual worlds such as *Second Life*, Sim City, Sandbox, Minecraft and the Metaverse. The search for lost interpersonal closeness due to the pandemic has created a substitute for this with avatars to live in virtual worlds, to make up for the impossibility of socializing in realities due to the COVID-19 pandemic. All these virtual universes will have to be built with new structures which will have to have a real layout in their appearance and functionality even if they are totally digital.

But what is the value of architecture for the construction of the Metaverse?
This is a deep topic and as Rem Koolhas puts it: “Architecture stands with one leg in a world that’s 3,000 years old and another leg in the 21st century. This almost ballet-like stretch makes our profession surprisingly deep. You could say that we’re the last profession that has a memory, or the last profession whose roots go back 3,000 years and still demonstrates the relevance of those long roads today. Initially, I thought we were actually misplaced to deal with the present, but what we offer the present is memory.” [14]. The concept expressed by Koolhas makes us understand how even the spaces of the virtual worlds that are emerging need the ideas of Designers and Architects to have a real and livable layout as in reality. Thanks to the advanced rendering techniques and the increasing of the internet speed, it would be unforgivable to leave the creation of the architectural volumes of the Metaverse to those who until now have created video games or environments that have only hosted the player in passing. In the Metaverse we have real residents, real people who immerse themselves in the virtual world and want to find an environment on a human scale and usable as in reality.

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Exploring representation tools for mapping landscape evolution. From historical maps to satellite multispectral imagery

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Abstract
Climate changes are impacting the landscape in many different ways. In the alpine region, some specific locations, localized in-between the cities and main mountainous tourist destinations, are affected by landscape changes, which are especially related to the vegetation and land-use changes (e.g. transformation of a vineyard or grassland into the wood and vice versa). In this framework, new research methods and digital survey techniques are required, in the field of representation, to recognize and map the ancient features of the landscape, which can be helpful to deeper comprehend the current spatial configuration. The maps, both historical and digital, are a great resource of geo-information for monitoring historical landscapes, which are the result of a strong interrelationship between natural components and man-made interventions, over the centuries. The research, by selecting a study area in the alpine region, explores different kinds of representation tools such as historical maps, cadasters, land-cover and land-use maps, and time-series of satellite imagery, which shows the potential of maps, as a preferential tool to analyze landscape changes over time. Furthermore, the research shows how GIS tools can be used to map long-term landscape changes, by comparing the ancient spatial configuration of the selected location, shown by the old depicted cadastre, to the current configuration.

Keywords: landscape changes, mapping, historical maps, satellite imagery, GIS

1. Introduction

Nowadays, climate changes, which are part of the 2030 UN Agenda for Sustainable Development Goals (SDGs), are affecting the landscape in many different ways. Increasing numbers of extreme phenomena such as flooding and drought, or natural afforestation and desertification, are currently affecting specific areas of our planet, more and more intensively. Landscape, as it is seen today, is the result of a unique combination of physical, cultural and local features [1]. As mentioned by the European Landscape Convention, the landscape is strongly related to its evolutionary process over history, transformed by nature and human interventions, and today perceivable as the result of previous events [2].
Understanding both the long-term and short-term evolution of the landscape, also in relation to climate changes, is a very challenging research topic, and it could be better understood by investigating the landscape's spatial features through time. Understanding landscape evolution means considering both the local dimension and the regional dimension. It can be assumed that all landscapes are local and site-specific; the local dimension enables to grasp of inner features of the landscape, particularly related to physical components; the regional dimension allows to better consider the exogenous variables that affect landscape changes [1]. Many socio-economic processes have determined landscape changes over the centuries: growth of population, industrialization, mechanization in modern agriculture, development of tourism and many others [3]. Each of these processes has played a fundamental role in the reshaping of the spatial configuration of the landscape. Facing the landscape evolution is a very complex topic, that requires a multidisciplinary approach. Nevertheless, an important contribution can be obtained by exploring maps over time. Maps, over history, have demonstrated to be an extraordinary tool to depict landscape features in a synthetic way. Over the centuries, more and more accurate maps have been drawn by each country, for specific purposes, such as the ones related to military,

administrative, fiscal and territorial planning purposes. Nowadays, in Italy, heterogeneous sources of information are available to analyze long-term landscape changes: historical cadasters, historical cartographies, land cover and land uses maps and satellite observations. They are extraordinary tools for visualizing spatial phenomena that affect the landscape, through time.
The current paper, by analyzing the depicted contents of maps, explores their potential as sources of information for detecting long-term landscape changes, in a spatial-temporal way. A selection of maps, ranging from the ancient depicted cadastres to modern cartographic representations by Italian Istituto Geografico Militare (IGMI) and Touring Club Italiano (TCI), till the most recent satellite earth observations by the European Copernicus program, will be analyzed in the next sections. Many landscape changes in vegetation, urbanization, infrastructure can be detected by analyzing land cover and land use maps. According to the Italian Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), the analysis of the land cover and land-use changes can be carried out by applying two different approaches: the map-based approach through the GIS (Geographic Information System), which allows managing spatial information in a visual way; the statistical-based approach, which needs punctual information [4]. The great advantage of the map-based approach stems from the GIS capability to manage and compare heterogeneous multi-layer sources of geo-information (e.g. historical maps and multispectral satellite imagery), through the georeferencing process. The analysis of historical landscape changes through the maps can support a deeper knowledge of the current spatial configuration of the landscape [5] [6].

2. Study area

Across the alpine region, many landscape changes have occurred in the last two centuries; urbanization has spread along the valleys, new tourist resorts and infrastructure have been built on the higher valleys, forests have gained more space due to the depopulation of inner territories and due to the abandonment of traditional agricultural practices from unfavorable mountainous sites [6] [7]. Nevertheless, some locations, where natural and semi-natural spaces have been well maintained over time, are becoming, nowadays, more attractive as new slow tourism destinations, due to their naturalness, high quality of open spaces, and low impact of mass tourism infrastructures.

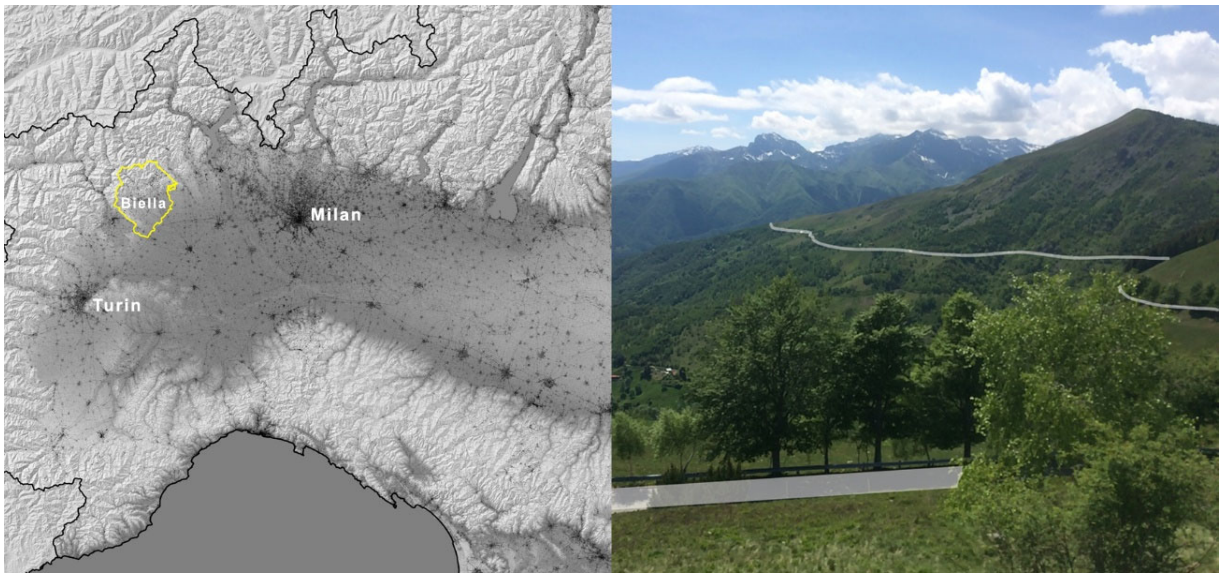


Fig. 1: On the left, the map of the study area highlights the Province of Biella, in between Turin and Milan. On the right, a photo taken along the panoramic road, which shows the alpine landscape crossed by the road, over the spring season, which is highlighted by a white line.

In this framework, a study area has been selected, in the alpine region, in the province of Biella, north-west of Italy, in between Turin and Milan, with the aim to explore the most suitable representation tools for mapping landscape evolution. The alpine landscape above Biella is accessible through a network of hiking paths and by a panoramic road, that was built between 1938 and 1952 by Ermenegildo Zegna, with the extraordinary idea to make accessible the upper mountainous landscape above Trivero and Biella. This mountainous landscape is marked by the sanctuary and UNESCO Sacred Mounts of Oropa, groups of chapels dedicated to different aspects of the Christian faith, which are integrated into the surrounding natural landscape of forests. The panoramic road, as a cross-valley connection at the mid-altitude of 1.000 a.s.l., crosses the typical alpine landscape, characterized by woodlands, high-altitude grasslands, meadows and pastures, spotted by small urban settlements and scattered farmhouses and private houses. The road can be considered as a sort of “balcony” overlooking the Alps and the Po

valley (Fig.1). Along the panoramic road, the area marked by the sanctuary of Oropa has been selected as a case study, in order to analyze, through the maps, the historical evolution of woodlands and grasslands, which mainly characterize that landscape.

3. Methodology: selection of maps

This section shows a selection of maps, ranging from historical maps to satellite multispectral imagery, that are extraordinary sources of information for mapping landscape changes over time. The maps have been selected, by exploring the available land cover and land use maps, which are the most effective to investigate landscape changes. All the maps have been georeferenced in a GIS platform, with the aim to compare their spatial features.

3.1 The cadastre of Savoy

The historical cadastres are extraordinary sources to collect spatial information about the places and to understand long-term landscape changes. In Italy, the depicted cadastres started to be realized since the XVIII century (e.g. Teresian cadastre in the Lombardy region and the cadastre of Savoy in the Piedmont region). The cadastre of Savoy was realized to “measure” the territory and to define the administrative boundaries of the municipalities within the kingdom of Savoy, with the main aim to foster a more equitable distribution of tax charges, among the communities [8] [9] [10]. The cadaster of Savoy has been digitalized and available through the digital library of Archivio di Stato di Torino [11].

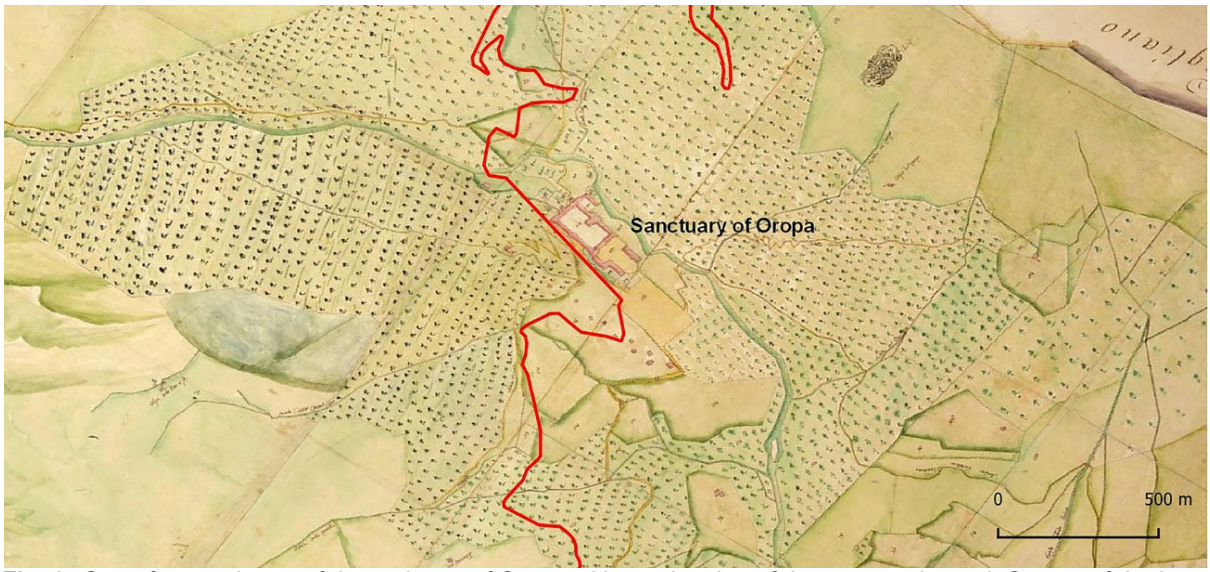


Fig. 2: Georeferenced map of the cadastre of Savoy with overlapping of the panoramic road. Source of the base map: Archivio di Stato di Torino. Title: Biella. Mappa “B”. Date: 1790. Author: Eusebio Colombino. Original size: 270x173 cm.

In the depicted cadastres, beyond the main topographical information about the places, even spatial information about land use is depicted with high spatial resolution. The maps of the cadastre don’t cover the whole territory of the kingdom; they represent limited areas. Referring to the study area, the map sheet of the Oropa sanctuary, along the panoramic road, shows the precise locations of buildings and roads, but also the spatial distribution of woodlands and grasslands which were existing at that time. In terms of graphic representation, the map has been drawn by combining iconic and symbolic language (e.g. woodlands have been symbolized through scattered dots) (Fig.2). The georeferentiation process within the GIS enables the comparison of the landscape features between the end of the XVIII century and the current situation.

3.2 Maps by Italian Istituto Geografico Militare (IGMI)

Since the end of the XIX century, the IGMI had the task of unifying and standardizing the Italian cartographic service, after the unification of Italy. The maps, realized by the IGMI, having been subject to constant updates, enable the accurate reconstruction of the evolution of the landscape [8]. Among the multiple cartographic products realized by IGMI, the series of the Topographic Map of Italy at the scale of 1:25.000, represent an important reference for detecting long-term landscape changes. Beyond the main topographic elements (e.g. contour lines, rivers, lakes, buildings, infrastructure), the map also shows spatial information about different types of vegetation. Woodlands, vineyards, orchards and scattered trees have been represented through a symbolic representation (Fig.3).

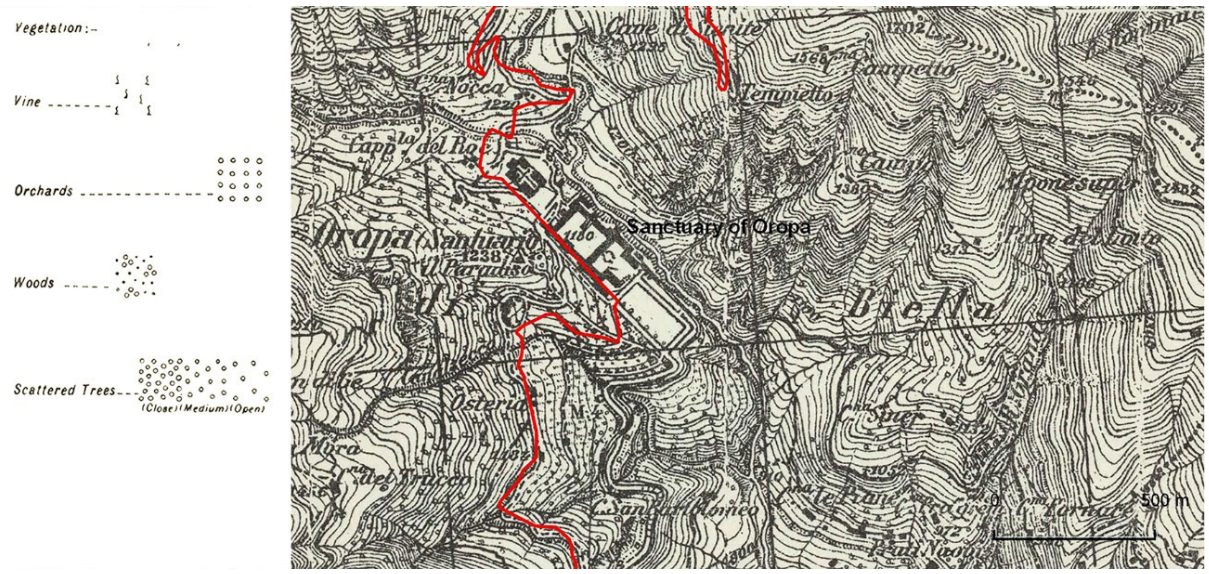


Fig. 3: Georeferenced Map of IGMI 1931. Sheet Name: Andorno Micca, Sheet number: 43-IV North-west. Source: GSGS series 4228. First Edition. Italian IGMI map dated 1931 and photolithographed by the British Ordinance Survey in 1943. Original scale: 1:25.000.

3.3 The 1936 Italian Kingdom Forest Map

The first map, which provides an overall visualization of the vegetation distribution across Italy, dates back to 1936 when it was realized the Italian Kingdom forest map, by Milizia Forestale of the Italian Kingdom. The map covers the entire country, through 276 map sheets, which provide spatial information about different types of vegetation. The spatial information was detected on the cartographic base map by IGMI on the scale of 1:25.000, and then definitely represented on the scale of 1:100.000 in the published version (Fig.4) [13].

In the last few years, due to its importance in landscape and ecological studies, the map has been digitalized, georeferenced and freely accessible through a specific WebGIS, as open data, available in raster and vector format [14]. In terms of representation, the map has been drawn by using areal entities, filled by thematic hatchings, which embody spatial information about each area. This cartographic representation mixes the iconic representation (topographic base map), with the symbolic representation (vegetated areas).

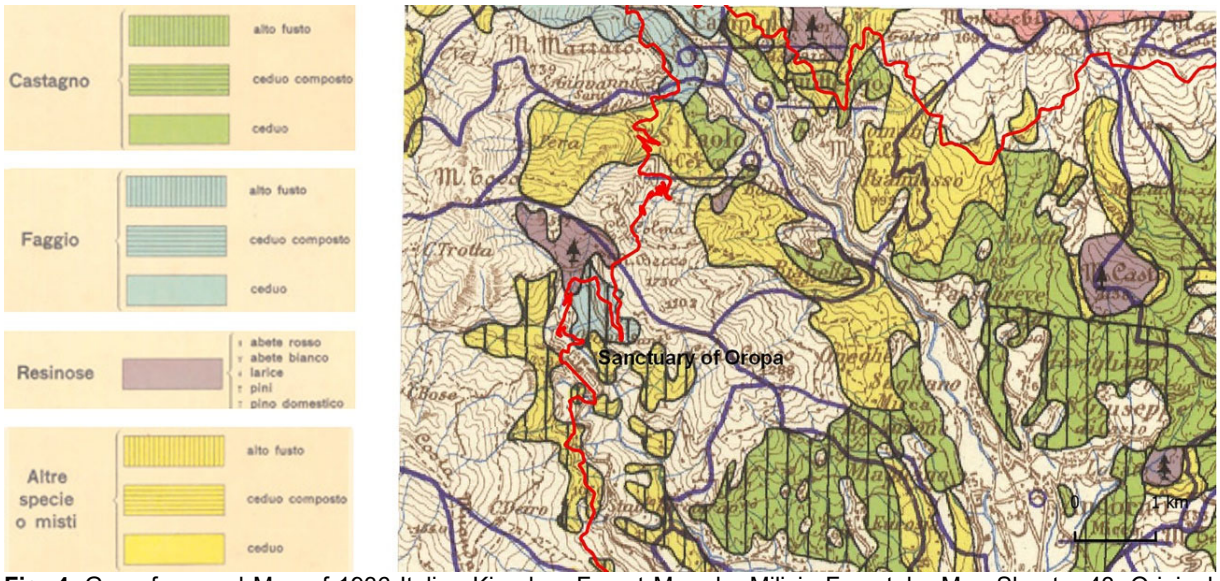


Fig. 4: Georeferenced Map of 1936 Italian Kingdom Forest Map, by Milizia Forestale. Map Sheet n.43. Original scale: 1:100.000.

3.4 Land use map by National Research Council and Italian Touring Club

At the beginning of the Sixties, the National Research Council (CNR) and the Italian Touring Club (TCI) produced the land use map across Italy. The map was realized on a scale of 1:200.000, starting from the TCI roads network map. The map was conceived with a specific focus on the rural landscape. In fact, as it can be read from the legend, the map shows 19 land use classes for the rural landscape and

just 2 classes for bare soil and anthropic settlements and other forms of land use [16]. This map represents an important reference to understand, in large scale contexts, land cover changes. As well as it has shown in the Italian Kingdom Forest Map, the cartographic representation mixes iconic and symbolic representation languages (Fig.5). However, it must be considered that the last two maps were made to represent the entire Italian territory. The information within these maps, due to the scale of representation, therefore, can be considered for regional-scale investigations.

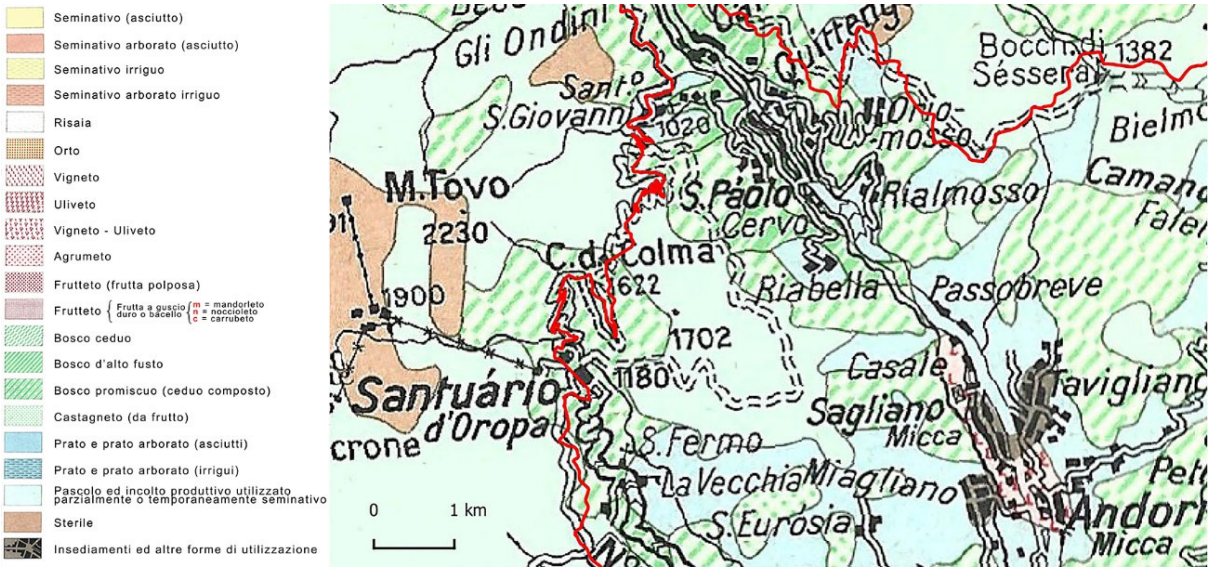


Fig. 5: Georeferenced Map of 1965 Land use map by CNR and TCI, with overlapping of the panoramic road. Original scale: 1:200.000.

3.5 Corine Land Cover (CLC)

Between 1985 and 1990, the European Commission promoted the program named “Corine”, for land and environmental monitoring, with the aim to make digital cartography, based on a geodatabase, named Corine Land Cover (CLC). The CLC geodatabase is the result of the photo interpretation from satellite observations (Landsat and Sentinel missions). The CLC, according to the scope of the research, can be queried at different levels of detail. The CLC geodatabase covers the whole European territory with 44 land use classes at the third level of detail, corresponding to the scale of 1:100.000. The CLC considers at least 25 hectares to separate different areas between themselves. The geodatabase has been released over the last three decades five times: 1990, 2000, 2006, 2012, and 2018.

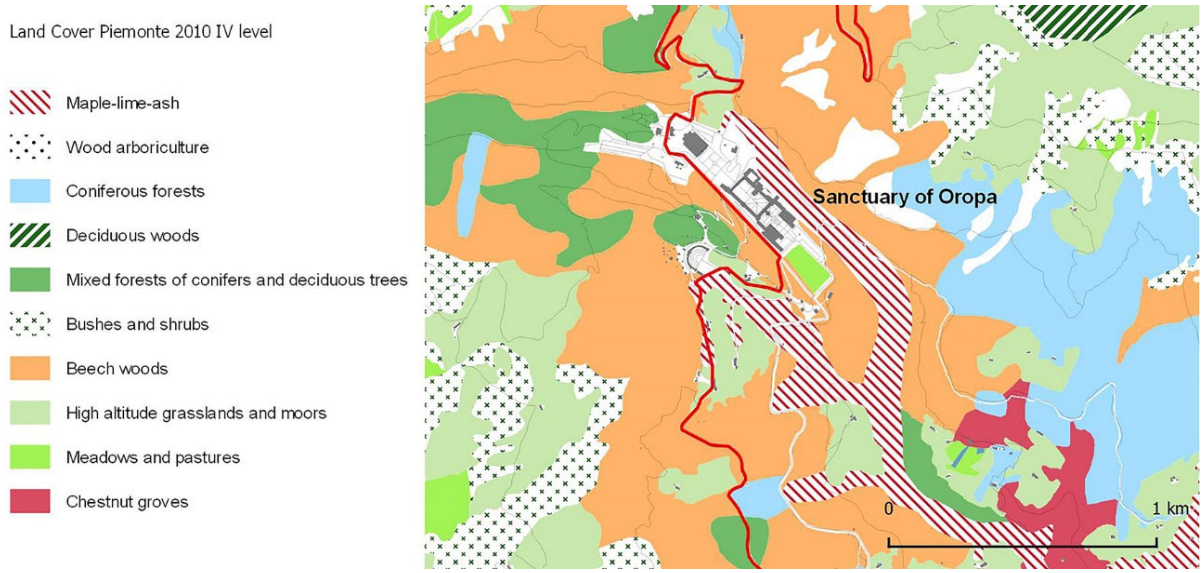


Fig. 6: Customized thematization of the vector cartography named Land Cover Piedmont (LCP) 2010, in the area of Sanctuary of Oropa. IV level of information.

The CLC databases allow comparing land use over time. In regional contexts, as in the case of the Piedmont region, more detailed land cover mapping projects have been developed by integrating information into the CLC from different sources, such as archives and maps already existing in

Piedmont, which led to the definition of the IV information level into a Land Cover Piedmont (LCP) (Fig.6). In recent years, the Copernicus program has led the enrichment of existing databases, with the high-detailed acquisition by satellites. From the representation point of view, the CLC and LCP, being conceived as digital cartography, are in form of a digital layer, raster and vector formats, that can be thematized at different scales of representation, according to the purposes of the research.

3.6 Satellite multispectral imagery (Sentinel-2)

Since 2014, the European Commission, in cooperation with other partners such as ESA and EUMETSAT, has started the ambitious program for earth observation named Copernicus. The Copernicus program supplies geospatial data and geo-information referring to six thematic streams: land monitoring, marine environment monitoring, atmosphere monitoring, security, emergency management and climate change. Particularly, the Sentinel-2 mission comprises twin polar-orbiting satellites in the same orbit, phased at 180° to each other, equipped with a multispectral sensor, which enables detecting high spatial-temporal imagery with 13 bands (image resolutions range within 10 m, 20 m and 60 m for single bands) [15]. The twin Sentinel-2 satellites enable the detection of landscape changes under cloud-free conditions every 2–3 days at mid-latitudes [17]. The Sentinel-2 mission supports the monitoring of landscape changes, by supplying high-resolution multispectral imagery, which is the base for developing further investigations. The high temporal resolution of the satellite imagery also enables the monitoring of short-term landscape phenomena, such as the ones which affect the scenic aspect of the landscape, which are of interest to the tourism sector (e.g. color changes which affect vegetation over the seasons: spring-blooming and autumn coloring). The combination of multispectral bands enables the making of customized digital representations, such as the one named “false color”, which highlights the different types of vegetation (Fig.7). Coniferous woodlands appear in a darker red color than deciduous woodlands; light red show grassland areas or areas with scattered vegetation. The characteristics of each vegetated area can be recognized through pixel-based recognition systems, which are based on a supervised or unsupervised classification approach. By comparing different Sentinel-2 acquisitions, landscape changes, for instance in the field of vegetation, can be detected. By combining multispectral imagery according to specific algorithms, vegetation indices, which are sensitive indicators for monitoring vegetative status, can be computed in large scale contexts.

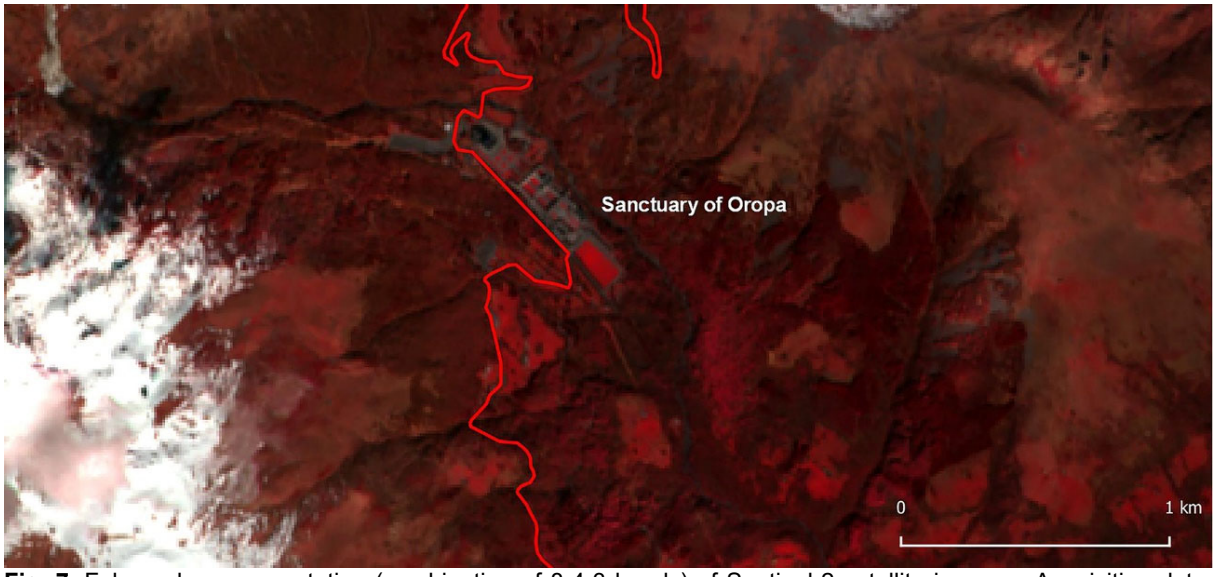


Fig. 7: False color representation (combination of 8-4-3 bands) of Sentinel-2 satellite imagery. Acquisition date: 14th April 2020. Spatial Resolution: 10 m.

4 Mapping long-term landscape changes

The process of geo-referencing historical maps into a GIS platform enables the comparison of the different spatial configurations of the landscape over time. The many sources of information, mentioned in the previous section, deserve to be applied in detail in a more specific research work.

In this chapter, the research shows how GIS tools can be applied to map long-term landscape changes, by comparing the ancient spatial configuration of the selected location, shown by the cadastre of Savoy, to the current configuration. The comparison of grasslands and woodlands, localized in the area of the Sanctuary of Oropa, has been performed with the aim to analyze long-term landscape changes in the study area. Two main criteria were considered to select the source of information: the maximum temporal distance between the selected maps and the level of precision of the spatial information linked

to the representation scale. According to these criteria, the cadastre of Savoy 1790 and LCP 2010 have been selected. In the ancient cadastre of Savoy, the grasslands and woodlands are depicted. They have been redrawn manually and represented respectively within red and black borders in the GIS platform. By overlapping the areas of the ancient cadastre with the current situation, some landscape changes can be detected visually (Fig.8).

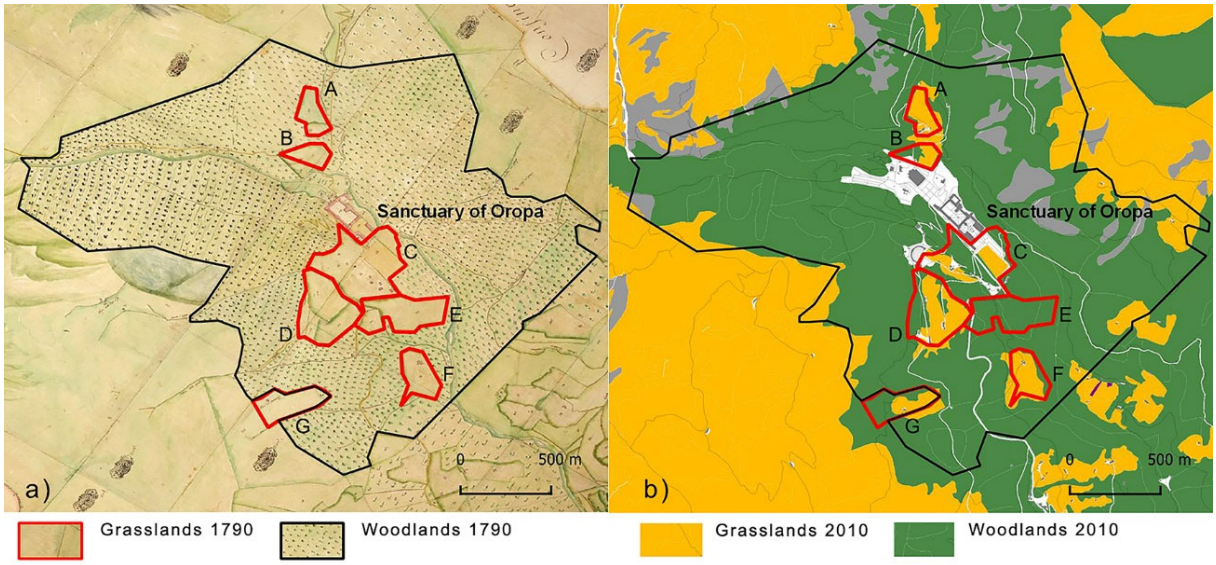


Fig. 8: Comparison of grasslands and woodlands in the area of Sanctuary of Oropa between the cadastre of Savoy (1790) and the LCP of Piedmont II level of detail (2010).

In the areas named A and F, few changes in the extension of grasslands seem to be detected. The areas named B, C, D and G show an increase in the afforestation. Particularly, in the area of the chapels of the Sacred Mounts (area C) seem to be a significant increase of trees. The area named E has been completely afforested by trees. By considering the whole extension of the woodlands some increasing extensions in the northern and southern directions can be detected; on the contrary in the eastern direction, it seems that the woodlands have been reduced (Fig.8). Further investigations, considering a broader perspective, may be addressed to better understand the reasons which have determined those changes.

5 Conclusion

The landscape is constantly changing over time. Some changes are very fast, whilst others are very slow. By the analysis of the selected maps, three points seem to be interesting for further investigation. The first one concerns the methodological approach. The comprehensive knowledge of the changes taking place in the landscape cannot be carried out without analyzing historical maps, which play a fundamental role because of their capacity to visualize, in a synthetic form, spatial information about the places. Land cover and land use maps, drawn over history, are needful tools to visualize the complex landscape changes over time. Nevertheless, it must be taken into account the different levels of information, due to the scale of representation of the maps.

The second one concerns the analysis of different types of processes that affect the landscape. On the one hand, long-term processes can be understood by the comparison of historical maps, such as the cadastres, with more recent maps. In this sense, the depicted cadastres, which are made over the XVIII and XIX centuries, are extraordinary sources of information, from which it is possible to recognize the historical and the identitarian signs of the places, which can inspire new strategies to support the safeguard or the restoration of the landscape. On the other hand, the short-term process can be better understood, by exploiting the great availability of open geospatial information related to the more recent earth observations through satellite missions. In this sense, the high spatial and temporal resolution of satellite imagery enables the monitoring of the earth's surface, which allows supporting research in the field of climate changes and ecological transition.

The third point concerns the great potential of the GIS tools to collect and manage geo-information, which is related both to historical sources, both to the most recent digital ones. The georeferencing process in GIS enables the making of specific geodatabase related to the historical sources, which is the base for diachronic studies in the field of landscape changes.

In this sense, further developments of the work will be addressed to compare the selected maps, one with each other, in order to capture short-term changes, but also to measure their physical consistencies through GIS.

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Safety begins with knowledge: a BIM approach for monitoring built heritage.

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Abstract
The seismic events of recent years and the need to cope with the analysis of the damage caused by them pose a problem of a social nature as well as a more technical one. The historical organization based on synthetic but reliable tools such as Aedes (*Agibilità e danno in emergenza sismica - Suitability and damage in seismic emergency*) and FAST (*Fabbricati per l'Agibilità Sintetica post-Terremoto* - Synthetic suitability for post-earthquake buildings) sheets might not be sufficient in the future. In fact, intervening with limited elements of assessment, when the earthquake has already produced its effects, makes rescue and safety operations complicated. Knowing a building in its complexity and the interventions that have been carried out over time allows to provide competent answers based on certain evaluation´ elements. Therefore, this contribution aims to analyse the possible relationships that can be established between the damage detection, prompt intervention and suitability sheets for ordinary buildings in post-seismic emergency and the Building Information Modelling methodology.

Keywords: Building Information Modeling, 3D models, Cultural Heritage, GIS,

1. Introduction

The study of the mechanisms of exodus from buildings in emergency situations in recent years has led to orienting research from a field of application on an architectural scale to the evaluation of the characteristics of exodus on an urban scale. This is because the simulation models of evacuation, limited in most cases to the single building, do not take into account a series of factors that are of fundamental importance in order to fully assess the potential for evacuation from a confined space. According to some authors, the potential for evacuation from a confined space can be traced back to four main factors. They are:
1. configurational factors with reference to the architecture of the single building;
2. environmental factors that in addition to causing the need to activate the evacuation also generate all those debilitating effects on the exposed;
3. procedural factors regarding the level of training on evacuation and prior knowledge of the environment;
4. behavioral factors, that is the behaviors assumed by people during the exodus process in consideration of the initial responses of their decisions, their interactions and relationships.
Many studies show that these factors are interconnected [1]. Although people's behavior is in fact recognized as a priority parameter for this type of analysis, it also depends on the urban context of reference and the seismic vulnerability of the individual buildings. Therefore, an in-depth study should also be dedicated to the other factors, such as configurational and procedural, through which it is possible to validate effective methodologies for identifying escape routes.
In fact, following the seismic events witnessed in recent years, it was possible to see that most of the human losses were recorded because fleeing citizens were victims of collapses of adjacent buildings. This is because, while for the single building the availability of engineering methods allows to develop in-depth analyzes on the relationship between the time available for the exodus and the time necessary for the survival of people, in similar situations involving the urban or territorial scale, little has been hypothesized [2].

In this regard, among other things, it should be noted that among the 2030 sustainable development goals, there is that of "making cities and human settlements inclusive, safe, flexible and sustainable". In particular, objective 11, point 5, hopes, by 2030, for a "significant reduction in the number of deaths and the number of people affected and substantially reduce economic losses compared to global gross domestic product, caused by disasters, including disasters related to water, with particular attention to the poor and people in vulnerable situations". Starting from these considerations, this contribution investigates the possibility of creating an infographic tool, based on the representation of buildings in a BIM environment, in support of sector operators and emergencies.

2. The importance of BIM as a tool for the knowledge of the heritage

Establishing which technologies are most suitable for the documentation and management of built heritage has long been the subject of extensive international debate. The enactment of the UNI 11337 law on "Digital management of construction information processes 2017" and the succession of technological developments in the fields of Architecture, Engineering, Construction (AEC) and Facility Management (FM) has led in the last years to a renewal of heritage documentation techniques [3].

If on the one hand the Building Information Modeling methodology represents a winning approach to integrated design for the construction of new buildings, its use becomes a strategic objective for the management of built heritage, historical and more. The use of BIM for existing assets, in fact, gives rise to a series of advantages that can be translated into the effective management of information resources that allows to overcome all the critical issues due to the insufficiency of the available documentation. In fact, simply by setting a series of information within a digital model, for example of a historical or technical-constructive nature to name just a few of them, the archiving and consultation of data for different purposes is facilitated. This aspect becomes fundamental especially in a reality, such as Italy, where interventions on built heritage represent a significant part of the activities related to AEC, since it allows to limit the uncertainties in the reconstruction of knowledge and in the assessment of the state of the places.

Mapping existing buildings, indicating both generic and specific information relating to the state of conservation, becomes important in order to safeguard the stability of the urban space. By analyzing the urban conformation of most of the Italian cities, it is possible to outline common characteristics. The presence of historic centers and the buildings built before the rule on "Measures for construction with special requirements for seismic areas" (law 02/02/1974, n. 64) makes our building heritage very vulnerable to seismic events; it is no coincidence that the areas with a high seismic risk represent about 44% of the Italian national surface [5]. These areas, in the event of an earthquake, certainly have different stability conditions than others. The knowledge of the built heritage through a virtual model, such as the one hoped for in this contribution, would allow the identification of the danger of urban areas, especially useful in the initial stages of an earthquake, when there is still no precise indications for rescue; usually, in fact, the civil protection for the first rescue operations carries out reconnaissance tours and intervenes on the basis of calls for help from citizens.

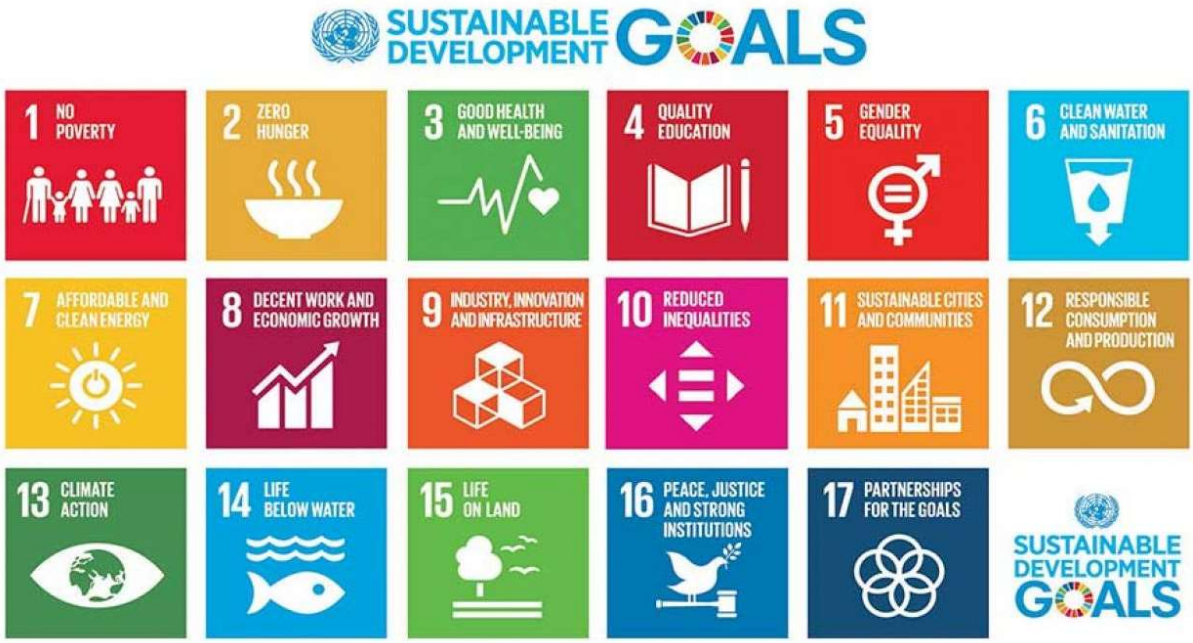


Fig. 1: Sustainable development goals of agenda 2030.

3. State of the art

Currently in Italy, it is customary to operate by verifying the viability or non-usability of a building only following the seismic event and to do this the FAST and AEDES document are used. The FAST sheet was introduced and governed by the Civil Protection in order to return a preliminary outcome on the unusable state of a property with a judgment that provides for the usability or non-usability of the building damaged by earthquakes. In the case of an unusable property, according to the FAST document, the procedure involves appointing a specialized technician to fill in the Aedes form. These forms are of great use and would be even more so if they were compiled before a seismic event and for the entire built heritage. In fact, rather than mobilizing the technicians after a seismic event, it would make more sense to have them intervene before the emergency, through the scheduling of the buildings, designed to verify the characteristics of the same and report any critical issues where necessary. This procedure, integrated with information deriving from the "summary of the seismic verification of strategic buildings for civil protection purposes", would allow to establish the seismic risk for each building on the basis of intrinsic data. As highlighted by the European project ReSCult, this information is also very useful for other types of analysis – for example to assess the vulnerability of the cultural heritage itself or for the urban context – to support emergency operations [6]. Various researches have been carried out, with different approaches, by various Italian research groups. In particular, the project promoted by the joint laboratories LS3D Landscape, Survey and Design (University of Florence) and Dada Lab (University of Pavia), having as its object of study the city of Pavia, dealt with the creation of digital databases for conservation of the urban heritage [7]. Beyond the experiments on the topic of HBIM, the METRICS project of the Built Heritage Innovation Laboratory of the CNR-Itabc for the management of architectural heritage in urban contexts is also interesting, which shifts the attention to documentation and description of the sites concerned by means of BIM systems. from the earthquake. It is the first industrial research project to develop innovative methodologies and technologies for sustainability and safety in historic centers [8]. The research, launched by drawing research group of the Department of Civil Engineering of the University of Salerno, considers a synthesis of the different approaches mentioned above with reference to the built heritage in general and outlines an interdisciplinary path whose objective is the definition of escape plans on an urban scale.

4. Methodological proposal

The proposed methodology provides for the validation of a workflow aimed at the collection, representation and management of data relating to urban centers to support the prevention and management of emergencies. The graphical representation of the data, present and available only in the form of a database, also as regards the results of the reconstruction process, but above all in relation to the processing of the same for a targeted investigation of the phenomenon, allows, through the univocal association of data from different sources in a single map, different readings, which in turn determine new survey scenarios [9].

The resulting database is enriched with a series of information associated with the individual buildings according to a BIM approach in which geometries and information parameters are attributed to each element of the factory. The resulting information, relating to the degree of vulnerability, will then be exported to the GIS environment in order to view thematic maps on the seismic risk that allow the definition of escape plans. Analyzing the documents developed by civil protection, it is clear how the information contained in them can be easily represented in a BIM model, whose semantic enrichment is the result of an evolution dictated by specific needs [10].

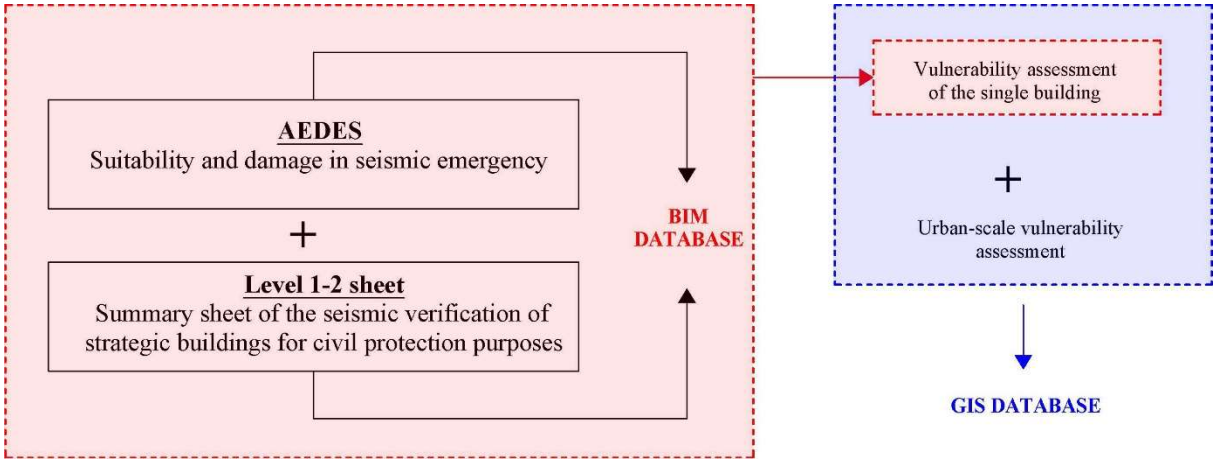


Fig. 2: Methodological proposal: workflow hypothesis.

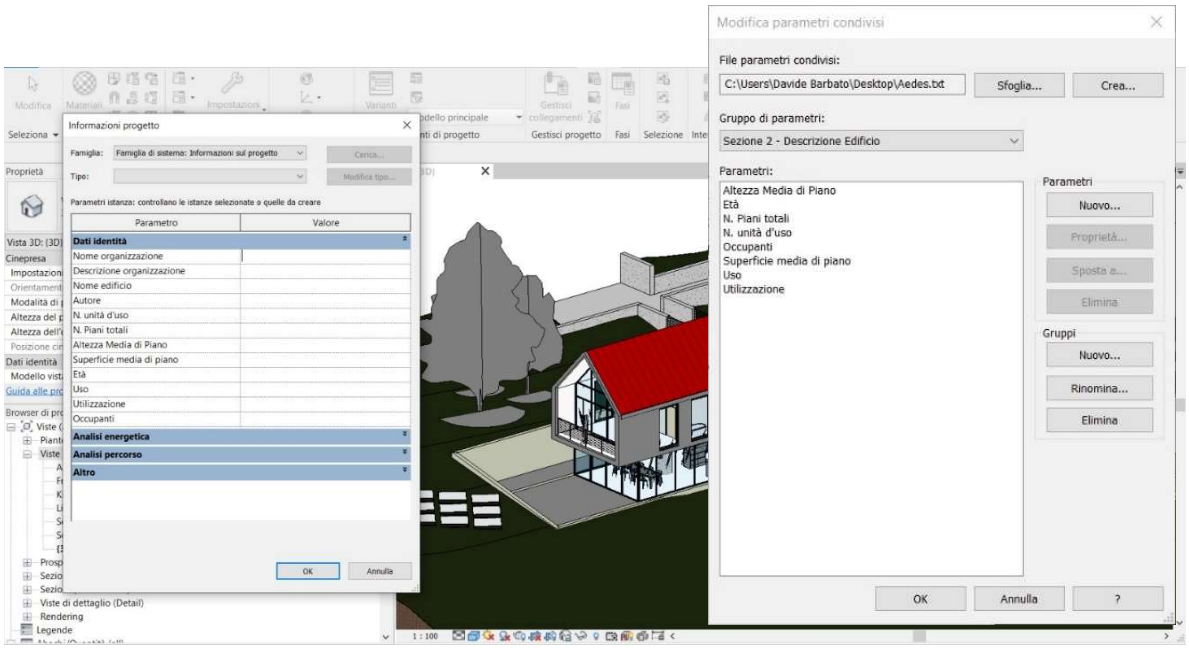


Fig. 3: Revit model with project information related to section 1 of the Aedes sheet.

The Fast document is very similar to the first section of the Aedes file, otherwise the latter has a greater level of detail. Therefore, in the following, we will only refer to the Aedes document which consists of 8 sections. The information reported in the first part of the sheet has been transferred to the model created with the Revit software. A similar approach, but with different objectives, is also followed by the research group of Catania [11]. Similarly, the different sections of the sheet have been broken down and re-proposed in the form of geometries and respective parameters. In the first part of the sheet we find general information with reference to the country, province, municipality and street of the property being evaluated. These data, within the software, allow the building to be geo-referenced in a unique way. Furthermore, through the provision of ad hoc parameters it is possible to add specific information to the model, such as:
- inspection identification, with indication of the square, number of the Aedes sheet and date;
- building identification, with indication of the Istat Reg., Istat Prov., and Istat Municipality;
- cadastral data, with indication of sheet, parcel and annex;
- building or owner name.

Among the information requested, in the first section of the sheet, there is the "map of the structural aggregate with identification of the building" within the urban context and the number of people living in the building. These two aspects, although apparently they may be of secondary importance, are actually fundamental.

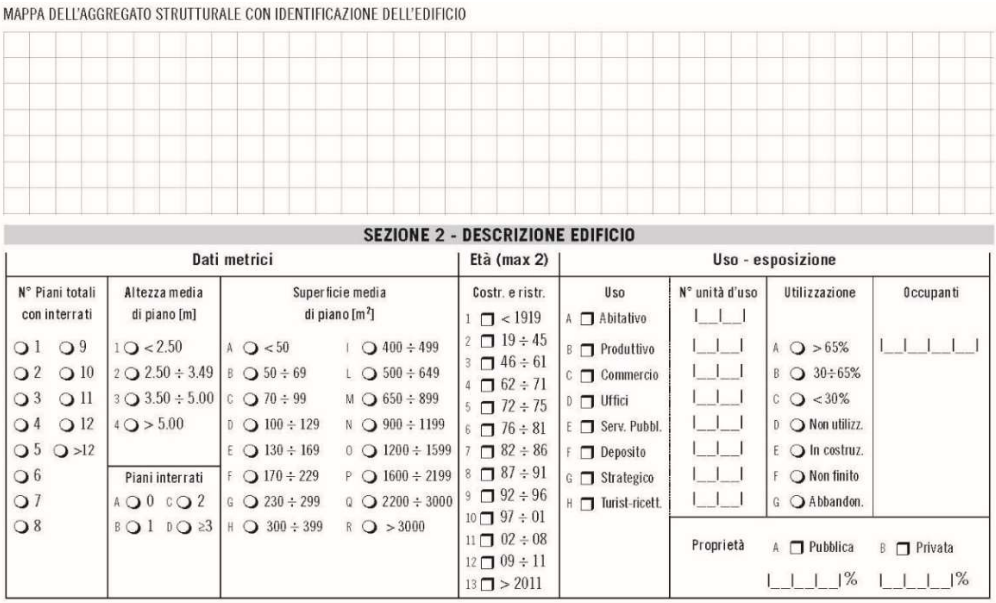


Fig. 4: Section 2 Aedes sheet.

In fact, considering the seismic vulnerability of an urban building proposed in an Istat study, the buildings are grouped into five homogeneous groups:
1. buildings with greater vulnerability, relates to "ancient" buildings built mainly in the post-war period (1946-1960), with a median of 2 floors above ground in masonry, with a condition of "good" state;
2. buildings with still high criticality, consists of buildings from the 70s, whose main peculiarity is the height, with a median of 4 floors, are mainly made of reinforced concrete and in a good state of conservation;
3. buildings on average vulnerable, groups the buildings with low population density, median two floors, of recent construction, in reinforced concrete.
4. buildings very similar to the previous group in terms of overall vulnerability, but with a lower average height, built in masonry but less recent;
5. low criticality buildings, this group includes new buildings which, unlike the previous ones, are more recent and lower.
This classification, deriving from the fact that most of the data in their possession is derived from censuses, this approach may be fine for a single building, but thinking in urban terms may not be truthful [12]. In fact, if an urban area with a high seismic hazard is devoid of human activities, the corresponding seismic risk for that area will be low. On the contrary, an area with a low seismic hazard that is however very populated has a very high level of seismic risk, since even a moderate earthquake could produce serious consequences. Another factor that affects the vulnerability of an urban context is the planimetric and altimetric configuration of the building and the width of the streets adjacent to the buildings as this factor affects the choice of escape routes. Based on this reasoning, the Aedes card is well suited for defining the parameters with which to increase the model. The modeling of the building, in a BIM environment, has made it possible to automatically extrapolate the remaining information contained in the sheet and in particular concerning the total number of floors, the average floor height, the average floor area and the destination of use. In the remaining sections of the sheet, the construction typology used for the horizontal and vertical structures is explored. This section deals more closely with the modeling of the architectural building in a BIM environment. In this case the model can be made with a LOD that varies depending on whether it is a masonry structure, in reinforced concrete. or steel and depending on the information we have. Only in the case of masonry structures, since it is a more complex construction type, it will be necessary to provide a series of additional information about the presence of:
- beams with deformable, rigid or semi-rigid slab;
- presence of vaults, with and without chains;
- quality of the masonry texture.
In the case of the remaining structures, the type will be indicated directly when modeling the building. By doing so, the reference LOD will arise according to the information in our possession on the architecture under study. Section 5 of the sheet also assumes fundamental importance in a reasoning extended to the urban context.

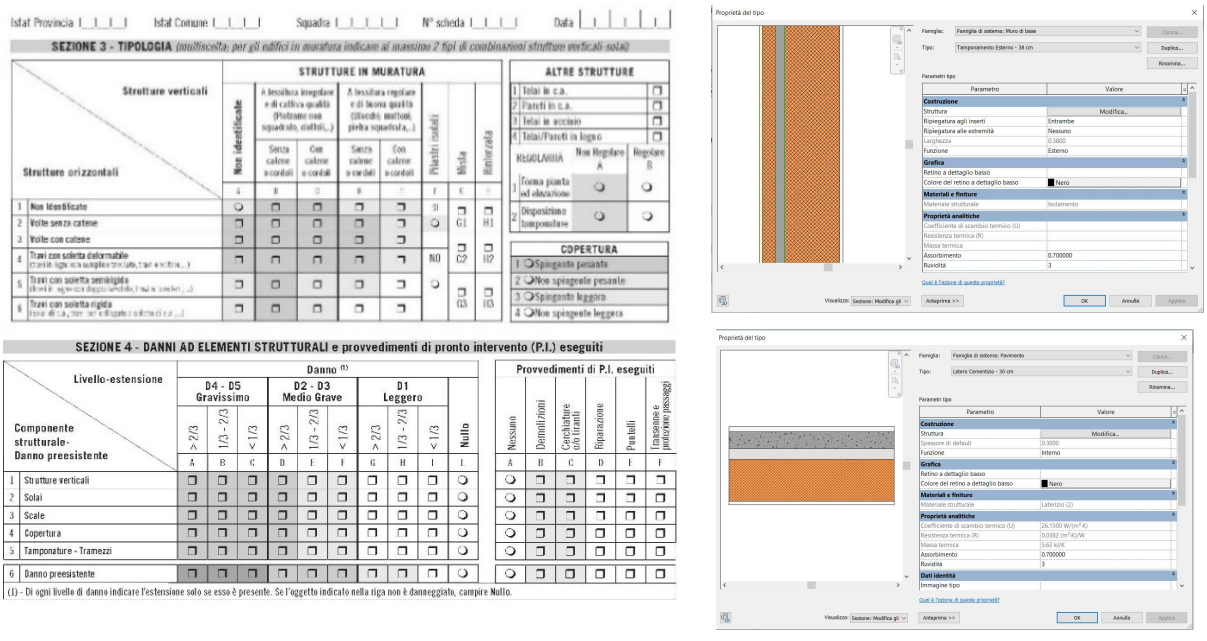


Fig. 5: Section 3 and 4 Aedes sheet and related data in the BIM environment.

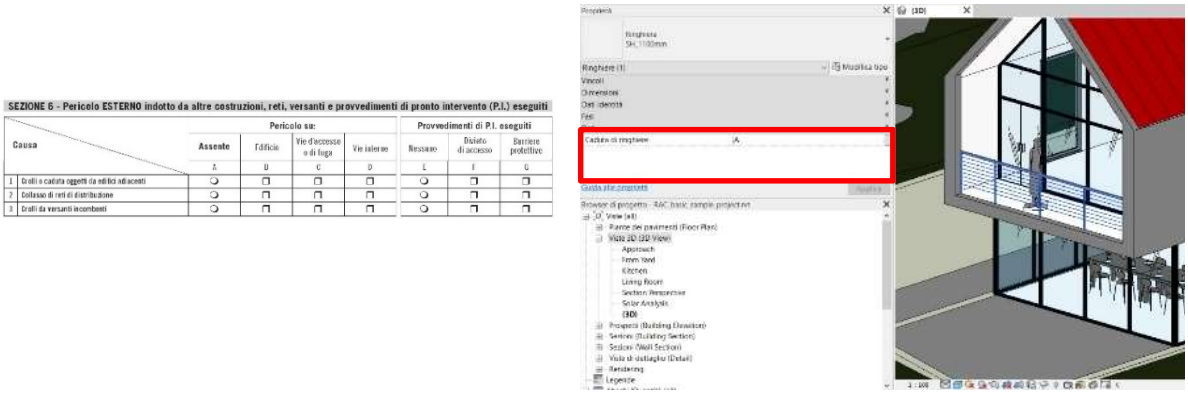


Fig. 6: Section 5 of the Aedes Sheet (Damage to non-structural elements) and related BIM model

In fact, this section provides an indication of the external dangers induced by other constructions, networks, slopes and emergency measures already carried out. Also in this case it will be possible to implement the parameters as evident in figure 6. The transposition of the form will give rise to a model, with different LODs, with different levels of maturity depending on the amount of information represented in the model compared to the total of the information reported in the sheet.
On the basis of the data obtained, the question is examined in depth, by integrating the information from the "summary of the seismic verification of strategic buildings for civil protection purposes". In this way it is possible to obtain a vulnerability assessment for the single building which takes into account a series of factors such as to make the value of this parameter more consistent with reality. The BIM models obtained will implement a database through which it will be possible to define the vulnerability assessment of the single building. This value will be weighted in relation to the analysis that arises from the study of the urban fabric. The intent is to propose a method that takes into account all those factors that may contribute to the increase or mitigation of the vulnerability of the exposed system and therefore to the extent of the risk, favoring the definition of a more realistic scenario.
A three-dimensional information system such as the one shown in this contribution represents a support for the creation and implementation of increasingly complex 3D city models that become the intelligent duplicate of the real city through its digital twin. The concept of DT today has become central in various fields of knowledge and represents a tool for better understanding cities and intervening on their future [13].

5. Conclusions

A three-dimensional model of buildings, such as the one hoped for in this contribution, is a very useful tool for both civil protection and municipalities. In the first case, allow the operators involved during the emergency to immediately identify the most critical areas of the city on which to intervene; in the second case it would serve to implement territorial policies in the context of emergency plans. The application described, in fact, wants to provide a key to rethinking the management of territorial information in order to safeguard heritage and human lives. Given the complexity of the city system, it is no longer possible to think of a single building, but knowledge relating to the entire urban settlement is essential. Therefore, in the light of these considerations, an interdisciplinary approach is necessary, which sees the involvement not only of representation experts, but also of figures who work in disciplines relating to building and urban design, urban planning, as well as providing for participation active and aware of the community

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Sustainability in Eyewear Design

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Design additions for building a truly sustainable model in the eyewear industry.
The beginning of an organic reflection on sustainable development is conventionally traced back to the report Our Common Future, better known as the Brundtland Report, published in 1987, in which the concept of sustainability is defined as: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.
Over thirty years have passed since this definition, but there is still some confusion about these concepts which, precisely because of their complexity, are sometimes manipulated or trivialized to the point of often generating inadequate design practices, which lead to the creation of partially "sustainable" products, in relation to some limited and circumstantial aspects of their life cycle.
This work focuses on assessing the environmental impact of an apparently simple product like the frame for ophthalmic lenses and solar filters and it tries to highlight, through significant case studies, which actions are today implemented in this sector in relation to the acquisition of raw materials, design, production processes and the use and disposal of products. The article also intends to highlight the importance of design in terms of the circularity of the system, as it can influence the entire life cycle of the product.

Keywords: Eyewear Design, Sustainability, Global system circularity, Fashion Design

1. From Brundtland report to today: the evolution of the concept of sustainability.

The beginning of an organic reflection about the subject of sustainable development is conventionally traced back to the Our Common Future report, better known as the Brundtland Report, published in 1987: in that document the concept of sustainability is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs ".
This first meaning of sustainability does not put the environmental protection as such in the foreground, but refers to the well-being of people, emphasizing the responsibility of the present generations who must, or at least should, use natural resources rationally and consciously to satisfy its own needs without compromising those of future generations, with the goal of a sort of "intergenerational equity". Subsequently, the concept of sustainability, precisely due to its being dynamic and applicable to different disciplinary areas, has gradually expanded, acquiring a 'multidimensional' meaning, which is interpreted as the interrelation between economic development, environmental protection and social development. Promoting sustainable development, therefore, means seeking a balance between the economic, social and environmental dimensions: a constantly evolving balance to interpret market changes while ensuring a conscious and efficient management of the planet's resources. More than thirty years have passed since the official Brundtland Report’s definition of sustainability has been posed, but some misunderstandings and confusion still remain, especially in the meaning of the manipulation or trivialization of complex contents, that in the end risk to favor inadequate design practices or to create "sustainable" products only limited to some aspect of their life cycle. As Maria Canepa points out, drawing up an updated balance sheet on the theme: "The adjective" sustainable "- along with other adjectives such as "eco", "bio", "green", etc. - it has become

a way to cloak market products that needed a new look to be still profitable with presumed quality. On the one hand this has led to an effort of innovation in many sectors, on the other it has often taken away the basic idea that the resources on our planet are limited and therefore they must be used carefully and sparingly" (Canepa 2018).
The observation that the word sustainability has actually been "watered down" over the years brings together many recent reviews and it is precisely to underline the improper use of this term and the superficial attitude that derives from it, that Robert Engelman speaks of "sustainability" (Engelman in Bologna 2012). What he writes "We live today in an age of sustainababble, a cacophonous profusion of uses of the word sustainable to mean anything from environmentally better to cool", once again highlights how the term rages in the media, fueling the belief that it is possible to continue in this direction with the objective risk of really compromising the well-being of future generations. Despite the undeniable positive actions taken, which also represent important signs of an effective change of direction, with the passage of time the international situation still appears far from reaching a level of real sustainability, to hypothesize more reassuring scenarios from the point of view of resource conservation.
Protecting the environment from actions (and omissions) that can damage it, often irreparably, must therefore not be a virtue signaling on the side of companies, but a concrete objective that involves, first and foremost designers as connective figures and catalysts of different knowledge, that can contribute significantly to the creation of truly "sustainable" products.

2. The concept of sustainability applied to the eyewear design.

The assessment of the environmental impact of a given product or service is an objective and complex process even if it refers to a relatively simple object such as a frame, whether it be for ophthalmic lenses or sunscreens. Even if the topic is not new, it turns out to be one of the strongest and most heartfelt theme of the contemporary world. Terms such as "sustainable", "ecological", "bio-compatible", etc... have become increasingly common in our daily life, while leaving spaces for a certain ambiguity.
It is known that the main stages of the life cycle of a product include the acquisition of raw materials, the production of goods, their use and disposal: all these stages, together with the transport necessary to move products and materials, must be taken into consideration, in an integrated approach that affects the technological, cultural, economic and social components. Sustainability is therefore also configured as an ethics or a new mentality, to face the present and future challenges of humanity. To implement such a radical change in the way of acting, all the actors involved in the production process must acquire a strategic awareness. For that, in the short-medium time, it is still possible to intervene with optimization procedures of existing structures and the development of new technologies capable to limit the environmental impact, by reducing the production of waste and polluting emissions.
Underlining once again that the concept of sustainability is complex and articulated, which very often it is reduced to a mere question of communication and recalling the dual nature of producer and consumer that sometimes does not coincide with an environmental interest, it is necessary to start a reflection on this issue with reference to the frame sector.
Let's start with the physical size of the object.
A frame is composed by front part, made up of the circles into which the lenses or sunscreens are inserted, the bridge that joins the two circles, the plates, or rather the supports of the frame on the nose; from the rods that have the function of supporting the frame laterally by anchoring it firmly to the ears; from the hinges that connect the temples to the front; from the muzzle (or nose), that part of the temple tip to which the lenses are connected in different ways and from the tube, that, in the metal frame, makes the closing of the rim stable after the lenses have been correctly inserted .
Although the improvements in the environmental performance of a product alone are not sufficient to ensure substantial reductions in the use of resources, it is also true that a system innovation in which the product-component is not adequately designed (i.e. respecting the criteria of the Life Cycle Design) will not be able to achieve this goal.
The ideal would be to have a frame made with a single sustainable material, with high aesthetic and functional qualities, such as to become, like other iconic models, an object with an high affective capacity but which, on the contrary, preserves with care and attention.
What we could define as "designed for the next generation" is what we think will survive in the future, to which a value is attributed and which, for this reason, as the famous Patek Philippe "Generations" campaign states: "You never own it completely. It is simply guarded. And it is handed down" and therefore it reduces the global impact on the environment. Beyond market strategies, the duration of a product contributes significantly to its being sustainable. In order to establish an "emotional bond" between user and product, it is necessary to "undertake a new design direction", capable of attributing values and making unique products, "such as to be able to emerge in an increasingly crowded and indistinct commercial landscape" (Gnasso, Iabichino 2014).

The designer must therefore become aware of the fact that the emotional dimension of physical objects, the so-called fourth dimension, can (and must) be designed; even in a complex historical moment like the present one, this means to capture emotions: the objects of modernity must leverage the consumer's emotionality and stimulate experiences, positive sensations and values he shares. For first we should fight against planned obsolescence, so that in my opinion we can produce effective and sustainable things.
That said, we cannot underestimate all those other actions capable to orient research towards experimentation and use of new materials. Nor can we underestimate the adoption of "good practices" in the production chain, (for instance aimed at developing eco-efficient systems), and many critical elements, fueled by different global trends, which can lead us to think that it is possible to intervene limited to a phase of the process without considering it as a whole.

3. Company best practices in the eyewear sector.

The transition towards sustainable and resilient systems also affects the frame sector which, for some years, has started actions aimed at reducing its environmental impact in the various stages of the production chain: from the choice of materials to final consumption. In this context, the fundamental role of research becomes fundamental, as it can guide evidence-based decision-making processes towards the identification of innovative strategies in which the objective of environmental protection is able to reconcile with the needs of productivity, competitiveness and profitability in a load sharing perspective.
Some case studies deemed significant have been selected below to exemplify sustainable business and production models, based on the use of cutting-edge technologies and design choices that aim at the durability and recyclability of products.

3.1 Raw Materials

The first step towards circularity moves from rethinking the raw materials that can be used in the production process. Undoubtedly cellulose acetate (a thermoplastic resin of natural origin traditionally used in the production of frames due to its undoubted qualitative and aesthetic value) continues to be one of the most widespread material in the optical sector because it allows to obtain chromatic and three-dimensional effects, not reachable with other techniques. It is known that cellulose acetate, obtained by reacting cellulose (natural polymer) with acetic anhydride and subsequently added with plasticizers designed to improve its workability above all, has a long history in this sector: starting from the end of the 19th century , in fact, both celluloid and acetate were used to produce different objects, from dolls to umbrella handles, from fountain pens to jewelry and eyeglass frames that looked similar to those that, up to that moment, had been made of tortoiseshell, ivory, horn, boxwood... materials of considerable value, worked by the expert hands of skilled craftsmen.
It was the tine when the entrepreneur Pompeo Mazzucchelli begun to take an interest in celluloid (a material later abandoned in the production of frames due to excessive flammability) and, in 1906, he had set up a new plant in Castiglione Olona for the processing of this promising material.
Today, the company "Mazzucchelli 1849" is a world leader in the production and distribution of acetate products for the eyewear industry and, like other Italian companies, is adopting a further sustainable approach in its business strategies: anticipating the evolution market it has developed a "revisited acetate", a bioplastic called M49, which combines the classic physical-mechanical characteristics of cellulose acetate with a high eco-sustainability due to the use of a vegetable plasticizer based on citric acid.
According to the definition of the European Bioplastic Association, M49 is bio-based and biodegradable.
The term bio-based means that it is a material of natural and renewable origin: M49 has a content that is up to 68% traceable to natural origin based on the results of the ASTM D6866 test (a standardized analytical method for determining of the renewable content of solid, liquid or gaseous samples through radiocarbon dating).
Regarding the biodegradability of M49, reference is made to the International Organization for Standardization which defines biodegradable any material that can be broken down (through the enzymatic activity of microorganisms, sunlight and other environmental physical agents) into simple chemical compounds such as water, carbon dioxide and methane. The rate of biodegradation is influenced by the chemical nature of the material and the environment: in this sense biodegradable plastic must guarantee the level of 90% degradation in an incubation time of no more than 6 months. M49 already exceeds 90% after 115 days, resulting therefore biodegradable according to the UNI-EN-ISO 14885-2: 2018 standard.
Mazzucchelli has also decided to introduce the production of sheets made with Acetate Renew™, an innovative flake generated through a process that transforms plastic waste into primary molecules in order to obtain a new raw material. The waste resulting from the processing of acetate is collected by Eastman (global supplier of advanced plastics), which converts it into a new material: a cellulose

acetate flake composed of 60% biological materials and 40% of certified recycled materials. This process makes it possible to obtain a 100% sustainable acetate flake while using the waste that is normally sent to landfills and contributing to the reduction of greenhouse gas emissions (Acetate Renew ™ reduces gas emissions from 20% to 50% greenhouse compared to normal acetate). And it is for this reason that Eastman has now concentrated its efforts on the large-scale collection and recycling of waste from eyewear manufacturers to convert them into the new material, guaranteeing a real closed cycle for the eyewear industry.
Luxottica, the Italian eyewear giant, has signed a partnership with Mazzucchelli with the aim of reducing the environmental impact of their respective activities in the long term throughout the value chain; similarly, the Thélios company, founded in 2016 from a joint venture between LVMH and Marcolin, has chosen to collaborate with Mazzucchelli and Eastman to develop new sustainable materials by testing different eco-responsible formulas based on certified organic and recycled materials.
In addition to these leading companies in the sector, which have greater opportunities for investment in research and in the implementation of policies and initiatives aimed at reducing the main environmental impacts, there are many industrial companies that have decided to adopt an eco-oriented, ethical and social, using bioplastics as raw material or experimenting with new materials.
Among these, "Etnia Barcelona", an independent eyewear brand founded by David Pellicer in 2001, wanted to highlight its commitment to promoting the circular economy in the document "Impact Review 2021", a work in progress analysis in which the contributions of the company are collected in terms of economic, social and environmental sustainability. In a recent interview, Pellicer said: “Our frames are made of natural acetate and our lenses are made of mineral glass. We are removing all plastic from our packaging and replacing it with sustainable materials. We are also auditing all of our processes to detect everything that we can and should improve. But the best contribution we can make is to produce a long-lasting product and to continue building a brand that is committed to the environment”.
Thomas Kimber, founder and CEO of the "Karün" company in Patagonia, also focused on values linked to sustainability: “We have created our own Karün Conscious Development Model™ which is recycling tons of discarded material, working together with hundreds of rural entrepreneurs to protect hundreds of thousands of hectares of pristine nature in one of the wildest areas in the world: Patagonia. […] This report is an important milestone for us, as it is the first outcome of a team effort in measuring as much of our impact as we can. It is a first step in a long road where we aim to prove through example that it is possible to change the way we relate to our natural environment, and we intend to measure every step of the journey and share it with the world, so that our discoveries as well as our challenges can serve as inspiration for others out there”.
The name Karün, which in Mapudungun, the native language of the indigenous indigenous Mapuche in Chile, means "to be nature", reflects the vision of the founder who, in his company, is building the entire value chain according to a circular and regenerative model, designed to help restore natural ecosystems and support local communities. The first phase of this model consists in finding discarded materials, such as fishing nets, ropes, metals, wood which, through an organization of local micro-entrepreneurs; once selected, they are sold to Karün. In particular, the fishing nets are sent to the Italian Aquafil which transforms them into regenerated polymer (commercially known as Econyl) with quality and processing characteristics equal to those of the substance deriving from petroleum but with an energy consumption lower than 50- 60% compared to the traditional product. In the medium term, Karün expects to be able to locally produce the raw material for its operations in order to avoid the carbon footprint that transport implies and which is currently offset by TNC carbon credits.
In evaluating the impact of its products, Karün does not limit itself to considering the sustainability of the raw materials with which frames and related packaging are made, but the entire production process aiming at the creation of high quality models, at reducing the negative effects of transport, to control the working conditions of their employees. Furthermore, the after-sales service encourages the customer to send back the old glasses which, designed according to the “made to be made again” logic, are regenerated if they are no longer recoverable or, alternatively, reconditioned and aimed at community initiatives. Even the Belgian entrepreneur François van den Abeele considers eco-disruption an inevitable, as well as desirable, process that will lead companies to be sustainable, not only for an ideological attitude or a fact of image and communication, but for their own survival. Founder and CEO of the Catalan company "Sea2See", van den Abeele, in his eyewear company, outlines new horizons in reference with the protection of the environment and the implementation of a circular economy, based on recycled materials. Sea2see is a vertically integrated company that collects marine litter in over 37 ports located in Spain and France, but also off the coasts of Senegal, Ghana and Madagascar. Through the support of hundreds of fishermen, who in this way have been able to access an additional source of income, an average of 15 thousand kg of plastic are collected per month: these are separated and selected to move on to the next phase of transformation into certified raw material (a variety of pellets called Upseatm Plast) which has obtained the Cradle to Cradle™ Gold mark (a globally recognized certification system to ensure safer and more sustainable

products made for the circular economy). For the realization of the finished product, Sea2See has chosen Italy, not only for the competence and high quality that characterizes the sector but also for the image benefits deriving from a recognized and consolidated tradition.
Following a similar logic that aims to obtain secondary raw material from a waste material, the "Re.Mo" (Mozziconi Recovery) project, with the participation of AzzeroCO2 and the CNR, aims to continue the research developed by the previous “Rinasce” project aimed at extracting cellulose acetate from exhausted cigarette filters to obtain plates to be used for the production of frames, in an advanced manufacturing context. Through a specially designed plant, contaminants are eliminated and the most valuable commodity fractions of filters are recovered, in particular cellulose acetate, in order to allow their re-entry strategy into the market for the production of consumer goods (including the frames). The research is still in progress, and now it requires further steps aimed at refining the process and making it repeatable at an industrial level.
Precisely for the aforementioned reason, before ReMo, other projects also at an international level, have investigated the application possibilities of the materials deriving from the recycling of filters: among these, Cigarette Waste Brigade was the first program, carried out in Vancouver, which provided for the dissemination of collection points for cigarette butts from which the Terracycle company of Toronto subsequently produced plastic pellets and objects; a team from the Royal Melbourne Institute of Technology has verified that clay bricks made up of 1% filters have the same characteristics as traditional bricks but use less energy for production; finally, the Chilean designer Alexandra Guerrero “spun” the purified butts mixed with a percentage between 10-20% of sheep's wool to make garments.
Launched in June 2016, the Austrian brand "Neubau Eyewear", part of Holding Silhouette International, also produces sunglasses and optical frames with a responsible approach to the environment, thank to the use of bio-based polymers from the processing of non-GMO castor beans (NaturalPX and Natural3D). Castor beans play an important role in the chemical industry, where oil and its derivatives are used as a raw material in the production of plastics (such as Rilsan), coatings, paints, pharmaceuticals and cosmetics. 80% of the world supply of seeds (equal to about 1.2 million tons) is produced every year in India, where this cultivation constitutes a constant income for many small landowners and family farms.
In May 2016, BASF (one of the largest chemical companies in the world), Arkema (multinational company operating in the chemical and advanced materials sector), Jayant Agro-Organics Ltd. (pioneer of castor oil-based chemicals in India) and the international civil society organization Solidaridad launched the “Pragati” project precisely to improve working conditions, create awareness for sustainable agriculture and increase yields thanks to more efficient agricultural practices. In addition, the project has established the unified sustainability code SuCCESS (Sustainable Castor Caring for Environmental and Social Standards) which defines a standard for certified sustainable castor oil, the first code on the global market.
NaturalPX and Natural3D frames are stable and lighter than acetate ones, and NaturalPX's characteristic transparency allows for a wide variety of color combinations and customizable finishes: color can be added before the material goes through the process by injection molding, or at the end of the process by airbrush, dipping dyeing or digital printing. Natural3D has slightly different properties but still offers great flexibility in terms of color and styles. Both are hypoallergenic, free from plasticizers, resistant to solvents and free of harmful chemicals such as BPA, BPS. In particular, NaturalPX is made up of 65% oil extracted from organically grown castor seeds, while the remaining 35% is a normal polymer necessary to give the frame resistance and elasticity. Natural3D, on the other hand, is 100% bio-based and is used in 3D printing using the SLS process (selective laser sintering), an additive manufacturing technology (AM) that uses a high-powered laser to sinter small particles of polymer powder and transform them into a solid structure based on a 3D model.
Sikalindi is another natural material with which the Salento company "Ferillieyewear" created its first limited edition eyewear collection. The Sikalindi fiber is extracted from the still green cladodes of the prickly pear, through a patented process that takes place in full compliance with the life cycle of the plant and without the use of pollutants. Considering that the prickly pear, due to its ability to reproduce quickly spontaneously, is classified as a weed, and therefore periodically thinning interventions are essential in order to contain its growth, the idea of using it as a covering in the front of the frames is undoubtedly interesting, not only for its aesthetic value and for the "uniqueness" of the piece (which derives from the heterogeneity of the texture that forms always different "graphics") but also because the woody fiber of the prickly pear it is extracted into sheets of modest size which therefore are well suited to the small size of a front. The coating is applied to a birch plywood and subsequently treated with special products and impregnating resins that have the purpose of preserving the material from attack by any parasites, increasing its mechanical strength and making it waterproof. During this phase, which is done by hand with a brush, the dense and slender texture of the wood fiber, with its characteristic honeycomb structure, becomes one with the support surfaces, and it itself takes on a



Fig. 1: Sikalindi is a material extracted from the still green cladodes of the prickly pear

considerable hardness and consistency. All the processing phases of FerilliEyewear frames, starting from the fiber extraction phase up to the realization of the masks, are carried out in artisan laboratories located in the Salento area and currently all the processed raw material is also obtained from pruning and thinning waste. of plants located in those areas.
From this brief excursus it is evident that not only large companies aim at sustainability as a focus for planning assets and investment strategies, but also small-medium-size ones are paying more and more attention to the research activity connected with the experimentation of new material entities, with the aim to reduce the use of virgin raw materials and transform it into a fundamental element of competitiveness in the global market.
Despite their formal simplicity, eyewear has a strong communicative value, as Ugo Volli underlines: "From a tool to see, glasses have become an object to be seen" (Volli, 2002) decreeing the importance of the aesthetic-expressive dimension of this accessory, which cannot be overlooked or underestimated. In other words, if a material, however eco-friendly, is not able to be resistant, flexible but at the same time light, aesthetically "stable" in the shape and brightness of its colors, in line with contemporary trends but also capable of not undergoing sudden changes in fashion… in the end if it does not ensure the performance that an eyewear must have, some other traditional materials may seem more useful for production and use.
It is therefore evident that design assumes the role of a connector between several aspects, intervening on production processes, calibrating the use of resources, selecting materials on the basis of functionality and aesthetic characteristics, or, in a word, coordinating the plurality of factors - economic, cultural, social - that affect the creation of a product.

3.2 Design and Production processes

One of the primary focus of many companies is the search for ways to minimize the environmental footprint of their processes and products and for integrating sustainability into the core business as an unavoidable premise in determining business strategies.
As John Thackara (Thackara 2008) writes, the environmental impact of many products that surround us is determined up to 80% in the design phase: the role of the designer therefore becomes essential as he has the possibility (and responsibility) to guide planning towards sustainable practices that lead

to the development of products or services capable even to "educate" the consumer towards new attitudes.
This ability to build new behavioral scenarios through targeted design is also a valuable tool for those companies that intend to pursue sustainable goals but need a "bridge figure" (designer) who knows how to interpret new social trends and translate them into products intended for increasingly evolved and aware consumers.
The designer's ability to synthesize knowledge and contributions not always (or not only) close to the area of planning, as well as his ability to interact with others, allows him to transfer knowledge and experiences to the various operators in the supply chain, favoring new dynamics of cooperation between the protagonists of the scientific world, the productive world and users. It is precisely through the development of these “virtuous connections” that supply chain relationships are strengthened and new production models are often created.
As Bieke Hoet, designer and co-founder of the Hoet company observes, innovative technologies can provide solutions for a more efficient use of resources and, at the same time, contribute to increasing the competitiveness of companies by innovating production and consumption models and targeting to the circular economy.
“We also only print what we need. I mean that in two ways. The additive process itself immediately reduces waste material, it’s much more sustainable, but we also print what we need in terms of stock – we’ll never have too much or too little. Also, because we can print according to demand, it helps us be responsive to consumer trends, for instance producing more of a certain color if it is selling well, or adapting shapes to reflect subtle shifts in taste. The decisions about a new line that you used to have to make up-front and then live with, are no longer fixed. They can be fluid. Really with 3D printing we have the design freedom to create new looks that capture imaginations, and then the business freedom to supply product according to how imagination translates to customer appetite. It keeps things fresh but also efficient”.
Surely the success of 3D printing constitutes an opportunity to consolidate more sustainable processes in many sectors, including the field of frame production, because it leaves a wide freedom range in designing and reshaping the product fitting and cause it significantly limits waste materials production.
Daniel Miko, designer and founding partner of the German You Mawo, also considers the use of 3D printing in the production of frames as one of the possible ways to reduce the environmental impact in this sector: a systematic life cycle analysis (LCA) carried out from the 3D printer manufacturer EOS and Fraunhofer EMI has in fact highlighted significant advantages, in terms of sustainability, of eyeglass frames produced in additive manufacturing mode compared to those produced with traditional techniques. In all 18 impact categories analyzed the carbon footprint of a custom 3D printed product, You Mawo eyewear, is about 58% lower than conventionally manufactured eyewear; CO2 emissions are three times lower; waste is reduced by 80% and it is possible to avoid long post processing. Research in this field continues to develop powders with an even lower footprint (for example, bio-based) and/or to optimize the recyclability processes of the powders themselves (powder refresh rate) and further contain energy consumption.
By innovating traditional production paradigms, 3D technology therefore plays an important role in the transition towards forms of circular economy. It allows a more efficient use of materials with the consequent reduction of waste and scraps; it has advantages as it guarantees a fast and efficient but also flexible and variable production; it allows the creation of tailor-made objects, an aspect that is not negligible in the frame sector, where customization is a fundamental parameter; it reduces production costs and lead time.
As recent analyzes have shown, additive manufacturing - albeit with some limitations of an emerging technology - can bring about sustainability benefits at every stage of the product life cycle, from prototyping to distribution, favoring the development of new business models based on the decentralization of the supply chain and the extension of the life span of the products through repair or on-demand production of components and spare parts. By transforming products into files, 3D manufacturing applies the acceleration and paradigms of digital to them: the ability to send the digital file containing the three-dimensional prototype of the single product to any part of the world allows its global distribution while maintaining production close to the consumer.
But how can design offer an effective contribution to sustainability?
Undoubtedly it can do that to the extent that helps to find technical solutions to limit the use of different materials in the frame (given the obvious difficulty to design using a single material) or to prefigure an easy to disassemble product, as to be able to dispose of it more easily. Giuseppe Leone's research has focused on these issues. In his thesis project, he revisited the maxi lines of the Seventies eyewear, lightening them visually and materially through the use of recycled titanium. Of course, this is a study that aims above all at the creation of eyewear that can be easily disassembled because, as is known, titanium, used for the first time in frames in the early 1980s, despite being suitable for use in this sector for its characteristics of lightness, resistance, hypoallergenicity, has

rather high processing costs. In this project, to minimize the components, we started with a single titanium plate engraved by chemical photo-blanking and then folded.
Of course, the environmental impact that a similar product can have must be estimated through the evaluation of various parameters and not be limited to the material one. It would be necessary to "make a perfect loop between the beginning and the end of the product's life" to use the words of Corrado Rosson, designer and founder of Lightbird Eyewear, “and in the eyewear sector we are still very far from this”. However, it is undeniable that, thanks to digital globalization, a greater sensitivity towards these issues is spreading even if the level of attention declared towards the issue of environmental sustainability does not always find adequate correspondence in production practice.
Even extending the life of a product by focusing on a high qualitative and communicational level of it, so much to make it assume the role of an icon in the collective imagination, represents a strategic action for the affirmation of the circular economy and the implementation of a sustainability-oriented design. Ernesto Gravante, designer of the Campania company Original Vintage Sunglasses, says "Truly sustainable eyewear is that one designed just to last, beautiful and of the highest quality available in time", a "relevant" object, that is an object to which a value is attributed and capable of establishing an emotional bond with those who have chosen it. Thus Zack Moscot, current Chief design officer of New York-based Moscot, underlines the importance of "working" on the relationship between product and user:
“A valuable consumer-product relationship is one that is driven by both function and emotional attachment” and he continues by reiterating the importance of extending the life of a product, which is fundamental for the affirmation of the circular economy, loading it with meanings that go beyond its manufacturing qualities: “Since eyewear has become a fashion accessory, certain brands and companies provide cheap, short-lived products. Names like H&M (clothing) and Warby Parker (eyewear) are companies that epitomize a system where cheap products reflect the current style, but are easily discarded of. In contrast to cheap fashion and wasteful purchasing, there are handmade items meant to last for years. During my semester abroad in Copenhagen, I was strongly inspired by the demand in the market for hand-made wooden furniture. I visited a factory called PP Møbler Furniture, where one chair could reach a price equal to that of an automobile. Incredibly, the person who buys this chair uses it for their entire life. The oils of the human hand and skin create a finish on the chairs arms that further enhances the beauty and timeless elements of the chair. The chair and its naturally changing aesthetics grow with the user and emotional relationships take form. Not only am I interested in the symbiotic growth that evolves between the chair and its owner, but also the sustainability of the chair via form, craft and material”. If until a decade ago, the designer's work was mainly linked to aesthetic/formal and functional issues, today multi-sensory marketing puts the 'sentimental' part of the consumer at the center of attention and tries to create empathy at the emotional, endowing the products with a strong and engaging identity on a cognitive and passionate level. Precisely for this reason it is possible to think not about the end of life of a product but about how to 'keep it with us', transforming the pleasure of using it into the pleasure of keeping it. The designer should be able to transpose, even in an apparently simple object like a frame, those intangible contents capable of making it timeless: a new idea of sustainability that passes through the emotional and evocative power that objects contain.

3.3 Sustainable design vs obsolescence: the other life of a frame

If in the past design became an accomplice of the unsustainability of the economic system, today it is increasingly configured as a fundamental tool to implement a paradigm revolution in terms of sustainability, focusing not only on the product, but also on the consumption choices themselves, contrasting an approach inspired by the principles of maintenance, recovery and recycling to the “disposable” culture. After all, also Objective 12 of the 2030 Agenda "Guaranteeing sustainable production and consumption models" promotes a radical change in the current production and consumption trends, as inseparable dimensions of the market to which a unitary strategy must be applied. In particular, the target 12.8 aims to "make sure that all people, in every part of the world, have the relevant information and the right awareness of sustainable development and a lifestyle in harmony with nature". This point out how important is to structure adequate communication strategies to orienting consumers and people in general towards increasing a sustainable mind-set.
In practice, it is a question of acting on the sense of responsibility of the potential buyer who, supported by clear, effective and above all reliable information, conveyed through appropriate channels, can direct himself towards those more sustainable goods and services, thus stimulating, with his own demand, an ever-increasing offer of products that meet these characteristics. Current environmental awareness campaigns mainly concern waste management through correct separate collection and, in particular, highlight the problems associated with the disposal of plastics and microplastics that pollute the seas and oceans. Emblematic for its communicative effectiveness is the Sand, Soil, Sea campaign, created in 2019 by The Leo Burnett Thailand agency and promoted by

Trash Hero, an environmental association actively involved in waste disposal: “just a second is enough to abandon plastic in the midst of nature, but it takes hundreds of years for it to decompose”.
In our opinion, however, what is often underestimated, is the concept of repair or service which, together with the object, can be designed from a sustainable perspective. In other words, "designing with the perspective of adjusting" is a concept often considered obsolete and not convenient, but which should be re-evaluated especially in a context, such as the current one, in which environmental issues are at the center of every debate. A contemporary “Make Do and Mend” that dignify and enhances the action of "repairing", as in the well-known Japanese practice of Kintsugi which tells and enhances the "wounds" of the object even highlighting them with gold or the Sugru (a silicone-based polymeric material, similar to plasticine in consistency and modeling methods, which allows you to repair but, in the limit, also to customize and innovate precisely through repair).
In this sense the “Réanim project: La médecine des objets”, by the French studio 5.5, is very interesting: “Réanim was first and foremost about questioning the proliferation of mass-consumption objects, produced for commercial purposes without any concern for durability: but it was also a true alternative designed to put an end to the constant turnover of our objects. Reanimating, recuperating, rehabilitating, recycling, rethinking, bandaging, healing. The designer is a doctor for objects, and put his skills in the service of injured furniture. […] These treatments, which face veritable epidemics, are based on systematic intervention principles that improve the perception of the object. Once treated, the object is reintroduced into regular commercial channel before returning to its original habitat”.
In the same way, the contribution given by the Platform21 project, created by a group of Dutch designers and aimed at enhancing the culture of repair with the definition of the Repair Manifesto, is a milestone, which summarizes in eleven points the fundamental prerequisites for the adoption of production methods and sustainable consumption.
On 2022 January the 11st an initiative was published by the European Commission aimed at promoting the repair and reuse for sustainable consumption of goods with the general aim of extending their useful life and empowering the consumer in the green transition. In fact, the Right to Repair is often denied because companies are not required to distribute spare parts, do not train repair workers and, in many cases, do not guarantee after-sales assistance today recognized as fundamental for numerous luxury brands.
Moreover, a change in this sense is already visible in the purchasing choices of generations Y and Z, who show greater attention to environmental issues and are inclined to verify that what is communicated by companies - not least the commitments undertaken in sustainability - is based on truthful, measurable and verifiable performance indicators. Bringing the concept of repair back to the eyewear sector, a leading expression of Made in Italy, it is clear that a distinction is required between commercial models and "special" products which, like any other object of value, must be entrusted to expert hands of specialized craftsmen: some models by Cartier, Chopard or Dolce and Gabbana (the DG2027B is an excellent example) are configured as pieces of jewelery, in precious metals, often studded with diamonds, whose indisputable value is evident , but so are those models with an iconic design that have become part of the collective imagination: from the colored ones by Sottsass that inspired the collection of the Spanish designer Nina Mûr goes Memphis, to the oversized frames by Hans Hollein, passing through the two-tone ones by Roger Tallon up to some models conceived by the brilliant and revolutionary mind of Andrè Courrèges that are inspired by the future.
Speaking of reparation makes even more sense if it is aimed at a gesture of solidarity. If the second life of sunglasses is often in physical or virtual vintage stores, it is different for “eyewear”. There are in fact many projects, often promoted by eco-solidarity or voluntary associations, aimed at giving a new life to used eyewear; among these, of particular importance, the program, which, born in 2003, has led to the creation and dissemination of Centers for the collection and recycling of used eyewear. These are cleaned, arranged, divided according to gradation and packaged by volunteers who distribute them free of charge to the people who need them, thus promoting a model of social cooperation in the territories. Similar initiatives are carried out by many opticians who, inspired by the entirely Neapolitan gesture of "suspended coffee", allow their customers to bring old glasses and buy new ones at a discounted price.
Essilor and Luxottica themselves, with the "Suspended Eyewear" campaign, have chosen to make eyeglasses (this time new) available, leaving them "pending" for those who find it difficult to bear the costs, at over 800 optical centers throughout Italy. This initiative has also affected Portugal, especially the Algarve region, whose economy dependent on tourism has particularly suffered due to the pandemic situation. The Portuguese project "Together 4 Vision" involved institutional figures, opticians and optometrists and was initially aimed only at children aged 6-17, children of unemployed parents, and was then extended, in a second phase, also to particularly adults. vulnerable regions of Madeira and the Azores.
Despite these initiatives, however, the concept of "repairable", especially in the eyewear sector, still appears quite limited even though it could lead to the experimentation of "new aesthetics" capable of adding further narratives to an accessory with an already highly communicative character.

4 Conclusion

The reflections carried out so far allow an appropriate positioning of the situations in which the project in general - and that one of a pair of glasses in particular - has been able to be innovative, also with reference to the current transition towards a planning that tends to sustainability. In fact we must consider that, if that eyewear is a small object, its diffusion (around 1.2 billion people wear glasses in the world) means that it too can offer an important contribution in this sense.

Of course, to evaluate the "sustainability" of a frame, the analysis of its entire life cycle should be considered: it should be checked whether the greatest impact on the environment occurs in the production, transport, use or disposal phase and, subsequently, implement an intervention strategy aimed at overcoming the criticalities emerged. In this study we want to highlight some initiatives undertaken by companies in the sector from an environmental and social point of view, in the awareness that only a global approach can make a significant contribution to sustainability. In many cases these are interventions aimed at the first phase of product life cycle (i.e. the choice of material), in other cases the focus is on sustainable production models or on the possibilities of recycling or disposal. However, it is clear that the implications go beyond the mere question of selecting less impacting materials and processes and choosing eyewear based on the ease of disassembly or the reduction of its material complexity. Therefore it is necessary to conduct a more complex analysis of the entire production chain, in order to be truly sustainable in design processes. It is essential to fight waste and try to give long life to products by focusing on quality, on a design that resists the time and that is able to establish a strong affective "relationship" with clients and users.

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Historical Transition of North Korean Commercial Art (1945-2019)

- Characteristics of representative trademarks, packaging, and advertisement designs divided by period-

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Abstract

As discussed in this paper, the historical transition of North Korean commercial art/design, which is a barren area of research due to the limitations in collecting data on North Korea, was accurately recorded. As a result of examining representative commercial artworks by applying the seven-stage chronological classification presented in this author's previous study, the ways creative intentions have changed in the social environment and political background was identified. Through the investigation, verification, and analysis of the empirical literature data published in North Korea, the trademark, packaging, and advertisement designs of commercial art were divided by period to organize the characteristics of graphic designs. The results of this study are expected to be shared as primary data that enable utilizing new points of contact and various academic perspectives on North Korean commercial art.

Keywords: North Korean Commercial Art, Design History, Trademark, Packaging, Advertisement

1. Introduction

Currently, in the Democratic People's Republic of Korea (referred to as North Korea in this paper), Selye, which is referred to as design in the Republic of Korea (referred to as 'South Korea' in this paper), is referred to as「Doan=design」and designer is referred to as「Doansa=creator」.

Since the establishment of the North Korean government after liberation, solid plans for art and design have been established. A characteristic revealed in North Korean art and design is that North Korean art and design are entirely purpose-oriented, focusing on building a socialist state by the Party with the people-centered on the leader. Therefore, in commercial art (commercial design in this paper), concrete expressions, such as traditional shapes, calligraphic typefaces, flowers, animals, and people, are preferred and expressed clearly.

North Korean design policy aims to achieve its purpose, and in a way, it is like the modern design that seeks to find the value of a Consciousness of the times in Europe and America in the early 20th century. Therefore, there is a self-evident "North Korean style" in the design of trademarks, packaging, and advertisements in commercial art. In each era after liberation, the characteristic elements of the North Korean style appear in each work of commercial art that the North Korean design world has implemented along with the historical transition.

In South Korea, the perception of North Korean design culture is underdeveloped. One reason is that there are many differences in the classification and division of design studies between North Korea and South Korea. Another problem is that the emergence of unfamiliar technical terms makes it difficult to grasp the meaning and content.

Therefore, the importance of this study is that it places value on overcoming the inhospitable treatment and ignorance of a society from a historical viewpoint of design studies and on presenting academically the goal of a scholar who wants an equal relationship with North Korea rather than a sense of superiority to heal North Korea. To accurately judge and understand the reality of design changes in society from a new perspective in South Korea, it is necessary to pay attention to the historical transition of commercial designs in North Korea. We must clearly understand that the reality of the history of North

Korean design culture and creative works of commercial art as such is a product of North Korean economic policies and North Korean people's lives.

2. Purpose of the Study

To understand the historical transition of North Korean art, which has remained an unexplored area in modern history from liberation to the present, the historical evolution of North Korean art is reorganized through the excavation and analysis of concrete empirical data on industrial art. The basic standard of living, the degree of industrial development, and the technological level of North Korean society are examined. The contents and backgrounds of publishing and industrial art changes are examined through verification using empirical data. In addition, the elements of the development of graphic design in North Korean industrial art over the past 60 years from the period of national economic recovery after the Korean War are discussed.

By examining representative commercial design works through the division of periods into seven stages clearly outlined in this author's previous study, this author examines how and in what parts the methods of expression of creative intentions have changed based on the period of the social environment and the political background. Through the verification and analysis of empirical literature data published in North Korea, the characteristics of a typographic design appearing in only the trademarks, packaging, and advertisement designs in commercial art by period are examined. The historical transitions of brands, packaging, and advertisement designs created in each period from North Korean commercial art, which is a barren area of research due to the limited collection of research data thus far, are accurately recorded.

3. Definition of North Korean Commercial Art

North Korean industrial art has grown over three generations according to leaders' demands and times and economic and political purposes. President Kim Il-sung established the foundation of national industry in the early days of the regime, and beginning in 1956, he found an art research institute at the Light Industry Science Academy of the Ministry of Light Industry for the designs of daily necessities, trademarks, and packaging to take charge of commercial art for everyday needs, etc. General Secretary Kim Jong-il newly reorganized the art research institute into a light industrial art studio in 1974 to create the designs of souvenirs, trademarks, packaging, and daily necessities. In the early 1980s, the 『Example of People's Consumer Goods』 (1982) [Note 1] was published to disseminate state-encouraged designs to local enterprises and factories.

Since the late 1980s, the definitions of the concept in the『Theories of Creation of Crafts and Industrial Art』 (June 1986), a series of literary theories written by General Secretary Kim Jong-il, have been followed [Note 2]. In North Korea, "commercial art," considered practical art that satisfies people's material needs, is divided into packaging, trademarks, and advertisement designs. In addition, the designs of packaging and trademarks in North Korea are defined as marks mainly symbolizing the brands of processed food and drinks, cosmetics, and export products, and advertisement designs are defined in a broad sense as planning and executing display designs of commercial stores.

4. Design creations and their characteristics that appeared in commercial art by period

In the case of the concept of North Korean art, the leader's guidelines, or views, on literary theories are reflected as the only definitions of terms. The characteristics, regulations for activities, and purpose of art have changed over time according to the succession of the regime by the leader. In this chapter, the characteristics of designs that appeared in representative creations of trademarks, packaging, and advertisement designs in commercial art by period are examined regarding the historical transition of North Korean commercial art through the division of the periods into seven stages.

4.1. Period of the introduction of industrial art (1945~1949)

After establishing the government of the Democratic People's Republic of Korea on September 9, 1948, the Soviet Army and the engineers dispatched from the Soviet Union, who had played an essential role in economic recovery, completed withdrawal on December 26 of the same year. The North Korean government announced a two-year financial plan on February 1, 1949, and President Kim Il-sung received new economic aid from the Soviet Union on March 17, which was a loan of 222 million rubles in total, to be given by the Soviet Union to North Korea over three years under the condition that North Korea would repay it at an annual interest rate of 2% [Note 3].

After the armistice talks began on July 10, 1951, 50,000 tons of food for both the continuation of the war and the preparation for post-war recovery were provided in the summer of 1952, followed by tens of thousands of tons of chemical fertilizers, more than 400 tractors, and tens of thousands of various agricultural machines, automobiles, large quantities of daily necessities, and agricultural support, the

construction of dikes and irrigation restoration, and medical help by the People's Volunteer Army [Note 4].

4.2. Period of the wartime system (1950~1953)

When the Korean War began in North Korea, the North Korean Art Federation established various measures to convert all artists' creative projects into the wartime system as soon as possible. During this period, the forms of art activities were posters, cartoons, etc., adapted for instigation and propaganda, and 30 posters and 280 cartoons were produced and appeared within three months after the war began and were distributed widely, ranging from the nearest rural areas to the far front lines. The representative posters created in this period include『The Korean People Are One』created by Lim Baek, 『Soldiers of the People's Army, Revenge for Us』, 『Hooray, Unified Korean People』, 『All Things to the Front Line, Everything for Victory』 created by Jeong Gwan-Cheol, 『 See! The Construction of Shining Democracy in the Northern Hemisphere』created by Li Suo, and 『Let's Destroy and Clear U.S. Mercenary Soldiers』created by Tak Won-Gil. These works, including many oil paintings, drawings, and illustrations, were exhibited 21 times, including three times in Pyongyang and three times in the Wonsan district. The number of visitors reached 191,945. Creative activities were not active from July 1950 to the beginning of 1951 due to the restrictions of the wartime environment. Still, the South and North Art Alliances were integrated to provide an opportunity to foresee the development of works of art [Note 5].

4.3. Period of establishment and development of thematic art (1954~1966)

In 1954, the Department of Industrial Art was established at Pyongyang Art University. Doansas and creators (designers) produced by the university were placed at significant art studios in various provinces and cities to competitively display their party character and revolutionary artistry. The Light Industrial Art Studio was established in the Ministry of Light Industry in 1955 and played the role of a comprehensive industrial design center as a "central base for industrial art creation." Mansudae Art Studio (established in 1959) functions as a "comprehensive art creation base."

4.3.1. Graphics in Joseon Art

North Korea's basic policy for economic recovery after the Korean War armistice was decided at the 6th Plenary Meeting of the Central Committee of the Korean Workers' Party held on August 5-8, 1953. Post-war recovery has also been positioned to establish economic, cultural, and military superiority over the South for the reunification of North and South. It should be noted that the financial support by allies during the Korean War was mainly related to living and that the relocation and construction of industrial facilities were carried out independently by North Korea. This stage can be considered the starting point of forming an independent economic structure centered on heavy industry. In North Korea, the period from 1954 to 1966, ranging from the armistice of the Korean War to the 21st anniversary of the founding of the Korean Workers' Party, was a period of the overall construction of socialist art when the countenance of the development of North Korean art was clearly shown based on the existing state of works implementing the thoughts and emotions of the people and the published pictures that declared the spirit of the times, reflecting the nature of socialism [Note 6]. In the overall construction of socialist art, a series of new characteristics appeared in the development of industrial art as many young artists participated in graphic designs, such as trademark designs. This is closely related to the new reality in which North Korean people were successfully carrying out the tasks for economic recovery and construction of the foundation for socialism after the Korean War [Note 7].

From 1957, North Korean art has focused on creative work for art exhibitions celebrating the 40th anniversary of the October Socialist Revolution, the 6th World Youth and Student Festival Art Competition, and the Art Exhibitions Tours across European People's Democratic Countries. Through this process, North Korea achieved outcomes to inherit and develop the classical characteristics of the excellent people while adhering to the purity of the Marxist-Leninist aesthetics. The factors that appeared in art creation were that the narrowness of the selection of subjects was broken down and that the subject matters were diversified [Note 8].

4.3.2. Packaging and trademark designs in commercial art

During this period, North Korea's industrial art began to expand into various fields, such as trademarks, packaging art, and daily decorative art, to meet real needs, and many packaging and trademark designs were created.

In addition, many designs, such as 「Egg Jelly」, 「Ginseng Wine」, 「Blueberry Scented Cider」, and 「No-aging Liquor」, reflected the rapidly growing standard of living of the people using food packaging design technology. The brand design of 「Egg Jelly」 emphasized vividness with overall pastel tones, and the design of「Ryongseong Beer」 enhanced the qualitative value of the brand while

giving freshness by simply using a dark-colored design on a white background and ears of barley in the form of an illustration.
In particular, the cigarette packaging design “Seagull” (Lee Woong-sik, 1960) enhanced the dignity of design art with a white line expressing waves swaying on a blue background that symbolizes the sea, the depiction of the shape of a seagull flying over it, and the clear and concise depiction of the object with the letters of the brand name and the expository text epitomized with a method of stylization in harmony with the preceding.
The numerous trademark designs reflected commercial art and trademarks and packaging art as they were, along with the development of North Korean daily life items while carrying out the 「7-Year People’s Economic Plan」. In addition, food brand and packaging designs were diversified. For example, there are 「Canned Fish Products」 (Lee Baek, 1963) and 「Raspberry Wine」 (Nam Song-juk, 1963) [Note 9]. During this period, as the commercial networks rapidly increased, many signs of various shapes and colors, advertisement paintings introducing products, and shop interior designs were created and developed so that streets fit the commercial system, leading to improved quality of cultural life.



Fig.1: Canned food brand design expressed realistically using the Molgol technique (Source: 『Made in Joseon』 (2018))
Fig.2: The first magazine advertisement was published on page 4 of the cover of issue #1 of 『Commerce』 (January 1957), an internal and external commercial magazine in North Korea.
Fig.3: Classified advertisement of 『Pyongyang Newspaper』 (October 15, 1992, page. 4)

4.4. Juche art heyday (1967~1982)

During this period, a turbulent era when a great heyday of socialist construction was implemented, industrial art entered a new development path as the North Korean economy developed rapidly. The three revolutionary tasks of ideology, technology, and culture were realized. General Secretary Kim Jong-il scientifically analyzed the role of industrial art and said, “Industrial art should draw paintings creatively from the position of Juche in all respects without imitating works in other countries. Industrial art must be developed to fit the socialist lifestyle.” He established a policy for the independent development of commercial art [Note 10].
By examining the canned food label designs from the 1970s to 1980s, the meaning of Juche art can be understood. It realistically represents the product’s contents so that people know exactly what they are seeing without looking at the text. In addition, the method of expression was the Molgol technique of Joseon painting, which is the basis of North Korean Juche art. The Molgol technique is a description method that expresses only shapes without outlines in ink painting. It was also applied to trademark designs, emphasizing realistic descriptions <Figure 1>.

4.5. Period of promotion of national industrial art (1983~1993)

Creative activities were vigorous even during the economic decline in the 1980s (1975 - 1989). In September 1984, the Joint Venture Act promoted foreign investments. Therefore, printed and TV advertisements equipped with forms appeared beginning in the 1980s, and there have been movements to attract commercial advertisements in earnest. According to this author’s investigation, the first magazine advertisement after the establishment of the North Korean government is an advertisement for 「New Products」 of a central grocery wholesaler, printed on the 4th page of the cover of issue #1 of 『Commerce』 (January 1957), an internal and external commercial magazine published by Pyongyang Commercial Company <Figure 2>.
The North Korean art world showed interest in industrial art by hosting the first National Industrial Art Exhibition in November 1984. In the previous exhibition, the designs of trademarks, packaging, and advertisements of liquors for export and food products and designs for daily necessities in the light industry were exhibited to show the characteristics of culture’s openness, emphasizing the brands of

trademarks. The commercial methods displayed at this time include 「Ginseng Cosmetics」 (Choi In-soo), 「Gaesong Korean Red Ginseng」 (Joo Seon-il), 「Processed Fish Products」 (Lim Neung-pae), and 「Liquor Brand Label Packaging Design」 (Han Hyeon-hee) [Note 11].
At the People's Daily Necessities Design Exhibition in 1986, about 400 designs were exhibited to boast of the scale. Subsequently, the National Industrial Art Exhibitions were held in April 1988 and in April-May 1989l; however, in the late 1980s, the Soviet Union and other Eastern European socialist countries, which were on the verge of collapse, could not produce sufficient food to supply to the people. As socialist countries stopped exporting food, North Korean foreign currency stores depleted.

4.6. Period of great prosperity during the heyday of the revolution (1994~2011)
From the beginning of the economic downfall in the 1990s (1990-1997), the number of events, including the national art exhibitions, decreased sharply [『Joseon Art History 2』 1990:118]. In the early 1990s, advertisements appeared in North Korean newspapers. Unlike 『Rodong Sinmun』, 『Pyongyang Shinmun』 contained information related to the lives of the residents, although very little. This newspaper, which is published on four pages every day, indicates which products are sold in which stores are placed <Figure 3>. Movie programs currently running in theatres are also shown.



Fig.4: Brand designs of Sindeok Spring Water, Geumgangsan Spring Water, Myohyangsan Spring Water, Pakyon Spring Water, and Gangseo Mineral Water (Source: 『Made in Joseon』 (2018), Today of Joseon)



Fig.5: Brand designs of Baekdusan Cider and Ryongseong Pear Cider (Source: 『Made in Joseon』(2018), Today of Joseon)
Fig.6: Brand designs of North Korean Ryongjin Cocoa Carbonated Sweet Water and Moranbong Cocoa Carbonated Sweet Water (Source: Today of Joseon)

North Korean advertising designs prepared an opportunity for a decisive change by the Free Economic and Trade Zone Advertising Regulations (April 30, 1996) [Note 12]. It was shown that the advertisements centered on daily necessities that had appeared in the early 1990s were replaced by ads for popular consumer goods, such as cosmetics and automobiles. For reference, after the June 15 Joint Declaration in 2000, South Korea began to produce advertisements with North Korea as the material. Since then, interest in North Korean design has already started to appear little by little.
In the Art Exhibition commemorating the 40th anniversary of the founding of Mansudae Art Studio in 1999 and the National Art Exhibition celebrating the 52nd anniversary of the founding of Pyeongya Art University, the ratios of design creation, such as food designs, including the 「Cigarette Packaging Design」, 「Koryo Ginseng Design」, and 「Liquor Brand Design」, and published art designs for stamps, calendars, and postcards were higher than before. From the late 1990s, in commercial art, the materials of food designs have been diversified. In the case of designs for drinking water products, such as 「Sindeok Spring Water」, 「Myohyangsan Spring Water」, and 「Pakyon Spring Water」 <Figure 4>, processed fruit products, such as 「Pungcheon Apple」, 「Canned Peach」, and 「Myohyangsan Tangerine Candy」, carbonated drinks, such as 「Raengcheon Cider」, 「Baekdusan Cider」, and 「Ryongseong Pear Cider」<Figure 5>, and 「Daehongdan Potato Starch Noodles」(Kim Ha-jin), not only product names in Korean and English but also nutritional ingredients and calories are indicated on the packaging and allows for implementing regularized labeling methods.

The printing technology of primary color combinations is used instead of simple packaging technologies. In North Korea, there are also self-developed colas, which are ‘Ryongjin Cocoa Carbonated Sweet Water’ and ‘Moranbong Cocoa Carbonated Sweet Water’ <Figure 6>. ‘Ryongjin Cocoa Carbonated Sweet Water’ won the gold medal at the 21st National Consumer Products Exhibition in North Korea in 2011. It is a carbonated drink produced at the Ryongbong Food Factory at the foot of the Ryongaksan mountains. It is sold under the brand ‘Ryongjin.’ This factory had the fruit-flavored carbonated drink (carbonated sweet water) for the first time in North Korea. It produced eight kinds of fruit-flavored carbonated drinks, including apple, peach, strawberry, blueberry, and lemon. One of them is ‘Ryongjin Cocoa Carbonated Sweet Water’ [Note 13].





Fig. 7: Cigarette packaging designs for Red Star, Glory, Paradise, Pearl, Pyongyang, etc., supplied to North Korean executives [Source: Free North Korea Broadcasting (2014.06.03)]
Fig. 8: North Korea’s finest cigarettes: Seven Star, Construction, Gwangmyeong, Hometown, Keumgangsan, Gangseon, New Spring, Star, and Daybreak (Source: http://picdeer.com/media)

North Korea’s representative brand names are ‘Pyongyang,’ ‘Baekdusan,’ and ‘Chollima,’ which gave revolutionary meaning to socialist construction, and such place names or names are used repeatedly for many products. For example, there are cigarettes from Baekdusan Cigarettes, Baekdusan Spring Water, and Baekdusan Cider, and “Pyongyang” is also used popularly for tobacco and beer brands. This is because Baekdusan Mountain is considered sacred as the cradle of the revolution and the birthplace of General Secretary Kim Jong-il in North Korea, and Pyongyang is the utopia that North Korean citizens aspire to [Note 14]. Currently, 80 kinds of cigarettes are produced in North Korea. These cigarettes are sold earnestly at tourist destinations in Geumgangsan Mountain and the Gaeseong Industrial Complex exclusively for foreign money earning. Cigarettes known for exclusive use by President Kim Il-sung and General Secretary Kim Jong-il are large ‘Baekdusan’ and 'Glory,’ and other filtered cigarettes supplied to executives include ‘Paradise,’ ‘Gold Star,’ ‘Red Star,’ ‘Pyongyang,’ and ‘Cheonlima’ <Figure 7>. The finest North Korean cigarettes are ‘Chilsung,’ ‘Construction,’ ‘Gwangmyeong,’ ‘Hometown,’ and ‘Geumgangsan Mountain’ <Figure 8>. The characteristics of North Korean cigarette products with improved packaging are diverse typographies and unique expressions of lettering with solid individuality.

4.7. From 2012 to now (period of great prosperity)

As the era of the ruling by Chairman Kim Jong-un began, culture columns of various media emphasized the importance of “industrial art as the scouting party of science and technology and the construction of an economic power” at the center of national industrial art. Through the「Trademark Act, Chapter 1, Article 2」 newly established on November 13, 2012, it is possible to guess the change into nationalistic forgiveness, meaning the content that does not emphasize ‘Juche art’ in existing trademarks:

> “Requirements must be observed in the definition of trademarks and the creation of trademark designs. The State shall comply with the following requirements in creating trademark designs. 1. Trademark designs should look good while being shaped to show clear meanings and vitalize the characteristics. 2. Trademark designs should not be artificially exaggerated and should be shaped to be culturally attractive. 3. If necessary, trademark designs should be shaped to be lively like comics while being realistic to attract people’s attention and make them curious about the product. 4. Too many primary colors should not be used to avoid indecent feelings, and colors should be used in harmony to fit the brand’s characteristics. 5. Globally common contents and marking methods, including standards, should be accurately followed.”

The Trademark Act added in 2012, introduced above, did not contain content on national forms, such as the cultural sentiment unique to the nation, socialist lifestyles, and the Juche position along with the ideological, revolutionary, and people’s natures, which were requirements before the adoption of the previous Trademark Act in 1998 [Note 15].

The National Industrial Art Exhibition in 2013 was held when the globalization of designs was emphasized, and among others, many cities' shop marks and signboard designs were exhibited. The preceding characteristic was introduced as works of the mark and signboard designs guided and ratified by Chairman Kim Jong-un. Representative results of the mark and signboard designs mainly were for facilities related to commerce, tourism, and foodservice industries, such as 「Mansu Bridge Soft Drink Store」, 「Mirae Store」, 「Mansu Bridge Meat Store」, 「 Rosa Rugosa Hall」, 「Royal Azalea Restaurant」, and「Jangjeon Sunrise Restaurant」 [Note 16].



Fig.9: A case where the 「Pyongyang Basic Food Factory Mark Design」 (2014) was applied to the「Transport Vehicle Design」 (2017) (Source: Seogwang)
Fig.10: 「Pyongyang Bag Factory Mark Design」 (2017) (Source: Ryeomyung)

The National Industrial Art Exhibition in 2014 was planned to highlight the impetus of the subjective creation of new generations and the construction of a self-reliant national economy. The representative works exhibited were decorative designs and symbol marks of federal critical facilities and street sign composition designs, such as 「Pyongyang Basic Food Factory Mark Design」<Figure 9> and 「Children's Hospital Industrial Art Design」. The National Industrial Art Exhibition in 2015 is characterized by many interviews with designers and local creative organizations.
Art studios developed trademark designs in many regions, such as 「Pyongyang Bag Factory Mark Design」 <Figure 10> and 「Pyongyang Sock Factory Mark Design」 <Figure 11> developed by the Pyongyang Industrial Art Bureau in 2017, 「Baekmasan Processing Factory Trademark and Packaging Design」developed by the Pyeongbuk Industrial Art Bureau, and 「Daedong River Fruit Processing Factory Product Brand Design」 developed by Pyongyang Art College, which is an educational institution.



Fig.11: 「Pyongyang Sock Factory Mark Design」 (2017) (Source: Joseon Central)
Fig.12: 「Taedonggang Beer Advertisement」 (2016) (Source: Today of Joseon)

The「Taedonggang Beer Advertisement」, the first commercial advertisement in North Korea, focuses on promoting the regime's superiority rather than boosting product sales. The 「Gaesong Industrial Zone Special Act」 enacted in 2004 separated the Gaesong Industrial Zone advertisement regulations to stipulate the content, form, and procedure through a total of 22 articles [Note 17]. Following the Taedonggang Beer Advertisement <Figure 12>t, the first TV commercial, commercial advertisements for various products, such as herbal medicines, home appliances, cosmetics, food, detergents, medical devices, etc. distribution, began to be broadcast [Note 18].

In addition, North Korea promoted a project to externally protect its global intellectual property rights of trademarks <Figure 13>. Therefore, North Korea joined the 「The Hague Agreement for International Registration of Industrial Designs」of the World Intellectual Property Organization on June 13, 2016, and the 「Singapore Convention on Trademark Law」was also joined in carrying out deliberation, registration, and protection projects on an international scale by the agreement and convention [Note 19].



Fig.13: Representative trademarks protected by North Korea's global intellectual property rights (Source: Today of Joseon)



Fig. 14: 「Samjiyeon Potato Flour Production Factory Mark Design」 (Source: Today of Joseon),
Fig. 15: 「Processing Factory Trademark Design and Packaging Design」Trademarks (Source: Today of Joseon),
Fig. 16: 「Galaxy」Cosmetics Packaging Design (Source: Today of Joseon)

Joseon Industrial Art Studio has been vigorously waging creative battles to develop more designs that contribute to the country's economic development and improve people's living standards. The industrial art creation projects have led to over 350 unique and diverse industrial art designs that reflect the needs of the times and the people's aspirations. The representative works include 「Samjiyeon Potato Flour Production Factory Mark Design」 (Kim Jin-soon) <Figure 14> and 「Processing Factory Trademark and Packaging Design」 <Figure 15>. With the creation of new designs of trademarks and packaging, North Korea is focusing on brand design more than ever before [Note 20].

According to the commentary titled 「Joseon Commodities」on 『Joseon Shinbo』dated, November 27, 2018, the 『Joseon Commodities 2018(Korea Commodities) 』published by the Joseon International Trade Promotion Committee is a comprehensive product information book (catalog) specialized in introducing 898 products from 43 representative North Korean companies. Starting with Korean ginseng, this book introduces various products, such as medicines, foodstuffs, alcohol and beverages, and cosmetics <Figure 16> in Korean, English, and Chinese.
Even in 2019, the Joseon Industrial Art Studio, Pyongyang Publishing and Printing University<Figure 17>, Industrial Art College, etc., have made external and internal advertisement designs in Samjiyon-gun, which will be built in Ryanggang Province, to which Chairman Kim Jong-un is paying special attention, with a modern feel along with overflowing national sentiment<Figure 18> [Note 21].



Fig. 17: 「2019 Processing Factory Trademark Design and Packaging Design」 Trademarks (Source: Today of Joseon),



Fig. 18: 「2020 Sun Day Celebration」 National Industrial Art Exhibition Hall (Source: Today of Joseon)

5. Conclusion and prospect

Although North Korean products will be modernized little by little, North Korea has a structure in which the gap between the people who want various designs and the national ideology must be filled gradually; however, North Korea has established industrial design education institutions and creation institutions since 1956, earlier than South Korea, so they have overseen designs for the light industry and heavy industry sectors and have been used for national development. Even in the current digital age, in the case of commercial art, conciseness, concentricity, and symbolism are excellently implemented to fit the characteristics of the subjects in trademark designs, packaging designs, mark designs, and text-decoration designs of daily necessities, and creators are expanding their works while sufficiently ensuring the informativeness and artistry of fonts.

North Koreans, who encountered products imported through trade with China, also have perspectives on design for commercial art distinctly different from those in the past. Hereafter, the needs of the residents cannot but be reflected. As marketization progresses and the number of goods increases, the right of choice returns to the consumers. Thus, the authority of consumption policies is partially reversed. An exciting change in North Korean society after Chairman Kim Jong-eun's regime began the introduction of branding designs of commercial art into significant facilities of the state. The Koryo Air mark and logo and hotel Ryugyeongwon's logo design, costume design, and interior design were

created with a sense of unity. Of course, North Korea's major facilities and symbols for events had been made to have political colors in the past. Still, the logos, colors, and clothes were not branded as a single product by designing them comprehensively through a single design concept. Branding design can be said to be 「the flower of capitalism」. Therefore, attention should be paid to this aspect.
This aspect can also be found in the special economic zones that North Korea has been focusing on recently. Special economic zones and cities determine significant businesses, and environmental designs are made differently based on the economic zone. This is because foreign tourists or foreign investments should be attracted. Because North Korea must focus on earning foreign money, it eventually chose branding design, which can easily attract foreigners' attention.
The role of commercial art (design) will also be important in unified Korea. Germany, Hong Kong, Vietnam, etc., need a standardized branding system for the whole society in the process of unification, and it is entirely in graphic design, specifically commercial art. Although it is not known what a unified Korea will look like, studies on the graphic design must continue.

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20th World Heritage and Ecological Transition
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Integrated 3D survey techniques for historical architecture. The Church of S. Maria Veterana in Triggiano (Italy)

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Abstract
In the field of Cultural Heritage preservation and enhancement, to faithfully reproduce the elements of historical buildings and archaeological sites is a challenging task, supported by ever-changing technologies and processes; together, the latter shape up on the 3D-digital-survey basis, as an aid to the consultation and storage of the rich documentation that is then collected. The architectural survey techniques, which employ both active (LiDAR) and passive (digital cameras) sensors, and digital modelling can scan architectural objects making them available as point clouds and 3D models, with a high realistic perception and an equally strong quality of metrics and morphology. The project aims at testing out an integrated survey workflow by employing laser scanning (TLS) and aerial photogrammetry (UAV) data, which have been collected through Iterative Closest Point (ICP) algorithms. Indeed, it was sought to obtain a hybrid and complete point cloud, that could reliably support further parametric modelling processes in HBIM environment.
Surveying the church of Santa Maria Veterana – built in 1580 on the ruins of a pre-existing medieval church in Triggiano – featured a multi-sensor registration which was accordingly used for a variety of purposes. Namely, in the point cloud, range-based data provided a reconstruction of the interior and exterior areas, whereas image-based data helped to detect roofs and fill gaps – caused by laser scanning the exterior walls from ground stations.

Keywords: Cultural Heritage, 3D digital survey, Point cloud, LiDAR-Light Detection and Ranging, CRP-Close Range Photogrammetry

1. Introduction and State of the Art
Architectural survey is one of the most relevant processes in documenting Cultural Heritage, as it allows a reliable model of the building locating it in space through the targeting of selected points considered to be noteworthy.
At present, LiDAR and CRP acquisition systems are part of widely applied methodologies [1], [2]; indeed, their use is significant to define the historical and archaeological value of buildings [3], [4], detect the morphological aspects of architectural elements [5], draw out 2D drawings and 3D reconstructions [6], [7], etc.
3D laser scanning belongs to the active sensing methods, while photogrammetry is an image-based, passive alternative, and the survey is executed using cameras mounted on aircraft, remotely piloted vehicles (RPVs) or unmanned aerial vehicles (UAVs), and smartphones [8]. Complex and irregular geometries can be acquired on a small and/or large scale, in terrestrial and/or aerial mode. TLS and CRP can generate 2D or 3D data (such as orthophotos, point clouds, etc.) in terms of geometric and colorimetric accuracy with additional texture information. A point cloud is a set of points in space, placed in a Cartesian coordinate system following the X, Y and Z axes, which may represent a 3D shape or object.

In the field of Cultural Heritage, an accurate survey obtained with 3D acquisition tools is now a must, to get a digital copy of the building with high metric precision. In specific scenarios, the high cost and low transferability of LiDAR technology has nevertheless fostered the adoption of the photogrammetric technique [9]. Each method has both pros and cons, so the most appropriate choice should be made in view of preliminary documentation and specific contextual demands.
There are three main differences between the two approaches: i) firstly, in active systems, the point cloud results directly from the acquisition, whereas passive techniques require two-dimensional images captured in compliance with photogrammetric principles; ii) the point cloud generated by TLS is considered a metrically correct reconstruction, as opposed to the one obtained by photogrammetry, which has to use metric references acquired onsite that might lead to errors in the capturing and scaling of the photogrammetric model; iii) the use of TLS may imply difficulties in the acquisition of parts of the building where the scanner may be unable to be positioned, such as on the roof, or texture quality problems.
Therefore, in order to remedy the critical issues of one or another digital survey technique, LiDAR and Photogrammetry are frequently combined [10], [11].
The geometric survey of the church of Santa Maria Veterana in Triggiano, Italy – built in 1580 on the ruins of a pre-existing medieval church – was carried out using a multi-sensor registration which was also integrated with terrestrial laser scanner surveys and UAV acquisitions. LiDAR survey-based data were used to reproduce the interior and exterior environments, whereas image-based data were used to detect roofs and fill gaps in the laser point cloud.

2. Methodology and Results

Modern techniques for digital scanning of Architectural Heritage allow to capture three-dimensional data, as support to documentation, for its valorisation and computerisation. The architectural survey hence becomes an essential resource for conservation as it enables the inspection of morphological and geometrical properties in virtual environment.

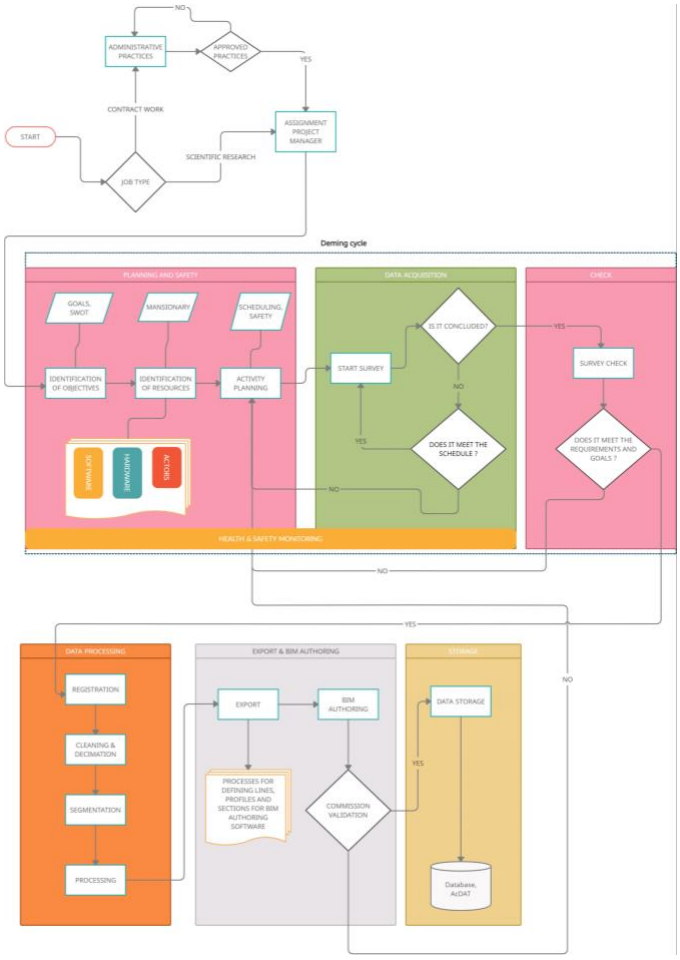


Fig. 1: Operational workflow

The project adopted a data acquisition-and-processing procedure-based approach that combined *range-based* (terrestrial laser scanner) and *image-based* (aerial photogrammetry) scanning techniques, in ensuring an integrated and complete survey of the building, to be displayed as a point cloud, thus being useful for subsequent reconstruction in BIM environment.
The section focusing on the instrumental survey is part of a methodological development based on international procedures for the digital documentation of Cultural Heritage [12]–[14], and defined by means of an operational workflow (Fig. 1) implying the sequential progress of various application levels *(Planning; Health and Safety; Data acquisition; Data processing; Export and BIM Authoring)*, as described hereafter.

2.1 Planning

The first step defines the requirements and criteria of the project to ensure an effective planning of activities.
In particular, it provides for onsite inspections, with a parallel definition of the in-depth information level and data morphometric accuracy, following quality indicators such as: the *LOC (Level of Completeness)*, i.e. the minimum quantity of surface detected [15]; the *LOA (Level of Accuracy),* i.e. the position measurement tolerance (given in mm) of each individual point of the cloud; the *LOD (Level of Detail or Density)*, i.e. the minimum size (given in mm^2) of the object that can be extracted from the point clouds, that is the point cloud density [16].
In addition, the architectural-constructive characteristics of the building, the morphology of the site, the expected weather conditions, further restrictions on the airspace occupation, possible occlusions and physical obstacles (power line cables and pylons), and areas of reduced visibility and accessibility shall be assessed. The digital format in which the survey is to be used and shared is furthermore selected, as per graphic needs, besides arranging the acquisition of archival and bibliographic documentation about the building and its time-evolution.
With reference to the case study – the area of which extends for about 34x36 m^2 – the minimum number and the position of the shooting points, in relation to the objects geometry (concave/convex, closed/open), were provided for the range-based survey performed with the CAM2® FARO Focus 3D 120 laser scanner, in connection with the vertical and horizontal angles (300°/360°) of the instrument operational coverage, as well as the core criteria about reducing shaded areas and the acquisition angle. One of the aims was therefore to obtain the completeness and homogeneous resolution of the scanned surface in line with the expected *LOC* and *LOA* values (Fig. 2).

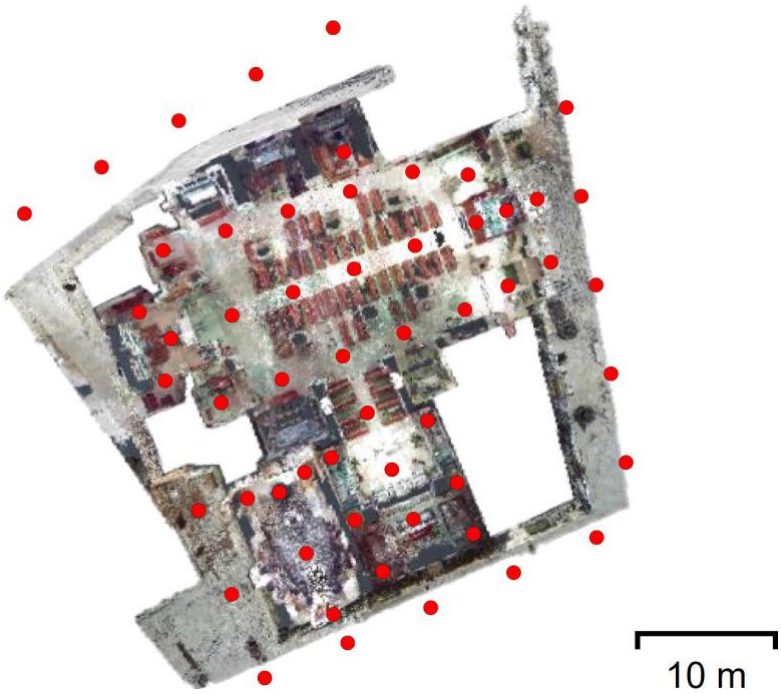


Fig. 2: Laser-scanning survey planning

As for the data acquisition operational phases, the planning of the aerophotogrammetric survey campaign preferred the central hours of cloudy days, so as to avoid the contrast between light and shadows and obtain an even illumination of the surfaces.

For the most accurate three-dimensional reconstruction during data processing, a series of manual flight missions (Fig. 3) were executed, in double grid and circular type, at different heights with frontal (0°), oblique (45°) and nadiral (90°) shots.
In terms of *LOC*, a front and side overlap of 60/80% between contiguous frames was ensured, with a *GSD (Ground Sample Distance)* value of approximately 6 mm/pix, and a total of 197 shots in JPEG format. For ease of alignment and correct scaling of the survey, the use of *GCPs* (*Ground Control Points)* targets, printed on solid panels sized 80x80 cm, was therefore adopted.

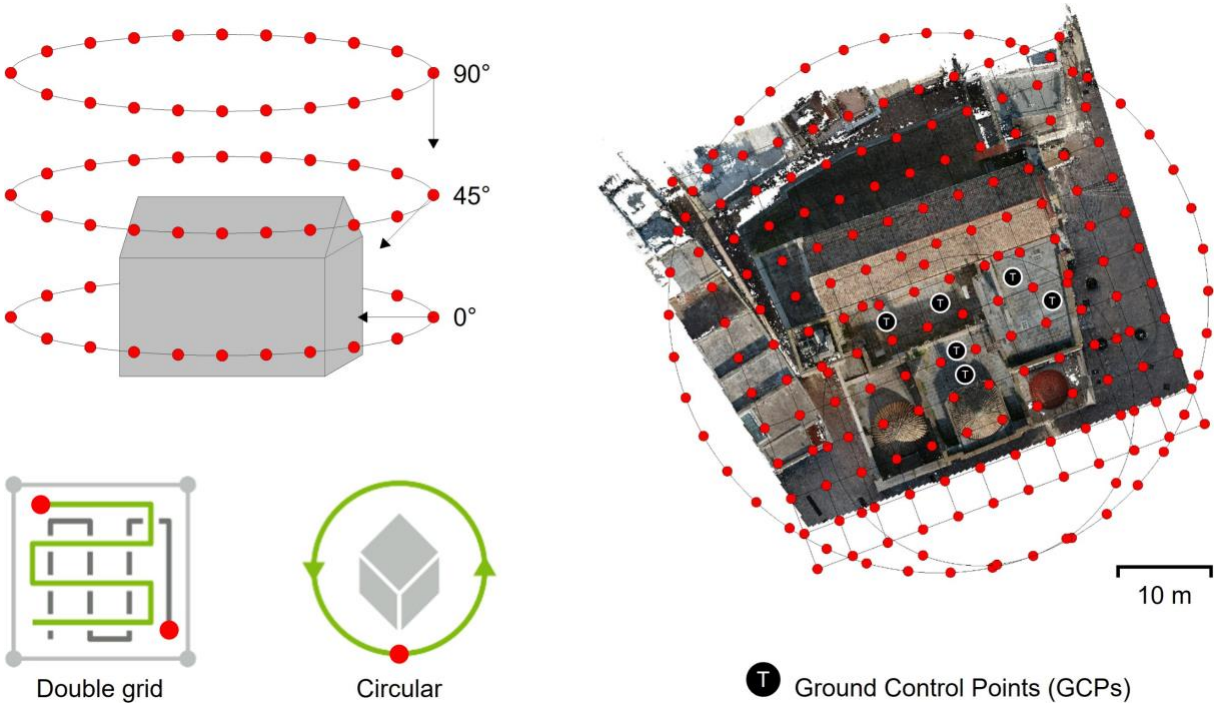


Fig. 3: Aerophotogrammetric survey planning

2.2 Health and Safety

National technical regulations on safety (D.Lgs. 81/2008 Testo Unico sulla Salute e Sicurezza sul Lavoro, DPR 380/2001) were taken into account, in order to form and inform those involved in the survey and to define the procedures leading to the adoption of specific safety measures for site activities, thus checking viability and safety certificates to access the survey area.
Moreover, a preliminary inspection was also carried out to examine the environmental conditions, whether there were any critical issues and interferences with urban mobility – for both pedestrians and vehicles – and the presence of construction sites or other activities in the workplace. Risk Analysis and Assessment Procedures were followed in the days leading up to the use of UAVs, including through consultation of thematic maps (Fig. 4) and the search for any *NOtice To AirMen (NOTAM)* communications.

2.3 Data acquisition

At this step, active and passive scanning methods are used, as well as support actions concerning the technological equipment (e.g., photographic survey, in situ annotations, targets and light sources arrangement).
It was hence possible to obtain 19 outdoor scans with a dimensional resolution of 28.2 Mpts (Megapoints per scan) and an acquisition resolution of 7.670 mm/10 m (i. e., the distance between points in a 10 m range), in addition to 36 indoor scans with a dimensional resolution of 11 Mpts and an acquisition resolution of 12.272 mm/10 m.
The scans position – as identified in the first planning phase – was either extended or adjusted: it can be seen that the presence of unforeseen elements has been significantly reduced (e.g., chairs, benches, curtains, panels, chandeliers) to ensure a better coverage of the main architectural elements. The exposure metering mode has been set to match the ambient light pattern. Notably, on the inside

and nearby the openings, a Horizon Weighted Metering was defined, whereas an Even Weighted one was performed on the outside.
Any changes in configuration (e.g., brightness variations, the opening or closing of doors and windows, transit of persons) during the survey operations were recorded, so that they could be easily identified and corrected in the succeeding data processing operation.
As a solution to a specific critical issue found when merging the scans of the nave and those of the wooden choir – reachable via a double-winder, U-shaped staircase – it was decided to evenly dispose different scans by placing the equipment with varying heights; the aim was to ensure a better scans surface coverage (Fig. 5).

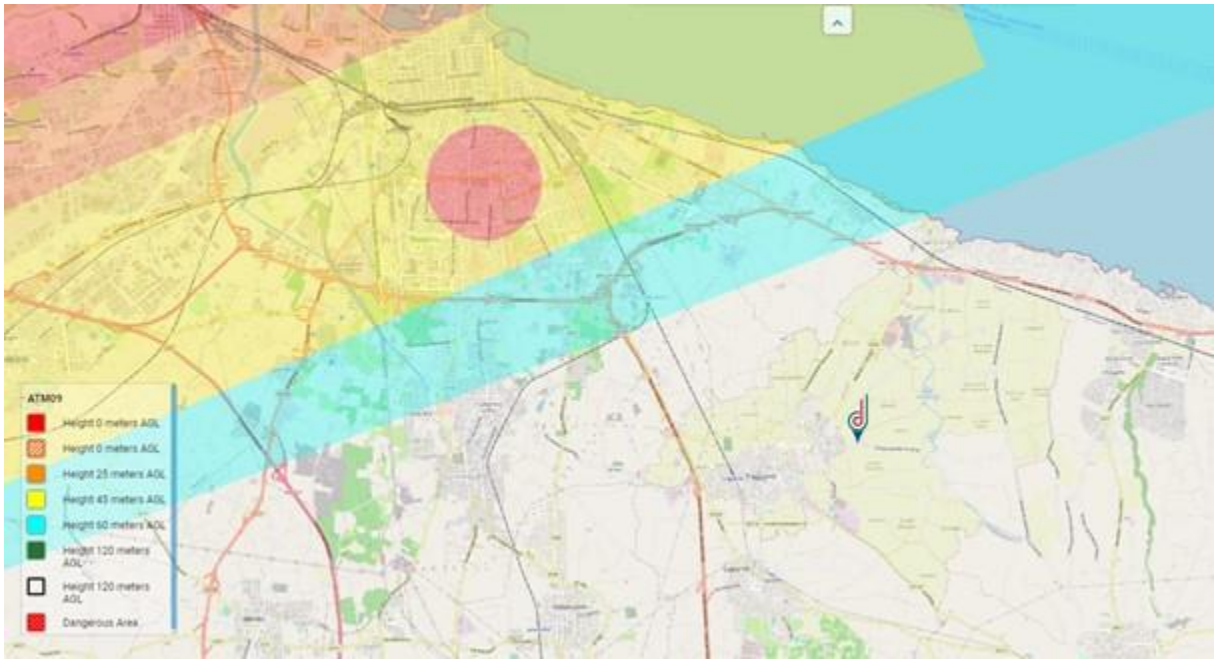


Fig. 4: Thematic map on airspace limitation



Fig. 5: Laser scanner stationing at different instrumental heights

2.4 Data processing

The LiDAR and photogrammetric data were aligned in the following softwares: Autodesk Recap and CloudCompare for the laser scanning (Fig. 6), and Agisoft Metashape for the outside photogrammetric survey; its point cloud was later scaled using the roof targets as a reference, by entering distances with a measuring tape (Fig. 7).

It was decided not to use GNSS technology, thus adopting a local reference system with the origin placed on the entry threshold of the church.



Fig. 6: Range-based point cloud: internal view

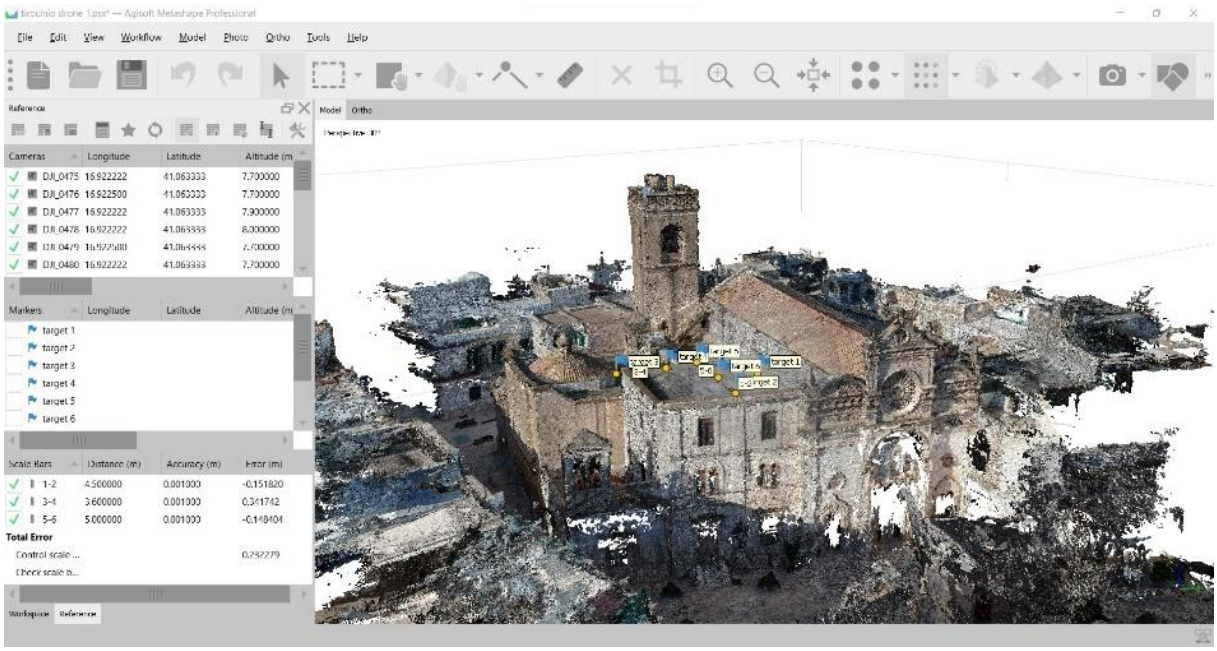


Fig. 7: Image-based point cloud reconstruction and target scaling



Fig. 8: Integrated point cloud: external view

The integration of the point clouds thus obtained (Fig. 8) was accomplished by selecting homologous points on the main façade of the church – those last ones being visible in both point clouds: a process of fine registration achieved through the ICP (Iterative Closest Point) algorithm, whereby distances between clouds of different origins were minimised.

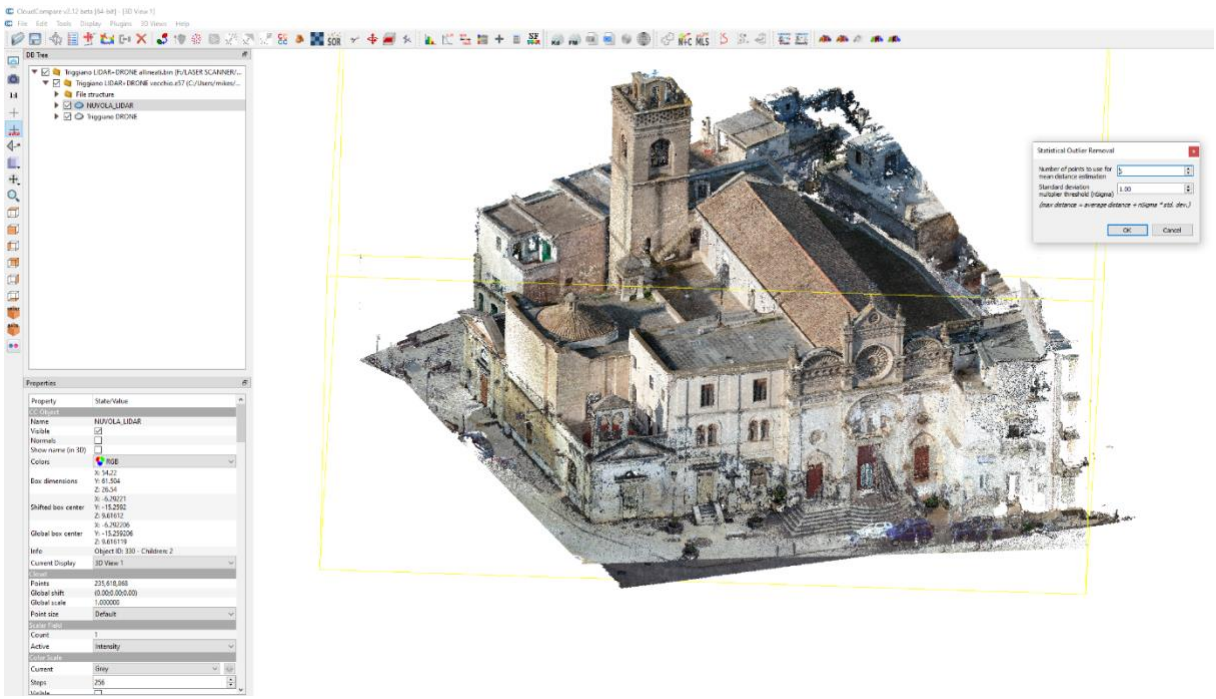


Fig. 9: Integrated point cloud decimation process

Having regard to the expected geometric requirements and once the processing phase was completed, the work was further post-processed by applying 5 mm decimation algorithms.
With a view to better optimise the point cloud, overlaps and interferences were then deleted and an additional decimation was carried out on a statistical basis, thanks to the SOR (Statistical Outlier Removal) algorithm, which detects and removes any isolated points, thus obtaining an even cloud both in geometric and spatial terms (Fig. 9).

2.5 Export and BIM Authoring

The processed data optimization (e.g., decimation, filtering) is related to the render settings (e.g., graphic and colours settings) and the files format selection (.RCP, .RVT, .FBX, OBJ, JPEG).
As part of a Scan to BIM process, when developing three-dimensional models, it is possible to extract geometric profiles in which generatrices and directrices – that can be used for the authoring phases – are identified. These operations shall take into account the graphic purposes (e.g., planimetric and three-dimensional needs, scale of representation) and the software used.

3. Conclusions

Executing an integrated digital survey has its own challenges, criteria and criticalities – which may vary due to metric/graphic needs and environmental features.
The work has led to appropriate operating procedures, following a standards-based approach in which quality and safety parameters have been applied along with the survey metrical and information requirements. In this way, an alignment of configuration stats, in harmony with the use of the developed project, was hence ensured. Behind all of it, a co-ordinated approach involves different technologies and expertise, with a view to optimising the methods and timing of the various operational processes, without recording or using superfluous information that may cause delays in the execution of the work, on site and while processing. It follows that giving importance to the information exigencies planning – for a more complete definition of the architectural survey and its graphic rendering – appears crucial and turns to be a key factor in making appropriate methodological choices.

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Preservation and enhancement of masonry arch bridges: restoration strategies

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Abstract
In the last decades masonry constructions have received great attention from many researchers both from a theoretical and a practical point of view. This owing to the complex behaviour of the masonry material and the structural modelling problem of real constructions.
Furthermore, this type of construction represents most historical and monumental constructions in the world, in terms of historical buildings, masonry arch bridges and monuments.
The Romans were the first to realize arch bridge constructions, and since then, and up to the nineteenth century, many masonry arch bridges were built to aid the development of transport infrastructure in Europe, where many thousands of masonry arch bridges remain.
However, these constructions are deteriorating over time after being subjected to a prolonged exposure to unfavourable environmental conditions, and extreme natural events. It therefore becomes important to plan their strengthening to preserve these cultural heritages.
To define reliable methods for the assessment and restoration of existing masonry structures it is important to develop advanced approaches other than those related to design codes, which require a deep understanding of the structural behaviour of masonry constructions. Furthermore, the main objective of the restoration process should be to keep the intervention work to a minimum.
On the basis and in the spirit of the above, the main frequent structural problems of historical masonry arch bridges are discussed. In addition, a review of the structural restoration is provided along with several application examples.

Keywords: masonry arch, modelling, experimentation, restoration

1. Introduction
Masonry buildings have long been the subject of great attention by many researchers, with the main objective of being able to define the structural model capable of capturing the behaviour of real buildings. Therefore, they are the subject of numerous investigations concerning both theoretical, practical, or experimental aspects [1, 2, 3, 4, 5]. In the literature it is possible to find many works relating to the determination of the complex mechanical response of such solids made of masonry, in which the constitutive bond is fundamentally characterized by the hypothesis of no-tension strength [6, 7]. Most masonry buildings fall into this area, such as historic buildings, monumental buildings, masonry bridges, where the masonry arch is of particular importance. Furthermore, it should be remembered that, not only in the national context, masonry arch bridges represent a significant part of the infrastructures that make up the road and railway network.
Arch bridges in masonry have undergone various damage or deterioration over time. This is due to their prolonged exposure to atmospheric agents and to the greater complexity of the static and dynamic loads applied. Therefore, it is necessary to identify methods of analysis and intervention for their strengthening, to preserve this important cultural heritage. To this end, it is of fundamental

importance to understand the structural response of historical masonry buildings, to be able to intervene appropriately.
The masonry elements are characterized by a high compressive strength and a low-tension strength, which is negligible. Therefore, the stresses produced by bending must be extremely limited or contained. This happens in arched or vaulted structures, which are therefore used to overcome large spans, such as roofing systems, arched bridges, etc., in which there is a state of stress characterized by compression.
To improve its structural performance, understanding the static behaviour of the masonry arch therefore represents a fundamental study, preliminary to the more complex analyses that then allow you to plan any restoration work.
Heyman made one of the most important contributions to the study of masonry arch structures [8, 9]. This was made possible through three fundamental and simplifying hypotheses: infinite compressive strength of the masonry, zero tensile strength, impossibility of sliding between the segments (block behaviour of the masonry). In particular: the structure is stable under a certain load if and only if it is possible to find a funicular of loads entirely contained in the geometry of the structure.
To improve the resistance capacity of masonry structures, reinforcement with composite material represents a suitable solution for the purpose. Such interventions make it possible to improve the ability to withstand the increase in loads resulting from current regulations, as well as to improve their anti-seismic behaviour.
To identify suitable interventions or appropriate design strategies, it is first necessary to define adequate and reliable assessment procedures capable of identifying the criticalities of the masonry arch [10, 11], including their seismic vulnerability [12].
In the preliminary study phase, it is also necessary to evaluate the structural conditions of the existing bridge. This requires a complex analysis, for which it is necessary, first, historical research to identify the physical and geometric characteristics of the bridge, as well as the construction procedure, and then a campaign of experimental investigations to be conducted both in situ and in the laboratory, associated with appropriate monitoring over time. In this way it will be possible to define both the characteristics of the materials and of some structural elements and thus capture the relevant aspects of the real response. These steps provide solid foundations for the choice of what may be the most appropriate type of restoration intervention and to make the choice of suitable materials [13].
As stated, the use of composite materials, in the reinforcement of the masonry arches, also goes in the direction of the architectural conservation of the historical and cultural heritage. In this context, a notable contribution to the study of the consolidation of masonry arches has been offered by various researchers [14, 15]. Furthermore, a large experimental campaign was developed analysing the structural behaviour of masonry vaults reinforced with diverse types of composite material [16, 17].
Numerous numerical analysis have recently been performed to define the model capable of representing the actual structural behaviour. The aim of these research is to establish numerical structural models, useful for examining the mechanical response of masonry structures, also with a view to defining suitable reinforcement systems. Some works are based on finite and discrete element methods [18, 19, 20, 21] and on limit analysis [22].
The performance of existing masonry arch bridges is often inadequate: in fact, many of them were designed for performance levels that have become progressively insufficient by increasingly demanding traffic conditions and structural safety requirements. Ever-greater numbers of vehicles, heavier weight/axle loads, higher traffic volumes, dynamical amplification effects vehicles are all reflected in damaging effects on such old constructions.
In Italy, masonry arched structures are common in the existing in-service bridges. For instance, Fig. 1 shows some bridges of the “Ferrovie della Calabria” rail line, located in southern Italy.
Most of existing masonry arch bridges date back to the period 1850–1930, and in many cases under designed for actual service conditions, not only require upgrading to improve user safety, but also require provisions to counteract deterioration and damage propagation effects owing to environmental interactions.
To define appropriate procedures for assessing and restoring existing historical masonry structures is important to follow modern approaches based on both theoretical and practical deep knowledge old masonry structures, which go beyond the normal design rules.
Therefore, it is necessary to define appropriate and reliable evaluation procedures useful to identify and analyse the relevant causes of damaging and weakness of masonry ach bridge typologies.
To this end, the evaluation of the state of health of existing bridges requires a complex process, in which it is necessary to conduct a preliminary cognitive action through archival research and in situ and laboratory tests for the characterisation of material properties, and more advanced investigations such as structural monitoring and dynamic identification.
Moreover, in order to define restoring interventions, it should be considered the actual state of maintenance of the structure and the interference of intervention works with the normal use conditions.



Fig. 1: Existing in-service bridges. “Ferrovie della Calabria” railway – Calabria (southern Italy).

In addition, requirements of durability and compatibility of materials and intervention typologies should be satisfied.
In this paper a theoretical and experimental study on a masonry arch is preliminarily illustrated. The experimental analysis refers to a progressively increasing application of loads up to a state of deformation corresponding to the incipient collapse of the unreinforced arch. Starting from this condition, the arch is then reinforced by applying composite material, thus evaluating the effects of the intervention of this reinforcement. The survey is accompanied by a similar numerical analysis using a three-dimensional finite element model.
The concordant results obtained allow us to draw useful information and conclusions on the structural behaviour of masonry arches reinforced with CFRP.
Then, a description of the main degradation and damaging factors is given, together with typical design and contraction defects affecting masonry arch bridges.
Typical restoring techniques compatible with the principles of intervention in structures with heritage value are discussed, giving an overview of some practical examples.

2. Some basic aspects of the masonry arch

Let us consider the masonry arch represented in Fig. 2a, where the masonry elements can be made up of stone elements or other types, such as those in solid clay brick.
To grasp the key features of the structural behaviour of the arch we examine the scheme represented in Fig. 2b, where the arch is acted upon its own weight and an additional point load F. For small values of the load F, the thrust line will safely lie within the masonry arch. As the load F is increases, this thrust line will move further and further away from the midline of the arch, until at a certain value of F it can only be contained just inside the masonry.
A way to overcome these collapse mechanisms can be represented by a suitable reinforcement by means of a tensile resistant material, such as advanced composite material.

The kinematics and the trajectories of the thrust line of the arch change if a composite material is applied on the intrados or extrados (Fig. 3). In fact, the added composite material is able to prevent the opening of the hinges, where the tensile strength of the composite material itself is mobilised. The presence of composite material reinforcement sheets also determines a change of the collapse kinematics with respect to that occurring in the case of not strengthened arches, where a hinging mechanism is found. Specifically, in the case of reinforced arches the collapse mechanism is associated with the damage of the masonry components, the composite material or both the masonry and composite elements, like masonry and/or composite failure or composite delamination.
At first some results concerning an experimental investigation are given by referring to the scheme represented in Fig. 4 where the arch masonry elements are made up of solid clay bricks.
The arch was made of solid brick masonry and cement mortar in the laboratory on a reinforced concrete.
The mechanical properties of the materials constituting the masonry were obtained by experimental tests are shown in Tab. 1, where ν is the Poisson’s ratio, E_c is the Young’s modulus and σ_c is the ultimate compressive strength.

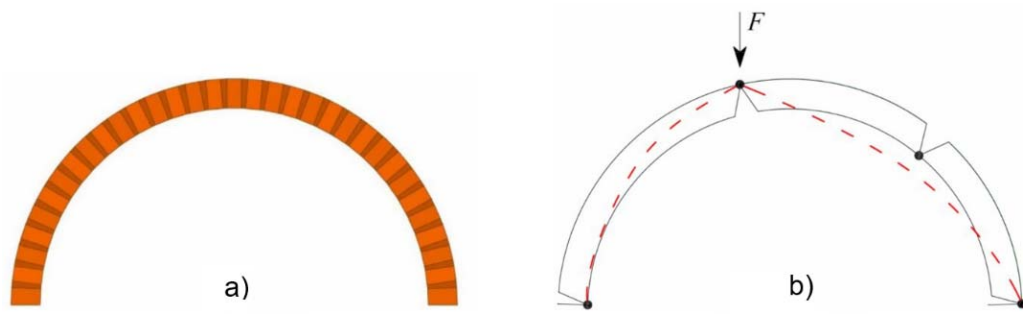


Fig. 2: a) The masonry arch scheme; b) Collapse mechanism of the masonry arch.

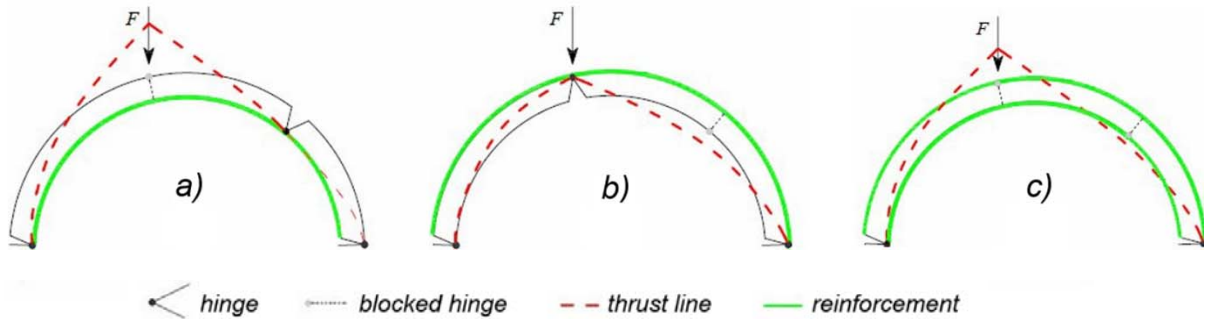


Fig. 3: Thrust line of the reinforced masonry arch subject to its own weight and to an additional point load: a) reinforcement placed on the intrados; b) reinforcement placed on the extrados; c) reinforcement placed both on the intrados and on the extrados.

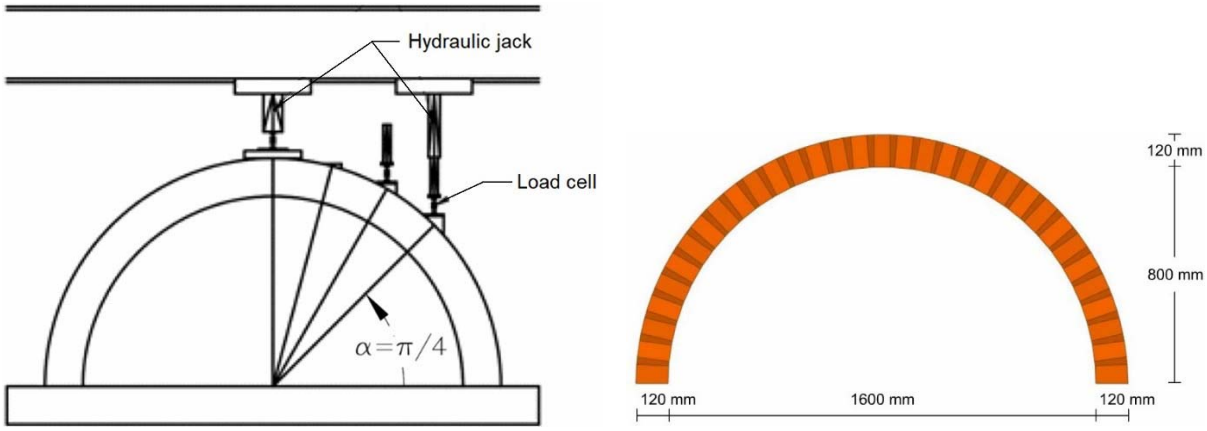


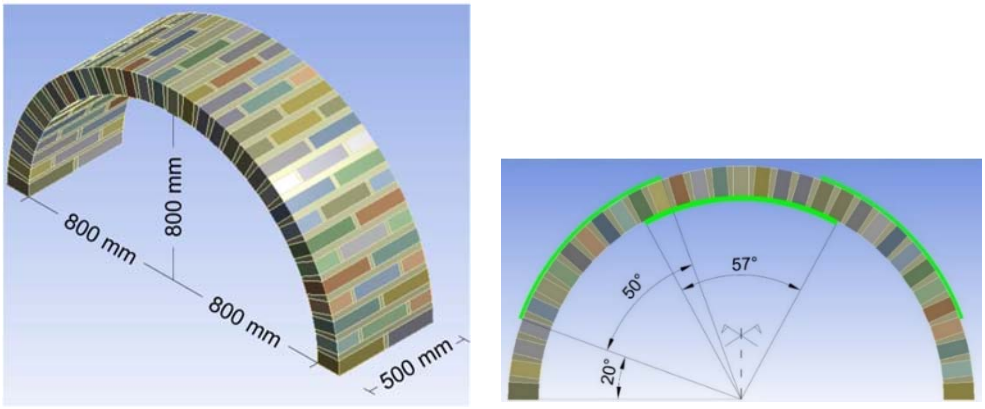
Fig. 4: Semi-circular experimental arch model.

Tab. 1: Mechanical properties of masonry materials

Material	σ_c [Mpa]	E_c [Mpa]	ν
Mortar	10	14,278	0.108
Brick	17	5,921	0.108

The experimental tests were conducted in the Large Models Laboratory of the Department of Civil Engineering of the University of Calabria using a contrasting steel frame. The loads were imposed by means of hydraulic jacks placed in the key section ($\alpha=\pi/2$) and on the kidney section ($\alpha=\pi/4$).

An experimental program was investigated, divided into two phases: in the first one, the arch model was subjected to loading on sections $\alpha=\pi/2$ and $\alpha=\pi/4$, with load increments of 200 N up to a value of 2000 N; in the second phase, in order to verify the bearing capacity of the vault model, the section was loaded in key up to cracking at the maximum load value of 5000 N.



a) b)

Fig. 5: The arch model: a) Unreinforced arch; b) Reinforced arch

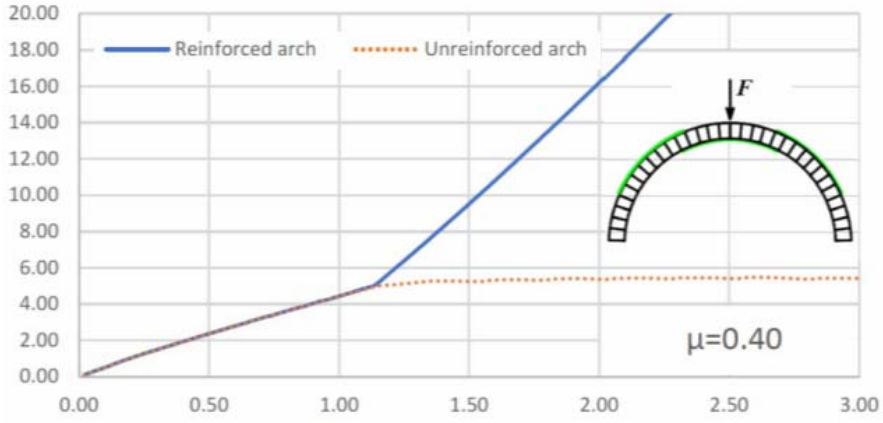


Fig. 6: Force-displacement diagram of the key section.

Subsequently, the arch samples were restored by applying strips of CFRP (tensile strength > 2400 MPa and elastic modulus equal to 150000 MPa) to both the extrados and intrados, repeating the two test phases in the same way to analyse the behaviour of the reinforced structure compared to the non-reinforced one.

A FEM numerical investigation was also developed by means of the Ansys software. In particular, for the arch studied here, brick and mortar were modelled as elastic materials and the interface between brick and mortar was modelled by introducing the contact elements provided in Ansys, named frictional. Specifically, it is assumed that the contact between these two parts is a nonlinear unilateral frictional contact, in the sense that the contact surfaces can freely separate in orthogonal direction and present a sliding resistance.

The geometry of the FEM model is based upon that defined above. The arch is then defined through a 3D modelling as shown in Fig. 5, where the brick unit and mortar were modelled using the Ansys higher order solid elements.

The unreinforced model is firstly analysed, followed by the reinforced one, where the geometrical and mechanical properties of the laboratory tests are employed. Moreover, as far as the internal friction parameter μ is concerned, the realistic mean value μ = 0.40 was used in numerical applications.

Numerical analysis was performed by assuming that the arch model is subjected to its own weight and the following additional point load: point load F at the key or at the kidneys ($\alpha=\pi/4$). Here some results are reported for the case of load at the key.

Numerical results show that the unreinforced arch model from exhibit a good agreement with experimental ones; in particular, it was found the concordant value Fmax = 5.2 kN of the maximum carrying load both for the experimental model and the numerical one. In addition, the displacement at the key section of the numerical model is v = 1.0 mm, which agrees with the experimental one: v = 0.92 mm.

Now, some results are given for the reinforced arch. With reference to the point load F acting at the key of the arch, Fig. 6 shows the force-displacement diagram, from which one can observe both the stiffness and the strength increasing capacity following the application of the CFRP reinforcement. As previously found, the maximum load carrying capacity of the unreinforced arch is represented by the maximum load value F = 5.2 kN. The reinforcement was applied to the deformed arch at the cracking deformation state corresponding to that just before the incipient collapse of the arch, at the load value F = 5.2 kN. At the load level F = 16 kN, the corresponding displacement of the key section is v = 2.0 mm, comparable with the experimental one of v = 1.9 mm.

3. Restoration of masonry arch bridges

As before mentioned, most of existing masonry arch bridges date back to the period 1850–1930. Therefore, they can be considered as part of the historical heritage. Due to their long in-service life, the effects of the environmental interactions led to inevitable deteriorating and damage of the construction.

As a consequence of the foregoing, the restoration techniques, used in the past for the monumental constructions of the historical heritage, can also be successfully applied for masonry arch bridge structures.

So, the intervention philosophy and strategy led to novel design concepts in practical applications, the aim being to minimise intervention works as much as possible.

The basic aspects are related to assessment of mechanical properties, safety evaluations and evaluation of structural performance.

Heyman in his basic research discussed about stability of the masonry arch bridges, showing that this type of construction is usually quite robust and that his failure is not related to the state of stress under its own weight but to asymmetric vertical loads or horizontal loads which can lead to asymmetric hinged collapse mechanisms [23, 24]. Substantially, the arch failure is related to the rigid limit equilibrium and mainly depends on the geometric characteristics of the structural system [25, 26, 27], as shown in Fig. 7, where the case of single span bridge is firstly examined illustrating both the two collapse modalities of the structure, i.e., local (arch collapse) and global collapse (arch and pier/abutment collapse) mechanisms, as depending on the ratio between the height and the thickness of the piers/abutments. Then, the case of global collapse modality for a multi-span bridge is reported.

Restoration techniques should therefore be able to counteract the above possible hinged collapse mechanisms which can occur as consequence of asymmetric live forces owing to traffic loads and horizontal forces (seismic actions). This can be achieved , for example, by adding composite material reinforcement sheets to the intrados and/or extrados of the arches (Fig. 3).

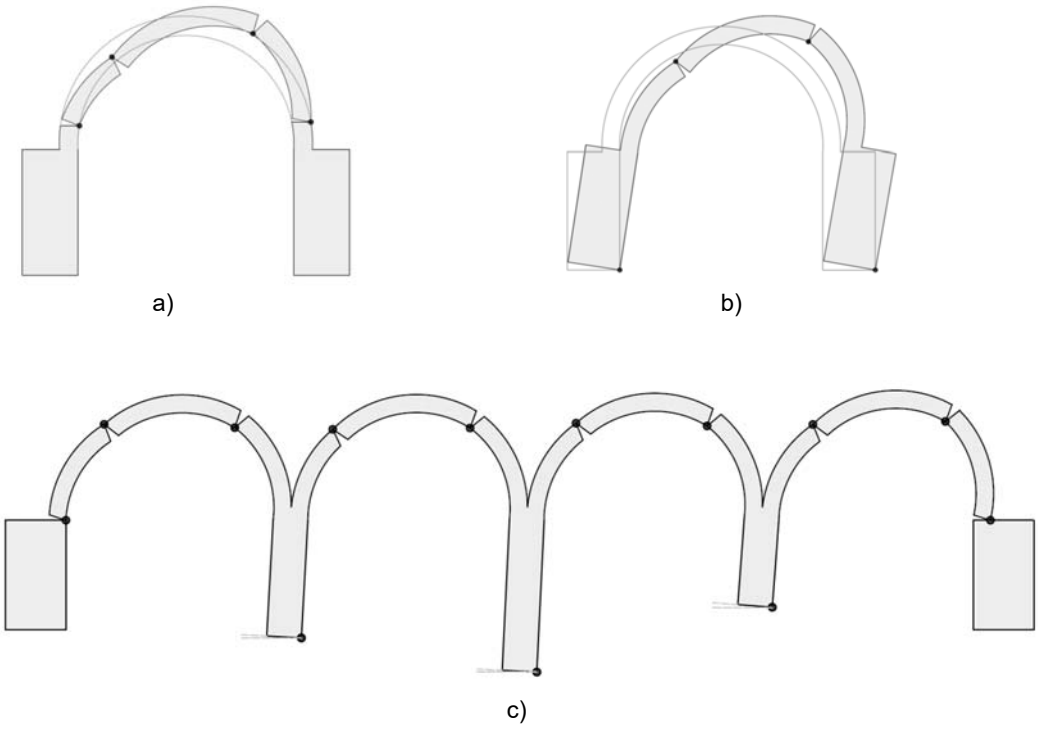


Fig. 7: *Asymmetric collapse mechanisms for masonry arch bridges*: (a) Single-span local mechanism; (b) Single-span global mechanism; (c) multi-span global mechanism.

In general, restoration may involve traditional or innovative techniques, according to material (solid bricks, stone blocks, etc) and geometrical characteristics of the bridge (shape of the arches, stiffness of the abutments and piers, etc.). Compatible materials should be use also and respect the dominant structural role of the existing masonry arch, making it a key part of the new restored structure.
The main typical weaknesses in masonry arch bridges concern damage both to foundations and to the upper structure. Defects in foundations refer to local undermining, differential displacements between base foundation of piers or abutments; material damage owing to loss of masonry elements.
The major defects of the upper structure can be easily detected by a simple visual inspection. The most recurrent defects in this type of historical constructions, are (Fig. 8) : deterioration of materials, such as degradation and loss of bricks, stone blocks, and mortar joints; fractures in piers and abutments; salt efflorescence in bricks; penetrating vegetation, etc.
The intervention techniques in the restoration of masonry arches consist in two approach methods. The first one is given by the strengthening of the original structure, by improving material properties, thickening the old structure with the same materials, etc; introduction of new additional resistant systems increasing the strength of original structure.
The most common techniques used for strengthening consist in thickening of the old masonry arch with new layers of bricks and application of FRP strips at the extrados of the vault [28, 29] (Fig. 9); masonry restoration, such as grout injections, repointing of brick joints, crack stitching and patch repairs by manual methods; construction of internal brick spandrel walls connected to the extrados of the arch, which contribute to avoid asymmetric deformation of the arch.



Fig. 8: Typical defects of masonry arch bridges: (a, b) loss of bricks, (c, d) salt efflorescence in bricks, (e) opening of arch joints, (f) penetration by vegetation.

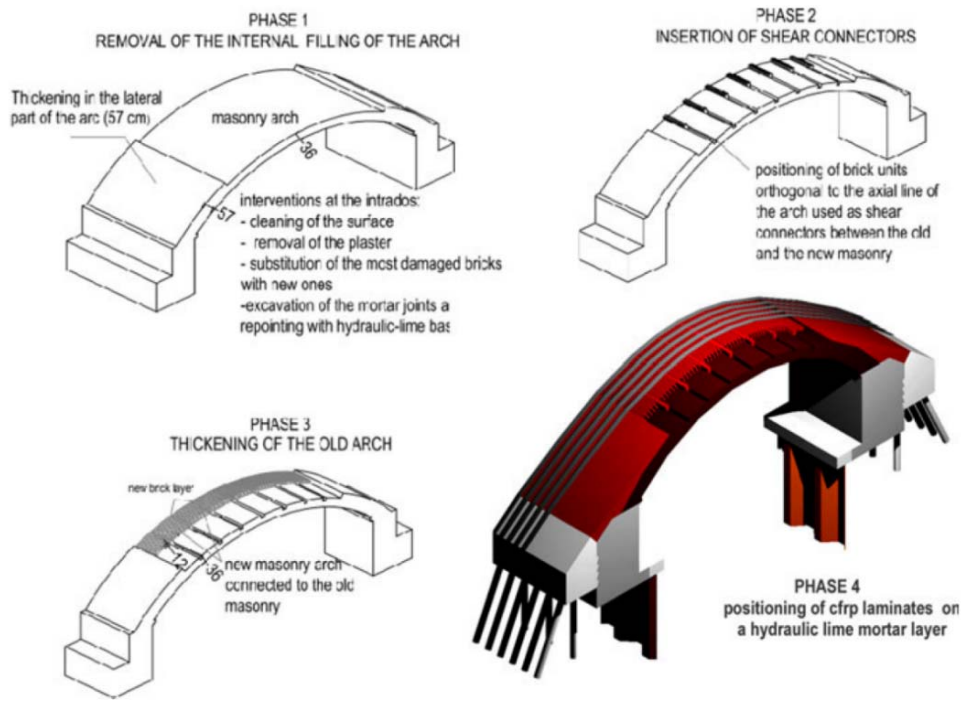


Fig. 9: Thickening of old masonry arch with new layer of bricks and application of FRP strips at extrados of barrel vault. *Sandro Gallo Bridge* (Modena *et al.*, 2015).

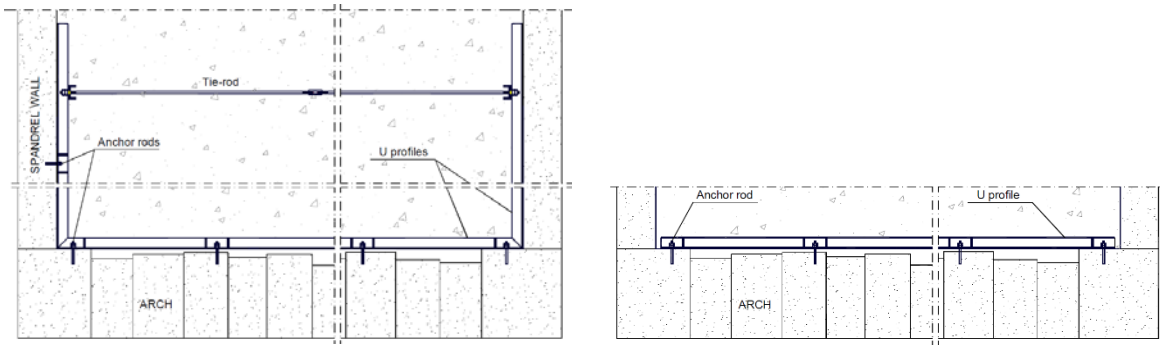


Fig. 10: Strengthening of the arch with U profiles: (a) current section ; (b) close to the crown section (Oliveira & Lourenco, 2004).

A further significant question concerns the improvement of the stability of the lateral spandrel walls. In fact, these structural elements present high sensitivity and weakness to out-of-plane actions. A significant increase in resistance can be obtained by the insertion of transversal stainless steel ties, which prevent them from overturning as suggested by Oliveira & Lourenco [30], who applied this technique in the restoration of the Donim bridge, where stainless steel U profiles to the extrados of the arch and to both spandrel walls, by means of anchor rods, as illustrated in Fig. 10; more precisely, a pretensioned stainless steel tie rod, placed at the top of the vertical profiles binds the spandrel walls together and reduces significantly their overturning sensitivity.

4. Conclusions

Masonry arch bridges represent an important part of the cultural Heritage in several countries of Europe and, in particular, in Italy. Furthermore, most of these old structures are still in service on both road and rail bridges. Nevertheless, they are affected by degradation, poor maintenance, and general deficiencies. Substantial restoration work is therefore becoming increasingly necessary for these structures. So, a deep understanding of the structural behaviour of these type of structures is necessary for subsequent assessing, repair, and retrofitting.

In this paper, are firstly presented some numerical and experimental results examining the improvement of the structural performance of the arch by using the wide reinforcement technique of advanced composite material. Then, the main recurring and wide degradation processes and defects affecting these old structures are illustrated with reference to the most common types of masonry arch bridges.
Restoration of original structures is discussed, and reinforcement techniques are illustrated, with reference to real cases available in literature.

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A new sustainable food delivery platform

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Abstract
In recent years, the food delivery business has expanded with great success and during the last months, pandemic have contributed to the growth of online food delivery.
Consequently, with this fast growth of the online food delivery commerce, it's important to analyze its environmental effects.
In fact, the downside is represented by the enormous volume of waste produced by this market, consisting of packaging mostly made with materials such as paper, cardboard, plastic, and aluminum; a problem which, in relation to the volume of orders and the limits of separate collection that is not always efficient, leads to a quantity of unmanaged waste.
This study aims to assess the impact of urban food delivery service packaging on the environment, taking the city of Palermo (Italy) as a place of investigation to promote the reasonable use of resources and confirm the ecological transition in the field of food delivery. The goal of this article is to create a service to be included in a new online food delivery platform that reduces the environmental impact and therefore differentiates it from other platforms on the market.
Therefore, with the strategic design approach, we will try to sensitize the players in the food delivery chain to the use of a separate collection system that will improve the disposal of food delivery waste and will lead us towards a circular economy.

Keywords: Online Food Delivery, packaging, environmental impacts

1. Introduction

Food delivery is one of the most sheering themes today, especially after the pandemic arrival, as it has been considered as one of the few possibilities for the food services to survive.
Food Delivery is a service that offers home delivery, using online platforms. In fact, this has had an increase in recent years, thanks also to the improvement of the Internet network, which has allowed the service to spread globally. An online food delivery platform is a mobile or desktop application that connects restaurants with final clienteles, working as an intermediate by taking the orders from customers and then delivering the goods to requested destinations, or by taking orders for restaurants that will take care of the delivery later. Every food delivery app also works as a marketplace, where final consumers can discover new restaurants based on their location and food preferences. The main strength food delivery from take-away service is that with food delivery a business can reach customers who are not willing to move too far from their houses to pick the food up. In this way, food delivery can represent a way to increase the customer base and thus business volumes for restaurants.
The idea of food delivery began around the 40s of the twentieth century, thanks to the British and for reasons of necessity. In the United Kingdom, the Women's Voluntary Service was born, an organization made up of women whose purpose was to help people in need in England, Ireland, Wales and Scotland. The women of this organization prepared and delivered food to families in need. The food was delivered by a means called "stop me". It initially consisted of a cart containing tea and cakes pulled by a woman on a bicycle. The cart was then pulled by a car. [1]
After the Second World War, the home delivery service for food continued its development. From Great Britain, food delivery arrived in the United States where it began to spread reaching its present form. In those years the delivery mainly concerned pizza, which was in great expansion.

The phenomenon has grown over time, especially in the US, and as already mentioned, the arrival of the Internet has changed its characteristics and growth. To differentiate itself from traditional food delivery based on in-person or telephone agreements, it has been given the name of Food Delivery Online (FDO).
Thus, the demand for food delivery had changed its structure, it was no longer a question of necessity, but a question imposed by reasons of comfort and by the lifestyle that was emerging. The exponential growth of the internet has affected retail. In 1994 Pizza Hut opened a website and placed the first online order. Subsequently, most of the pizza chains had created their own mobile application. At the same time, various platforms arose for ordering food over the Internet. These platforms made the service quicker and more available, in chronological order the foundation of the most important food delivery companies, the first being Just Eat in 2000 and Grubhub in 2004; followed by Delivery Hero, Caviar and Takeaway.com in the two-year period 2011/2012. In 2013 Deliveroo and Door Dash, while in 2015 it was the turn of Uber Eats and Glovo [2].
So, the companies started their process of international expansion, and the experience was also consolidated in the East. This has led to a different offer of home deliveries: pizza, restaurants, sushi, ethnic foods, etc. These food delivery companies originally operated as intermediaries, giving the client the occasion to select the restaurant and place the order, but food preparation and logistics were the restaurant's responsibility. After, the platforms started to activate the delivery autonomously. They not only allow you to decide the food you prefer among the different restaurants on the platform, but also take attention of the logistics. So, food delivery, as already mentioned, has changed its structure, which has imposed itself for reasons of convenience and for a new lifestyle. The improvement of the internet has influenced online retail and the expansion of e-commerce in general. The growth of online selling presents an infinite choice of products and services, such that the consumer can greatly benefit from product personalization and fast delivery. Therefore, online food delivery sees the coexistence of different causes that push the consumer to use it. Among them it is possible to identify those who do not have time to take a lunch break, because they are too busy working, through a mobile app on their smartphone they can order the food they want most and within a few minutes they will find it at home or in the office. This service can also be useful for those with mobility problems, such as the elderly and disabled, or due to adverse weather, the user can use this service. These are just a few examples that lead us to understand why the food delivery service is certainly a convenience [3].
Furthermore, the Covid-19 pandemic has made food delivery essential for restaurant activities in crisis due to lockdowns. These same trends have been observed in many countries. In recent years, according to the Just Eat survey. 96% of respondents say they order ready-made food to take a moment to relax and 62% say they "feel happy" when placing the order. For these reasons that enhance the value of online food as a carrier of positive emotions, experts predict a consolidation of this mode of consumption. This new food habit therefore opens new consumption scenarios and raises important issues concerning food and environmental safety. While there is a list of ingredients in retail products or supermarket ready meals, this information is completely lacking in ready-made products sold online. No less important is the increase in environmental pollution, due to the use of Online Food Delivery packaging. Starting from these considerations, this text begins by presenting an overview of the online food delivery sector to help understand the innovations made in the sector, continues with the environmental impact that food delivery generates and ends with the design idea of a system that improves the disposal of waste deriving from food delivery.

2. E-commerce Market and Online Food Delivery

The e-commerce market has conversant development over the past decade. This change has been driven by a series of diverse elements, that include: a growth in income, longer work and commuting times; improved internet penetration and better protection of electronic payments; an intensification in the number of stores having an online presence [4].
The development of e-commerce over the last few years has occurred in China and on its own, China signifies 54.7% of the global e-commerce market, a part near twice the market portion of five countries (US, UK, Japan, South Korea, Germany) united [5]. The E-commerce has produced a new form of commerce, such O2O (online to offline) [6]. It is a system based on information and communications technology (ICT) through customers place orders for goods or services online and obtain the goods or services at an offline outlet [7].
The expansions that have driving the O2O commerce have been the of smartphones and tablets and the structures to provision payment and delivery. O2O services have emerged in several fields, such as food, hotel rooms and car rentals [8]. Online food delivery refers to the process through food that was ordered online is cooked and carried to the customer. The expansion of online food delivery has been supported by the development of integrated online food delivery platforms, such as Uber eats, Deliveroo, ecc. online food delivery platforms attend a variety of purposes: a diversity of food choices, the taking of orders and the transmitting of these order to the food producer, the supervising of payment, the company of the delivery of the food and the providing of tracking facilities.

2.1Online Food Delivery

Food delivery suppliers can be considered as being either Restaurant-to-Consumer Delivery or Platform-to-Consumer Delivery. Restaurant-to-Consumer Delivery providers make the food and deliver it. The order can be made directly through the restaurant's online platform or via a third-party platform. These third-party platforms also provide online delivery services from partner restaurants which do not offer delivery services themselves, a process which is defined as Platform-to-Consumer Delivery.

Online food delivery necessitates proficient and real-time distribution services. Restaurants can use present staff, such as waiters or they may use specified teams who are working for this position. Restaurants can also employment crowdsourcing logistics, a network of distribution people (riders) who are autonomous workers, a model that offers an efficient, low-cost method to food delivery [9]. Online food delivery platforms can either engaging and preparation professional delivery people, or they may also choice to crowdsourcing logistics, using distribution people who are not working in the online food delivery platform. Qualified delivery people are usually educated, and at minimum part of their salary is assured, while a quota is commission based. the autonomous delivery people who are commonly known as "riders" are compensated on a commission basis.

2.2 Online Food Delivery and COVID-19

Official governments around the world implemented actions to contain the epidemic Covid-19 as social distancing and lockdowns of the population.

These isolation phases with people obliged to stay at home caused losses on the global economy. The major affected industries have been travel, automotive, entertainment, sport and stores of the fashion and food.

The new situations of life made customers change their habits. Commercial sectors that took advantage from these new circumstances were the ones tied with digital services because they represented the only way to communicate, work and buying products.

The multi-market research directed by GlobalWebIndex in April 2020 seems to confirm this line. From this study a detail stands out: at least an half of respondents of every country involved in the research exposed a growth in usage of their smartphone. The identical type of study by GlobalWebIndex demonstrates that a more intensive usage of smartphones does not come just from the younger generations (Generation Z), but also from Millennials, Generation X and Baby Boomers.

This augmented usage in digital technologies simplified the change to online purchases. GlobalWebIndex report attentions that food products were the ones with the percentage of people who augmented their online consumptions in every country included in the analysis except Germany [10]. This information demonstration a growing interest by customer to get food in this new situation and online food delivery prosperous starts.

2.3 Online Food Delivery before Covid-19 in italy

In Italy, the experience of food delivery has always been controlled but constantly growing in the last decade in the consumption. In fact, just think that in 2009 online food delivery characterized 1% of the total online acquisitions but, in 2016, a research by Osservatorio Nazionale and GfK Eurisko highlighted that 19% of Italians showed interest to purchase in online food delivery platforms by using apps or websites [11].

This predisposition to use online platforms to order delivery meals has been established through the years. In fact, annual report by FIPE (Federazione Italiana Pubblici Esercizi) pointed out that in 2018 the 30.2% of Italians an online food delivery service at least one time.

For the same report by FIPE, the choice of ordering through online delivery platforms it was a lack of motivation in eating out, a lack of food available at home and a lack of motivation and time available to cook food (Federazione Italiana Pubblici Esercizi, 2019) [12].

In the 2020 the food delivery has been added to the basket used for consumer prices developed by ISTAT (Istat, 2020) [13]. The Coldiretti at the beginning of 2020 underlined that in Italy, food delivery was a market that involved 18.9 million of Italians [14].

The motives why customer chose to use food delivery services were tiredness and lack of motivation in cooking and of to make a good impression towards friends with quality meals.

2.4 Online Food Delivery and Covid-19 in Italy and in Palermo

Move from offline to online consumption also hit the Italian market. Whit the Coronavirus outbreak, non-essential retail supplies were forced to close for various weeks, and it is in this situation that food delivery begun to attract a great interest on itself.

The Just Eat study describes the state-of-the-art of the Italian market in 2020, underlining the impacts that epidemic had on the sector One of the most attractive data of the study says that in 2020 digital

food delivery experiences represented almost 25% of the whole delivery sector, with growth if equaled to the preceding year when it represented the 18%.
A influence of Covid-19 on the Italian online food delivery market is showed by the following data obtained by the Just Eat observatory study: one third of clienteles questioned by Just Eat exposed that they had never ordered food delivery online before the quarantine at home among them, over 60% confirmed that they did not feel the need to order food delivery before; 44% of customers told that they started as it was not possible to pick food up from restaurants. This suggests that Covid-19 signified an occasion for food delivery acquisition market shares. Online food delivery growth contributed to promote another larger experience that began after the health crisis: digitalization of the Peninsula. Just Eat alone registered a growth of 30% of new associated restaurants. The same time to a major digitalization of restaurants and food commercial, online food delivery also sustained the use of digital systems of payment by final clienteles. In fact, even to prevent hygienic problems, Just Eat reported a growth of 36% in digital payments by clienteles while ordering food delivery, with a middling spending higher than in cash payments (Just Eat 2020 A).
Lockdowns that necessary people staying at home for several weeks signified a energy for online food delivery in Italy. The growing use of digital platforms donated to modification customer customs and, purchasing behavior, pushing the digitalization process of the country by development the acceptance of apps and digital payment systems [15].
Among the cities in the south, Palermo recorded significant growth in the last year with + 56% of restaurants active on Just Eat. The data are presented by Just Eat, in the context of the fifth "National Observatory on the online home delivery food market". Palermo is one of the most active cities in comes. Food Delivery arrives in Palermo with Just Eat which dominates unchallenged for years. Palermo has proven to be a city where this market has room for growth. In fact, in 2013 this growth accelerated thanks to the launch of Socialfood, a company of Palermo origins, which in 2022 was purchased by Glovo.
Over the years, platforms present in the rest of Italy will arrive in the city. In 2015 Prestofood arrives, in 2016 the English Deliveroo and the American Uber Eats, in 2020 FuddApp of Palermo origin The introduction of this new way of ordering food from home, has made it possible to spread new kitchens and the affirmation of existing ones, from pizza to burgers, from ethnic to Asian cuisine.
This new eating habit therefore opens up new consumption scenarios and focuses on the issue of environmental safety. In fact, one of the drawbacks of food at home is the use of disposable plastic, cardboard and aluminum as food packaging for food, which after just one meal is discarded as waste. The huge amount of food containers discarded in this way will significantly weigh on the environment, increasing pollution.

3. Environmental Impacts of Online food delivery

One of the most pressing environmental evident from in online Food Delivery is the sheer volume of waste generated. The effectiveness in which different countries are dealing with the waste generated by online Food Delivery is dependent on the development level of their recycling infrastructure. In China, for example, on the back of an increase in online food delivery, the total volume of packaging waste went from 0.2 million metric tons in 2015 to 1.5 million metric tons in 2017 [16]. In 2020, in many parts of the world the use of single-use, disposable food packaging increased is due to the COVID-19 pandemic, because many consumers believed single-use packaging was safer and more hygienic This is exactly what is happening inside the food delivery industry: with low consideration to circular behaviours within the system.
The factors stimulating the market have already been mentioned in the previous part and are mainly related to changing lifestyles made possible by growing urbanisation, higher income and mobile internet access. These are all positive elements for a growing economy but leave behind a negative effect related to the incapability of the waste management to address the challenges proposed by the stream of waste generated by the sector.
In the current waste system, which is quite ineffective, the highest impact to evaluate is the end-of-life one, where the biggest resources loss happens.
This may pose environmental threats, and the entire society, should make efforts to tackle problems that may occur.
The elimination of food delivery packaging waste requires the efforts of food delivery service providers, consumers, package manufacturers, and food delivery service platforms.
Food delivery providers should enhance awareness of environmental protection and promote their brands with customized product packages, they should attempt to produce also packages for environmental protection
Consumers should cooperate with food delivery platforms in adopting related strategies.
Food delivery platforms, which bridge food delivery service providers, consumers, and manufacturers, should encourage consumers to make environment friendly choices.

4. ECO-FOOD a new sustainable food delivery platform

Today, in Italy, few food-delivery companies have considered the problem of the environmental impact thatgenerates the market in which they operate generates. For this reason, ECO-FOOD is born, a new food-delivery platform which among the values will also have sustainability. The goal is to create a system to be included within the ECO-FOOD service that goes to counteract the environmental impact and therefore differentiates it from other platforms on the market today, creating a system that improves collection and disposal of waste deriving from food-delivery.

4.1 ECO-FOOD a new platform

We have seen how up to now the online food delivery market is an established reality in Italy and in Palermo and how it has created new social habits. But we have also seen that food delivery produces a lot of waste, mainly for two reasons: on the one hand due to excessive and often non-differentiable packaging; on the other hand due to incorrect disposal of waste by the consumer. So we thought of a system that involves the Municipal Collection Centers of the Municipality of Palermo (CCR). The Municipal Collection Centers are areas set up by the Municipality to serve citizens and managed by the company RAP (Risorse Ambiente Palermo). The CCR are areas available to citizens to increase separate collection, and discourage the abusive abandonment of waste

In these centers, citizens can deliver urban waste, even bulky ones and waste from electrical and electronic equipment. By going to the CCR, citizens have the opportunity to bring waste, already sorted at home, every day, without being bound by the waste collection calendar active in their neighborhood.

Citizens leave paper, plastic, glass and organic waste in the CCR after weighing them and receiving a receipt with the details of the operation. A receipt that the consumer keeps for no purpose. Thus was born ECO-FOOD a food delivery platform with an environmental footprint and with a system that sensitizes the consumer to the separate collection of waste derived from Food Delivery and not, through a loyalty that offers economic advantages to the consumer and the company with an increase of sales. Specifically, the ECO-FOOD platform system integrated with the CCR will give customers, who will go to the CCR to weigh and deliver the differentiated paper, plastic, glass and organic waste, points. The customer will be able to convert the weight indicated in the receipts to get the points within the platform. These points will be used by the consumer to obtain discounts on orders. Furthermore, the food ordered on ECO-FOOD, by the restaurants involved in the project, will be delivered through packaging on which a QR code will be printed. By scanning the QR code, customers will be able to consult the instructions for separating the packages received and reducing their size. Restaurants that adhere to the ECO-FOOD platform will also receive a guide for choosing sustainable and recyclable materials to package food for delivery, thus helping consumers to make even more careful separate collection.

5. Conclusions

Today the affirmation of online food delivery is visible in the daily habits of Italians. This certainly imposes an even greater responsibility on us with respect to the environmental impact and a sustainable approach to these new lifestyles. To this end, we want to contribute and lead by example to act in a sustainable way, ensuring that the life cycle of food delivery can be virtuous and with a lower impact on the environment. It is from this commitment that the ECO-FOOD platform for a sustainable food delivery, and to educate to a more conscious lifestyle and in particular that moves away from a linear economy. In fact, in the approach to food delivery, through the ECO-FOOD platform we can ensure proper separate collection and waste management to lead us towards a circular economy.

Food Delivery

The customer chooses and orders the food he wants to eat through the platform's website and app



The order is validated and sent to the local partner for the preparation of the food to be packaged



Packaged food is transported to the customer by a platform rider



Delivery of food to the address indicated by the customer and possible payment



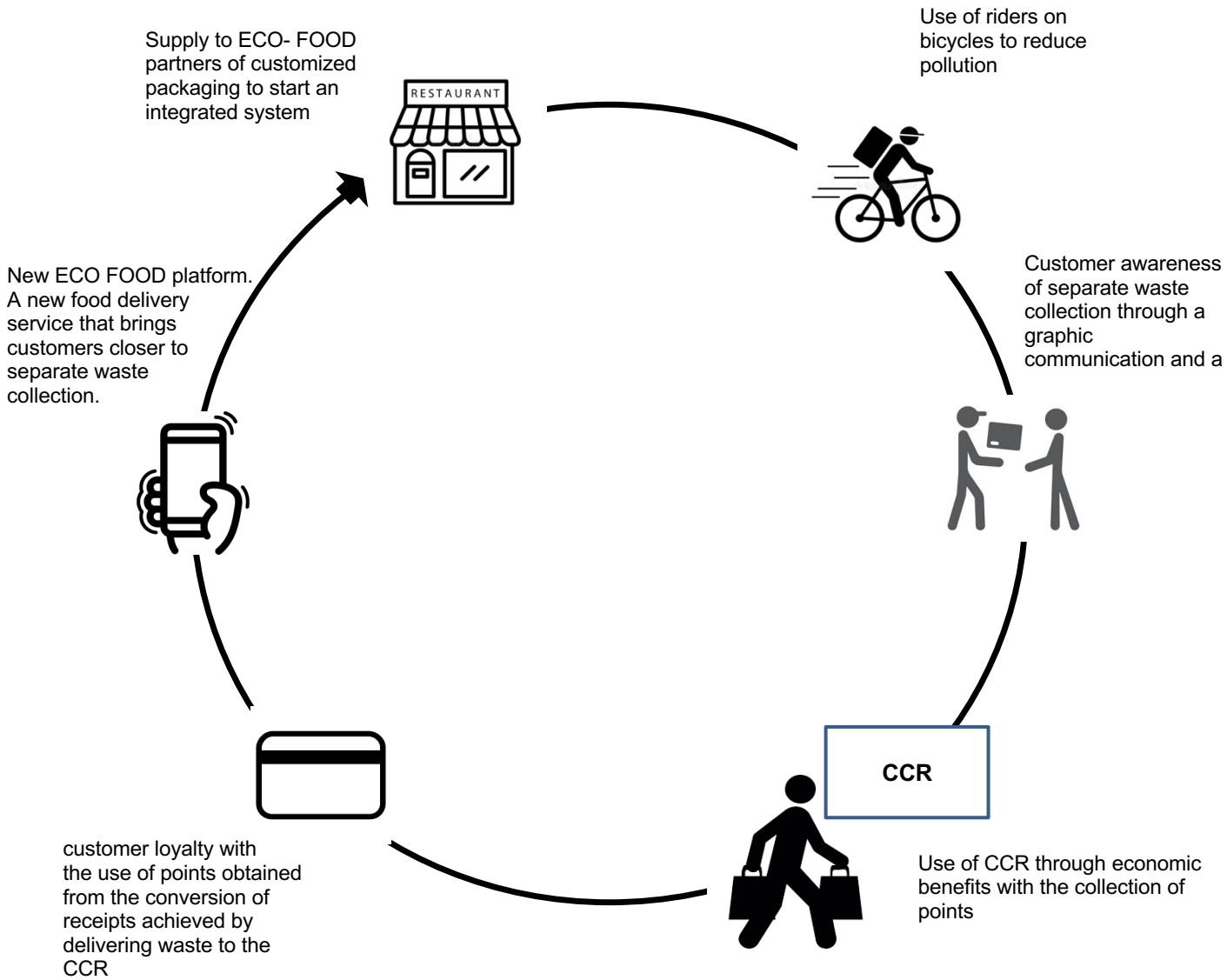
After packaging in paper, plastic and aluminum, end up unsorted municipal solid waste



Food Delivery



ECO-FOOD a new platform



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Chan Chan Archaeological Park: looming threats and suggested remedies

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Abstract
Chan Chan, the largest city built in adobe on the American continent, was the capital of the Chimor Empire, developed on the north coast of Peru between the third and fifteenth centuries of our era. Included in the UNESCO WHL in 1986, was then the subject of an extensive management plan approved by the Peruvian Government in the year 2000 and known as Plan Maestro. The MIPE (Italian Mission in Peru) of the ISPC (Istituto di Scienze del Patrimonio Culturale), from the year 2002 has been working for the realization of the Plan Maestro in close collaboration with the Ministry of Culture. This is carried out through the documentation of architectural structures and urban settlement, the regularization of the boundaries of the core and the buffer zone and the enhancement of the archaeological complex through modern visualization technologies. The natural threats recorded in recent years (floods due to phenomenon of Niño, wind erosion, groundwater level and rising humidity) often also caused by an incorrect human behavior, have even more harmful effects on a material such as that of raw earth. The poor management of the core zone, crossed by a driveway, and the lack of legislative regularization of buffer zones cause increased air pollution and devastation of the historical landscape. The MIPE has therefore activated a project for the evaluation of threats and the verification of vulnerabilities of the site even with support of traditional and ancient practices.

Keywords: Chan Chan, raw earth architecture, buffer zone managing, monitoring of risks, Ecomuseum of *totora*.

1. Introduction
Chan Chan, the capital of the Chimor empire (IX-XV cen. AD), is the largest pre-Columbian city built in raw earth. It is located about 600 km from Lima, near Trujillo the second city in the country, and extends over fourteen square kilometers with articulated architectural structures surrounded by imposing walls, remnants of popular houses, and structures of worship in the shape of stepped pyramids named huacas [1]. The highly complex and structured Chimú's territory includes urban and extra urban paths, cultivated fields, walls and irrigation channels that reflected a high level of social and economic organization (Fig. 1). This magnificent example of urban organization has been rightly recognized as a synthesis of developments in the various successive cultures that lived along the coast during preceding centuries and hence an important contribution to Andean culture, resulting in the listing of Chan Chan as a UNESCO World Heritage Site in 1986 [2, 3, 4].

Unfortunately, Chan Chan is suffering from a dramatic material and urban decay. This process is not only a result of natural causes, such as its proximity to the sea, the presence of marine salts, strong blowing winds. It is also due to human factors, such as the activity of the *huaqueros* (grave robbers) since colonial times, the continuous invasion of the site by *campesinos* and especially, the uncontrolled growth of the nearby city of Trujillo, which is encroaching more and more onto the archaeological complex. For all these reasons, the site is currently inscribed in the List of World Heritage in Danger.

As required by UNESCO for all World Heritage sites, Chan Chan also has a very complex and articulated management plan, the Plan Maestro de conservación y manejo del Complejo Arqueologico Chan Chan (Plan Maestro), drawn up by the Ministerio de Cultura and approved by the Peruvian Government in the



Fig. 1: Chan Chan. One of the paths, flanked by high walls, which led from the city to the cultivated fields.

year 2000. In recent years, the Plan Maestro has been revised and updated by the Ministry of Culture and by the Proyecto Especial Complejo Arqueologico Chan Chan (PECACH), a special unit which has been operating in Chan Chan with economic and managerial autonomy since 2006 [5]. The new Plan Maestro 2021-2031 is divided into projects and sub-projects organized according to objectives that aim mainly at the conservation of the *adobe* structures and the tourist enhancement of the site, but also giving new and particular attention on the protection and management of the surrounding landscape. Despite the awareness of the threat to the site represented by wild urbanization, up to now the PECACH has very few tools available to counter it, even if actually this is the main cause of degradation and loss of integrity of the archaeological complex.

We must remember here the importance that the authenticity and integrity of a site assume in the process of inscribing a monument on the world heritage list. In the "UNESCO Operational Guidelines" for the inscription of sites in the WHL it is explicitly mentioned: "... integrity, authenticity and state of conservation. It is necessary to pay special attention to the description of the conditions of integrity and authenticity of the property, with reference to the values that justify its candidacy on the List. In the same way, its state of conservation must be illustrated, since it is evident that a property that is not properly maintained cannot aspire to enter a list that includes sites of excellence." [6].

The UNESCO description of the integrity of Chan Chan is the following: “Chan Chan retains all the elements that carry its Outstanding Universal Value over an area of fourteen square kilometers, which although less than the original area of the city, contains representative features of the architectural units, ceremonial roads, temples and agricultural units that convey the property’s significance. The earthen construction of the city, as well as environmental conditions, including extreme climatic conditions caused by El Niño phenomenon, renders the archaeological site susceptible to decay and deterioration. However, ongoing maintenance using earthen materials has mitigated the degree of physical impact. The setting and visual integrity of the property has been impacted negatively by illegal farming practices, exacerbated by pending resolution of land tenure and relocation issues, and by encroaching urban and infrastructure development, including the recent animal food plant and the Trujillo-Huanchaco highway that cuts the site in two since colonial times” [7] .

On the basis of these considerations, the Plan Maestro 2021-2031 foresees the drafting of a risk management plan focused mainly on environmental risks and on the El Niño climatic phenomenon, but which, in our opinion, does not take into due consideration the aspects of environmental policy and of urban design.

La MIPE, Italian Mission in Peru of CNR- Istitute of Heritage Science, has activated a joint research project with the Universidad de Lima and the Universidad Privada Antenor Orrego in Trujillo in the frame of the bilateral agreement CNR-CONCYTEC (Consejo Nacional de Ciencia Tecnología y Inovación Tecnológica) 2021-2022. The main objective of the project is to draw up a plan on environmental and anthropic risks by using, in an integrate way, GIS, GIS 3D and HBIM for managing and monitoring the territory and the architectural heritage.

This article describes the main results of the bilateral project concerning the analysis of environmental and urban decay and the consequent proposals that our working group has formulated to counter the uncontrolled growth of the modern city. The latter, is slowly suffocating the archaeological site without

any respect for the buffer zone, depriving Chan Chan of its undeniable beauty and fascination and causing further environmental and climatic damage.

2. Core zone and buffer zone

The first intervention of the MIPE, aimed at strengthening the protection of Chan Chan, consisted in georeferencing the polygonal of the intangible area approved by Resolution Suprema No. 0518-1965-ED of June 1967, whose vertices, provided with geographic coordinates, have been positioned in the territory by using a topographic GPS with precision of one centimeter. The vertices were superimposed to the high resolution Quickbird satellite image (60 cm per pixel) and managed in the GIS of the monumental complex [8]. The polygonal, with its georeferenced vertices, was approved by the *Comisión Nacional de Arqueología y la Dirección Nacional del Instituto Nacional de Cultura* (INC -2008).
We began, then, to survey the architectural structures and the different paths that cross Chan Chan and connect it with the cultivated fields and the sacred places, such as the long *camino ceremonial* that linked the sea with the mountain. This last path, which is well preserved in some sections, still has the original paving made up of stone pebbles with side ditches to drain rainwater [9].
Touring the territory of Chan Chan has allowed us to see the beauty of its impressive natural landscape, the relationship of the city with its important and ancient irrigation system and with the sea, primary source of sustenance (Fig. 2).
Once the archaeological area was safeguarded, it became important to perimeter the area with a second polygonal, based on a specific project of *Plan Maestro* and the proposal of the Ministry of Culture. The second polygonal moves away 500 m ca from the first one, and defines a buffer zone to protect the monument from urban expansion, development plans and excessively invasive infrastructures, possibly caused by the urban growth of the neighboring city of Trujillo.
The creation of a buffer zone has made it possible to establish an important relationship of collaboration, but also of coordination and surveillance between the Ministry of Culture and the Trujillo Territorial Development Plan Office (PLANDET) of the Provincial Municipality of Trujillo in order to regulate the use of this territory. To this regard, it appears important to take into consideration the proximity of the site, the existence of the archaeological remains, the vocation of use (substantially agricultural), the permitted uses, the construction coefficients and the heights of the constructions near the intangible zone.



Fig. 2: Chan Chan. View of the *Huaca Obispo* and one of the irrigation canals.

It was therefore possible to realize a first georeferenced map of the archaeological complex with the intangible area and the final definition of the buffer zone. The latter, thanks to the agreement between the Ministry of Culture and PLANDET, has been subdivided into zones of different construction densities, with the aim of leaving large green areas along the limits with the archaeological site to protect its original architectural and natural landscape.

3. The looming threats

The main threats to the survival of a monumental complex built in raw earth are mainly represented by atmospheric phenomena and by the effects, they have on architectural structures.
In the case of Chan Chan, the danger is particularly serious given that the city is located in the tropical zone and right in the central area of the Pacific Ocean where the El Niño phenomenon occurs periodically and develops particularly disastrous effects every twenty years.
The phenomenon, also known by the acronym ENSO (El Niño-Southern Oscillation), takes its name from the fact that it generally occurs in the vicinity of the period December-January and therefore in correspondence with the birth of the Child Jesus (Niño in Spanish), causes floods, drought and unstable weather that vary with each manifestation.
The phenomenon was also well known to the Chimu who, once the city was positioned along a terrace that gently slopes towards the sea, took steps to protect it from the frequent streams of water that form on those occasions, building a special barrier. It is a mighty wall structure, about 10 km long and known as *Muralla*, which, by joining Mount Campana with Mount Cabras, prevents rainwater from flowing violently onto the settlement.
The problem of rainwater has been accentuated in recent years since, due to global warming, the frequency of extreme El Niño events will undergo a decisive increase, going from one every 20 years to one every 10 years, according to what a specific study states as early as 2014 [10,11] .
The last event of particular intensity occurred in 2017 when following the heavy rains, violent streams invaded the center and the outskirts of Trujillo and the fishing village of Huanchaco, submerging them with mud and debris.
On this occasion, Chan Chan was not affected, leading us to re-evaluate once again the wisdom of the ancient people in the knowledge of their territory. This knowledge has been lost with the passing of time, until the current possibility to build in highly risky areas such as the gorges of mountain streams.
We soon realized that Chan Chan is also suffering serious threats to the maintenance of the original historic environment. Due to unfortunate interventions carried out in the distant and recent past, its attractive landscape presents increasingly invasive and destructive threats. The main one is represented by the construction of a road that connect Trujillo with Huanchaco and the nearby airport crossing the archaeological area and dividing it in two parts and, therefore, definitively attacking the authenticity and integrity of the monument and causing dangerous expectations for what a flow highway implies in terms of connections, residences and commercial activities.
The road, paved and equipped with municipal lighting, cuts through the Squier (Fochic An) and Gran Chimu (Tush An) palaces, causing great damage to their walls. In short, the road not only cuts the original form of the urban population, but also causes serious gaps in its conformation of architectural and urban integrity.
The road connects Trujillo with Huanchaco, that is to say, a city of more than eight hundred thousand inhabitants with a settlement that now turns out to be the natural expansion of the population towards the sea and that acquires greater importance every year as an international center for the practice of surfing, attracting athletes from all over the world.
As if that were not enough, the same highway also constitutes the communication of the second city of Peru with the nearby airport from which a large part of the commercial and touristic traffic is distributed.
The consequences of these developments in mobility and trade is also evident in the slow but constant transformation of Huanchaco where, even today, fishing is practiced with the characteristic *caballitos de totora*. In recent years, the village has progressively changed. Our annual missions have allowed us to verify, in little more than ten years, the gradual but growing construction of five or six-story buildings that completely disrupt the landscape, transforming the old fishing village into a true seaside resort.
Over time and with the development of private traffic, a growing series of economic activities have been concentrated along the Huanchaco-Trujillo road, which for simplicity we will call HT Road. Grocery stores, pharmaceuticals, mechanics, small restaurants, gas stations, etc. they are gradually lining up along this axis, sometimes creating major environmental problems.
The most obvious and impressive manifestation of what we have just said is an industrial building that produces feed for chickens and that was built in the early 2000s near the Museo de Sitio and a few dozen meters from Huaca Toledo, which precisely in these recent years the PECACH has brought to light in all its beauty. Due to the height of the metallic structures, the impressive building is visible from any point of the archaeological complex with a potential pollution that, due to the bad smell it emits, is not limited to the visual aspect.
Finally, the damage caused by the construction of houses, religious complexes, funeral facilities that have spread along this road, is amplified by the construction of a Mall immediately near the buffer zone. A large shopping center with shops, restaurants, car dealerships and cinemas where the population flocks on weekends.

But the most dangerous signs come from the buffer zone where, despite initial prescriptions, intrusive construction complexes have been carried out mainly on the west and east areas, where buildings have reached a height of 9/10 floors (Fig. 3).
This happens despite the fact that there are continuous requests for the regulation of the building in the buffer zone: “Que, es necesario adoptar medidas de protección y conservación integral de la Zona de Amortiguamiento del Complejo Arqueológico Chan Chan, en concordancia con las disposiciones nacionales e internacionales que rigen este tipo de tareas, armonizando las exigencias del desarrollo en la época actual” (*Plan Maestro* 2021-2031).
The lack of control over the buffer zone and the consequent increase in the building density also entails a relative problem in the garbage collection and the disposal of building rubbles. The first ones came frequently burned, especially to the northern limit of the archaeological area, with subsequent obvious problems of air pollution; and the second are abandoned along the *Via de Evitamiento*, a road that passes along the southern limit of Chan Chan, through the archeological site and the sea.
Therefore, it is extremely important to establish appropriate intervention modalities that prevent the appearance of a new threat to the historical landscape of Chan Chan.

4. Proposals for risk’s prevention

4.1 Analysis of the buffer zone and GIS elaboration

As described above, the core and buffer zone of Chan Chan were positioned on a Quickbird georeferenced image from 2003 that has a resolution of about 60 cm on the ground.
The image, however, no longer reflects the current situation of the area, which in the last twenty years has been affected by a much-accelerated development due to the increase in the economic well-being of the Region. Therefore, in order to be able to proceed with concrete proposals for the safeguarding of the buffer zone, it is necessary to have a clear picture of the current condition of this territorial zone with regard to the use of the land, the building index, the height of the buildings, the state of the infrastructures.
The first step was to carry out a multitemporal analysis of the buffer zone by comparing high-definition satellite images with the aim of identifying the areas most affected by anthropic risk.
We looked at Quickbird image from 2003 and WorldView3 from 2019, as well as numerous other Google Earth multitemporal images for further comparison. The analysis made it possible to identify the north east (Villa del Mar) and North West (Tropic) areas of Chan Chan as the most at risk and to quantify the extension of the urbanized quartiers (Fig. 4).
We have therefore started a collaboration with the Universidad Privada Antenor Orrego and Universidad Nacional de Trujillo for carrying on the ground truth control by means direct surveys on the territory with the supervision of the PLANDET.



Fig. 3: North East sector of the buffer zone. New 10-storey high buildings are visible from one of the *ciudadelas*.

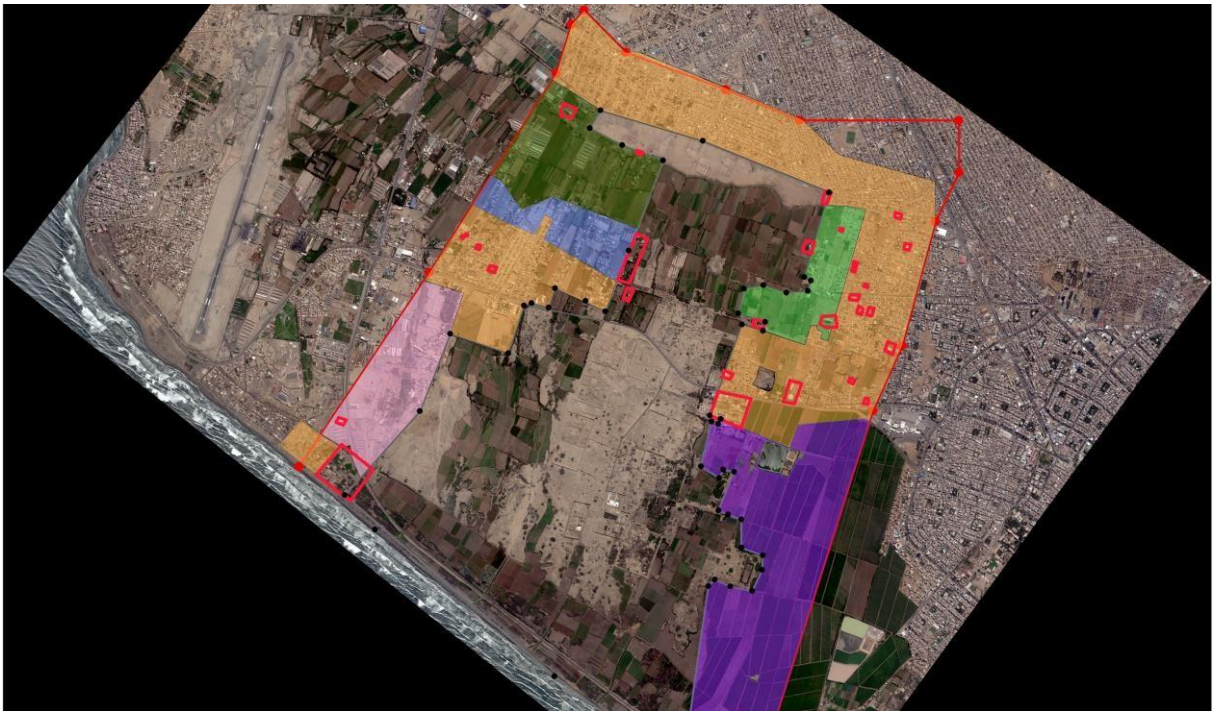


Fig. 4: WV3 satellite image (2019). The areas with the highest building density are marked in red. The sectors with different colors correspond to an initial zoning proposal.

The purpose of the survey is to verify the volume and height of new buildings and any further causes of urban decay such as garbage dumps, lack of infrastructure, weight of traffic and pollution.
A group of young undergraduates equipped with information forms, GPS and cameras is going to the field for the necessary checks. The information collected by the students, suitably georeferenced, will be managed within the GIS platform containing the satellite images, the land use maps, all the existing plans so far, the zoning plan of the buffer zone developed by PECACH, the *Plan de desarrollo urbano* 2012-2022, the further proposals for urban planning proposed by the PLANDET [12].
We are also planning the implementation of a 3D GIS by carrying out a photogrammetric flight with a drone over the areas of greatest interest. Only the three-dimensional rendering of the data, in fact, will be able to provide the PLANDET with a tool for monitoring the buffer zone with regard to the volumetric growth of buildings.
The GIS it will allow to obtain thematic maps, story maps and further friendly products to present the results of the analysis to the political bodies and institutions responsible for the protection of the territory which, through 3D reconstructions and dynamic presentations, will be able to better understand the entity of risk and its effects on archaeological monument and landscape.
The ultimate purpose of this documentation, processing and data analysis activity is to formulate a concrete proposal, updated and based on the real situation on the terrain, for zoning the buffer zone,
In fact, only if the buffer zone will be equipped with a special legislation in the development plans of Trujillo and Huachaco, it will be possible to save what remains of the original landscape by preventing the definitive environmental degradation of Chan Chan.

4.2 HT Road relocation project

The objectives of our project are to reduce the polluting power without interrupting the connection between Trujillo and its airport, and to recover the original material and immaterial integrity of Chan Chan. These purposes, which can only be achieved through important and immediate measures, are linked to the definitive closure of the HT Road. The possible replacement by an underground tunnel that crosses the entire archaeological zone and part of the buffer zone, will re-establishing the original road connection between Trujillo and its airport and allow the complete reunification of the archaeological complex and the recovery of its original integrity.
Of course, this solution presents the big problem of starting an archaeological excavation in the subsoil of Chan Chan. This is an area that has never been investigated and where there are good chances of finding important testimonies of the first construction activities in the Chimu settlement. However, it is also true that the construction of the underground tunnel can represent a great opportunity for deep archaeological research, with detection and documentation of the remains and their visualization through augmented reality procedures.

At the same time, it will be convenient to carry out two other interventions: the first refers to the expansion and arrangement of the highway that runs to the north of the archaeological area and separates Chan Chan from the urbanize zone. This road have to become the only connection of Trujillo with the airport and Huanchaco, creating a route that will connect to the Pan-American highway and it will allow heavy traffic to move towards the south of the Country. The second intervention refers to the gradual but decisive demolition of the *Via de Evitamiento* as a transit route for heavy traffic, so that the archaeological, architecturally and landscape-reunified city can re-establish its ancient link with the sea and its legendary origins (Fig.5).
This new situation will allow a recovery of very interesting folk and craft aspect.
Between Chan Chan and the sea is the *huachaque* area where the Chimu cultivated the *totora*, a typical local reed with which they realized traditional boats (*balsas* or *caballitos de totora*), traditional dwellings (*tapa* houses), and mat weaving (Fig.6).
The elaboration of artisan products means continuity of ancestral wisdom and technology, thus contributing to the formation of regional and national identity that is part of its intangible cultural heritage.
According to our project, the *Via de Evitamiento* will no longer separate Chan Chan from the sea, but will be limited only to the connection with the new structure of the "Ecomuseum of the *totora"* that safeguards the *huachaques* and preserves the ancestral artisan skills of the anglers of the coast.

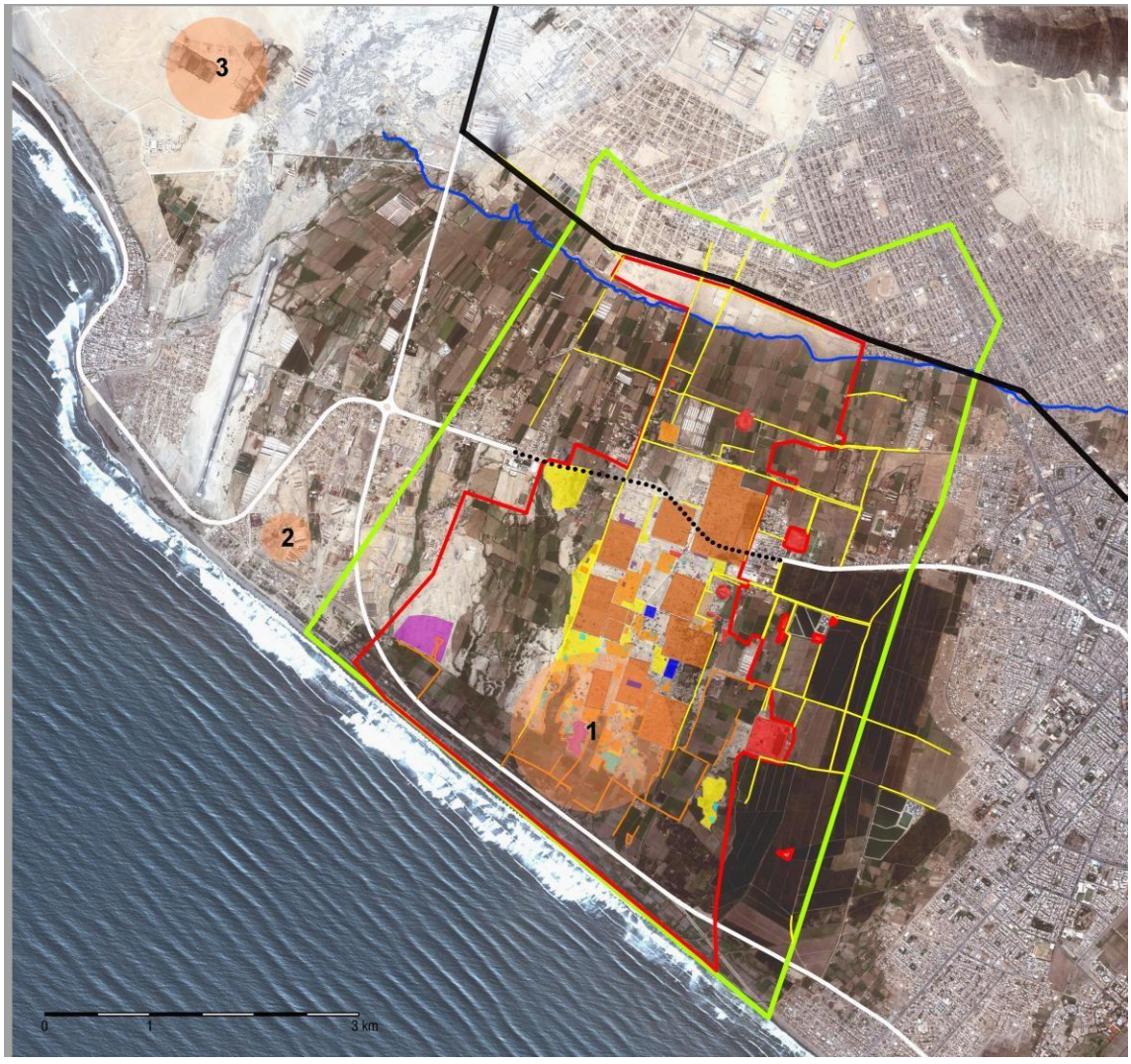


Fig. 5: The Archaeological complex is finally unified. An underground tunnel (black dots) replaces the HT Road. The *Via de Evitamiento* is limited to the connection of the eco-museum components (points 1, 2, 3), while the heavy traffic is moved to the north of the archaeological complex (black highway above).



Fig. 6: Ecomuseum of *totora*. Moments of cultivation, artisanal use and fishing with *caballito de totora*.

4.3 Ecomuseum of the totora

When presenting our proposal for the creation of a *totora* Ecomuseum, we must remember some important elements: the *caballito de totora* and the traditional use of the *totora* on the north coast of Peru have been declared Cultural Heritage of the Country: "...por ser portadora de conocimientos y prácticas ancestrales todavía vigentes que constituyen un eje de la vida social y económica, así como por ser un referente de la identidad cultural de los pescadores, de los artesanos y de la población local".
The *Balsar* of Huanchaco is a complex of artificial basins for the cultivation, the drying and the processing of the *totora*. This is a Regional Protected Area since 1992 and has been recognized by the Ramsar Convention as "Wetlands Built by Man"[13]. To the Balsar of Huanchaco is strictly connected a minority of anglers who still use to practice the traditional form of fishing.
The Plan Maestro includes a project for the recovery and rehabilitation of the *totorales* in the southern sector of the core zone of Chan Chan. The dual objective is resuming and valuing a traditional activity in the area and, at the same time, safeguarding the archaeological site by lowering the level of the water table, thus reducing the danger of water infiltration into structures.
The objective of our project is to support the Plan Maestro creating a connection, at a tourist level, between Chan Chan and the *Balsares* of Huanchaco and offering help to the socioeconomic development of the population of the Chan Chan area by creating an Ecomuseum.
An Ecomuseum of the *totora* is the solution to preserve a peculiar example of an ecosystem of life and work. Here the eco-cultural relationship translates into care for the conservation, documentation, education, memory, free time, communication of a specific cultural ecosystem, that of the *totora* and its entire links.
The expected results are a reinforcement of the tourist vocation of the area and the direct benefit derived from it for the social condition of the local population, historically and economically linked to the archaeological complexes of the coast.
In the Archaeological Complex of Chan Chan, an uncontaminated oasis will also emerge, a natural refuge for various forms of life, where an ancient process of agricultural cultivation and the multiple forms of its practical and artisanal use can be carried out and documented.
Similar experiences have been carried out all over the world. Iven in South America, where the recovery of traditions and workplaces do not limit to presenting a product (*mandioca* processing in Brazil, the natural areas of the Argentine *pampas*, the Caroní hydroelectric plant in Venezuela, etc.). They rather use a territory from an archaeological, tourist and environmental point of view and prepare its development based on the participation of local communities.

The Ecomuseum of the *totora* includes: the *Huachaques* of Chan Chan, the *Pampas de Gramalote* in Huanchaquito, the Balsar of Huanchaco (Fig. 5) and an Interpretation Center with an exhibition hall, a visitor service center, classrooms for training and a space for the sale of craft products [14].
The Center will be a meeting place and association of the local community for the maintenance of cultural identity and the conservation and enhancement of the *totora* ecosystem. The Center will deal not only with environmental education but also with natural, historical and archaeological heritage.
The guided tours will allow a better understanding of the natural environment and the history of the region documented by the archaeological site. They will be aimed at national and international tourism but also, having a didactic-educational nature, will be oriented to the training of the local schools.

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The experience of the limit

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Abstract
"The present humanity is in struggle with the cosmos-material for the purpose of domination [...]. In this way man ends up, according to Hegel's logic, by becoming a slave to what he intended to dominate: matter and machine ".
But as A.L. Huxley: "Experience is not what happens to a man. It is what a man does with what happens to him ".
In our relationship with nature we can say that we have reached the point that Karl Jasper defines as "limit situations" where the limit is understood both as the limit of our experience and as the limit that is within our experience, if we refer to the permanent pandemic crisis , which dominates us and which we cannot dispose of.
In redefining and imagining the relationships with the element of nature, where the whole is more than the sum of the parts, creatives are called into question by Ursula von der Leyen in the definition of a New European Bauhaus to disseminate new interpretations and give concreteness to responsible development.

Keywords: experience, limit, creativity

1. The limit
The latest events that have occurred on a global scale for some years now have confronted us with our condition as human beings. But what does this mean specifically?
After about a century of delirium of omnipotence on the one hand, advances in science and technology, some scholars have begun to claim the human condition as the founding element of society as opposed to rampant materialism.
The permanent crisis presents us with a challenge, where the need for a paradigm shift can represent a great opportunity.
"I share with you the principles that I believe are fundamental for an epochal transformation in the context of spirituality and ideality, the crisis we are experiencing from all points of view is a unique opportunity for growth, it is the best opportunity for us to become more human, more free and responsible; let us allow ourselves to be positively provoked by current reality and aim to achieve a goal of greater happiness for all humanity. First of all, I would like to recall a decisive factor: there is no lasting change that is not based on personal interiority. Beyond the beliefs of each one, only those who live the spiritual dimension and draw from the depth of their own being the reasons for change will win the battle with laziness, obsessive and compulsive gain "thus intervenes Father Mauro Gambetti Cardinale during the first meeting of the signatories of the Manifesto of Assisi.
But what does it mean to regain possession of one's humanity and recover the profound sense of humanity? "What binds our life together is the experience of the limit". Analyzing the etymology of the word, in German "to experience" (erfahren) has the same root as "to travel" (fabren). Erfahung derives from erfaheren, to pass through. The experience appears to be connected with a constellation of

meanings that imply the idea of travel, that of putting oneself to the test by exposing oneself to danger. In chapter 4, Tagliapietra works on the term peras, which can be translated both as a link and a limit. The experience of the limit has to do with the experience of ties and the experience is itself a web of ties, the limit is something else with respect to the border or with respect to borders, because the limit is not what can be crossed or continuously movable, the limit is what allows life to take shape, because if there were no limit, life would not take shape but would be an indistinct happening, a continuous and indistinct flow in which there is no possibility of taking shape From what does our life take shape? Starting from the experience of the limit and first of all and fundamentally starting from the experience of the limit of death. Because we continually experience death because it is something that runs through our life. We experience the limit, that is, the impossibility of being unlimited, the impossibility of being omnipotent, immortal, absolute and so on, we continuously experience the limit that comes our way and precisely because we experience the limit that our life can take shape. The limit is what gives shape, what gives an identity, allows the outlining of a face

"From the etymological memory of the word emerges the double consideration of the peras linked to the overcoming of a border, to its crossing, but also in the ascertainment of the limit as what determines, in itself, the living being located in its environment and in its corporeity, in the singularity and belonging to one's own death. " [...] "Experience is made up of bonds, a fabric forms the canvas of life, which envelops everything but which as such cannot be crossed."

In then distinguishing the limit from the border, Tagliapietra then defines the limits as boundaries not yet reached and exceeded and highlights how contemporary man, basing himself on the prodigious results obtained by techno-science in some fields of daily life, seems to cherish the idea that all limits are reducible to borders, he then concludes by underlining how experience through circumstances situates us in time and orients us in it as the horizon does. "Looking at the horizon, I orient myself and locate myself in a place, in a limit that circumscribes me [...] then it is perhaps this orientation that allows us to inhabit the world that the ancient Greek name of experience refers to, en-peiria , emperiirìa.

2. The manifesto of Assisi

Starting from the awareness of the limit and from a reflection on the discrepancies caused by man in his relationship with the environment, Pope Francis in his Encyclical "Laudato Sì" establishes a dialogue that crosses all age groups, beliefs and professions, where everyone we are called into question.

Through some of the fundamental points such as the human root of the ecological crisis, an integral ecology, it claims an awareness of belonging to a world shared by all, and for this reason a new common lifestyle is necessary to re-establish the economy, to put at the center people, the environment and life.

In acknowledging this thought, Ermete Relacci, with Symbola, promoted a Manifesto which, presented in Rome, which is currently signed by 4068 people, starts from Assisi to define the concreteness of the actions in declining the word act in concrete facts. Among the promoters of the document there are also: Catia Bastioli, CEO of Novamont, Vincenzo Boccia, president of Confindustria, Father Enzo Fortunato, director of the press room of the Sacred Convent of Assisi, Ettore Prandini, president Coldiretti, Francesco Starace, (Enel) and the Sole Ore group as media partner.

“Three elements are needed: knowledge, shrewdness and a dream. Knowledge: The encyclical Laudato si presents us in a clear way the picture of the current reality where everything is obviously connected, the energy choices of a nation, or of a part of a population affect the state of well-being of all the others "(and never how at this moment we can understand how concrete these words spoken just a year ago can be) "the use of the resources of some causes poverty, suffering and death for many men and women but also for many animals and plants, the accumulation of wealth for some it involves forms of oppression and sometimes slavery for others. Each belongs radically to the earth and is illuminated when he is in a reciprocal relationship of respect, benevolence, esteem, gratuitousness and beauty with others.*” [1]*

"The real crisis of living consists in the fact that mortals are always in search of the essence of living, that they must first of all learn to inhabit" says Heiddegher, the relationship of man with time and space, his dimension ethics, all those norms and values shared in the daily life of the modus vivendi. Man must take care of the quadrature (Geviert) of heaven, earth, divine and mortal.

"A new ecological, economic paradigm does not arise without this level of basic knowledge".

"Wealth is made to be put into circulation not to accumulate, the root of shrewdness is to change the existential economic objective, when I do business before profit I have to have the good and the beautiful at heart and I mean both common sense actions daily such as shopping and those

[1] Padre Mauro Gambetti, incontro dei firmatari del Manifesto nel Sacro Convento di Assisi, 24 Gennaio 2020

elaborated by corporate strategies that make up marketing and finance, those who want to shop or do business in an intelligent way must respect the environment and not take advantage of people's needs. The shrewd entrepreneur invests in innovation, supports research and training, promotes family and social life from all points of view and invests in green, one of the most profitable ethical investments, promotes sustainable and integral development in the area.
The dream is a place of revelation that allows us to correctly interpret reality, the dream is nourishment for the soul, it precedes us and constitutes a time. Our dream for an economy on a human scale is the song of life without end, it is the amazement of the timeless and the limitless of the relationship that weaves the verses of the song, a creature in the midst of other creatures caught in the midst of inextricable relationships in the experience of wounded and lovable humanity. Everything is in relationship and in the immediate relationship with everything and with everyone is life. This is the dream of an economy tailored to a fraternal humanism that respects, nourishes, safeguards, welcomes, offers itself; fullness of relationship and fullness of life. I decline this dream into a vision, that is, into a possible realization, "Perfecta Letitia" a garrison of circular economy and a place of cultural irradiation that offers training itineraries and "assisi paths", a place that offers a Human Hospitality with a receptivity oriented to a slow tourism and also making use of interactive multimedia technology to act as a fractal multiplier of virtuous proposals for welcoming tourism, training and production to create a real European circuit of paths and integral knowledge in the spirit of the song. Best practices aimed at changing our world for the better starting from everyday life. We also accept the mandate to be witnesses of a lifestyle inspired by the canticle of Friar Sole and to translate into practice the ideals shared in the manifesto"[2].

3. New European Bauhaus

"If the European Green Deal has a soul, then it is the New European Bauhaus which has led to an explosion of creativity across our Union"[3].
"*The New European Bauhaus is a creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences.*
The New European Bauhaus initiative calls on all of us to imagine and build together a sustainable and inclusive future that is beautiful for our eyes, minds, and souls. Beautiful are the places, practices, and experiences that are:

- ***Enriching**, inspired by art and culture, responding to needs beyond functionality.*
- ***Sustainable**, in harmony with nature, the environment, and our planet.*
- ***Inclusive**, encouraging a dialogue across cultures, disciplines, genders and ages*". [4]

"The three keywords to define this movement are: beautiful, sustainable, together.
It is a multidisciplinary project that was born with a variety of profiles, the key objectives are shaping a movement :

- To explore how to live better together
- to make the Green Deal a positive, tangible experience, for all of us
- to connect people from different disciplines and backgrounds and weave different perspectives and cultures
- to move beyond "form follows function" factoring in the planet and social purposes
- to support the development of lead markers in sustainability
- to make EU think and deliver "out of the box"

The initial purpose started more linked to the buildings, urban/rural spaces where we live and the way we experience them, then, thanks to this multidisciplinary and bottom-up approach, the scope is expanding. We are no longer talking about buildings but places in an extended sense, so the relational component, the inclusion component become central to this type of project. Inclusion is the main challenge, inclusion means precisely creating virtuous places not only from an aesthetics and quality of experience point of view, sustainability and including circularity so that the transformation is not only a transformation of places but also a transformation of our mind-set, of the culture of the way to live with an impact on business ecosystem and markets. The timeline of the New European Bauhaus includes three phases: Design, Delivery and Dissemination.
The Design phase, the first phase, which lasted from October 2020 to June 2021, is already an innovation in the modus operandi of a commission, we can define it as a phase of sharing experiences:

- Shaping the New European Bauhaus movement together

[2] Padre Mauro Gambetti, incontro dei firmatari del Manifesto nel Sacro Convento di Assisi, 24 Gennaio 2020
[3] Ursula Von der Leyen, President of the European Commission
[4] https://europa.eu/new-european-bauhaus/index_en

- Collecting insights
- Defining the scope
- Gathering concrete contemporary examples that already exist

This thematic border has been created (virtuous, sustainable and inclusive spaces and places) within which, as a reference to concrete examples, dialogues, conversations and concrete examples.
These are the three entry points for any type of professionalism, not only open to professionals in the sector such as architects, engineers*. Inspiring examples*: existing space, structure, object, material, event, practice or habit that for you represent concrete contemporary examples of new forms of living showing that the values of the New European Bauhaus already exist.
Another way of sharing is through the *ideas and visions* and ultimately the challenges and needs to create this situation, proposal and ideas, summary of a conversation, new narratives for the new European Bauhaus initiative; dreams, sensation, memories and intuitions you would like to see reflected in this initiative. (take account of the needs of ageing people in designing buildings).
Challenges & needs: examples that clearly illustrates a problem, or a challenge, that we should solve together to improve the quality of the place we live in.
Another way to intervene to better understand what it means to create these places is to host a conversation to extract principles or lessons for the project. Organic themes are created inspired by necessity and through these themes the concept is faced and developed. The last form of participation is to become a partner, this is the most expensive way in view of the effort required because the idea is to organize a path together, it starts with sharing some ideas but then evolves into the creation of a hub community around the project, an example is the work done with euro cities, the activation of their network, trying to understand within their network which are the issues related to the New European Bauhaus that are most of interest to the network, and then create a series of conversations and events that better articulate some of these main themes such as co-creating urban spaces, how to balance the focus on tradition, the historic building and the need for the new buildings".[5]
In September, the phase of pilot projects began to implement some ideas and visions shared through the platform, this will be followed by a dissemination phase to share best practices as possibly replicable methods.

4. Conclusioni

The school, an effigy of total art, whose character echoes over the centuries, was chosen by the European Commission as a reminder for creatives in the disciplines of the project to realize the actions for an inclusive society and a dialogue between different cultures.
"The new European Bauhaus wants to be an incubator and an accelerator of initiatives, a point of reference for all European innovators, in an overcoming of disciplinary frontiers inspired by the cultural cut of the historic Bauhaus, to which are added the objectives of sustainability and inclusiveness ".
In this conception that the whole is more than the sum of the parts, speaking of Bahuaus we cannot fail to mention Kandinskij, specifically his publication "The spiritual of art" where as a secular prophet he prophesies the advent of a new era like hopes current dictated by a need for change for a new phase of improvement of an integral ecology.
"The work of art is the daughter of its time but at the same time it is the mother of our feelings [...] those works that are crushed on the present are works that are not pregnant with the future while the work of art generates , the work of art is the daughter of our feelings, it sets in motion that spiritual energy which is the one which is capable of transforming reality, which is capable of giving life to a new time.
The artist is fully involved in reality, he is not detached from reality for this reason the artist has a responsibility that is also political in some ways, to be able to contribute to the advent of a new age, to make the advent of the new age solid. it is an age of the spirit. This prophetic capacity of the artist expresses this perspective of responsibility for his own time and for the future.
The place of what is at the origin is the place of what is generative. This work is auroral because it is the beginning of an artistic path, a new phase of this path because in fact the main works of Kandinsky are after the publication of this text, it marks a moment that is a decisive moment that is the fruit of a maturation, Kandinsky himself says what I wrote here I matured through years of experience; this relationship between experience and thought is very important, that is, even in this text there is a life inside, there are intuitions inside, which have matured in a lived experience, in an all-round experience, experience is not only an artistic experience, it is his life experience, here they find insights gained through years of work, of experience, through a life conducted in research, in a desire for understanding, in a perspective of openness that opens to the hope of a new age, in the overcoming of materialism.

[5] Alessandro Rancani, Centro comune di ricerca (JRC)-EC

It is an auroral text not only because it announces a new age that is coming, which is just beginning, it is the beginning of a new phase in its artistic and existential story, but also because it wants to be like a seed. The strength of this book lies in the fact that even if that age of the spirit, what he announced, did not happen, this book as well as Kandinsky's works continue to have a generating force, they continue to be what he says must be there. 'art, daughter of its time and mother of our feelings, capable of generating and opening up to a possible future, has and continues to preserve this auroral character regardless of the fact that what is announced then has actually been realized, has a value generative, they have the ability to arouse energies, generate feelings that set life and history in motion, they have an extraordinary force of involvement. Art always goes beyond. The meaning, the communicative capacity, the eloquence, the generating capacity of the work of art is something that infinitely exceeds even the intentions of the artist. The symbol has this ability to evoke and above all to relate, the symbolic force of art is exactly in this, art as a vital and generative transmission of further experiences.
The artist is fully involved in reality, he is not detached from reality for this reason the artist has a responsibility that is also political in some ways, to be able to contribute to the advent of a new age, to make the advent of the new age solid. it is an age of the spirit. This prophetic capacity of the artist expresses this perspective of responsibility for his own time and for the future.
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How the artist responds to his inner need, which supports the artistic experience and guides the work of art in its realization, expressing an art that is fundamentally an inner art, an expression of the spiritual life, arouses, generates , it helps to generate capacity for interiority and spiritual life, that is, those realities that are the true driving force of history, the true revolutionary force of the history of human beings, so today the creatives within the project are called upon to give their visions for creating a new lease on life.



Fig. 1: Vassily Kandinsky, 1926 - Accent rose

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A possible sustainability in the conservation of the material heritage: examples in the port of Genoa

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Abstract
Is it possible to preserve historic buildings, pass on their memory, make their history understood and at the same time give them new functions? How much can the new demands of life and work be reconciled with the maintenance of historical structures? How much in carrying out conservation projects can one count on political will, on popular participation? How can we intervene to help a change of mentality: from transformation and destruction to conservation and respect? Is it possible to achieve sustainability in a heritage conservation project? These are some of the questions that have been focused on in recent years. For this purpose, it was decided to present a research project on an area rich in history and transformations: the area of the ancient port of Genoa. The project is part of a broader research plan already started some years ago in cooperation with the Universidad del Pais Vasco and CISAPSI-Switzerland. In this essay we want to address the issue of warehouses serving the port; medieval warehouses, transformed several times. Today, in many cases, they are faced with yet another change. In particular, the methodology applied for the Salt Warehouse in the Molo District will be illustrated (historical analysis in various city archives, complex archaeological high level analysis, urban research). It was possible to identify the first nucleus of the building and the subsequent modifications of the 17th-18th centuries. Currently, the Porto Antico area of Genoa, adjacent to the Molo District, is a highly tourist area.

Keywords: Sustainability, conservation, material-heritage, port, Genoa

1. A possible sustainability in the conservation of the material heritage
"The concept of sustainability here proposed, with particular reference to the process of conservation and management of Cultural Heritage, refers to a very broad horizon, touching various spheres: cultural, economic, social, environmental, before the purely technical and energetic one. It is not just a simple matter for economic or social sciences, neither a purely investigation on suitable technical answers to questions concerning ecological footprint, energy effinciency, environmental behavior of industrial products or building techniques. It is a crucial question for every human activity, even concerning the destiny of our inheritance...The protection and management of architectural heritage, both in terms of landscape and culture, by creating a balance between conservation and change, is in fact one of the key foundations from which it is possible to pursue the goal of sustainable development… More broadly, in fact, the discussion about the relationship between sustainability and heritage includes topics such as: the increase in cultural vitality, both in terms of tradition and local identity; a long-term view on education regarding environmental responsability and conservation of resources; economic growth"[1] [2].
Given the importance of these issues [3,4,5,6], research into the conservation of tangible and intangible heritage and sustainability has been carried out in the Department of Architecture for years (see University Research Project P.R.A. 2016 "*L'archeologia dell'architettura nel cantiere di restauro"* with Universidad del Pais Vasco / Facultad de Letras, Departamento de Geografia, Prehistoria y Arqueologia, area de Arqueologia, prof. Juan Antonio Quiros Castillo, P.R.A.2018 "*Conservazione e restauro: metodiche di analisi e strategie di monitoraggio*", with CISAPSI di Lugano, prof. Cristina Kopreinig Guzzi, P.R.A. 2019 "*Conservazione e restauro: metodiche di analisi e strategie di*

mantenimento del patrimonio materiale e immateriale" and P.R.A. 2020 "*Conservazione e restauro: strategie per un progetto di qualità*" scientific responsible for all projects is prof. Daniela Pittaluga) [7].
One topic in particular was developed in this research and concerned one of the oldest areas of Genoa: the area of the medieval port (fig.1,2,3,4) [8].
In this article we give an account of what emerged from this research (D.P.)





Fig.1: View of the port of Genoa today. Fig.2: Genoa, Molo district (red line).



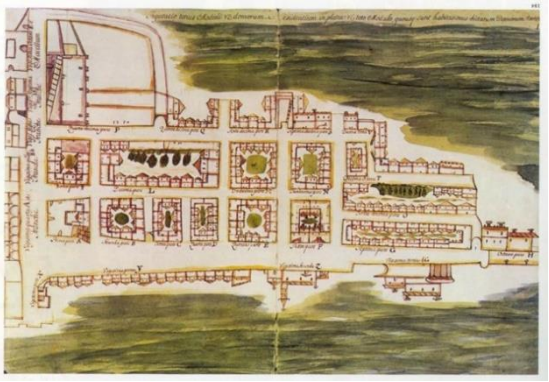


Fig. 3: Genoa XIII-XIV Century (source : [9] p.26). Fig. 4: Genoa XVI Century, "*Veduta in pianta della contrada del Molo, 1540"* (source: S.a., Gabella Terraticorum sive Embolorum, code Figuratis (Archivio di Stato di Genova, Fondo San Giorgio, collocazione E 65).

2. The district of the Molo, a district of Warehouses

1125 is the year in which the first urbanization of the Molo district begins, it is the year in which the city within the Carolingian walls reaches a critical point in its development. This state of necessity therefore requires the city government to into building plots of the district and construction of a religious building, the church of San Marco).
Since then, the municipal consuls have understood the vocation of this strip of land as an ideal place to host all those types of workers who dealt with the construction, maintenance, and launching of boats, and more generally with maritime trade and shipping.
The planned intervention is aimed at giving a precise urban identity to the neighborhood in 1281 a special magistracy was established called "Salvatores portus et modules" for the safeguarding and management of the port and the pier, whose expand the urban defensive organization outside the old walls, now also including the stretch of water between the peninsula of the "Molo" district and the Port. This sudden interest in the Molo peninsula is also due to the nearby new construction of the Ripa arcades (1133-1334), conceived as a privileged place for the sale of goods. This leads to the need of establishing a political-territorial-administrative organization of the Molo district, which takes place according to the dynamics of the time (targeted division office, the "*Palacietum*", has been located since the 12th century in front of the church of San Marco. And it is precisely at the end of the 13th and the beginning of the 14th century that, again thanks to the intervention of the "*Magistratura del Porto e del Molo*" (port and molo magistracy), they also began to organise the various unloading points of the warehouses to protect and store goods. In 1418 the Municipality decided to grant the administration of the wharf to the "*Banco di San Giorgio*", with rights on the redemption of the land

which could be used for a very long time. And it is precisely in an administrative document of the Banco di San Giorgio, dated 1444, we find the first representation in plan of the Molo district, now available for us in the version drawn up and updated a century later, i.e. in 1544.
This document is part of the "*Cabella embolorum sive terraticorum*", an administrative list of leases of houses, warehouses and businesses ordered by owner or family name, and represented in plan and elevation with the metrature indicated on the side. It is at the end of the 15th century that the Molo begins to "specialize" according to functional areas - sailmakers, remakers, coopers. If on the one hand in the seventeenth century we find on overcrowding building extended to the whole district (that will end at the end of the following century), on the other hand we record a significant development of a new specialized commercial structure that we will find permanently throughout the 1700s. and beyond, namely the Warehouse. Already in 1544 in the Mandraccio there were seven warehouses in total, before becoming eight with the "*Magazzino dell'Abbondanza*" a few years later in 1556. The "*Magazzini del sale*" reached 30 units in 1660 (fig. 4), to which others will be added 4 largest during the 18th century [10]. Another type of "overcrowding" recorded at the turn of the seventeenth and eighteenth centuries, is the one related to the boats and landings that saturate the entire area of the Mandraccio; this leads to work on the Molo on several occasions, which is further enlarged in 1638.
At the end of the century it will no longer be necessary to pay all this attention, except for modest repairs to the Old Molo, the work of the Molo Nuovo will be finished, where the "*Lanterna*" currently stands. This work frees the harbor from the incessant storm surges of the libeccio and allows the port to regain the prestige it had enjoyed for a long time; proof of this is the constant increase in the number of warehouses throughout the eighteenth century, intended to accommodate the most varied goods: coffee, sugar, salt, spices, cocoa. (D. P., G.C).

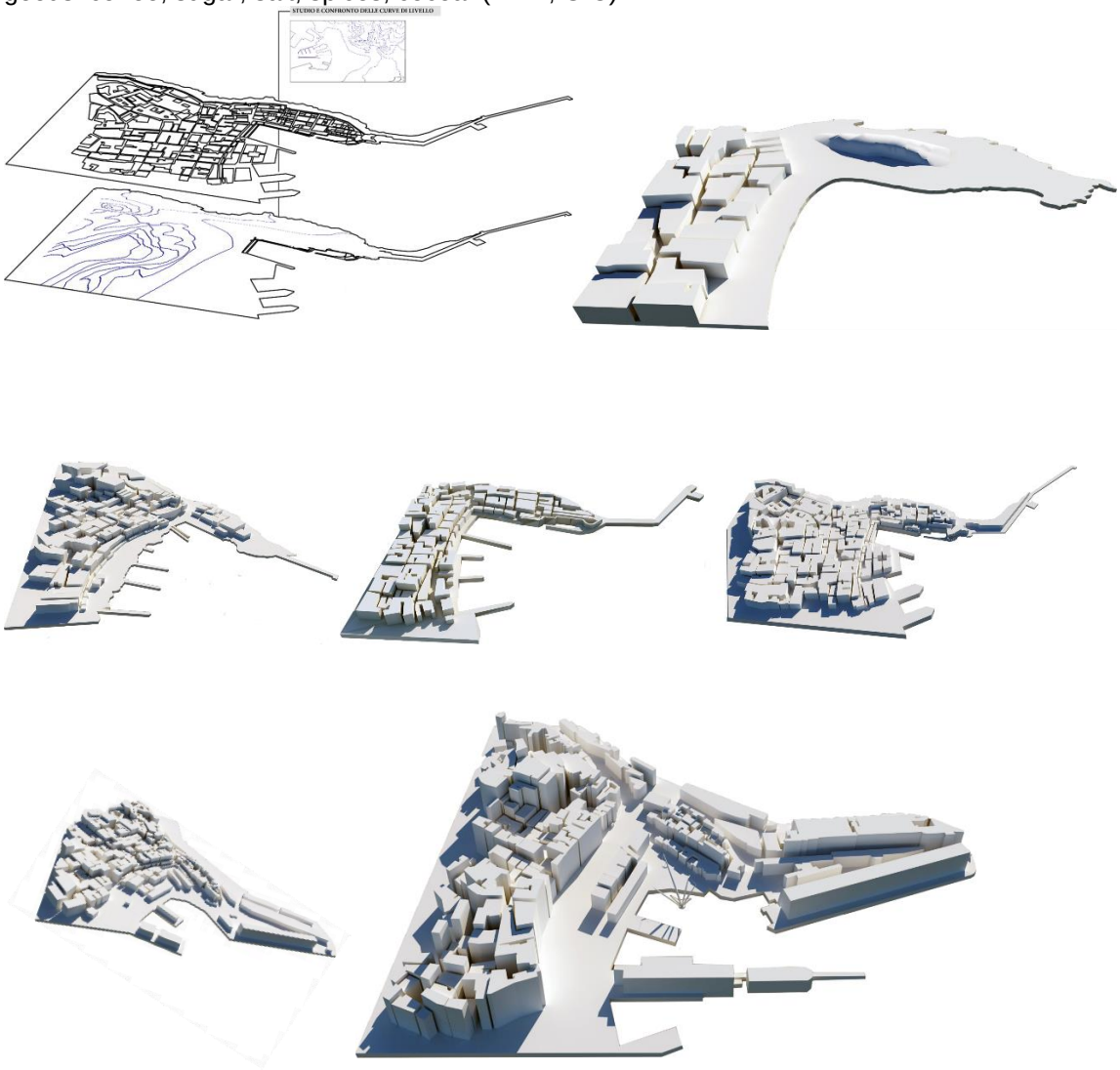


Fig. 5: 3 D reconstructions of the port area in different centuries, X, XII, XIV, XVI, XVIII, XX Centuries (source: [8])

3. The Salt Warehouse in vico Malatti

The historical research work began by proceeding backwards, on the basis of the only certain source of the presence of the Magazzino del Sale of Vico Malatti (currently identified with the number 13r), the "*Fondo Tipi*", preserved in the Archive of the State of Genoa. This is a figured register in plan and raised with the attached sizes of the 27 Warehouses present at the Molo in 1660; each representation has a note at the top of the page which gives us summary information about the owner of each warehouse and the arrangement and use of the same. A complex 3D reconstruction was carried out of the whole district of the pier by comparing the different data available (unpublished written sources, published written sources and material sources) [8] (see fig.5): in this part of the study it was important to have a good understanding of how many and which warehouses have been preserved up to now in this particular area. (D.P., G.C.)

3.1. The warehouse analyzed through the indirect sources

The historical research work began by proceeding backwards, on the basis of the only certain source of the presence of the Vico Malatti Salt Warehouse (currently identified with the number 13r), the Fondo Tipi (the collection of documents), kept at the State Archives of Genoa. Through the investigation of the warehouse under stuy, numbered according to the Fund as the twenty-second, it was possible to trace the surname of the owner of the building, that is Rovereto, literally quoted as "[..] *warehouses I buy from Rovereti*"[8]. From this single documentary trace, the first existing documents on the Molo district were subsequently analyzed, namely the "*Cabella embulorum*" and the register "*Embulorum figuratis*", the latter dated 1 March 1544.

Since it could be seen inside, we found out it contains information dating back to a century earlier (1444). This precious document contains the painted list of all the houses and shops on the pier, accompanied by their measures. Following the verification carried out on the building located in plan at the tenth-eighth angle (fig.4), the correspondence was found, albeit with the relative approximations due to the non-rigorous representation, with the current location of the Magazzino del Sale in Vico Malatti 13r.

The archaeological reports made by the Soprintendenza Archeologia, Belle Arti e Paesaggio di Genova and other scholars during the last century help us to clear up all sorts of doubts and confirm that the building still retains the original foundations of the 16th-17th centuries. (in particular reference is made to the excavations of Piera Melli in 2007 and 2014). In the footnote at the top of the page in the map of the Tipi Fondi, it appears that the warehouse inside also had a house and a "*vacuo*", that is an empty space, from which the salt was introduced at that time; a very precise indication is also given of how many salt mines it could contain (also based on the type of boat that transported it).

The document also refers to a preexisting building (identified as a ruin), but unfortunately the unit of measurement given is not sufficiently precise to identify another pre-existing warehouse at east. The warehouse di vico Malatti is represented in plan with a rectangular shape and an area of about 150 square meters; in it, we can clearly see a recess at the corner of the short side to the east, which, in the elevation, is recognized as a primitive silo dug out of the masonry where the salt from the aforementioned vacuum was presumably thrown.

On the long side, to the north, there is a staircase that in plan would seem to be included between the walls of the warehouse even if outside the actual compartment - this is because it served as a service staircase to reach a second floor from which the salt was unloaded- the traces of which are still visible today on the walls. In the elevation, which we cannot define as either a section or elevation as the author gives it a misleading tridimensionality in order to embellish the representation, there is no trace of the staircase which we can therefore think was completely external to the perimeter as it is still today.The house inside the Warehouse seems to have been built on a third floor connected internally by a wooden staircase, as was the custom at the time; we have no evidence of this pre-existence except in the elevation mentioned above, where a continuous floor is drawn over the entire width of the building. Unfortunately there is no more certain information about the Magazzino until 1798, in the middle of the Napoleonic period, when it was registered within the Cadastre of the Ligurian democratic republic; the property no longer belongs to the Rovereto family but is attributed to two brothers, Capurro Bartolomeo and Capurro Nicolò (see: S.a., Cadastre of the Ligurian Democratic Republic 1798,vol.1168,p.137,sub.1,p.https://mappe.comune.genova.it/MapStore2/#/viewer/openlayers/1000000789).

At the end of the eighteenth century, the Warehouse houses inside a house of 4 mezzanines and a land fund, usually used for the storage of goods.

It is only from the following century that the Magazzino del Sale of Vico Malatti is again cited in an official document, a census of the inhabitants of the Molo referring to the years 1865-1871, which can be consulted in the Historical Archives of the Municipality of Genoa (Municipal Administration Fund). The only information that is provided to us by this source is that the names of those occupying the property are not listed under Vico Malatti 13r, as in the other pages of the census, but there is only the wording "Warehouse", together with the given that it was owned by the former Port Finance Office. In this document there is no information either relating to what type of goods it contained, or whether this

building was already made up of a single room without floors as it is today, or if it still had at least one floor.
Probably at the end of the nineteenth century the Magazzino del Sale and the entire Mandraccio district were already beginning to suffer from the displacement of the port infrastructures to the west, and it is perhaps for this reason that on 24 September 1904 the property passed ownership to Consorzio Autonomo del Porto, which in turn officially sold it in 1925 to the Society of Caliphates and Carpenters of the Port: following the last transfer of ownership, the former Salt Warehouse is no longer used exclusively to contain salt, but all types of goods that required a place for storage (Sa, Warehouse of Vico Malatti (Archive of the Port Authority of Genoa, envelope E1 / 167.3, p. 7).
Following the progressive abandonment of Porto Antico, in 1937 the former Salt Warehouse was reconsigned to the State Property, which in 1955 drew up a new survey of the plan (currently kept at the Soprintendenza Archeologia, Belle Arti e Paesaggio di Genova).
Subsequently, the property is leased to SOBOLT srl, a bolting company founded in 1985, which uses it for the storage of goods until 2009. In this same year, SOBOLT acquires the Warehouse from the State Property through the stipulation of a deed of sale. 2009 is also the year in which the Soprintendenza affixes, on 8 July, the monumental bond to the former Salt Warehouse declaring the asset of "*particularly important Historical, Artistic and Archaeological interest*", protecting its architectural integrity and its conservation. To date, what remains of the original structure are the load-bearing masonry, composed of stones and bricks (exposed, on the internal walls, plastered, on the outside), and the wooden roof with trusses that support the main beams, the secondary joists and the plank on which the typical Genoese slate slab roofing is placed. It is also possible to access the internal courtyard shared with civic 3 of Vico Malatti where you can see the external staircase belonging to the Warehouse. (.D., P., G. C.)

3.2 The warehouse analyzed through the direct source

In the course of this research, we have tried to trace a precise historical reconstruction of the former Magazzino del Sale and its development in the urban context in which it is inserted, and of all its elements and construction phases and to trace a pre-diagnosis on the conservation conditions. The survey of the structure was carried out, the only one present to date so detailed, paying particular attention to the masonry compartment and the elements of the wooden roof. The analyzes and studies on the wooden roof, despite the constraints due to a partial visibility due to the work activity that has never been interrupted in this building, have shown how these direct analysis tools, once compared with indirect historical sources, allow to build solid starting points for a correct archaeological reading of the building [11]. Clearly, the reconstructions that emerged following the discovery of the documents in the various archives (see prgph.3.1), needed confirmation, and this was possible thanks to the comparison with the direct analyzes carried out on the structure. A scrupulous visual pre-analysis of the roof, compared with the manuals and other contemporary buildings, and the mensiochronological analysis [12] carried out on the masonry sector, allowed us to confirm the theories and expand our knowledge of the structure. We now know, with good certainty, how both the roof and the masonry compartment have undergone several construction phases, the main ones of which have been identified in this research.
The trestle roof with “pseudotruss” dates back to the seventeenth century and was probably built with the use of the building as a warehouse. It has undergone some limited reinforcement additions identified (some struts, wooden chains of the trusses, and iron chains subsequently placed in the seventeenth-century masonry, as seen in the mensiochronological analysis) [13]. These roof reinforcements also affected the masonry, as evidenced by the external buttress, in correspondence with the central “pseudotruss” (B), visible from the shaft on the east wall. Even the masonry itself could be divided, macroscopically, on the basis of the studies carried out, into 3 main phases: the medieval / sixteenth-century structure of the ruin, partially survived and still visible today in the three stone pillars. dear marly on which the three arches on the west wall and in the pillar on the north wall currently rest, the main seventeenth-century brick structure, and the various infill or repairs that took place between the nineteenth and the first half of the twentieth century.
Furthermore, the visual pre-classification of the wooden elements, the thermographic investigation, the pre-analysis of the degradation of the roof covering, the thermogravimetric and calcimentric investigation, also allowed us to draw a first picture of the general condition in which the building currently is. If for the main beam no critical situations of deterioration were found, it has been seen that for the planking and for the secondary beams there are some portions that need further study. (D.,P. G. C.)



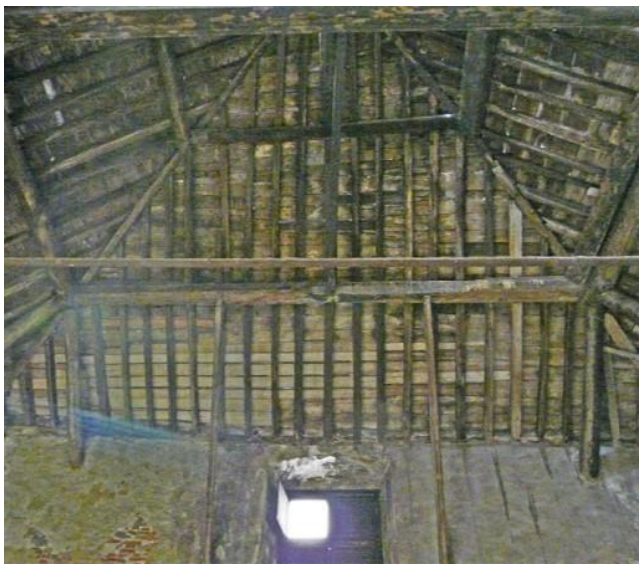


Fig. 6: Salt storehouse, exterior (source: [8]). Fig. 7: Salt storehouse, interior (source: [8])





Figg.8-9: Stratigraphic analysis (source: [8])

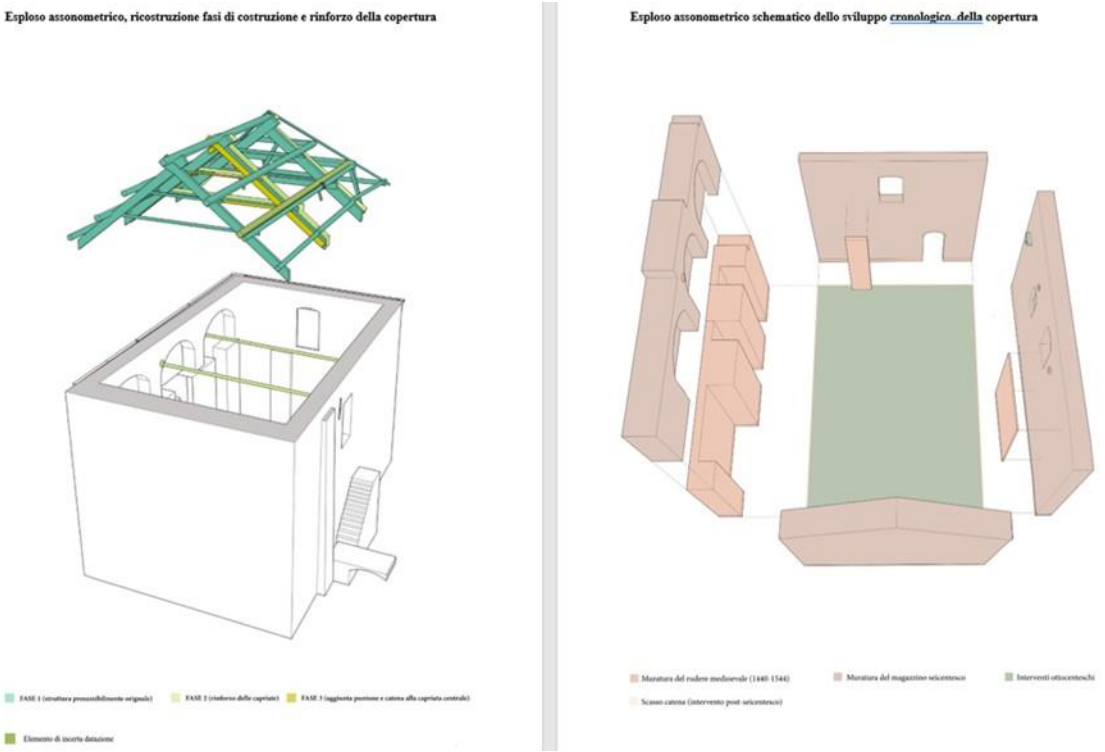


Fig. 10: Reconstruction of transformations from the 16th to the 20th century (source: [8]).

4. Conclusion

The Molo district in Genoa is a living place, rich in history, in the past and still today, in the present. It represents a framework of life and can be seen as the sum of different forms of life organisation. So how was the neighbourhood organised? What was the civilisation that could be read there? What is the civilisation that can still be read there? What was the civilisation of which it was an expression? It was a civilisation based on trade, on exchanges, on the relationship between people from different cultures and different countries. This was the Molo in the past and, although to a different extent, it is the Molo today. The knowledge project, which is briefly described in this essay, can be seen as an innovative project for measuring and representing the built environment: it is intended to be a tool for building relationships between the present and immediate future of the district and the legacy of its past. This heritage can and should also be seen as an economic value, not in the strict sense but in a broader vision.

So what economic value can the Port's buildings have for Genoa today? It is an economic value in the broadest sense, a value that cannot disregard elements that are not easily monetised, such as all the intangible heritage closely linked to the tangible heritage. The study we have summarised here for reasons of space but which can already be perceived from this summary and the bibliographical references attached, can really try to answer the initial question (innovative project for measuring and representing the built environment as a construction of the relationship between the present, the future and the legacy of the past as an economic value). This question can be answered in the affirmative because when an archaeological reading of the elevated such as the one described is applied, all the relationships of the material with its heritage, including intangible heritage, are grasped. In fact, the relationship that the building has with its working vocation, with the functions that were attributed to it in the past, is grasped. In other words, the material is related to the people who lived and worked here. The building studied has an economic value, today, in relation to the use that can still be made of it. Specifically, today, the Magazzino in vico Malatti has a use value also in relation to the tourist vocation of the area. Since 1992, with the Columbus celebrations, the entire Port area has taken on a specific connotation in this sense. How, then, should we deal with what has been learned from this study, what has been measured and described in detail?

This question is more closely linked to the issues of restoration and conservation. There may be ad hoc guidelines on how to manage it, but the most important thing is that the essential objective is

understood: what has been learned and measured must first of all "be preserved" so that it can be passed on to future generations. The second concerns understanding: this clearly has to be mediated by those who have a full understanding of the object. In order for the message to be received correctly, however, it is also important that the language of the person explaining is comprehensible to the listener. In other words: it is necessary to identify the possible users (and these may be different), understand their language and conform to this in order to get the message across to them.

Technology can be of great help in this regard, especially when interacting with the younger generations.
The use of technological innovation must have the aim of entering into the body of the content and objects, it must be able to analyse the different facets through a multi-criteria analysis of all the components. This will make it easier to understand the added value of the results.
In contexts such as the one described above, even the intervention on a single building has far-reaching effects. In fact, we cannot forget that in the port area there have been several interventions of redevelopment of buildings, In recent decades: some with a touristic vocation such as the Galata [14, 15], others with activities linked to the field of education, in particular the university [16]. This is one of the few warehouses still preserved. It could be put in relation with the other warehouses of the Molo and help in the understanding of these building artefacts that, today, are more transformed and therefore less comprehensible by non-experts. It might help to understand some of the history of this neighbourhood.
In particular, economic disciplines have recently focused on a number of strategic objectives that any intervention on the built environment should pursue: 1) economic, environmental and social sustainability of assets in a life-cycle perspective; 2) the possibility of generating "positive externalities" (e.g. reduction of land consumption, increase in local property values, development of new economic activities and jobs); 2) the protection and redevelopment of local natural, urban and cultural landscapes, in the light of the multidimensional nature of the project. 2) the possibility to generate "positive externalities" (e.g. reduction of land consumption, increase of local real estate values, development of new economic activities and jobs); 3) the protection and requalification of local natural, urban and cultural landscapes, in the light of the multidimensionality of values; 4) the preservation of local identity, 5) the transmission of material and immaterial assets to future generations, in line with the principles of value and intergenerational equity.
The other point on which the economic-estimative disciplines in particular have focused in recent times concerns certain strategic objectives that any intervention should pursue: 1) assess economic, environmental and social sustainability on single/complex assets from a life-cycle perspective, 2) promote the protection and redevelopment of local natural, urban and cultural landscapes, in the light of multidimensionality of values; 3) to generate positive externalities, such as the reduction of land consumption, the increase of local real estate values and the development of new economic activities and jobs; 4) to preserve local identity, 5) to pass on tangible and intangible assets to future generations, in line with the principles of intergenerational value and equity.

How can this be made economically sustainable? At present, the warehouse is the private property of a citizen and has its own function: it is a storehouse, no longer of salt but of various materials.

One consideration that can be drawn from this example: as we have seen, this neighbourhood, the Molo and the buildings it contains are rich in history, rich in civilisation, rich in life, rich in the lives of the people who have lived and worked here. If we want to think of a reuse that is truly sustainable and ecological in the broadest sense, it is necessary to think of a reuse that preserves all the dimensions that were there in the past and are still partly there today. To clarify this concept: you cannot turn this area into a tourist area only. While taking into account that in recent years there has been a change in Genoa in this sense and that the port area itself has received this message to a greater extent, it is also good to preserve the other aspects of daily life in this area. This is also part of a respect for authenticity.
The proposal that is being made for the Salt Warehouse in Vico Malatti is a solution that contemplates the cohabitation of a commercial activity in line with the current one and a partial use of the asset for tourist purposes. To this end, distinct areas of intervention and separate accesses are being studied for the different uses, all of which, however, will respect the historic building without affecting its historical value. And this is possible thanks to the in-depth knowledge of the property, from the faithful and detailed representation that we have. This knowledge will allow us to identify guidelines that may be useful in the intervention.
In conclusion here emerge the themes of the comparison between the action of value recognition and protection, the quality of urban processes and the assumption of responsibility towards heritage conservation, the response of the real estate market and the economic operators to the "quality theme" and "conservation". From the research described above, it emerges that the challenges of the

near future will be increasingly linked to the ability to activate resources and attract investors. However, redevelopment processes should not be limited to simple territorial marketing operations; increasing the competitiveness of a city and its ability to attract capital must be accompanied by problem-solving processes and multidimensional mapping of expediency. In addition, a synergistic coexistence of top-down and bottom-up processes with public-private and social partnerships should increasingly be activated. (D.P.)

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On the Margins of the Anthropocene. Landscape, architecture and sustainability

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Abstract
In the age of Anthropocene, landscapes, which are expression of the human glance of the planet, all too often reflect the galloping of uncontrolled transformations that give rise to *continuous anthropised spaces*, polarised around increasingly populated urban areas. In these huge extents of continuous human settlements (cities, agricultural and industrial areas), the fragile natural balances are compromised, highlighting the importance of *new marginal territories* of no current interest to man. They are not only reservoirs of nature and forgotten heritages to be protected, but also, at the same time, opportunities for experimenting with new settlement methods inspired by the principles of ecological transition.
In the first phase, the research questions the *spatialisation* of the Anthropocene, trying to define, by subtraction, all those spaces that escape, to varying degrees, human control, proposing a classification inspired by Gilles Clément's concept of *Tiers Paysage*.
Subsequently, exploring the condition of margin as an opportunity to recover a dialogue of profitable coexistence and symbiosis between architecture and nature, the contribution focuses on marginal, transitory and/or hybrid spaces in eastern Sicily, in which innovative inter-scalar and inter-disciplinary design strategies based on a landscape approach are able to combine nature, minor or forgotten heritage elements and new human activities, pursuing sustainability objectives referable to the UNSDGs of Agenda 2030.

Keywords: Anthropocene, Marginal places, Landscape architecture, Sustainable design, Cultural identities and memories

1. Landscapes of Anthropocene
In the last 50 years, there has been an unprecedented increase in the transformations that man has brought to the planet. Since the economic boom of the 1970s, all the balances between human activities and the environment have begun an exponential process of alteration: concerns about the future of humanity began in the 1980s, corroborated by serious events such as the explosion of the Chernobyl nuclear power plant or the famines in Africa, and converged in the UN report "Our Common Future", known as the Bruntland Report (1987), within which the strategy of sustainable development was notoriously outlined [1]. However, it was not expected that, within a few decades, we would too quickly start talking about the *Anthropocene*, recognising in those processes of alteration of the earth's surface the beginning of a new geological era [2]. The limits between what the planet can offer in terms of resources and what humans 'consume' to satisfy their needs have been crossed: the Anthropocene is the beginning of a human-dominated era, which differs from the Holocene – the warm period of the last 12 millennia when the first human civilisations appeared – in the acceleration of CO_2 production, the rise of the Earth's temperature, the disruption of the biosphere, and the amount of transformed materials from the available resources [3]. This era can be spatialised in the idea of *planetary urbanisation* as preconized by Lefebvre four decades ago [4], now extremely useful in defining the current worldwide socio-spatial organisation in which even spaces that lie well beyond the traditional city cores and suburban peripheries have become integral parts of the worldwide urban fabric [5]. Lefebrvre's prophecy

is being fulfilled by making the opposition between city and countryside disappear, as the countryside also becomes, in some ways, an extended city, and infrastructural networks extend to every edge of the Earth's surface [6].
Through concepts such as Teilhard de Chardin's *Noosphere* [7], Jurij Lotman's *Semiosphere* and later the *Infosphere*, the intangible is also part of the spatialisation of the Anthropocene, completing a framework of the humanisation of the planet that is not limited to the physical dimension but also extends to the immaterial dimension.
Landscape is the visible manifestation of how much these changes have transformed our frameworks of life and compromised fragile natural balances. Within the meaning of the ELC [8], landscape is not limited to the aesthetic contemplation of what surrounds us, nor to the complex interaction between ecosystems studied by ecology sciences: it is a complex and multiform concept, with a physical-material dimension and an intangible dimension. It expresses the relationships between man and his living environment, perceived and restored through the mediation of cultural models [9], and at the same time it narrates the continuous transformations impressed on the environment by natural and human factors and their interactions. The landscape returns the sensitive perception of our living spaces by extending everywhere, from beautiful places to degraded and abandoned ones. By shining a spotlight on everything, and not only on high-value elements, the landscape invites us to reflect on the extent of the transformations made by man on the planet. An emblematic example of this is the work *Anthropocene: The Human Epoch* by Canadian photographer Edward Burtynsky [10], whose incursions into land released by quarries, mines, refineries, railway lines, and large-scale plants and infrastructures, describe places that we generally do not have direct experience of, even though we interact with their products on a daily basis. His images are a metaphor for the dilemma of modern existence, in which man searches for well-being and at the same time is aware of the damage inflicted on the world to satisfy this quest [11].

2. Margins of Anthropocene

The geological concept of the Anthropocene is related to the cultural concept of Anthropocentrism. In the history of Western culture, the centrality of the human being with respect to other living beings has characterised specific currents of thought, such as Humanism, the Renaissance and the Enlightenment. This centrality has been regularly challenged by means of veritable revolutions: Copernicus, Darwin and Freud are the protagonists of the first three revolutions that have been extensively analysed in the literature; a possibly fourth revolution can be identified in in theories surrounding anti-speciesism, which, originating from the spread of ecological thought in the 1960s and 1970s, do not recognise man as having a moral status different from other living beings, emphasising the need to reconsider man's being in the world from a co-evolutionary rather than predatory perspective [12]. This last revolution can be interpreted as a reaction to modernity and the faith it had placed in human capabilities and technological progress, fuelling an anthropocentric approach to the construction of the human world. Today, the world has become polarised around large urban structures, which attract more and more inhabitants in search of social inclusion and easier access to services, making it grow urban margins (suburbs) with serious structural deficiencies.



Fig. 1: Agence TER, *Parc du Peuple de l'Herbe*, Carrières-sous-Poissy. The park explores the possibilities of co-evolution between human and non-human habitats, creating agro-urban ecotones on the fringes of the non-urbanised sectors along the Seine. Photo: Authors' archive.

At the same time as the rapid growth of the urbanisation phenomenon, from the 18th century onwards the clear distinction between city and countryside, between urban and natural, began to weaken, thus blurring the definition of the urban margins.
On the one hand, the city expanded into the countryside, weaving relations with the agricultural world and enervating it with infrastructural networks and production facilities; on the other, there was an increasingly pressing demand to bring nature into the city, with the creation of parks and public gardens. This requirement, originally linked to the satisfaction of specific human needs (health and aesthetic enjoyment) has increasingly shifted towards the pursuit of an integration between human and non-human habitats, paving the way for new design postures that today undermine the classic canons of open space design (fig. 1).
If, therefore, the Anthropocene is producing a continuous hybrid human settlement, made up of cities, production plants, infrastructural networks, agricultural fields, in which even natural areas are often under human protection, it is also true that there are already discontinuities in this apparently unstoppable advance, margins from which new ways of living and new balances can be re-established. In 2004, Gilles Clément coined the pioneering concept of *Tiers Paysages* to describe them, giving dignity to all abandoned, interstitial and marginal spaces, and recognising their value as reservoirs of biodiversity [13]. The *margins of the Anthropocene* are therefore all those areas that, today in a state of abandonment, on the one hand were once the object of human activity (infrastructural fringes, disused quarries, abandoned buildings or plants); on the other hand, they are enclaves between settlement structures, pockets of wilderness that have remained caged in the processes of urban growth, interstitial areas that retain a certain naturalness despite the surrounding context.
The landscape constitutes a privileged lens for their observation. The marginal spaces with respect to the structures that have led the planet to the era of environmental crisis, making the need for an ecological transition imminent, not only constitute reservoirs of naturalness and forgotten heritages to be protected, but increasingly produce “new species of urbanity” [13] in which, through design, it is possible to introduce wilderness into the city [14], regenerate toxic soils [15], juxtapose new apparently contrasting functions (fig. 2), restoring a perspective of sustainability to the landscapes of the Anthropocene.

3. The Landscape Aproach: the *Garden of Anthropocene*

In light of the 17 Sustainable Development Goals (SDGs) drafted by the United Nations in the document known as the 2030 Agenda, [16] there is a pressing need for a systemic, post-anthropocentric approach to planning. In the pursuit of many of these goals – good health and well-being (3), sustainable cities and communities (11), climate action (13), life on earth (15), to name but a few –, in harmony with other forms of life and with respect for the planet, landscape design can make an important contribution because it can articulate performing ecosystems and constructed aesthetic experiences: “Sustainable development requires more than landscapes designed that are created using sustainable technologies. Design is a cultural act, a product of culture made with the materials of nature, and embedded within and inflected by a particular social formation; it often employs principles of ecology, but it does more than that. It enables social routines and spatial practices, from daily promenades to commuting to work. It translates cultural values into memorable landscape forms and spaces that often challenge, expand, and alter our conceptions of beauty.” [17]

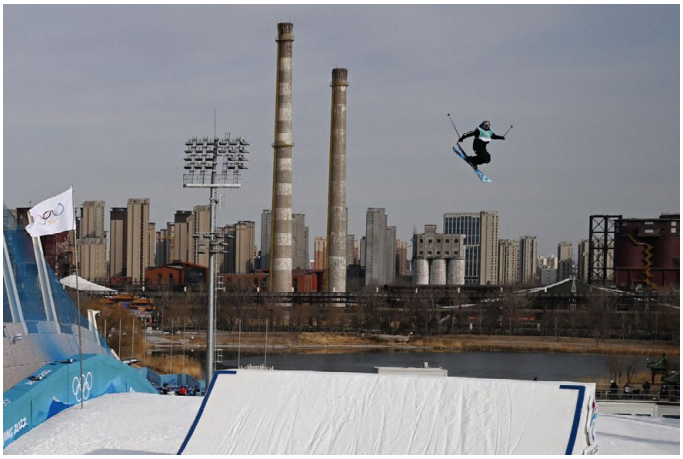


Fig. 2: Winter Olympic Games, Beijing 2022. The *Big Air Shougang* sports facility was built inside a former massive disused steel mill in the west of Beijing. Photo: M. Vatsyayana/AFP via Getty Images

The lanscape approach also responds well to recent European policies which, with the *New European Bauhaus* initiative, encourage the creation of places and experiences that combine the aesthetic and ecological dimensions, while encouraging a dialogue across cultures, disciplines, genders and ages [18]. Through landscape design, marginal, hybrid and transitory spaces can not only regain ecological qualities, but also regain the status of identity and qualified sourroundings, in which people can project their future and imagine new ways of dialogue between man and nature.
Today, the global pandemic of Covid-19 forces us to look at the world we have made with different eyes. The virus spreads through the infrastructure of the Anthropocene and forces us to rethink our way of life. Just as in the 18th century industrialised cities felt the need to build parks, plant trees and re-establish a link with nature, first from the point of view of health and hygiene, and then also from the point of view of aesthetics and "embellissement", so today we need to rethink new human habitats innervated by *infrastructures of ecosystem services designed for man and nature*, which can refer to a new garden model: the *Anthropocene Garden*. The continuous city, made up of urban, agricultural and industrialised areas, needs more than ever to be crossed by living spaces that allow us to reconnect with the natural and environmental dimension. With the landscape project, marginal or abandoned areas of the continuous city can be transformed into a *new infrastructure of ecosystem services* capable of:
1) Contribute to finding solutions to the environmental crisis
2) Guarantee the right to a qualified living framework with which the inhabitants can identify themselves
3) Creating safe and comfortable living spaces.
In the following, a significant case study is illustrated, in which, through a strategic landscape design, a sustainable future is imagined for a coastal territory in eastern Sicily which has been stripped of its values by the heavy transformations caused by the settlement of a petrochemical pole.

4. A Landscape Project for the Gulf of Augusta

The coastal area of the province of Syracuse, in eastern Sicily, is profoundly marked by human activity, which has irrevocably altered the original layout of the area, creating a complex stratification of archaeological, urban and industrial elements. The favourable natural conditions – conformation of the gulf, ease of landing and abundance of water – have allowed man to settle here since prehistoric times, building up a rich and stratified historical and archaeological heritage (Stentinello, Megara Hyblaea, Thapsos, etc.).



Fig. 3: Collage of sensory, social and symbolic features of the landscape of the Gulf of Augusta in Sicily.



Fig. 4: The landscape map of the Gulf of Augusta brings together the “inhabited city” (residential settlements, in orange), the “steel city” (industries, in grey) and the “invisible cities” (forgotten natural and cultural heritage, sparkling spots).

The same resources that led to intense and ‘refined’ anthropisation in ancient times, have led to the current problematic concentration of settlements and uses. The heavy transformation of the territory began in 1949. Since then, the progressive flourishing of highly polluting industries, power stations, purifiers, incinerators and refineries disrupted more than 20 kilometres of coastal territory. This abrupt transition from a backward agricultural society to forced industrialisation profoundly changed the physical image and identity of the area. Today it is possible to recognise that the industrial policy, accompanied by irreparable environmental damage and pollution, has partially failed and has not succeeded in achieving the aspired self-propulsive development of the territory.
Intended as a work of reading, interpretation and reinvention of the landscape of the Gulf of Augusta, the landscape project attempted to restore centrality to the identity features of the cultural and natural heritage, triggering new relationships between places, heritage and communities. The construction of the cognitive framework, carried out by means of a technical-spatial immersive analysis, started with the dialogue with the stakeholders and continued collecting the territorial, ecological-environmental, patrimonial and symbolic-perceptual characters of the landscape (fig. 3), aggregated into thematic systems of “characters”. The subsequent interpretative reading has returned in a Landscape Map (fig. 4) the sedimentation of the different layers of identity, considering them as complex systems indicated metaphorically by the term “city”: the “inhabited city” (residential settlements), the “steel city” (industries) and the “invisible cities” (forgotten natural and cultural heritage). At the base of these overlapping layers a ‘natural matrix’ has been identified, understood as the mineral and biotic support consisting of the geomorphological substrate, the former salt marshes, quarries and watercourses and agricultural crops.
In the following, we briefly illustrate the strategic design on which the landscape project for the requalification of the area is based, and then focus attention on three design insights. Going through the scales [19], we want to provide the new project narrative with an experiential, lived dimension. The three project focuses are marginal areas that need actions able to give them back a role in the territorial context, a perceptive and cultural identity, as well as an environmental quality. The archaeological site of Megara Hyblaea, saved from obliteration by the petrochemical industries thanks to the excavations

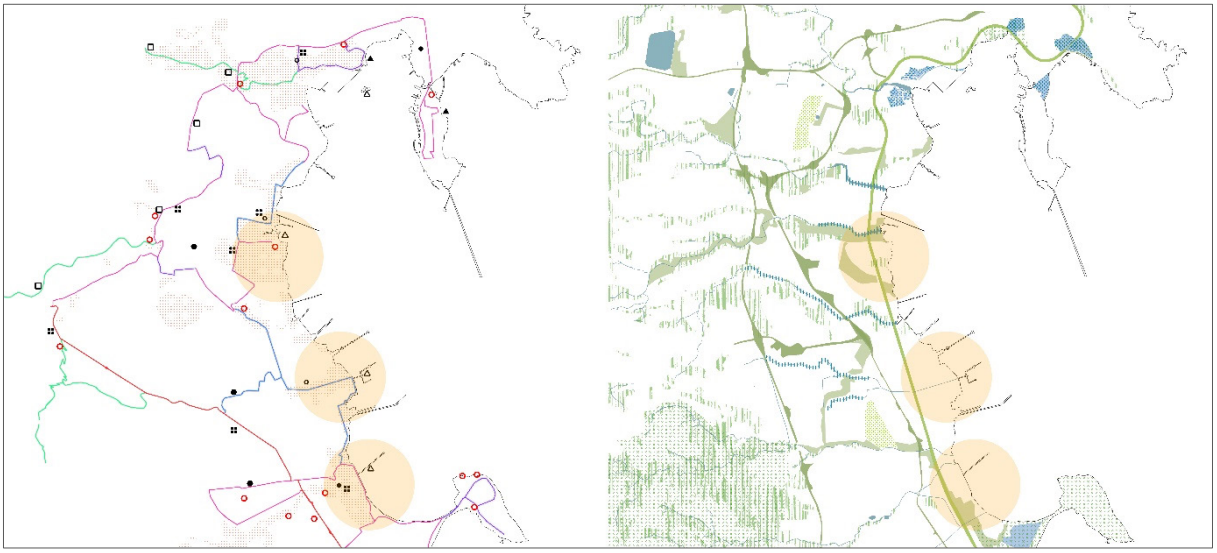


Fig. 5: The network of naturalistic-cultural routes (a) and the ecological-environmental network (b). Highlighted in orange the strategic projects, from north to south: archaeological park of Megara Hyblaea, coastal park of the city of Priolo, the Boulevard.

carried out in the 1960s by the Ecole Française de Rome, owes its condition of marginality to the incomprehensibility of the archaeological traces. The landscape project aims to improve the reading of the traces of the past, bringing them into dialogue with the current context, without denying it. The second focus concerns the small town of Priolo, immersed within the petrochemical pole. Its waterfront is in a marginal condition, since it is an interface/barrier area between the built-up area and the coastline. The landscape project aims at creating new relations between the inhabited centre and the sea, while maintaining the memory of the industrial stratifications that inevitably characterise the context. Finally, the third focus has a more marked utopian dimension, which is essential to be able to imagine all the possible stories that the project can transform into real scenarios. A designed landscape is inserted, like a *Trojan horse*, in the heart of the industrial structures, with the aim of giving rise to a project of reconversion and re-appropriation of the places by living beings (human and non-human). Its condition of marginality, of rejected and irreversibly degraded area, is so overturned through the project.

4.1 The Landscape Strategic Design

The need has emerged to reinterpret widespread cultural and landscape resources as a system and to consolidate their identity value in the collective memory. So, the Masterplan has the primary objective of strengthening the characters of traditional local landscape connected to nature, traditional rural landscape and historical assets through the implementation of four main strategies.

The first strategy aims at linking heritage and landscape. The creation of a network among the available territorial resources (Fig. 10a) is possible through the definition of itineraries connecting destinations able to make attractive the high number of assets that alone do not have sufficient attractiveness. The system effect is realised in the organisation of itineraries, in the integration of the offer and in the multifunctional use of facilities.

The second strategy is to enhance the historical and cultural heritage. The Masterplan proposes redevelopment and enhancement measures, the inclusion of new facilities and functions, and active management involving the promotion of events, shows and exhibitions.

The third strategy aims to restore and enhance the environmental network (Fig. 10b). Agriculture it is not just a primary sector for economy, but it also fulfils more complex functions such as landscape protection, sustainable resources management, preservation of biodiversity, and support for economic and social vitality. The necessary reconnection of the ecological network takes advantage of residual and marginal areas, such as roads and railways buffer strips or wooded riverbeds. Along the coastal strip, the redevelopment of wetlands (former *Regina* and *Punta Cugno* salt pans), streams and canals is promoted.

Finally, the fourth strategy consists in planning the transformation of industrial plants. In a long-term vision, an evolutionary process that involves the partial and progressive abandonment of part of the industrial activities currently present in the area is imagined. This possibility opens up new and unpredictable opportunities for structuring spaces and functions.

4.2 Megara Hyblaea, a hidden heritage

Megara represents a case of great importance in the archaeological panorama of the whole of Magna Graecia, as it provides overlapping and clearly legible archaeological evidence of the first colonial settlement dating back to the end of the 8th century BC, the archaic phase of the city, and the subsequent Hellenistic phase of the 4th century BC. Besieged by the Syracuse petrochemical complex, the site needs to be connected to the main communication axes and tourist circuits. To achieve this aim, the revitalisation project aims to improve the accessibility of the park and its integration within the territorial dynamics, and finally to facilitate the comprehensibility of the excavations and their stratigraphy too. Therefore, the project is intended as a tool to tell the story of the area of the excavations, today difficult to interpret due to the presence of only the remains of the foundations and the lack of elevated structures. To this end, the proposed intervention starts from a new system of routes (fig. 6). By following the traces of the archaic urban road system, the new routes become the instrument to bring out the urban structure of the city and to accommodate punctual interventions within the area of the excavations, mini-architectures and responsive roofs. Architectural objects have been conceived as devices that allow a deeper reading of the remains. They take the form of *projections of the traces of the past* capable of revealing the absence of what is no longer there (fig. 7). The new architectural facilities are thus generated from the projections of the planimetric footprints of the most representative buildings along the main routes. The mini-architectures are traces that can take on different configurations depending on their position and function: seating, shelters, information totems, privileged observation points and pavilions housing exhibition or service. [20]



Fig. 6: View of the excavations of Megara Hyblaea (left) and general plan of the archaeological park (right).



Fig. 7: Plan genesis of an architectural facility inside the archaeological excavations area (left) and a photo-insertion of interventions (right).

4.3 The urban park of Priolo as an instrument of reconnection

The image of the town of Priolo and its territory is strongly linked to a negative perception due to the proximity of industrial settlements. Since the 1950s, industrial settlements have replaced agricultural activity and saturated the coastal landscape, encircling the city and overlapping its historical and natural heritage. The territory includes natural sites and historical-archaeological sites of considerable interest: the *Saline di Priolo* natural reserve; the *Canniolo, Mostringiano* and *Castellaccio* streams; the *Magnisi* Peninsula with the remains of the prehistoric settlement of *Thapsos* and connected to the mainland by a narrow sandy isthmus. Today, following the change in economy paradigms, the production sites are witnesses to a past that is being erased but in which the population recognises part of its identity. This identity can be maintained by putting people back at the centre of the transformation of the territory through processes of social re-appropriation and by intervening on separate contexts, borderline places, making them as part of contemporary life. The resolution of conflicts of use along the coastal strip can allow the development of a range of leisure time facilities which can include, as evidence of the disused activities, the preservation of part of the imposing and suggestive set of warehouses and cisterns, metal structures, converted to accommodate new functions for production or for cultural, educational and recreational uses. The project envisages the reconversion of an industrial area between the coast and the city centre and aims to open up the city towards the sea, redefining a part of the territory through the transformation and reuse of the traces of industrial activities. The park is therefore an extension of the city's built-up area and at the same time a tool for reconnecting with the city's heritage and areas of natural beauty (fig. 8). The project is articulated on a superimposition of functional levels. The reuse of the cisterns and reservoirs, which constitute a recognisable landmark, allows for the creation of new spaces for the community, auditoriums, exhibition pavilions and arenas for shows (fig. 9). Circular thematic gardens regain the reclaimed space and "sprout" from the existing cisterns. A large square opens the park towards the sea, giving a new centrality to the redeveloped seafront, while a pedestrian and bicycle path connects the city and the park, crossing the railway and reaching the existing pier.



Fig. 8: General plan of the coastal park of the city of Priolo.

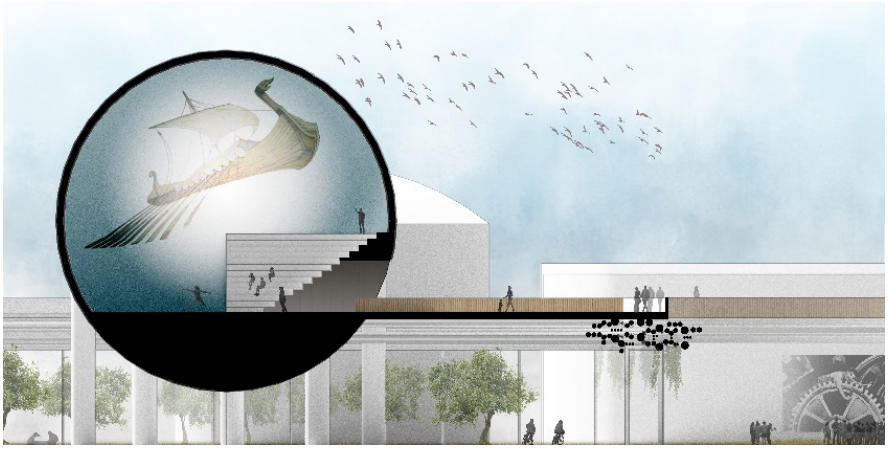


Fig. 9: Representation of interventions on spherical tanks.

4.4 The *Boulevard*: a radical intervention for a post-industrial landscape

This strategic project involves a part of the territory densely occupied by industrial plants; a landscape previously defined as the *City of Steel*. The industrial development of the area, in addition to having created a visual and physical barrier preventing access to the sea, has strongly contributed to the pollution of the territory and its natural elements, such as the stream that crosses the site and the sea area in front of it. The industrial plants, memories of a past characterized by an idea of progress that proved inadequate, have led to a severe impairment of the landscape, identifying themselves as a waste area that has strengthened their condition of marginality. The project aims to activate a transformation process through a radical intervention, unhinging and overturning physical and perceptive barriers, and returning a strip of land to community use. To make the industrial *enclave* permeable, the project intervention is configured as the "Trojan horse" of a cascade process of reconversion that starts from the inside and reconverts larger and larger portions of the industrial fabric, using a waterway that flows among the industrial plants.

The first implementation phase of the project consists of the creation of a *Boulevard*, a tree-lined axis approximately 50 meters wide, as a "grafting" element for the opening of an ecological gateway in the impermeable enclave of the industrial area (fig. 10). During this phase, it is also planned to create bicycle and pedestrian paths that cross the *Boulevard* to the coastal strip and connect to the network of territorial routes. The second phase of the project consists of the reconversion of part of the industrial facilities to guarantee the installation of new cultural, educational, and recreational functions.

Along the *Boulevard* it is planned to create equipped public spaces, called *Free Island* (fig. 11). They have forms that suggest their main functions, such as sports fields equipped with stands, other sports spaces, rest areas and hanging gardens. The realization of the Boulevard is the first step towards a perspective of the progressive dismantling of the industrial activities present on the territory today, requalifying the areas and preventing processes of industrial decline and abandonment.

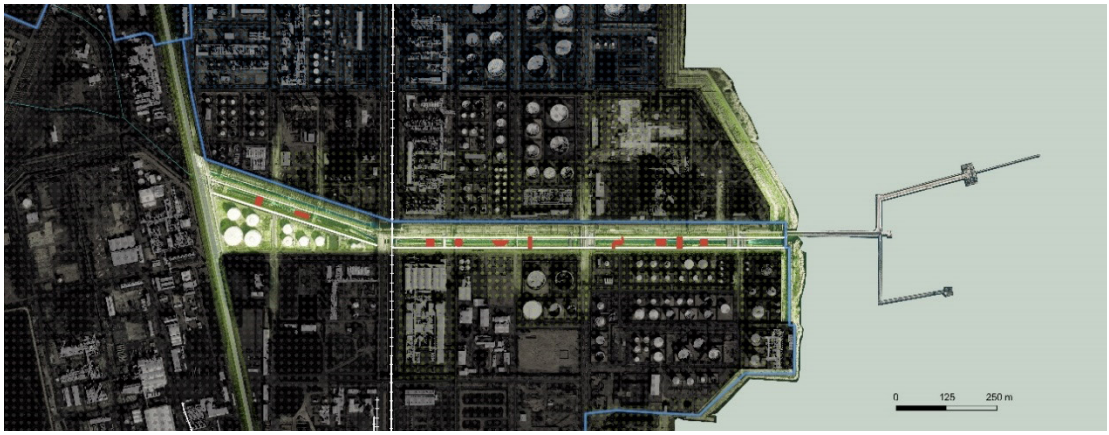


Fig. 10: General Plan: a "Trojan horse" in the industrial enclave. In green the *Boulevard*, in red the *Free Islands.*

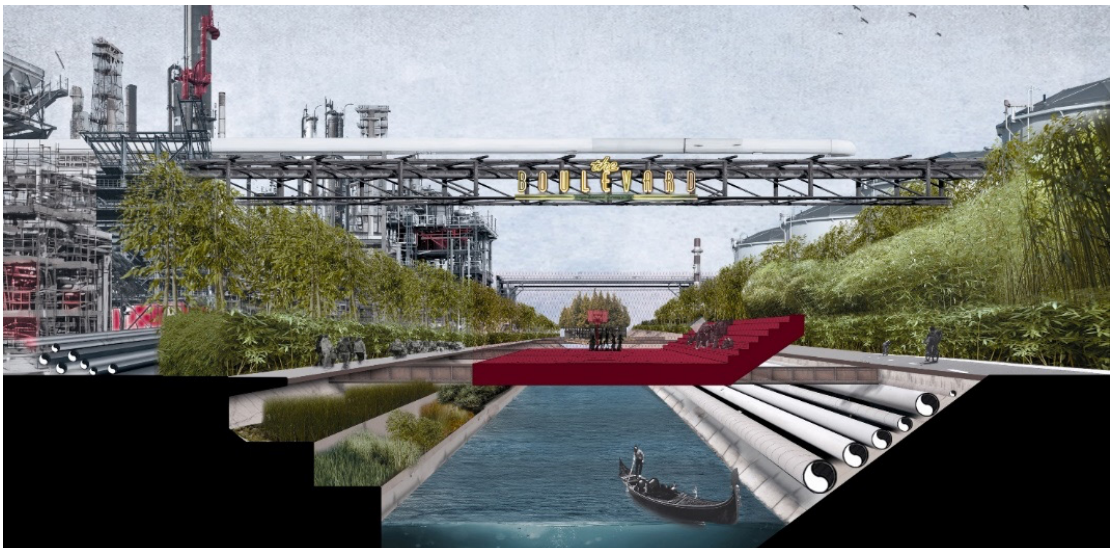


Fig. 11: View of the *Boulevard* and the *Free Islands*, floating platforms above the waterway.

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Best drawing for best conservation of Dawan Chinese village

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Abstract
When I had the opportunity to deal with the survey of a Chinese village of Miao ethnicity - Dawan village is located in the Chinese province of Guizhou, the poorest Chinese province - in order to offer the support for a proposal for the improvement of the quality of the places, where a slow process of transformation was taking place. I immediately realized that in terms of the planning proposals of the interventions, it would have been necessary to deal with offering a different management model of the community, assuming a strategy that had aimed on the one hand at the conservation of the peculiar characteristics of this village, essentially a peasant village, with the notation of belonging to a Miao ethnic community, and that it would allow its development with the protection of the minority and the historical culture of the place. The landscape offers significant areas of interest and for this reason a transformation of a tourist type is developing from a mainly agricultural activity. Dawan village does not have mineral resources, is away from the main routes of the country and is characterized by an orography with high mountainous and is nothing more than an agglomeration of just over a hundred houses all made entirely of wood and with roof tiles. We stayed in this place for less than a week and we dedicated ourselves to interpreting the places with metric surveying activities, photographic and film shooting as well as with sketches on paper and textual annotations.

Keywords: Landscape, chinese village, survey, urban transformation, representation

1. Introduction

Dawan is nothing more than an agglomeration of just over a hundred houses all made entirely of wood and with roof tiles. There are fewer families living in the village than the houses, resulting in some of them being empty. The main activity is agriculture, to which in recent years they have also been adding that of tourist hospitality. I lived in this place for less than a week and we dedicated ourselves to interpreting the places with metric surveying activities, photographic and film shooting as well as with sketches on paper and textual annotations. The analysis work was an integral part of a research “Guidelines for a detailed conservation plan in a mountainous rural settlement - Dawan village,Tongren (china) – under the supervision of Prof. Cinà, and in collaboration between the School of Architecture of Dalian Minzu University (China), and Politecnico of Torino (Italy). Technical team: Giuseppe Cinà, coordinator, Francesco Maglioccola, Qi Mu, Qi Ni, Naixuan Jiang, Xi Chen

2. Methodology

When I was able to take care of the survey of a Chinese village of Miao ethnicity in order to offer the necessary support for an intervention proposal for the improvement of the quality of

the places where a slow process of transformation was taking place, I asked myself which it should have been the best outcome I had to aim for. In the first tour, I immediately realized that in terms of the planning proposals of the interventions, it would have been necessary to deal substantially with offering a different management model of the community, assuming a strategy that had aimed on the one hand at the conservation of the peculiar characteristics of this village, essentially a peasant village, with the notation of belonging to a Miao ethnic community, and that it would allow its development consistent with the protection of the minority and the historical culture of the place. It was immediately clear, from the first visual impact, that the model towards which the local community is moving at the moment is that of privatization and personalization of interests rather than reinforcing the sharing and collective development that were part of the constitutive nature of the village.
A compact group of people with a high number of relatives, all bent on manifesting their ethnicity, with the same levels of incomes, obviously low, deriving from peasant activity almost exclusively delineated to respond only to the needs of the community, was initiated into a process of modernization in which the examples that have been found on the assumption of a predominant position by some members by virtue of a better working position - such as public employee in another city, or having reached a high level of training - having graduated, or having started a productive activity with a higher than average income, etc. they come to represent models of development that must be read positively except for the fact that at the same time they open a gap between these individuals and the community by privileging individuality without having repercussions on the social well-being of the community.
One of the new activities, which implemented on site, have represented a model is that of tourist accommodation. Without straying too far from the description of what we have grasped in the social structure of the Dawan village, in reality the conversion from an agricultural village to a tourist attraction is certainly the most widespread transformation initiated in China to favor the increase of the per capita income of peasant populations in remote mountainous areas like Dawan village.
The tourist reception, which is not connected to the prevalent agricultural activity of the community, has led to the advantage of a limited number of subjects who, either for entrepreneurial skills or intellectual capacity, or for political roles, have benefited, and continue to pursue this way, in economic terms, in terms of visibility and "power" as well as for having assumed a role of model to be imitated precisely for having increased their patrimony. These situations, let's say of excellence, have also brought about a change on the social level and on the level of urban transformations. With regard to the first, the places that have become tourist reception places, let's define them here as pensions rather than rooms for rent with adjoining dining options, are becoming closed and fenced areas independent of the context and attributable to this only in relation to the architectural presence. Those who have therefore started these activities have begun to "close themselves off" to the local community, opening up to patrons who require protected environments. These places of excellence are, for example, the boarding house where the work group settled during the period of the on-site survey activities. The restaurant, with a reception room, etc., also has rooms for rent. Another similar accommodation facility, that has completely transformed its building unit by renovating it, also fencing and protecting it from the surroundings. Other similar situations are in progress and others will probably be initiated, thus constituting a sort of winning model.
This type of tourism development, actually using the common benefit which is the landscape, nature, the built environment which is the result of the transformation of the territory by the community, belonging to the ethnic minority, etc. is exploited by few to their advantage and perhaps with minimal impact on the rest of the community. Not denying the fact that in any case tourism does constitute a possibility to favor the economic development of the community, this should equally have positive repercussions on the whole community and not favor only a few in a privileged way.
There are examples of this which that have already given positive results in China and that could also have an application in this case. To implement it, however, a different model of integrated community management is needed. For example, improvement interventions should be carried out in all areas of the village without favoring any direction but be

implemented everywhere in the identified area by perpetuating the whole constituted by the inhabited area.
Uncovered areas should not remain that are independent of the transformation action that could be implemented, but only the spaces within the architectural artifacts should be excluded in a totalitarian way. Therefore, those currently fenced and delimited areas that are excluded from collective use should be expropriated and adapted, albeit with a reduction, perhaps achieved with light prohibition elements, of the use by people unrelated to the home of which they constitute appurtenances.
The classification of the project area on which to intervene would thus result in the internal territory of the study area from which the platforms with the overlying building relating to the buildings identified as the basic typological model and its additions would be excluded. On these latter, the specific indications of the type of interventions, would have a targeted address dictated by the safeguarding of the basic typology, the construction of new buildings in continuity with the formal canons of the pre-existing ones, with limitation in the use of traditional materials only, excluding the use of masonry with cement or stone material but providing for the exclusive use of wood. Surface treatments designed to be according with pre-existing artifacts, etc. For this, formal solutions taken from existing ones would be allowed.

3. Survey

By virtue of a conservation and evaluation of these elements, a survey was carried out that would determine a sort of abacus of formal solutions from which to derive an abacus of compatible elements for architectural, urban and environmental recovery for the ethnic Miao Chinese village of Dawan.

Wooden artifacts, roofing - The wooden elements that grafted onto the external supporting columns of the roof coverings and that allow this to extend about 1 - 1.5 meters beyond the vertical line of the row of pillars, have a particular upward curvature and an engraving decoration in the bottom. It has no pictorial decoration. Above this beam, which has a slightly raised upward trend, there is another vertical element triggered in the previous one and which supporting another roof beam. This element has a particular shape like "clothespin like the one used to stop the clothes hanging out to dry". These two elements should be present in the construction, reconstruction or reinforcement of the roofs. They could be simplified but no more elaborate than the typical model identified.

Method with which the survey was conducted - The procedure that was followed in conducting the survey of the Dawan village followed a process that, preordained during the preparation phase, complies with the conditions that were objectively found on the spot. The preliminary investigations were aimed at collecting as much data as available relating to the morphology of the places to be surveyed as well as to what was attributable to the historical process of formation.
With regard to the morphological structure of the places there is not only the dimensional characteristics or volumetric aspect of the characteristics that can be summarized in simple graphs but also the diagrams relating to the structure of the land that could reveal characteristics such as landslide, the presence of karst phenomena, the presence of vegetation capable of carrying out the function of soil retention, etc.
These analyzes were carried out by making observations on large-scale thematic maps which served as a general reference. The observations of the satellite photos made it possible to complete a first collection of contextual information that frames the building in the territory and through which we tried to identify a possible matrix that expresses the phases of growth of the village from the first settlement until today.
The buildings were, therefore, related to the context giving rise to a first representation in which the built is seen as an element that has gone to settle in a pre-existence and is found there in this most suitable place to be born.

The access system to the village is also of considerable importance in this part, which is generally referred to the main road, the only driveway, which coming from other centers, runs along the ridge of the mountain to the east of the village and leads to the village itself but keeping detached if not skirting some buildings located in the lower part of the internal settlement. The fact that this road has a historical marginal role could also reveal information relating to the events of the settlement and evolutionary process of the village. Surely this role has never assumed an important role beyond the fact of connecting the village with other inhabited centers, precisely because nothing has been built by adapting to the road. The buildings have their own arrangement which is absolutely independent of this road. Only recent transformations, but which do not adapt to the buildings but to the areas of relevance, have meant that there are adjustments or adaptations to make it possible to bring road users closer to the buildings. In some points, where the conditions of the ground and the water channeling network have allowed it, areas have been modified so as to become expansions of the road and obviously be used for the circulation or parking of vehicles. This happened only in the southern edge, obviously due to the clinometric characteristics of the terrain and the ease and cost-effectiveness of the transformations. However, it should be noted that there is a complete absence of minds due to favoring the circulation of mechanical means except for what concerns motorcycles. Mezzo, which is in general the only user for economy, consumption and the ability to travel along narrow and unpaved roads made of beaten or cobbled earth.
The arrangement of the buildings is dictated exclusively to the condition of the ground, so their orientation is always such that the long side is arranged according to the contours of the contour lines. There is no reference to alignments except in some cases where the steepness of the ground is less harsh and it has been possible to build in relation to another construction rather than being forced by the ground.
Therefore, having ascertained that there were no possible geometries that could be used to simplify the survey operations, we worked in such a way as to use the basic module of the building as a reference to which to report all the surroundings for which to relate an area of relevance of one building to another through constructions and not for example
As there are currently no large animals that could be of help in agricultural activities, there are not even privileged paths of adequate width, for example for the passage of a horse or an ox with a towed cart. Agricultural activities were certainly such, and are currently, that they did not require this type of support. Even the cost of purchasing these animals and their maintenance does not seem to be supported by an agricultural community whose activity was aimed at self-sustenance. In addition, it could probably have been much cheaper in the past to sell or eat the meat of these animals rather than keep them for the few tasks they could support, bearing in mind that we are dealing with a type of agriculture that takes place in mountainous and therefore they are closely linked to the seasonality of productions with long periods of inactivity in which these animals should have been fed without being active in their support functions.

Relationship built and viability (internal) - The connection that relates the buildings to each other occurs exclusively for the front of the buildings. This is essentially due to the fact that the buildings, which were built alongside the slope of the mountain, were almost always cut to insert the building. Therefore, from the back there is never a direct passage except in very few cases where there are buildings on the floor one behind the other.

Elements of urban decoration [Fig. 6E] - What we Westerners call Chinese lanterns are located in the vast majority of buildings, that is the lanterns that are suspended on the occasion of the lantern festival held on the fifteenth day of the first month of the lunar calendar. In Chinese, this event is referred to as yuan xiao jie 元宵节 which is the final event of what is the 春节 spring festival. The lamps in the village certainly date back to February 2018. They have not been removed and will only be removed when they are replaced by new ones on the occasion. of the Chinese New Year.

Surface treatment - environmental values [Fig. 6A] - Masonry consisting of masonry with prefabricated with cement elements lightened with two holes. Used in the construction of new rooms or small cottages alongside the basic construction or isolated. They are completely detached from the context and their diffusion is linked to the ease of implementation. Generally it is then covered with wooden planks in order to hide them.
The system of wooden planks with elements arranged vertically that is superimposed on the vertical face of this masonry does not fulfill the task of making a "formal compatibility to the context" as this wooden structure is made up of simple axes without any corrections on them or interlocking panels as for houses or expansions of these. Furthermore, they are used to cover the masonry structure of prefabricated concrete bricks which, in order to "attack" the spaces around the houses as much as possible, follow the profile - curved path of the paths. The curved shape is never present in the plan so the result is a material and shape element that is foreign to the context. Wall surface made up of medium and large stones which are roughly stuck dry.
In some cases this masonry has been re-proposed in a version with the insertion of cement mortar which has been used in considerable quantities such as not only to act as an adhesive between the segments but to cover a large part of the segments themselves, representing a good percentage of what is visible on the facing.

Masonry with prefabricated solid concrete elements - Used for low walls and small artifacts or in some cases to reinforce containment walls. They are not compatible with the environment as they have a formal regularity, a gray color and require mortar in order to provide for their function. There are already small walls but there are many deposited waiting to be used. Masonry with scaled stones arranged in a prevalent vertical direction. It is a local stone material which, depending on the "vein" of the constitution of the rock mass, appears in nature with an almost vertical arrangement or with a homogeneous oblique direction. The natural warping is taken up in the construction of retaining walls that were probably built by inserting stone elements by contrast in the cracks or in continuity of a pre-existing natural structure. It is very widespread but it is clear that no maintenance operation is carried out with the same material (it is probable that it is difficult to obtain from the quarry due to the lack of workers able to carry out the cut or how many due to cost-effectiveness of processing with roughly roughed stones that are placed at in the most common applications, it is not cemented and therefore very likely subject to easy collapses with the need to provide for continuous restorations. However, it is very particular and certainly consistent with the history of the places. other cases the upper terminal part, rather than with rough stones, is used pebbles of various sizes, material that could come, being available, along the river that flows near the village.

Bare face of the cut side in the mountain - This is the front of the mountain where it was cut to create the horizontal surfaces where the housing artifacts were built. The cut in the rock can give rise, if it occurs along the fault of the rock in such a way as to highlight flat surfaces. Where the cut instead intercepts a vein in a orthogonal direction, vertical elements result as in the case of vertical flake masonry.

Column plint [Fig. 6G] - At the base of the wooden columns there are stone elements that form the basis of the construction system and the first element of the construction as it is placed on the beaten ground or in any case on the level from which the construction starts. It consists of simple squared stone elements in the form of a parallelepiped with a square base in which the height is about half the width. The pillar will be placed in the center of that base. In all cases, simple shapes that were not decorated but only squared were identified. An exceptional case is recorded because it was found in a single specimen but it could be more widespread, consisting of a base that shows an engraved texture consisting of rhombuses within a double box. The fact is that for the investigated area it is present only once so it cannot be defined at all as a recurring element. It could represent the type of decoration allowed in case you want to create this constructive element with a value higher than the smooth surface.

Terminal roof decorations [Fig. 6F] - At the lower front end of the roofing system there is a wooden plank with a rectangular section that ends with a simple molding on the lower side consisting of a sequence of arched lines interspersed with small straight cuts. The following examples have been identified. In some cases this terminal element consists of a double wooden axis arranged one on top of the other and in the more complex case both have a decoration.

Access platform to the entrance door of the house [Fig. 6G] - Given the formal structure of the wooden construction in which the system of frames perpendicular to the main facade of the architectural artifact are connected by transverse beams, and since these are also located at an altitude just above the base plinth, it appears that the entrance rooms have a entrance height higher than the outside between 30 and 40 centimeters. To overcome this difference in height, a step is placed below the entrance door which facilitates overcoming the difference in height. These are simple blocks of stone that have no decorations. Also in this case a case was found in which in a house, the one that in the consulted report is indicated as a house dating back to the period of the Ming dynasty, there are two steps that serve the two accesses to the artifact that have engraved representations symbolic. There are floral decorations on the short sides (the blocks have a diagonal cut that smooth the side corners), and the representation of mythological animals on the main face.

Windows - Opening systems [Fig. 6D] - The openings that allow ventilation and lighting towards the interior are essentially made up of wooden elements that define a sort of grate formed by squared wooden elements with a rectangular section which are interlocked and which in the simplest model is made up of elements approximately 16 - 18 vertical elements with corresponding horizontal elements positioned three in the center and two pairs in the lower and upper part. More elaborate configuration is that in the intertwining it forms three octagonal elements inserted in a bundle of seven horizontal rods. In almost all cases these openings are not provided with glass and therefore there is a continuous passage of air. This condition is very likely to be linked to the fact that in the past, and still happens in some homes, the heating of the rooms took place by burning wood or coal, which produces carbon dioxide that must be expelled from the environment. Since these environments are completely closed, having no other ventilation system such as windows, the latter were absolutely not closed. Heavy curtains attenuate the entry of cold air and protect from solar radiation even if the entrance of the latter is limited by the same formal structure of the gratings affixed to the windows as well as the fairly high position of these openings. In fact, these windows are not high enough to allow a possible view. The upper part of the opening corresponds to the height of the ceiling of the room to which it overlooks and therefore appears to be in a position to allow the combustion fumes to escape.

Balconies - parapet [Fig. 6C] - The shape of the parapets made where there are the small protrusions present at the upper level of the isolated block are very simple consisting of balustrades with a constant square / rectangular section for their entire length. Recall that being structures that are installed interlocking, they have wooden elements of greater consistency on both sides that protrude by about ten centimeters from the horizontal element. The top end of these side pieces has a diagonal cut or a curved bevel.
In other cases, clearly not in conformity with the simplicity of the entire architectural structure, the balustrades are very decorated with richly elaborated profiles but which represent a discrepancy in the linearity and simplicity of the construction as well as not consistent with the type of dwelling which does not include any elaborate decoration beyond what simple and elementary cuts.

Ramps and stairs in the external paths [Fig. 6I] - Stairs with steps made of concrete and pebble inserts up to 5-8 cm in size placed on the treads while with concrete smoothing on the surface of the risers. Steps made with local gray stone that becomes dark when wet, which are extracted into slabs even of gradual dimensions and thicknesses equal to the height of the steps or used overlapping to reach the desired height. Steps made integrally with cement mortar. All edges are sharp. The coloring is towards light gray.

The rooms of the houses - The rooms that are used in the house as places of rest and stay are those arranged on the sides of the base rectangle. The central space is not used for these functions. In some cases it is completely open and free from fixed furniture elements and the agricultural products that are stored here find a place. It could be spaces used for storage or better for the treatment of earth products such as drying.
However, it seems that this environment retains a certain value of sacredness as it is not substantially occupied, where there is a clear need to have more space for residence where the resident family is increased in number. The sacredness of the place could be related to the fact that it welcomes the most important for the survival of the family considering the definition of this community as an exclusively peasant society.

4. Typological analysis

Housing block [Fig. 3A-3B] - The architectural elements that characterize the housing block are substantially constituted by the base on which the stone bases are placed on which the wooden columns rise which with a system of beams form a building skeleton. This skeleton consists of frames which are arranged in the direction of the lesser thickness of the base rectangle and which are modularly repeated four times constituting the two end frames and the two intermediate frames. The connections between these frames are implemented with horizontal beams which serve both as a transverse connection between the frames and as a support structure for the planking which constitutes the roofing surface of the ground floor rooms. On the upper level, the spaces are almost always unused or partially used for storage. Obviously, this consideration emerges from the observations made during the period of the significant operations that were carried out in the period at the end of September. This may imply that these spaces are considered unused because perhaps it is in this period that this happens but being a building that also serves as a support for agriculture, it could accommodate products that require ventilated spaces in temporary storage. This hypothesis, however, is not supported by the fact that there are no architectural elements that in the event of use, albeit occasional, of such room, would be necessary to facilitate access to the upper floor. In fact, the vertical connection elements such as ordinary stairs are missing, having however detected the presence of portable ladders resting almost vertically on the internal wall generally positioned in the central room.
Observing these constructions from a functional perspective, it seems that there is a waste of material or in any case of volume, since the roof is then considerably distant from the ceiling of the room on the ground floor. It could also be assumed that this space, which is currently unused, may have been used in the past and currently, having changed the lifestyle of the inhabitants, has undergone the emptying of use.

Variants of the house basic model [Fig. 3C-3D-3E] - Where, perhaps due to needs dictated by the increase in the number of occupants, an expansion of the residential space was implemented, it was done by adding an additional module to the three basic ones, choosing the right or left side, in relation to the available space that had been free from constructions. The addition has almost always been implemented respecting the pitch of the basic module and aggregating new frames parallel to the existing ones and merging the new part with the existing one as if it were originally born as such. What generally shows the extension, obviously apart from the added volume, is the roof structure which has formal discontinuities such as the upper part of the roof at different heights. The continuity of the lowest points of the coverage does not give any signal of discontinuity and therefore does not allow or perfectly mask the addition implemented. These are just a few details, which can be noticed by observing the building very closely, highlight the discontinuity between the added part and the pre-existing part. The edges that define the lower limit of the pitches are treated with a minimum of decoration that can only be found in the cut of the profile. The variations of this cut are indications of the transformation.

5. Conclusion

Dawan is a village where progress is finally coming. After centuries of life lived among fields to be plowed, of winters spent at home with the hope of the provisions stored during the summer being able to make the population survive, the revolution has arrived. You will no longer need to move to go to the hospital and travel miles to reach it, but a public clinic has been opened. Everyone can turn to this health center to get the diagnosis of the diseases that have infested these poor people. Certainly we have not arrived at the daily opening but I hope it will be reached soon. We certainly haven't gotten to have the doctor come home but we'll get there soon. Medicines are not always available but with a little effort and money you can get them. The roads are now passable by vehicles while previously it was difficult to get out when it was not raining. Of course now they are not asphalted but cemented and with some stones but even if you slide there is no problem that, as mentioned, there is an outpatient clinic. And given the economic prosperity, even the houses are finally getting sanitized. If before they were on one floor, now you can also make them on two floors. Beyond it is not easy because then making them out of wood with the traditional technique is a little more dangerous. But in any case it is much better because those houses with tiled roofs made with natural materials that it took the craftsman to make them properly today can be done much more easily with industrial building material. And it is a great development because those who produce them have increased their sales and have now become one of the richest in the area. Even those who made the cement for all those streets are now doing much better. You see that you can improve. Yes, the streets were narrow and outside the houses there was little space to play and the pavement of natural stones did not lend themselves to putting them out to dry the seeds for the winter. Now the gray background of the concrete is a long gray tongue that develops throughout the village and climbs up the mountain, widens in front of the houses, and it is nice to see where they have now made the parking for the cars that arrive in the summer. many to transport the many tourists. And some of them also enjoy dancing and singing on the large square, which is also all beautiful concrete floor that can also be seen from the top of the mountain. There are also the two baskets to play ball for basket. Here in this place, there are few young people who have gone out to work but when they come back for the New Years holidays you know how many of them are going to play basketball.

But tourists are the ones who come in the summer. Less in winter but this too will change soon. The road to get to the village has been widened and it is hoped that it will be a little more so that even the buses, the big touring ones, can arrive. Here the places to host them there are so much in a while the elderly will leave it as with the improvement that is looming they will go to the city, some of them with their children to keep their grandchildren. I have already listened to who has left and what are you talking about. He has running water at home, the supermarket downstairs where he can also buy Italian spaghetti that he has never seen in the village. You've never even seen each other on television. Here the television until recently did not arrive. He says the signal doesn't travel well in the mountains. Better because if they had bought televisions it would have been a useless expense. Better for the pockets of these who previously could hear the news with the neighbors' stories. But now everything is changing. The older lady's house, the one that used to be near the river has finally been elevated one story and has a lot of nice furnishings inside. They are prestigious, ancient things, things that had never been seen here before but they are, they say, part of the tradition of the village. It seems that someone from the city comes to live here and has been fascinated by the place and the food that is produced in these parts. But now they are putting mosquito nets on the windows which also have glass. It will be someone who knows what problem he will have because here the glasses are not used. And in front of this building a nice restaurant with a panoramic terrace. They prepare excellent fish, vegetables and chickens that were previously a nuisance here that you saw ducks and chickens everywhere. Now there is one who holds them all together that are beautiful to see many and many of these in a single enclosure. But now everything is going better and in a while you will no longer hear about this village in the middle of the mountains because it will be called "Resort".

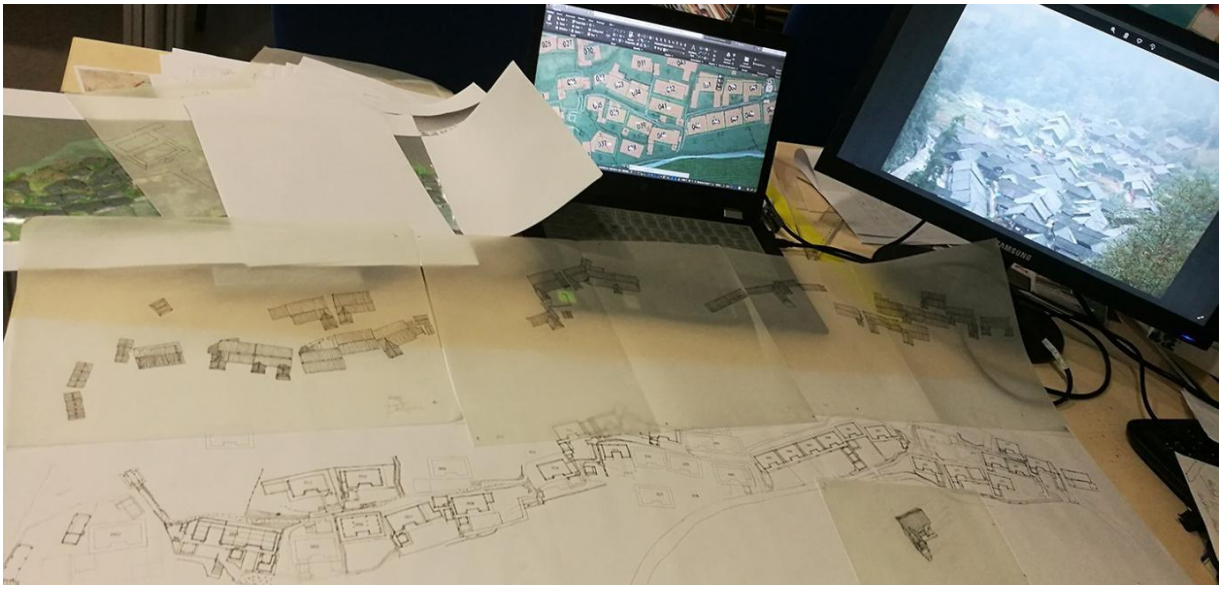


Fig. 1: Map of the buildings analyzed of Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

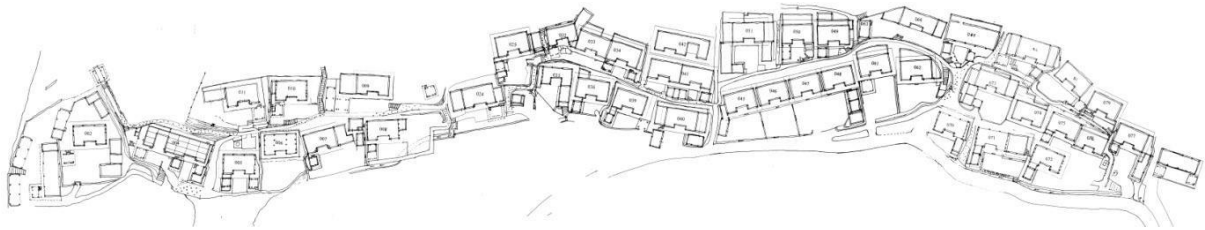


Fig. 2: Map of the buildings analyzed of Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

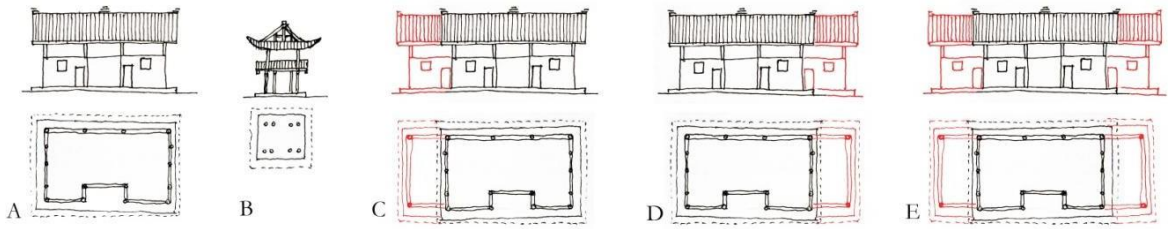


Fig. 3: Variants of the house basic model. Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

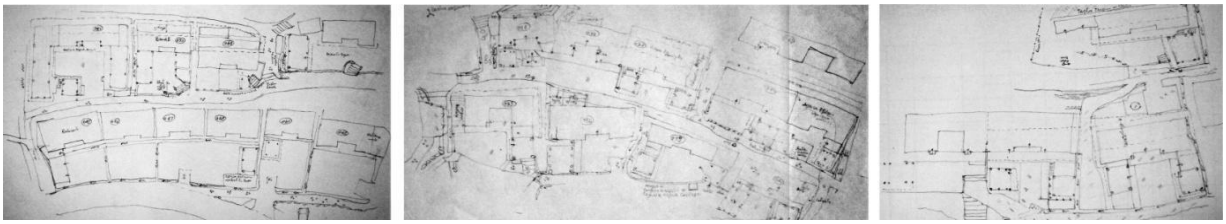


Fig. 4: Urban survey sketches. Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

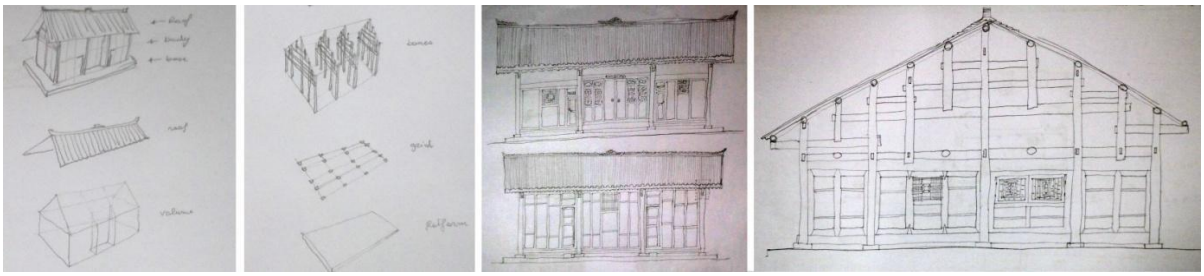


Fig. 5: Urban survey sketches. Main elevation and composition of the side facade of a building used for the hospitality of tourists.Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

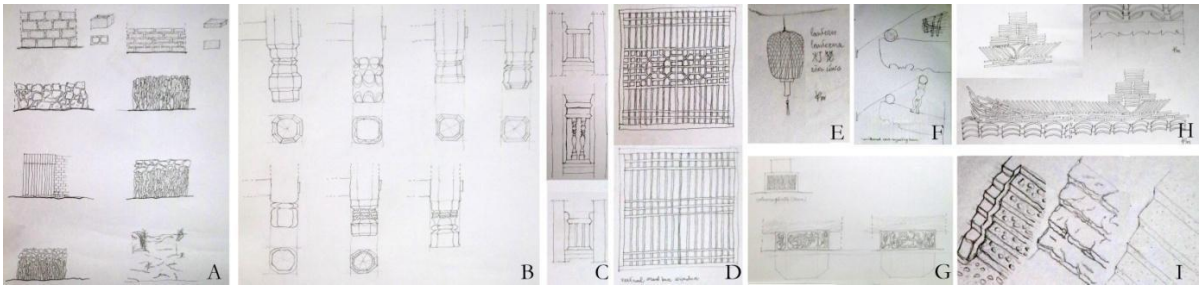


Fig. 6: Urban survey sketches. A Surface treatment - environmental values, B. Decoration of the lower terminal of the columns of the additional bodies. C. Balconies, parapet, D. Opening systems - windows, E. Lamtern, F. Cantilevered support of the cave, G. Column pillar and Access platform to the entrance door of the house, H. Terminal decorations of the roofs, I. Ramps and stairs in the external paths. Dawan village: Survey and drawing by Maglioccola Francesco, 2018.

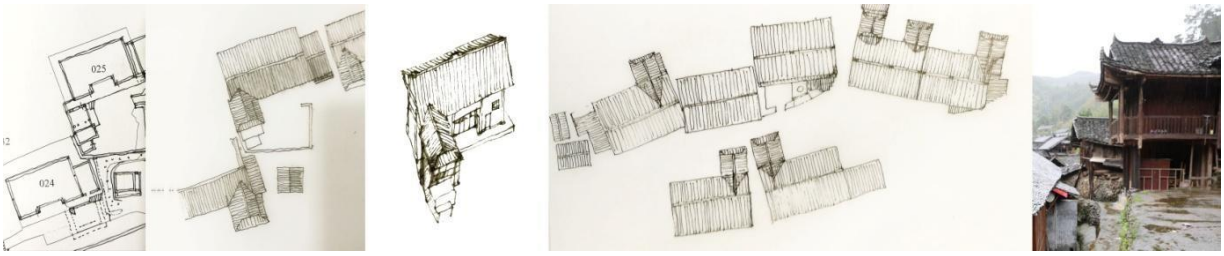


Fig. 7: Urban survey sketches. Dawan village: Survey and drawing by Maglioccola Francesco, 2018.



Fig. 8: Dawan village. Photo by Maglioccola Francesco, 2018.



Fig. 9: Dawan village. Photo by Maglioccola Francesco, 2018.

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The talking garden. Distant dialogue with San Lorenzo ad Septimum

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Abstract
The nineteenth-century garden of San Lorenzo ad Septimum in Aversa become the background for new didactic and promotional pavilions.
The starting module is sized on a grid of 3x3 m, and its duplication in several directions generates an incomplete wooden framework. These “captive objects” configure a relational community dedicated to meeting, studying, and exchanging. Around the cubic composition, raised on a platform, an irregular route connects the eighteenth-century garden to the “comfort zone”, activating original relations with the old building. It is the place of shared knowledge in the garden of slow and inspiring rest. It is the concentrated center of a cellular origin from whose perimeter the “rooms” of voluntary isolation radiate, freeing themselves from the rule of the quadrangular grid.

Keywords: reuse, garden, platform, timber-frame, tectonic

1. The platform strategy
The recovery of the San Lorenzo ad Septimum garden allowed us to think about some fundamental themes for the new millennium’s architecture and its link to the past. The proposal aims to allocate space for outdoor activities; the first part of the garden will be destinated for citizens while the second part to the DADI students (UniCampania). The area has been in disuse for several years, and the project aspires to recover this urban void. The idea is to build several small structures to compose an always different space with a modular approach. These small buildings start from the concept of the platform and the pavilion, two elements that we find in European, American, and Eastern architectural cultures. The project becomes an opportunity to design according to these two principles and combine them in a single spatial solution. (E.P., M.R., N.S.)

The interaction of contemporary architecture with the existing environment is one of the central themes of our time. Contemporary architecture generates an active dialogue with the context throughout its open, porous, and ambiguous nature. These expedients were partially defined by the masters of the Modern Movement and developed with greater force by subsequent generations until now.
In Mediterranean culture, this stratagem coincides with the theme of horizon control; with this solution, various sensations can be generated due to different stories heights. The artifice of the podium that emerged from the ground is a constant of Wright’s “long and flat” architecture. He builds above ground level “to get a better view” of the surrounding environment; the platform emerges from the ground and stops just above it, forming a natural “base” for the roof [1]. We know for sure that Wright’s influence in Europe originates with the celebrated exhibition of 1910 and the two consequent publications: *Ausgeführte Bauten und Entwürfe* (Studies and Executed Buildings) of 1910 and *Ausgeführte Bauten* (Executed Buildings) of 1911. A definitive ‘rediscovery’ of the character occurs only in the mid-twentieth century from the articles by Mumford, Giedion, and Fisker in The Architectural Review and other American magazines [2]; the change of mentality can be perfectly described by the words of Mumford, who criticizes Giedion for having gone from promoter of the “mechanical rigorists” to supporter of Wright in a 1947 text [3].

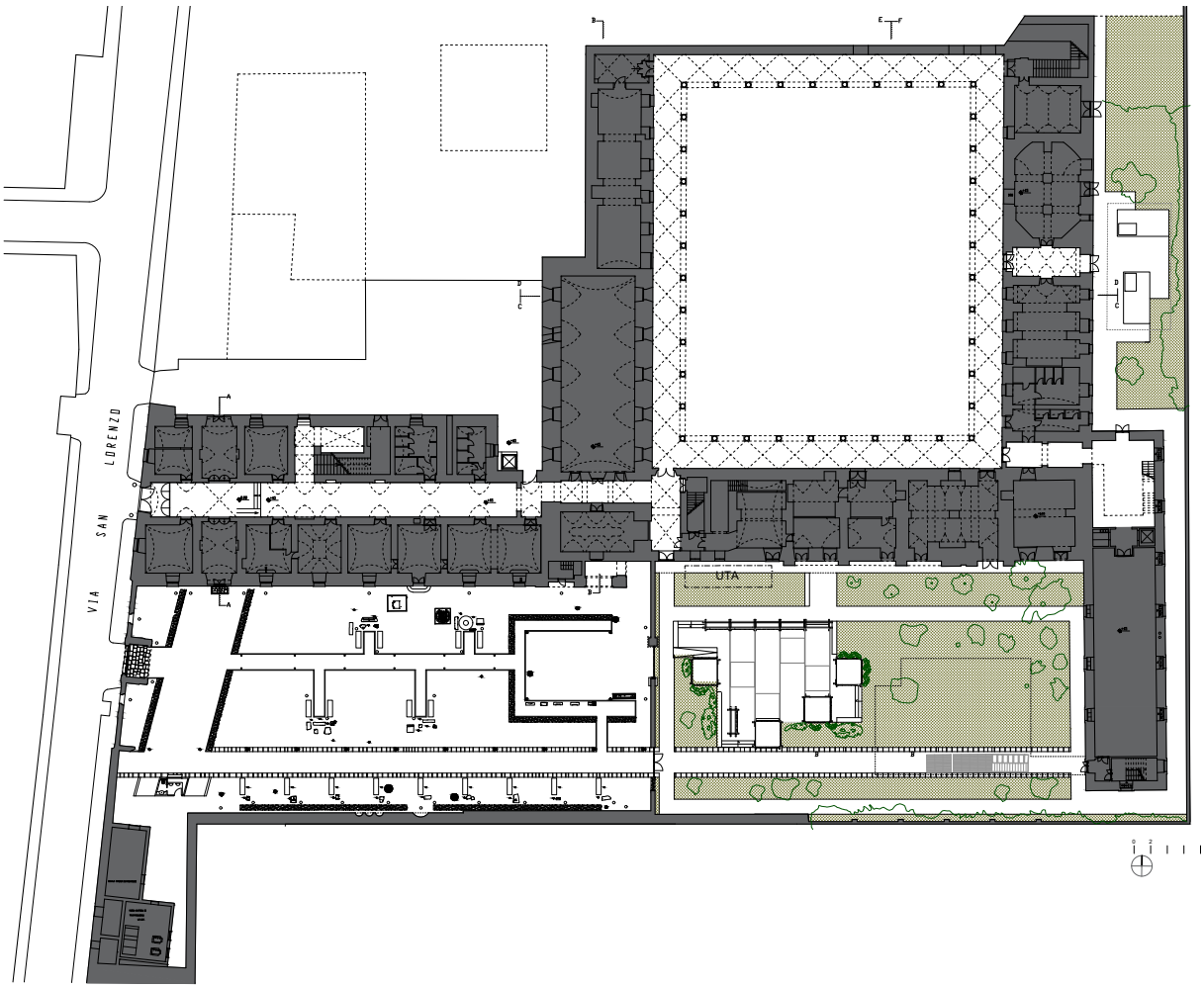


Fig. 1: New San Lorenzo historical garden.

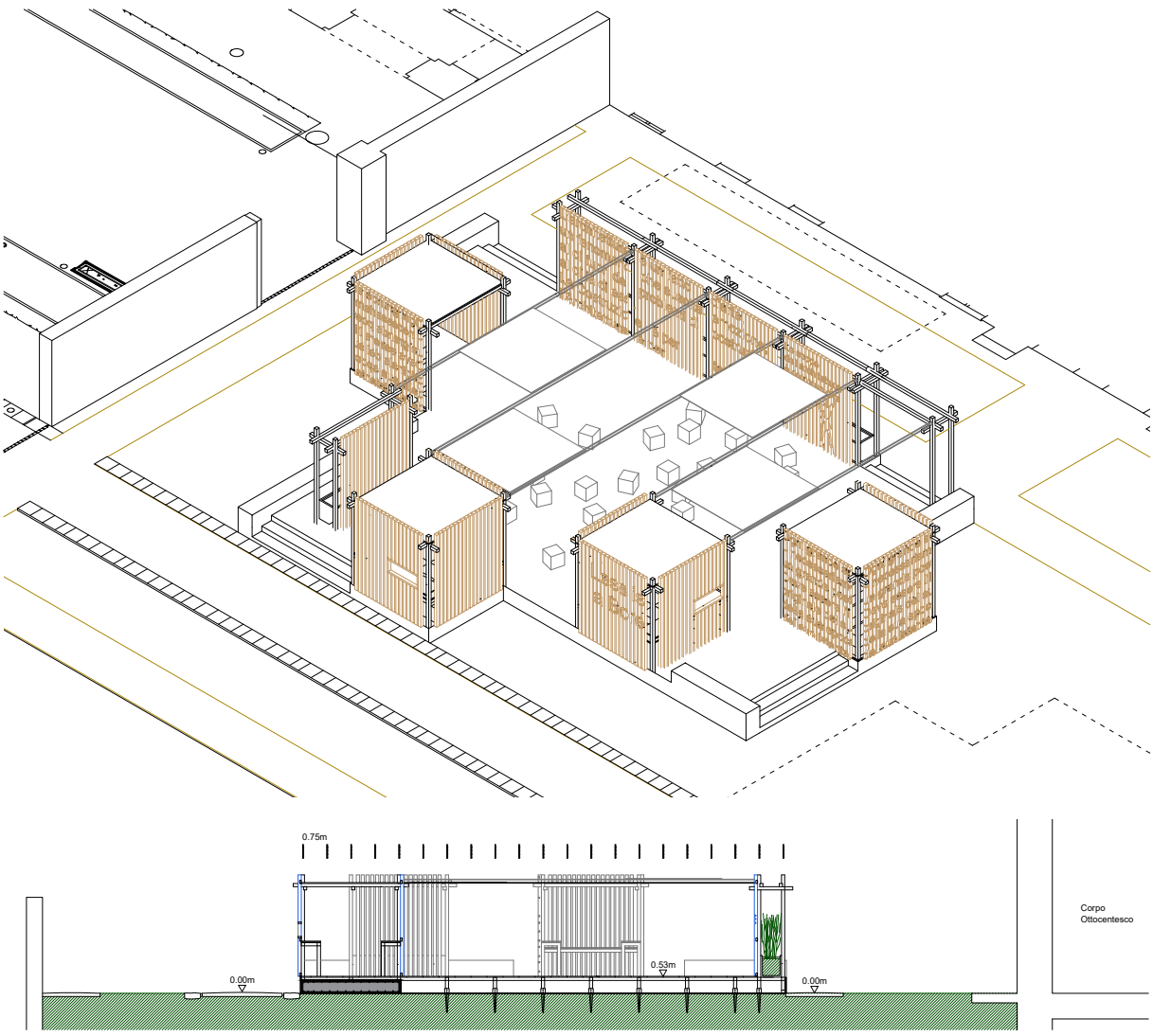
Bruno Zevi credits him with breaking the box or destroying elementary stereotomy, alluding to a composition of Froebelian games; he fitted together “buildings of various sizes and shapes” in his 1910 compositions [4]. The bodies are reduced to planes, certifying the end of the wall as a separation of the interior from the urban or natural world.

Mies has a debt toward him and his mechanisms, as stated by Wright in his speech in honor of the German’s appointment as director of the Armor Institute (18th October 1938) [5], later IIT. Raising the main floor to eye level brings the roof height to coincide with the almost flat horizon, just like in the Farnsworth House (1945-51): ‘on the main floor of the house one feels as if one were standing on a raft, which floats slightly on the water’ [6]. We speak of a raft as its architecture is very close to Japanese aesthetics, where the ground floor is raised from the ground, becoming an elevated surface. The same feeling can be traced back to Le Corbusier’s Ville Savoye (1929), where the reference to the transatlantic and the idea of being on the deck of a ship is even more evident, according to the analysis of Alberto Campo Baeza [7].

Mies obliges his clients to look at the landscape as if it were framed within a large canvas. This idea is evident in the Resor House in Wyoming (1937), conceived as a device for observing the boundless landscape [8]. For the German master, as emerges from the renowned interview by Christian Norberg-Schulz in 1958, nature or the landscape should not be disturbed by our homes, and, from his buildings, it acquires a more profound meaning [9].With the crisis of the Modern Movement, these concepts persist. A fundamental contribution to the platform’s theme can be traced back to Jørn Utzon and his other compatriots. Although we can think of a break from the previous two generations, Danish architects work worldwide, and their study period in the USA is fundamental to get in touch with these concepts. The connections between Mies and Danish architects find several testimonies. One of the most relevant is by Utzon, who, with Halldor Gunnløgsson, Poul Kjærholm, Erik Christian Sørensen, proposes a synthesis between the spaces of Mies and Wright. They look to these two masters for ‘simplification and the purity of their buildings’ [10].

The famous sketch of the roof resting on the base summarizes the idea of the Dane, bringing attention to a dialogue between stereotomy and tectonics, base and pavilion. Utzon traces the origin of this union

in traditional Chinese architecture, summarized in the layout of the Chinese pagoda. A significant point of contact with oriental culture is the discovery by Utzon and Tobias Faber of the architectural essay Ying zao fa shi written in 1103 [11]. It is a fundamental document in which 'the carpentry elements necessary for constructing each type of building' [12]. The first part of the treatise focuses on the idea behind the buildings and the terms connected to them; in Chinese architecture, the lightweight structure built on the podium is explicitly referred to as the term "Chien-Chu". The attack on the ground, attributable to the term "Chu", is the stable element of the composition, the part of the building created by pressing the ground with bamboo [13], on which stone is then worked. The term "Chien", on the other hand, alludes to the wooden structure placed on the base. The wood comes from the tree and therefore is seen by its nature as something that stretches upwards. Chinese carpenters combine the two archetypes: the architecture built above the ground, representing the place where the dynasty or the house is founded, and the building inside the earth, symbolizing the sepulcher [14].
Even today, many architects work according to this expedient. Alberto Campo Baeza transported this mechanism into the new millennium. He first tried this expedient in the Philarmonic of Copenhagen in 1993, and later, he built the famous Blas house in 2000. In Spain, the dualism between stereometry and tectonics became a theme analyzed in the 1950s by great masters such as Javier Sáenz de Oiza[15], who blended these ideas with a language based on technological precision.
On the theoretical level, an essential contribution is due to Francesco Venezia, who has often worked with horizontal volumes in his career. Venezia specifies the possibility of conceiving 'the new building as a base for the pre-existing' [16]. His accessible roofing, as for Utzon, allows us to see the landscape above the horizon. This expedient is implemented in the Regensburg museum's extension or the new building on the Sydney waterfront. In the latter case, he converses with the Utzon Opera House with a new base or 'an elevated platform on the edge of the sea' [17]; demonstrating the validity of these concepts even in contemporary architecture. (M.R.)



Figg. 2,3: Main structure in the garden and section.

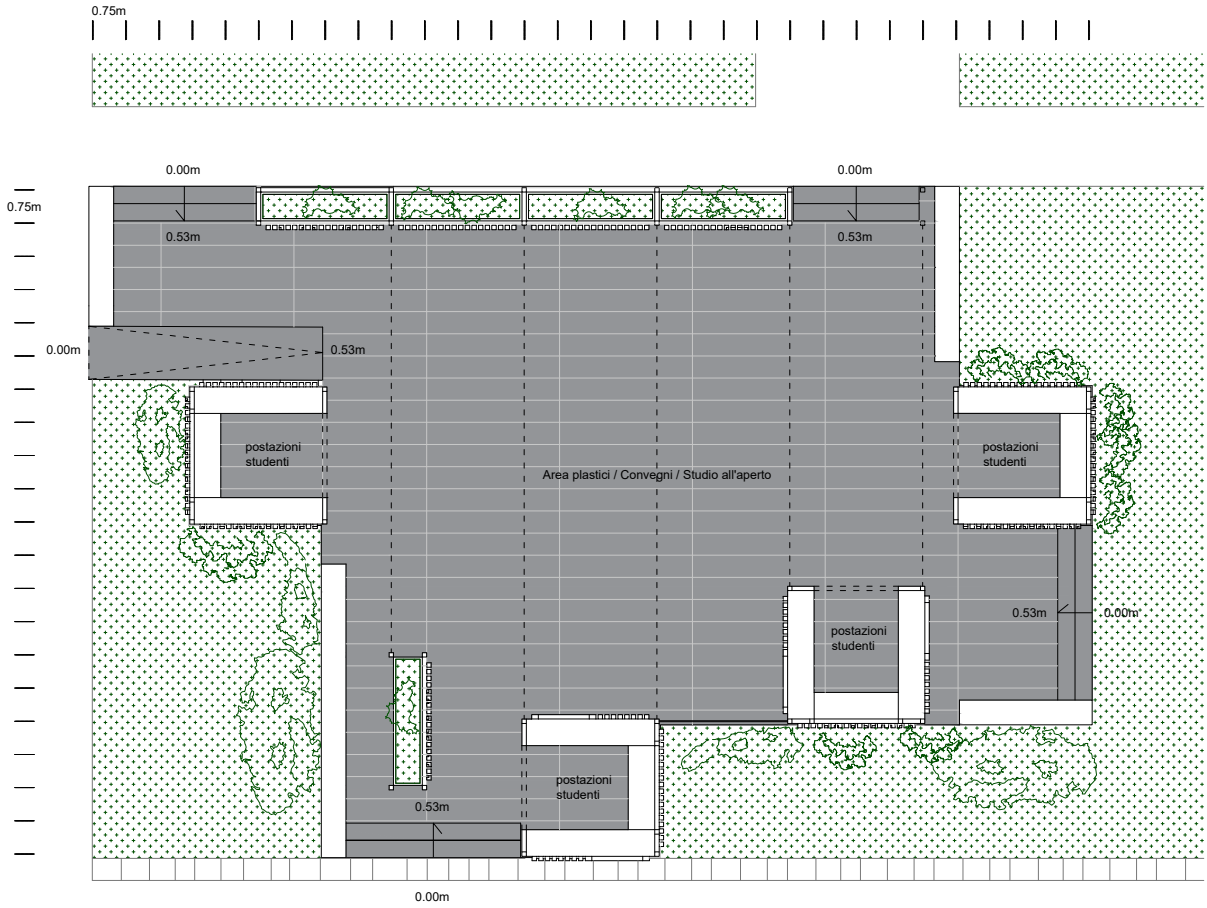


Fig. 4: Plan of the main platform.

2. Wooden structures in the 1900s

An inseparable bond characterises the entire history of humankind with nature and man's ability to shape it for his own needs. In the process of transforming nature into built space, architecture evokes ancestral memories by recognising nature as an integral part of architecture. Marc Antoine Laugier identifies the primitive hut, illustrated on the frontispiece drawn by Charles Dominique Eisen in the occasion of the 1755 edition of Essai sur l'architecture, as the origin of architecture, claiming: 'we must consider a city as a forest' [18]. For Gottfried Semper the original hut, the primordial phase of the art of building, is turned into a Caribbean hut, devoid of all mysticism to become real material. He focuses on building skills rather than on form, which derives from nature, contributing to a vision of architecture rooted in craftsmanship that considers material as inherent in the building process. The construction practices of the past were mostly handicrafts until, due to new social, environmental and economic demands that would lead to the process of industrialisation, a necessary speed of production was achieved. 'It is the machines in the factory and not the craftsman's workshop that produces the timber building today. The ancient, perfected art of craftsmanship enters modern machine technology. Here it finds new possibilities of use, new forms' [19]. The aim was to give greater intellectual depth to the typical mastery of the craftsman. Thus a new architecture was developed, capable of 'civilising technology' [20]. The evolution of traditional techniques has contributed to the spread of wood-based construction technologies. At the beginning of the 19th-century, the first houses were built in America using the method known as balloon frame, characterised by the use of wooden planks which are replicated with modularity, forming a double-beam system in a box-shaped casing, of fast and serial construction typical of industrial processes. In 1893 the World's Columbian Exposition was held in Chicago. Several architects were present at the exhibition and made works inspired by it, including Frank Lloyd Wright, who learned of the Imperial Villa of Katsura (Kyoto) thanks to a reproduction of the building. Impressed by this highly innovative language, also expressed in the Ho-o-den pavilion, which caught the attention of both Wright and the Greene brothers (who built houses in the American bungalow style), he made several trips to Japan which influenced all his subsequent organic works, which skilfully integrated the concept of nature into the materials, inspired by Japanese architecture traditionally characterised by wooden structures (in 1923 he designed the Imperial Hotel in Tokyo).





Figg. 5,6: The main platform.

The Katsura villa is undoubtedly the ultimate expression of classical Japanese architecture. The first occasion on which the villa appeared in modernist literature was when Bruno Taut wrote about it in 1935 [21]. He found in Katsura the same principles pursued by modern architecture, finding a wise synthesis of innovation and tradition in reinterpreting the architecture of the palace in a functionalist key. Even the floor plans have a strategic function. The layout of the villa is made of superimposing staggering levels. The three bodies, built in three different historical phases, reveal elegantly varied directions so that they are always seen diagonally (an arrangement known as ganko, meaning “formation of geese in flight”) and an absolute absence of symmetry. During the Edo period, in fact, a new type of architecture called sukiya-zukuri (lit. ‘building of refined taste”) became widespread. According to Gropius, it is a ‘project intimately connected with man, his life and his needs’ [22].
In history, the system of references to Japanese architecture has always been recurrent from Wright to Gropius to Alvar Aalto (remember Villa Mairea). Between 1941 and 1949, Konrad Wachsmann and Walter Gropius did their utmost to experiment with serial processes that did not limit the constructive and formal quality of the result, as demonstrated by the Bauhaus experience, and created the package house system for the General Panel Corporation, a system for the production of prefabricated wooden components based on elementary articulations between the parts that allowed experimentation with a universal cubic wooden joint in which twelve panels converged. However, the system had its issues, perhaps since it was impossible to make changes because, as it was intended for mass production, it was characterised by unmodifiable prefabricated elements. Gropius gave architecture a mainly functionalist connotation based on industrialisation and social equality aspects. He affirmed that the nature of an object was primarily determined by its function, as exemplified by the Sommerfeld House (1920) in Berlin, which best summed up the principles of timber construction in those years. (N.S.)



Fig. 7: On the main platform.

3. The talking garden. Distant dialogue with San Lorenzo ad Septimum

The design proposal for the reconstruction of the “Orti di San Lorenzo ad Septimum” follows the historical traces of the site. The first part, with an entrance on Via San Lorenzo, deals with the redesign of the site of the 18th-century garden; the second part, separated by a stone wall, recovers the site of the 19th-century garden; the third one, in a position close to an external side of the quadrangular cloister, occupies an interstitial area between the 16th and the 19th-century body and the perimeter wall of the complex.

The 18th-century garden - defined by a subsequent and accurate design intervention by Paolo Giordano - is structured through a central spine that goes from the entrance to the building body until it reaches a U-shaped “Green Theatre” open towards the separation wall between the 18th and the 19th-century section. The two gardens are linked by a single path, bordered by the ancient recovered paving stones and scattered fragments, which from Via San Lorenzo runs alongside the retaining sidewall to the transversal body on the opposite side of the entrance.

The 19th-century garden is built around a rectangular ring-shaped path in which its four fronts are connected in a kinematic sequence. Inside the ring-shaped circuit, in counterbalance to the ‘Green Theatre’ on the opposite side of the wall, there is an artifact for student activities. This building is composed of a basement with flattened margins on which, on the perimeter edges, according to an open aggregative process, are placed four wooden pavilions. Each of the four pavilions is equipped to host small study groups facing the central space. This space can be partially modified for different teaching needs: conferences, group study, and the creation of scale prototypes. Metal cables are stretched from the top of the pavilions, on which sliding sheets generate portions of shade on the area below. In addition, a partially greened wooden front is placed to screen the UTA elements on the building front. The cubic elements, measuring 3x3x3 m, comprise a series of vertical slats appropriately spaced to encourage a semi-transparency between the different areas. On the vertical surfaces, with negative pantographed lettering, aphoristic passages taken from the most important literary and theoretical works in the history of architecture and design are engraved. In this way, using the cut-up technique, they become pages of a book where disconnected passages can be juxtaposed for a new textual meaning.

The assembly method follows the legacy of traditional wooden architecture, where the junctions are made of joints that ensure static functionality. In order to provide, in case of changed functional needs, the restoration of the old site, materials and elements that can be removed and re-assembled are employed.

The third recovery area is connected to the gardens through a “life-path” equipped by Doe Morelli. This area is used as a “comfort zone” located near the “study room” and the “teachers’ room” in the body on the cloister. It consists of two wooden parallelepipeds, with a base of 3.60 x 7.20 m and a height of 3.60 m, at right angles to each other and joined by a truss structure for shading the outdoor seating area between the opposite fronts of the indoor rooms. The latter has an interior characterised by intensely coloured walls interspersed with large semi-transparent sliding openings, which establishes a relationship of continuity between interior and exterior. The external surfaces have a vertical texture of slightly spaced wooden slats, and the trussed roof has a continuous system of slightly curved sheets to help rainwater runoff.

Last, the whole project follows the recursive principle of the self-gemming of an inaugural nucleus which feeds on its rule of origin from the particular to the general. (E.P.)

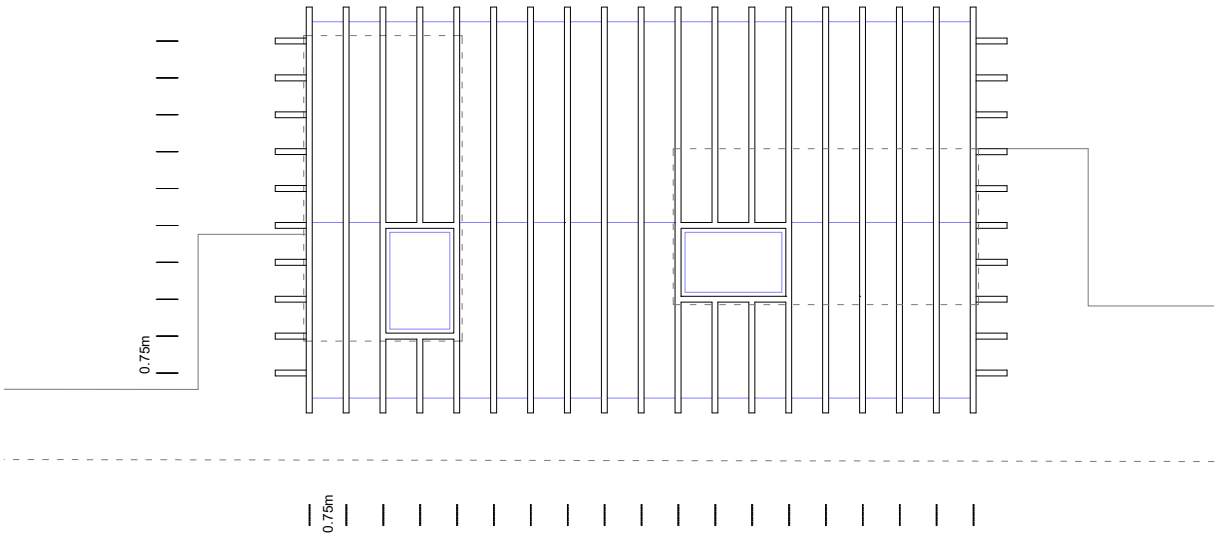
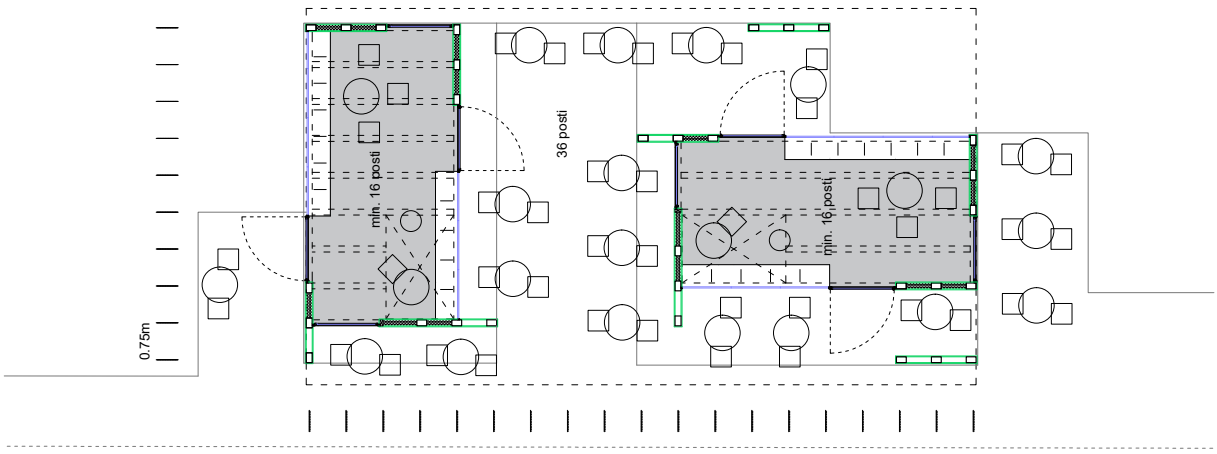


Fig. 8: A rectangular and wooden roof covers the two pavilions.





Figg. 9,10: Interior of the two pavilions.



Fig. 11: The wooden canopy.

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The role of the UNESCO Chair in the strategies for the enhancement of Cultural Heritage. An overview between Garda Lake and Mincio river

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Abstract
The UNESCO Chair in Architectural Preservation and Planning in World Heritage Cities is caring about the problem of enhancing the architectural and archaeological heritage even in critical terms that show a renewed attention to the sustainability of the project, under the aegis of the 2030 Agenda.
"The future as eternal present" means a new awareness of the existing heritage, the only one capable of guaranteeing the correct transmission of Cultural Heritage to future generations.
This attitude can be summed up in the correct interpretation of the concept of authenticity. With reference to the 2000 Krakow Charter, "Authenticity means the sum of substantial, historically ascertained characteristics: from the original up to the current state, as an outcome of the various transformations that have occurred over time".
The process of enhancement must consider every factor that interferes with the object, without setting limits of time and space, demonstrating the ability of a correct analysis of the object itself, with a specific focus on its economic, social, and environmental conditions, also with a view to optimizing resources and paying attention to the sustainability of the project.
Through the perception of the "legacy of the past as an economic value", the paper intends to investigate, with an overview between Garda Lake and Mincio river, the work that the UNESCO Chair is carrying out as a support to the enhancement strategies of Cultural Heritage.

Keywords: UNESCO Chair, Cultural Heritage, Enhancement, Authenticity, Territory.

1. A necessary premise: the UNESCO Chair in Architectural Preservation and Planning in World Heritage Cities
The UNESCO Chair in Architectural Preservation and Planning in World Heritage Cities (*Cattedra UNESCO in Pianificazione e Tutela Architettonica nelle Città Patrimonio Mondiale dell'Umanità*) was established in 2012 at the Mantova Campus of Politecnico di Milano.
In full compliance with the UNITWIN / UNESCO Chairs Program, the UNESCO Chair of Mantova is part of the largest international network of UNESCO Chairs which, by their very nature, are committed to promoting international inter-university collaboration and network organization to relaunch institutional capacities through knowledge sharing and a collaborative work [1]. Universities, through the Network, share their human and material resources to face the most pressing challenges and contribute to the development of society. The Network of Chairs is able to provide experts and mediators between the academic world, civil society, local communities, research and politics, demonstrating its usefulness in informing policy makers, establishing new educational initiatives, generating innovation through research and contribute to the enrichment of existing university programs, always guaranteeing a sensitivity to cultural diversity.
The program of the UNESCO Chair in Architectural Preservation and Planning in World Heritage Cities aims to highlight the strategic and multifaceted value of architectural heritage and encourages its enhancement as a strategy to promote a sustainable evolution of urban contexts.

Drawing on a complexity of multi-scale problems related to architectural and environmental conservation in contemporary cities, and in particular to the interaction between conservation and transformation instances, the specific approach of the UNESCO Chair of Mantova is based on the interconnecting of theories and practices and on the cooperation between different disciplines.
The Mantova UNESCO Chair has specific objectives:

- to promote the development of highly innovative and interdisciplinary educational and training activities.
- to support the promotion of knowledge in the field of architectural design for world heritage sites and the consequent development of innovative theories and practices for the same places.
- to promote training and research activities through international cooperation resulting from the establishment of an intercultural network of partners.
- to facilitate the exchange and transfer of knowledge within different areas of the world, with particular attention to promoting cooperation between the North and South of the planet, in the field of heritage conservation and enhancement
- to promote the dissemination of the results of research and teaching activities ensuring their dissemination to a wider audience. In this context, the activities of the Mantova UNESCO Chair are promoted through a program that merges education, research, and dissemination.

In the field of education, the UNESCO Chair of Mantova, supported by the AUIC school (Architecture, Urban Planning Construction Engineering) of Politecnico di Milano aims to develop and encourage educational and training activities with high innovative and interdisciplinary value in the fields of architectural design and conservation in world heritage cities.
In this context, the educational practices promoted by the Mantova Campus of Politecnico di Milano aim at the implementation of a critical approach to the related issues, based on the assimilation of knowledge and interpretative skills and on the recognition and experimentation of the possible intertwining between the different disciplines involved.
As part of the research, the Mantova UNESCO Chair supports numerous activities aimed at exploring innovative theories and practices in the field of architectural protection and design in world heritage cities.
The Chair recognizes a high value in promoting research activity, which contributes in a lively and innovative way to studies for the enhancement of tangible and intangible heritage.
The theoretical scientific activity is flanked by research projects conducted together with local administrations for the enhancement of the historic center and the cities' suburbs.
All the research activities promoted by the Mantova UNESCO Chair draw on and contribute to the development of cooperative practices based on the precious contribution offered by international exchanges that let the research have that level of interculturality indispensable to nourish and ensure the progress of sensitive, sustainable, and multicultural knowledge.
In the field of dissemination, one of the objectives at the center of the program of the UNESCO Chair of Mantova is the dissemination of knowledge on innovative approaches to research and training in the field of architectural conservation in world heritage cities.
To develop this task, various strategies and tools have been implemented, ranging from the dissemination of research results through a book series ("Architectural design and history" series, among which we need to mention as useful text for this paper [2] [3] and [4]) the relationship with the local, national and international press as well as through the implementation of digital communication tools; the organization and promotion of cultural events, stimulating meeting, interaction, debate and exchange between students, teachers, scholars and policy makers.

2. The *"Architetture d'acqua"* project

It is precisely in the context of this attention to a possible opening of relations with the outside world that the UNESCO Chair, fulfill its role as a bridge between the academic reality and the territory, faces the challenge of collaborating in the realization of a collective research project, named *"Architetture d'acqua"*. Eight research groups will contribute to the definition of this project, led by as many professors belonging to the Mantova Campus of Politecnico di Milano and two visiting researchers, the architects Andrew Berman and Martin Corullon.
The methodological approach, from the beginning of the research, foresees the work on different scales and themes in which the values of the architectural heritage are manifested and on which the contemporary project is called to operate, in order to respond to the demands of protection and conservation, of the reuse and adaptation to new needs, restoration and technological innovation, in a vision of enhancement as a necessary strategy for the sustainable growth of the environment, territories, cities and built heritage [5].
In particular, as encouraged by the mission of the Chair itself, it is necessary to guarantee "the formation and promotion of innovative and interdisciplinary theories and practices for the development of the interaction between conservation and transformation instances, with the aim of educating future

generations of architects to a conscious and efficient approach to the opportunities and challenges of the sector [6][7]".
The *"Architetture d'acqua"* project is therefore characterized by a clear vision on the importance of create a network both at the academic level, that is, by fielding the numerous skills and scientific disciplines represented by the various professors involved, and at the territorial level, involving municipal administrations and entities belonging to the provinces of Mantua and Verona, with the idea of creating a solid study and intervention project on the natural and artificial artefacts that characterize these territories.



Fig. 1: Conca di San Leone. Photo by Elena Fioretto, 2022.

Looking at the *new*, with a view to innovation and sustainability, is accompanied by a sensitive attention to the *antiques*, so that the rich heritage of territories and places along the Mincio, Po and Oglio rivers can be rediscovered, valorised and lived once again.
The research investigates a series of case studies as project sites with a certain historicity and planning strategy. From the Garda Lake (with Peschiera del Garda), through the line defined by the Mincio river (with Valeggio sul Mincio, Marmirolo, Curtatone, Mantova, Borgo Virgilio and Bagnolo San Vito) until reaching the Po River (with San Benedetto Po and Sermide), considering, by proximity, also the Oglio River (with Bozzolo and Marcaria).



Fig. 2: Map of the involved places.

The research, considering the network of interventions on a local scale, is rooted in a renewed attention to the project in its context. The wise reading of the context, on the other hand, becomes the common interpretative key of the *"Architetture d'acqua"* project. A natural and man-made context, whose interpretation is complex and certainly not reducible to a single theory.
In fact, there is a dense plot of traditions which have to be recognized and that contribute to the definition of the environment in which the different projects will weaving a new dialogue with the place.
It is possible to find the value of Intangible Heritage in the real meaning of the word *tradition*, not intended as an extension of the very concept of Cultural Heritage in quantitative terms, but rather as an interesting bearer of a new and current value of Cultural Heritage.
UNESCO, in 1989, defines with the term *folklore* "a traditional and popular culture of a cultural community as a reflection of social and cultural identity. In addition to the values transmitted orally, these forms of tradition are language, literature, music, dance, mythology, rituals, customs, crafts and finally architecture and other arts" [8].
And, in our opinion, the destiny of authenticity lies precisely in the relationship between the material and immaterial dimensions.
It is in fact necessary to avoid the revival of memory with an instrumental attitude, by virtue of economic and historical-social needs. The risk is to run into an activity of "redesigning" the history, a use that conceives the architectural heritage as an entertainment activity or, even, as a "cultural attraction".
Instead, it would be necessary to verify whether the traditional and still powerful faculty of the mind to associate memory with the place that gives access to our perception of the "past" still has the same coordinates; and if memory is still that "constructive" action depicted by Maurice Halbwachs [9] and which allows us to acquire our past through a mental representation that starts from the places and things we experience with.

This is a line of thought on architecture rooted in the idea of a possible continuity and updating of the tradition. History as memory [10], architecture and the city as a monument, a representation of civil values imprinted over the time by humans.
In a "*future assumed as an eternal present*", the past asks and invokes to be the continuous guarantor of the configuration of this present in a correct and modern interpretation of the very concept of authenticity.
The place of authenticity lies in the populated space and in the relationship between the permanence of matter and the becoming of values. This is so in architecture, where authenticity can be manifested in the relationships of the stratifications in relation to human experience.
If the history is conceived as the bearer of interpretative tools of the present time, the theme of authenticity cannot be flattened to its interpretation as the sole original condition of the object or its authorship. (The meaning of the term "authenticity" is the result of a long and interesting debate. Having overcome the authorial vision proposed by Lemaire, according to which everything related to the initial moment would be authentic and authenticity would be essentially determined in a work by the absence of modifications or alterations with respect to the initial forms: "in this sense, only the monument, painting, sculpture which have remained in the conditions desired by their creator are truly authentic" [11] [12]; following the Nara document on Authenticity [13] and inspired by the Venice Charter of 1964 [14], it is finally possible to reach the definition proposed in the 2000 Krakow Charter, according to which "the authenticity means the sum of substantial, historically ascertained characteristics: from the original up to the current state, as an outcome of the various transformations that have occurred over the time" [15]).
It is not possible to consider the history of a pre-existence only as an element for knowledge, looking like it could be only a tool useful to transfer a good practice. It's rather important to consider its dimension as it is partially infused in the material consistency of the pre-existence, and partially in the community's perception. It is, in fact the community that has been able to introduce and foster different transformations of the pre-existence itself.
In the project, therefore, there is an opportunity to verify the nature of the architecture with which it intersects, even in the most hidden aspects, of the correspondence to a collective imagination and consequently to build a response to general needs. The project is a historic response to an equally historic question.
The interventions that this research, *"Architetture d'acqua"*, will propose will build projects aimed at alignment, at the meeting between two realities, the existing one and the one to come. Without this happening through the sacrifice of one or another dimension that is not reasonable, weighted, in the general economy of the framework of objectives.



Fig. 3: Conca del Bertazzolo. Photo by Elena Fioretto, 2022.

The project challenge itself on a broader level, such as that of large-scale intervention planning; considering the value also of the contexts as well as the one of the single buildings; the relationships between urban planning, conservation processes of the existing and economic planning with the related involvement of economic disciplines for the evaluation of Cultural Heritage.
With a look at the future developments of this research which, in October 2022, plans to open the doors to an exhibition of the final results at the *Museo Civico Polironiano* in San Benedetto Po, it is possible to affirm that the projects arise from real occasions for which the University, in particular through the UNESCO Chair, is called to make a scientific contribution to solve collective problems, to guide the future developments of the city, to build a horizon of meaning for the strategic choices of the public and private operators involved.
In a complex historical context, such as the one just described and read through the lens of authenticity, the project, in order to be coherent with its meaning and not to be a refined "procedure", is called to be inclusive of the objectives belonging to a superior and responsive to the more general questions concerning collective living.
It is the application of a method certainly not intended to translate into systematic and freezing procedures, but conceived in an extensive sense, to abstract from the project actions some essential moments for the success of the project: therefore, a reference framework to measure oneself, to make the research can be compared, to favor their interaction and intersection towards an expansion of knowledge.
Indeed, a relationship between the ability of the administrations to manage the territory, the public and private interests of the communities and stakeholders involved, and the scientific competence derived from university research, united by the value of the project, is more than ever necessary.
The past itself, the achievements, the interventions must be understood in their reasons and in their developments: this is necessary to decode the present with an appropriate sense of historical responsibility.
This mission is stimulated by a specific conception of heritage as a living entity, capable of continuously producing new, sometimes unexpected, results. In this vision, heritage is not only an asset to be preserved and handed down, but also an actual vital body, from which discoveries and projects come to life.
To enhance the architectural and Cultural Heritage it is therefore necessary to continue to imagine it as an active part of the life of the city and the territories. This implies that it cannot be abstracted or excluded from the processes of change those cities necessarily undergo over time: in practice, heritage cannot be protected, as a fact, but it is necessary to continue to evaluate and update its role and meaning through the project, which is an instrument of imagination and control of transformation.
If it is true that each instance presents itself as unique, the "case by case" approach does not mean without theory, it rather means rejection of a protocol of "solutions". It means addressing each case in its particularity with the tools of thought.
In conclusion, the *“Architetture d’acqua”* project, in its developments phase, will take into consideration this analysis phase in order to develop a strategy for the intervention and the project definition.
By other themes, the visitor will be able to retrace again the history of a land which was, by its very nature, capable of an *ante litteram* sustainable development, based on the human effort of finding a balance between the power of the nature and the necessity to regulate it [16].
The final user of those lands, both the inhabitant, both the tourist, need to acquire a new perspective view, based on a slow mobility, which is the once of a conscious visit, based on the acquirement of a correct interpretation of those sites.

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From “villa” landscape to industrial landscape. And now?

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Abstract
At a time when questions are being asked about how to safeguard the environment, the city, its history and its transformations are the focus of attention. While cities have undergone a whirlwind development over the last century, new scenarios are now opening up that confront us with two distinct realities: on the one hand, new housing models are being proposed in an attempt to reduce their impact on the environment; on the other hand, people are persisting in experimenting with grandiose, futuristic settlements that continue to disrupt territories that are still not very anthropised.
The first scenario is the one that characterises much of the western world (which experienced the uncontrolled developments of the 20th century); the second is the one that seems to be found in the middle-eastern (and eastern) world, which is now going through an unprecedented phase of urban development.
Models of cities built using sophisticated building technologies; urban layouts designed in absolute freedom: this is the scenario that seems to disregard attention to the environment and our planet. Projects for eco-sustainable buildings, but also attempts to give cities back spaces that have finally been freed from overbuilding, summarise the typical attitudes of a scenario that aims to respect the environment with the ultimate goal of safeguarding the future of our planet.
In this context there are excellent opportunities - often untapped - to recover the urban dimension that has characterised our cities for centuries and that has always been in harmony with the environment: industrial development has distorted landscapes characterised by villas and gardens that have now lost their identity and are in search of a new urban, territorial and environmental balance.

Keywords: Urban Transformations, Urban Landscape, Representation, Cartography

1. The years of great transformation.
The decades between the end of the nineteenth century and the beginning of the twentieth century strongly influenced the transformation of cities. Industries were at the height of their development and communication routes were discovering new means and new roads. Throughout the western world there was an unprecedented demographic increase that radically transformed the city and the lives of its inhabitants. Everywhere, the 'human scale' dimension that had always guided the urban development of places was lost: the roads were suddenly inadequate for the new means of transport and the environment was compromised by the pollution induced by the new industries.
Renewed housing needs, combined with the use of new technologies and new construction materials (first and foremost the use of iron for buildings), generated cities that were completely transformed in terms of shape and image. In the first decades of the twentieth century, in America, extraordinarily tall buildings were constructed, while everywhere the lack of urban living space was responded to by building large blocks of flats. At times, historical centres (or parts of them) were sacrificed to make room for new buildings, due to an ever more pressing progress that suggested new forms of urbanisation. [1]
In those years we witnessed the beginning of the great urban transformations that would leave a legacy of modern cities in which every link with the identity of the place was lost. This process began in the great European capitals such as Paris, London and Berlin, but it soon affected cities across the Atlantic. This process involved above all the cities affected by emigration from the ports of England, Italy and Spain, thanks to the increasingly efficient trans-oceanic routes that were able to move millions of people

in the space of a few years. Between 1880 and 1915, some 9 million emigrants arrived in the United States, almost half of them from Italy. [2]

1.2 Genoese Ponente's case

The great transformations involved all cities affected by industrial progress: every city, in fact, after having based its development for centuries on commerce and artisan production, had to face new needs dictated by the continuous development of industrial activities. The response to this need was to build factories and industrial sheds of ever greater dimensions (thanks also to the habitual use of iron structures), taking ever larger areas from the territory and finding solutions to develop urban agglomerations destined exclusively for workers' housing.

In this context, Genoa finds itself playing a role of primary importance for several reasons: the first is linked to the presence of a port that for centuries had been among the most important (if not the most important) in the Mediterranean and that in those decades found itself hosting an immense traffic of goods, but also of migratory flows towards the Americas. Another reason is still linked to the port and in particular to the fact that it was the natural outlet to the sea for the industries that were developing in the meantime in the plain behind it and, in particular, in Turin and Milan.

All this led to a rapid urban development that irrevocably transformed the city. Starting from the second half of the 19th century, also as a result of the construction of the first railway lines and the intensification of transport flows, the city had to be "rethought", adapting it to the emerging needs: new road axes were designed, parts of the old medieval city were erased, and the port basins were enlarged, taking advantage of an orographic structure that already defined rather wide and distinctive natural boundaries. The last wall, built in the first half of the 17th century, clearly defined the city's limits, marking the two ridges that descend from Mount Peralto towards the sea, protecting the city from the Bisagno and Polcevera valleys and enclosing the entire Gulf of Genoa. [3]

The transformations that affected the Ligurian capital in these years also involved some neighbouring municipalities of the immediate west, elements of connection towards the French coast. The first act of these transformations started in 1842, with the construction of the new "National Road" wanted by the Kingdom of Sardinia to connect Genoa to the port of Nice through the municipalities of Sanpierdarena and Cornigliano located on both sides of the Polcevera valley, west of the city.

This was only the first step in a series of transformations that would turn these two towns, which until then had been considered peaceful seaside resorts with a long, continuous beach, into industrial centres serving the great city of Genoa.

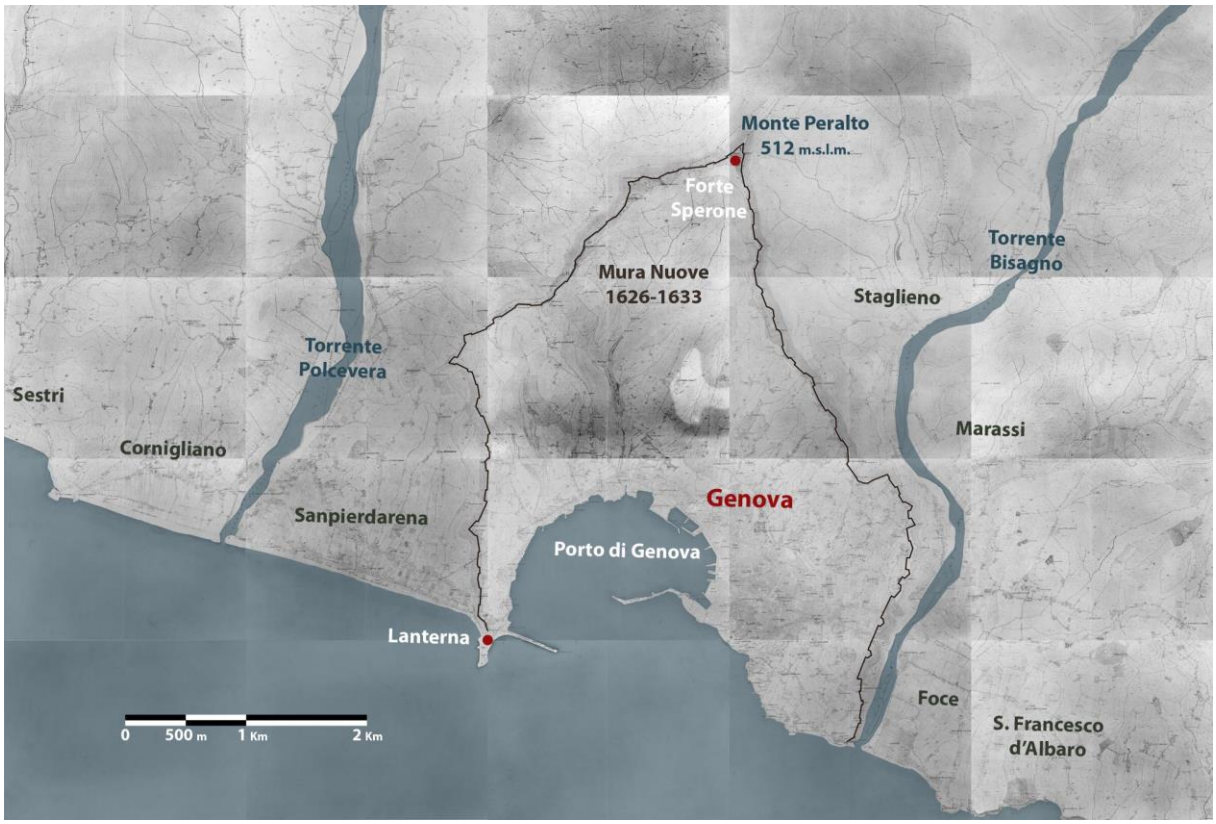


Fig. 1: Analysis of the Genoa area; elaboration of cartography by Ignazio porro (19th century)

1.3 From Villa landscape to industrial city

The name of Sanpierdarena, an ancient fishing and farming village annexed only in 1926 to "Greater Genoa", derives from the ancient church of San Pietro dell'Arena. The original name evidently referred both to San Pietro (who, according to legend, landed in that place) and to the sandy shore, i.e. the long sandy beach along the coast. This beach, of which now only photographic and iconographic documentation remains, continued uninterrupted even beyond the mouth of the Polcevera, along the coast of the adjacent town of Cornigliano.

They were both villages of fishermen and farmers who drew their resources from the sea and the plain of the river. From the end of the 15th century, these pleasant places were chosen by the most important Genoese noble families as holiday resorts on which to build magnificent examples of Renaissance villas. The villas were built at the foot of the hills, a few hundred metres from the beach, from which they were separated by a succession of gardens, orchards and citrus groves. This building process, which went on for two centuries, helped to strengthen the identity of these places, which were enriched with splendid examples of architecture in full respect of the territory and its peculiarities.

Cornigliano continued to maintain a close link with the sea until the dawn of the 20th century, managing to preserve the landscape values that had made the town particularly popular with Genoese families and well known throughout Europe.

If between 1842 and 1853, first with the construction of the National Road, then with the construction of the coastal railway line, the link with the sea began to be lost, with the imposition of conspicuous breaks in the territory (long elevated stretches of the new straight road and the entire elevated route of the railway line), it was with the expansion of industrial activities that the layout of these places was definitively changed.



Fig. 2: Views of the Cornigliano gardens and the route of the National Road (Gustavo Dufour, c. 1870 and early 20th century photograph).

Initially, the nascent industries replaced the crops that had characterised the plain along the banks of the river for centuries, and also took over part of the gardens of some of the villas. At the same time, even the villas along the original road axis (Via del Borgo) had to give up part of their land to the demand for housing imposed by the increasing use of labour in the industrial plants. The number of inhabitants of Cornigliano doubled in just twenty years: they went from 4700 in 1881 to over 9139 in 1901, imposing a radical transformation of the urban fabric. [4]
Despite the fact that these major transformations were radically changing the town's urban layout, at the dawn of the 20th century the main industries still remained confined to the banks of the Polcevera and left the town's tourist vocation almost intact. Following the fashion of the time, as was the case on the Riviera and on the nearby Côte d'Azur, numerous bathing establishments and splendid hotels were built in those years and were even mentioned in the guides of the time. [5]

2. Saturation of the urban fabric

The first decades of the twentieth century were a period of great expansion for all cities. In those years, following the important nineteenth-century layouts, a continuous process of building growth began that would seamlessly complete the fabric that was developing in the outlying areas. These were the years in which large blocks of flats were built, concentrating many residences in single high buildings. These buildings were generally conceived in groups which replicated sequences of built volumes and empty spaces with a repetitive scansion, generally following straight street axes. In places characterised by a complex orography (in general like that of the Ligurian territory), the result of these constructions is the loss of the identity elements of the place itself. In this way, the ancient routes, which sinuously followed the contours of the land, are often cancelled out by rectilinear routes which also aim to "level out" differences in height by means of excavations and embankments.
Cities expand far beyond the boundaries of their historical fabric and annex their surroundings, turning them into new peripheral areas of the city and new neighbourhoods.
What happened in Genoa is emblematic of what was happening in large cities. If until 1874 the municipal territory of the city of Genoa coincided with the urban area within the seventeenth-century city walls, the so-called Mura Nuove, according to a subdivision into six districts ("sestieri"), with the significant increase in population, having saturated all the spaces within the medieval city, an urban expansion plan was drawn up that led to the redefinition of the city's boundaries to make room for new infrastructures and residential areas for the middle class.
In particular, the Genoese administration aimed at incorporating the neighbouring municipalities of the lower Bisagno valley where there were already infrastructures serving the city (such as Staglieno, where the monumental cemetery had been completed a few years earlier, but also Marassi, San Fruttuoso, San Martino and San Francesco d'Albaro and the Foce).
In those years, expansion towards the west was not contemplated, also because of the presence of a hilly structure that still represented a difficult limit to cross. The hill of San Benigno, in fact, quickly reaches 100 metres in height and closes the city with a particularly steep slope that continues as far as the Lanterna rock, making any crossing towards the west difficult.
Although the municipalities in the western part of Genoa had not yet been incorporated into the nearby capital, they were playing an important strategic role in the industrialisation process of the whole country. The Sanpierdarena and Cornigliano shipyards and steelworks were expanded and during the First World War production was used to meet the needs of the war.
In 1926, in the midst of the Fascist regime, the "Greater Genoa" was established: the City incorporated other municipalities in the immediate vicinity, including the municipalities of Sanpierdarena and Cornigliano, which formally became the industrial area of the Greater City. In this way, a further process was set in motion that guided the expansive logic of the two districts throughout the 20th century, which were definitively dedicated to industry. The Cornigliano steelworks became the largest Italian centre for the production and processing of steel, while the nearby Sanpierdarena shipyards were dedicated to the manufacture and assembly of the final products. Ships, battleships, locomotives, but also cars, aeroplane parts and industrial machinery were produced in this part of the territory, which had now abandoned its old vocation as a "holiday resort" and was losing its physiognomy and original identity.

2.2 The loss of identity

If for centuries the landscape of the western part of Genoa remained almost unchanged, it took only a few decades between the end of the 19th century and the beginning of the 20th century to irreparably change the urban and landscape structure of the area. With the advent of the Second World War, the steel and shipbuilding centre between Sanpierdarena and Sestri Ponente had become increasingly large and important for the economy not only of Genoa, but of the entire nation. The characteristics that for centuries had made this area an enchanting holiday resort, were also particularly suitable for the development of industrial activities: the river plain at the mouth of the Polcevera was in fact the ideal

place for the establishment and development of factories and plants, while the presence of the coast represented an important element of connection with the nearby port of Genoa.
The only existing border between Genoa and the Ponente was the hill of San Benigno, which, however, a few years after the establishment of the Grande Genova, was eliminated by excavating its end. The work lasted five years and led to the creation of a large flat area for the future business centre of the port. These works were also necessary for the opening of two important roads: the new road towards the Ponente (west) and the opening of the Camionale road which was to be the first section of the Genoa-Milan motorway. The earthworks were imposing and radically changed the perception of the city, which suddenly found an outlet (not only on the road, but also visually) towards Sanpierdarena. The enormous quantity of material obtained from the demolition of the hill was used to fill in the new piers in front of Sampierdarena. A new city was being designed that was completely different from the existing one, a city that imposed itself on the site and radically transformed it.



Fig. 3: View of the Colle di San Benigno from Genoa towards the west. Comparison between a current photograph and one taken by Alfred Noack at the end of the 19th century.

Within twenty years those places completely lost their relationship with the sea: the coastline of Cornigliano advanced by 800 metres and the new fill was used for the expansion of Cornigliano's steel industries, shipyards and port activities (in the Sanpierdarena area), while the stretch of water in front of Sestri Ponente soon gave way to the new aeronautical yards and, later, the airport.
The large-scale urban development projects of the twentieth century, made necessary by the impressive industrial development, radically transformed the area of western Genoa between Sanpierdarena and Sestri, moving the inhabited areas away from the sea to make room for the industrial plants. In the process, some valuable buildings had to be sacrificed and, above all, the original landscape was completely erased.

2.3 A worrying comparison

It took only a few decades to radically transform this part of the territory, which had remained virtually unchanged for centuries. The first settlements were small villages scattered along the road leading to Genoa or along the hill or coastal roads; villages of peasants and fishermen which were only joined by the prestigious Genoese noble villas at the end of the 15th century. These splendid constructions did not alter the territorial structure and characterised the landscape even more with their elegant volumes covered with "pavilion" roofs covered in slate. The villas, with their vegetable gardens and gardens that descended to the beach, were the connotative element of these places until the last years of the 19th century.
We are witnessing a particularly rapid and devastating evolutionary process that today appears disturbing: the orography of the territory is now illegible and the built environment seems to have developed without any connection with it. It is enough to compare a twentieth-century map with one from the end of the nineteenth century to see how the transformations have distorted an entire territory, completely erasing its identity.
As part of a research project entitled *La Rappresentazione per le trasformazioni del Paesaggio Urbano* (University Research Project, FRA 2020, for which the author is scientific director and whose results are presented here), a historical cartography was drawn up using contemporary graphic techniques. The aim of the research is to facilitate the comparison between the phases of the evolutionary process of

the city by means of works that use the same graphic language and that are thus perfectly superimposable and comparable.
It was decided, therefore, to translate with a photo-realistic language (characteristic of ortho-photogrammetric surveys) different ancient cartographies describing the territory at significant historical moments. For the study of the evolution of the Western Ligurian area, and in particular of Cornigliano, the cartography made by Ignazio Porro around 1835 was used.
There are basically two reasons for using this cartographic material and its graphic elaboration. The first is linked to the period in which the survey was carried out, i.e. the 1830s. In those years, in fact, the great transformations that would affect every city from the mid-nineteenth century had not yet been initiated; the railway line had not yet been planned and the sharp industrial development would begin only a few decades later.
The second reason is linked to the surveying method used by the surveyor. Ignazio Porro, in fact, carried out the survey with the help of the officers and soldiers of the Zappatori battalion, using optical instruments and adopting for the graphic rendering (on a scale of 1:2000) the system of isohypses, i.e. contour lines, which was particularly innovative at the time, since the "sfumino" technique was generally used to represent the surveys. [6]
Porro's cartography appeared to be particularly accurate and allowed for a perfect superimposition with the current one, which was undoubtedly made with more performing tools.
The main differences between the two maps concern only the graphic technique used to draw them and, naturally, the (substantial) difference in the built fabric.
Fortunately, there are quite a few buildings present in both maps and it is precisely these elements that have been used as "cornerstones" to superimpose the two drawings. Cornigliano, in particular, still has a heritage of more than thirty villas, mostly built between the 15th and 17th centuries, in full respect of the architectural canons of the Genoese Renaissance villas. In addition to these, there are also some religious buildings and fragments of the ancient settlements which, together with the villas, allow the original settlement layout to be interpreted.
In order to translate the graphic language of nineteenth-century cartography, made up of line drawings, into photo-realistic terms, reference was made to a wealth of iconographic and photographic documentation that made it possible to visualise this territory in its three-dimensionality.
The result is an elaborate work composed of superimposed levels that retrace the evolution of the place from its origins to the present day.
The simple comparison of the two extreme steps, i.e. 1835, before the great transformations, and the current state, offers an immediate vision of how much has been lost and how much, on the other hand, remains despite having completely lost its identity.

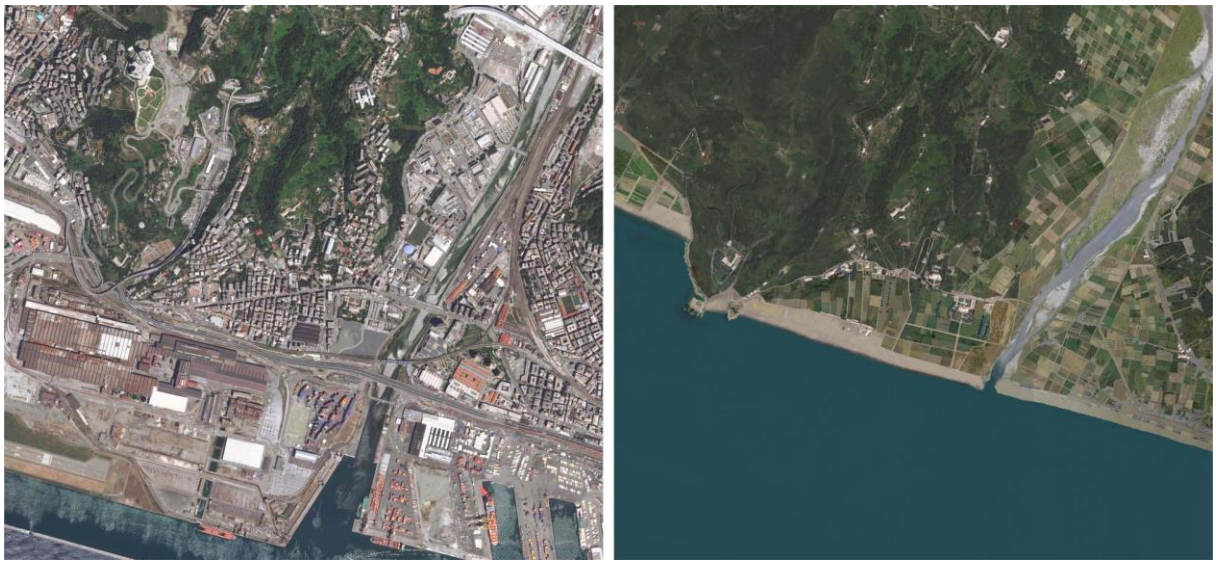


Fig. 4: Cornigliano. Comparison between the current aerial photogrammetric cartography and the cartography of Ignazio Porro (1835 ca.) reworked according to a photorealistic graphic language. (University research, FRA 2020 Project, entitled: "Representation for Urban Landscape Transformations", scientific responsible Massimo Malagugini).

This is particularly the case for the villas and the coastal strip. The villas that had sprung up along the ancient route were part of a complex system generated by the sequence of the building with the gardens, the vegetable gardens and the annexed crops that developed as far as the sandy shore. The cutting of

the road axis (the National Road built a few years after the Porro survey) marked the first major caesura in this landscape and triggered a process of building unrelated to the territory itself.
The extraordinary beach was the source of livelihood for fishermen and locals for centuries and made Cornigliano an extraordinary holiday resort. It has now completely disappeared and given way to a fill that covers some 700,000 square metres.
The filling up of the stretch of water in front of Cornigliano (completed in the 1950s) has completely changed the landscape and the relationship that the place had always had with the sea, but it has also made most of the old buildings detached from their context. There is no trace of some of them, as they were demolished together with the landscape context on which they were built and for which they were conceived.

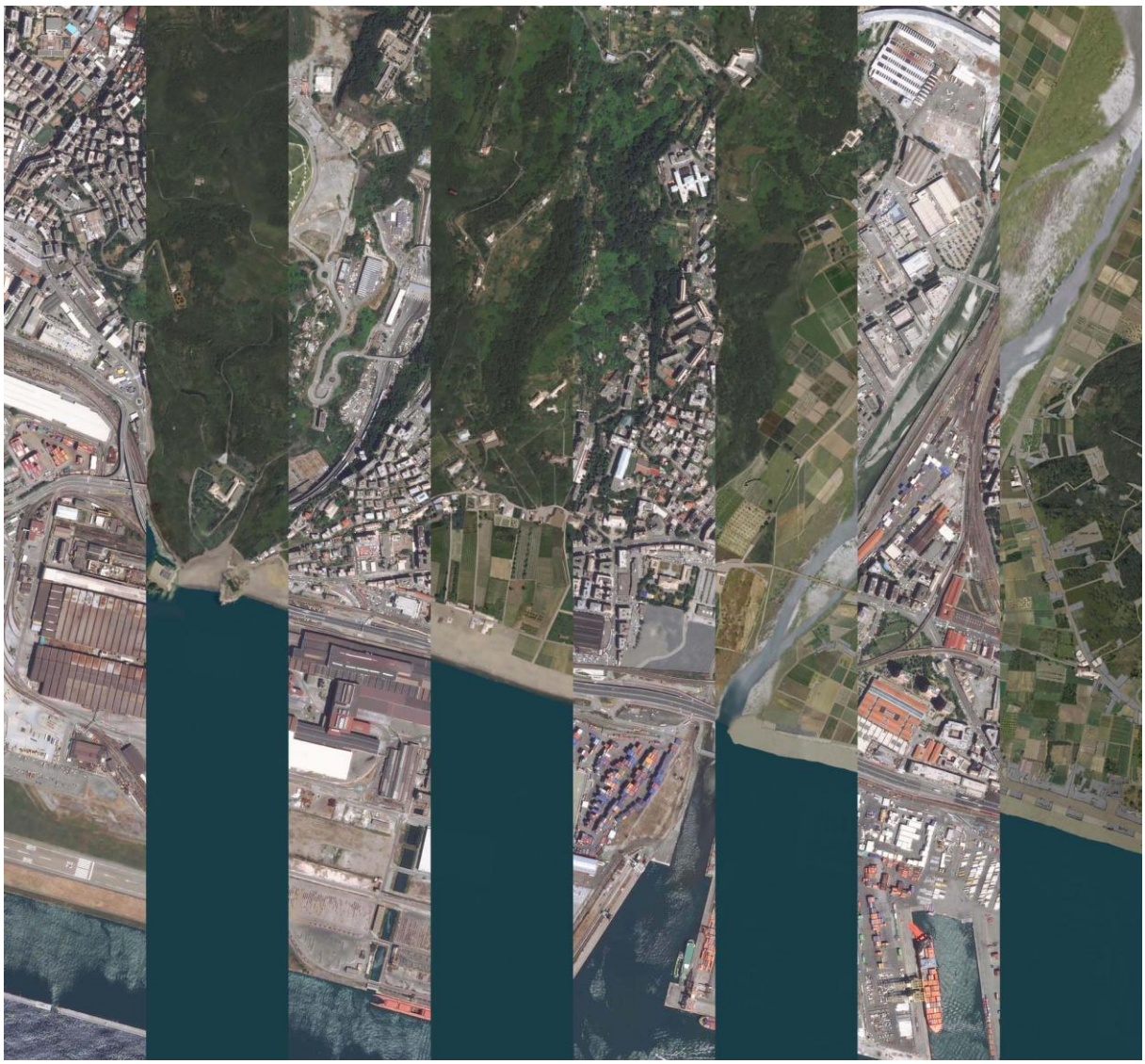


Fig. 5: Cornigliano. Superimposition and tessellation of current cartography and graphic elaboration of Porro's cartography (1835 ca.)

An emblematic case is the castle built by Count Edilio Raggio at the end of the 19th century on the Sant'Andrea rock, where there was a powder magazine built for military purposes on the remains of the almost thousand-year-old church of Sant'Andrea Apostolo.
The project was entrusted to architect Luigi Rovelli, who conceived a sumptuous residence inspired by the eclectic Miramare Castle built in Trieste at the behest of Archduke Maximilian of Habsburg and designed by Austrian engineer Carl Junker.
The castle was inaugurated in 1892, on the occasion of the celebrations for the fourth centenary of the discovery of America, with an event that involved the main authorities of the Kingdom of Italy and brought Cornigliano to the height of beauty and tourist interest at the end of the 19th century. [7]
The extraordinary position of the castle, built overlooking the sea on the small island that had been connected to the beach over time, and its imposing and elegant architecture, made it the symbol of the

place for half a century. Its early abandonment by its owners and subsequent destruction during the war turned the splendid building into a ruin that would soon be demolished along with the island on which it stood to make way for the steel industry.
This took place in April 1951 and marked the last stage of a transformation that has made an enchanting place unrecognisable.
Comparison of the two maps gives an incredible insight into the evolution of this place and makes it possible to identify exactly the site of the building and the position of the natural rock on which it stood, where the main traffic artery with its road junctions now runs.



Fig. 6: Sant'Andrea's rock. Transparency superimposition of the situation in the first half of the 19th century with the current one.

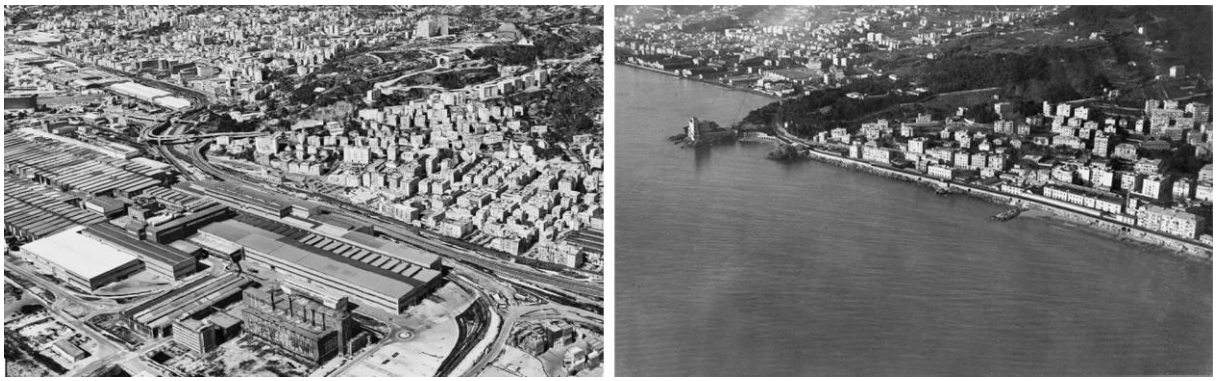


Fig. 7: Castello Raggio on the Sant'Andrea rock. Comparison between an aerial image from the 1930s and a current one. The position of the castle at the end of the ridge between Cornigliano and Sestri Ponente is clearly visible.

3. Future of the city

The expansion of the steel industry in the western part of Genoa since the end of the 19th century proceeded in alternating phases. During the Second World War, under the impetus of the Fascist regime, the entire production was dedicated to the needs of war, but with the end of the conflict it was necessary to think about a reconversion of the entire integrated steel cycle. This happened in the years of post-war recovery, when Cornigliano further increased its industrial fabric, increasingly linked to the nearby shipbuilding, port and aeronautical activities. In the 1960s the motorway link connecting Genoa to Ventimiglia was built, and the two mountainsides between Sanpierdarena and Cornigliano were connected by an imposing viaduct (known as the Morandi bridge) built with an innovative reinforced concrete structural system. In addition to the importance that the viaduct had for Genoa and for the entire nation as a link with France, it is unfortunately even more famous that the viaduct will come to an end with the tragic collapse in 2018.

After the recovery and increase in industrial activity, which reached its peak between the 1960s and 1970s, the 21st century opened as another period of change and transformation linked, however, to the progressive reduction in industrial activities and related production. These are years in which the factories appear oversized and in part now unused, offering new opportunities for the entire city.

In 2002, the coking plant was closed and in July 2005, as a result of the agreement between the Riva Group and the institutions, hot production was completely shut down. Following these changes, about 350,000 square metres of free areas where the plants had once stood were returned to the public institutions and the city. The industrial plan envisaged the expansion of "cold" activities and the employment of the 650 or so laid-off workers in public service projects promoted by the local authorities, such as the protection of green spaces, maintenance and so on.

Although the assumptions were good and gave hope for the redevelopment of the entire western part of Genoa, a few years later the results of these operations do not seem to have succeeded in restoring dignity to these places.

On 31 March 2022, work was completed on the redevelopment of the main road through Cornigliano (the historic National Road, which later became the Provincial Road), which has now been freed of traffic that has been diverted onto a new road axis along the lost coastal strip. The project included new plantings, a cycle path and resurfacing, with the aim of increasing the liveability of the entire neighbourhood. The project certainly improves the environmental quality of Cornigliano, but it does not have the necessary strength to give the place back its original identity.

In recent years, a large area in front of the gardens of Villa Bombrini has also become available, freed from the two gasometers that for several decades had "suffocated" the villa and its gardens. The gasometers, the largest of which was 98 metres high, were demolished in 2008 and have freed up the entire area, which until the beginning of the twentieth century was occupied by the fields and crops opposite the Cornigliano beach.

The proposed projects are causing a lot of discussion, but none of them aims to reclaim what for centuries have been large green spaces. The area freed from industry could represent for Cornigliano - and for the entire city - a precious opportunity to experiment with a new way of converting areas freed from industry: not new buildings and shopping centres, but open spaces that can be dedicated to green areas. Not flowerbeds and small plantings, but large spaces that can really become the green lung of an area that until the end of the nineteenth century had been a popular holiday and tourist destination for centuries. This should be the first step towards the conversion of other spaces that will become available in the meantime, with the final objective of safeguarding the precious heritage of the villas of Cornigliano and Sanpierdarena and rediscovering those environmental characteristics that industrialisation has perhaps irretrievably erased.



Fig. 7: Via Cornigliano redevelopment project. Overall views of the main road redevelopment, works completion March 2022



Fig. 9: Comparison between the original urban layout of the Villa Bombrini area and its gardens and the current one; the space in front of the garden was cleared of gasometers in 2008 and is now awaiting a new layout.



Fig. 10: Photo of the proposed project for a sports hall in front of Villa Bombrini. The proposed building would further erase the prestigious architectural and landscape heritage of Cornigliano and would be the umpteenth renunciation of the identity of that place.

3.2 Search for a new identity

What was for centuries a holiday resort, at the dawn of the twentieth century became an industrial site; today many of those industries have been closed down and the western part of Genoa has the opportunity to rediscover its identity. It is no longer the outlet to the sea of the industrial triangle made up of Milan, Turin and, precisely, Genoa, but a place that could rediscover a strong landscape and

environmental identity that could represent a direct view of the sea for the inestimable historical, artistic and cultural heritage of all of northern Italy.
In recent years it has been realised that Genoa's "waterfront" has incredible potential; Renzo Piano imagined it in his first "fresco" and recently specified it in the master plan for the "East woterfront". In it, the archistar succeeds in maintaining the union between the peculiarities of the landscape, which for years have been forgotten (and erased), and the needs of shipbuilding activities, which are constantly expanding.
In the light of recent changes, it would also be necessary to think in a unified way of a "west Waterfront" that would be capable of redesigning the layout of that part of the city that has been most tampered with by urban development, but which still retains some of the peculiarities that for centuries have made it a pleasant and coveted place.

3.3 A tool for learning about the history of the place and planning its future

The final objective of the research carried out by reading the cartographic and iconographic representations of this area is to clearly visualise the history of the place and its transformations in order to identify the key points on which to base a recovery plan for the entire area. It is not just a question of thinking about new residential or infrastructural interventions to reconvert the areas that have become available, but of trying to imagine an entire area in which new interventions can restore the identity of a place that has transformed its urban, landscape and environmental characteristics in just a few decades. Only by knowing the history of the place and appreciating its lost greatness will it be possible to refine the design awareness and sensitivity that every architect should have. The graphic designs that are being prepared are intended to be an integral part of a necessary tool, made up of images and maps, which can offer food for thought and from which to start any future work.

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New urban communities and the strategic value of knowledge. How networks are changing the urban future by offering an emergency way out

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Abstract
The thematic articulation of the following research work is based on the awareness that a new urban cycle is now at the gates, and that the urban planning discipline is faced with a double challenge, which on the one hand requires mobilizing resources intellectuals available to analyze in depth the radical changes that are taking place, or that will mature in the near future also as a result of the very recent health emergency, on the other hand it requires to insert the relationship between public policies and the plan design in a finally coherent and long-term framework. We intend to provide a working hypothesis and a contribution of ideas. The study of problems, increasingly evident in the current government of cities, has now become such a delicate and important phenomenon, so much so that it defines the century that opens the third millennium, the century of cities. Complexity conditions the urban phenomenon, in which the architecture of cities and the human factor that consume their existence in them interact.

Keywords: Urban Intelligence, Predictive analytics, Physical and digital space.

1. Reasons and research results

1.1 Scientific framework
The city is in a continuous evolution determined by its own endogenous capacity for self-organization. The multiple interpretations of the governance of urban space and the use of cities and its changes over time involve the territory, the city, individuals in the role of inhabitants. Knowledge, as a strategic element, in conditioning the definition of urban phenomena. It is thus understood that the involvement of citizens, for a direct and conscious participation in the problems of public government and urban planning, makes it possible to promote the political strategies of the city. In this context, security is one of the fundamental parameters of smart cities, a decisive area for verifying the transformation of public security. In some cases, we are witnessing the passage of power from states to cities. In 2050, 66% of the world's population will live in cities, which will replace the state in various respects and develop international relations between them, becoming a pre-eminent political entity. If we examine some indicators, including social cohesion and conflicts of power, various problems emerge: from immigration to youth unemployment, from the impoverishment of people to tensions with the Roma population, from transport to waste, from works publicly designed public areas for intellectual emigration. All these areas intersect with crime and corruption. The most aware (intelligent and sustainable) cities could allow an optimal management of resources from the point of view of safety, coordinating both public institutions (from the police force to the judiciary, to local authorities) and private individuals (in the pro- disposal and management of tangible and intangible infrastructures). The sectors of mobility, logistics, waste

disposal, energy, all with a high possibility of criminal infiltration, will be central. At the same time, there will be obvious problems in relation to the private sphere of citizens, as we will all be connected to the network, and therefore all potentially under surveillance[1]. The progress of cities over the centuries has not been linear. Periods of stasis were followed by moments of great change, as in this historical phase, due to the great technological transformations underway in the world of networks, and the pandemic emergency. In this perspective, a component that we intend to explore is the study of innovations that make use of artificial intelligence, as well as human intelligence. Cities are not just places for living. They are also powerful creative devices to activate the different present and explore the possible future if they allow a community life that builds fruitful relationships, generates fertile synapses, produces new economies and accelerates innovation. When, on the other hand, they are fragmented places of inequalities, spaces of unresolved conflict and generators of marginality, they lose their co-evolutionary function with humanity. The challenge of the most responsible and innovative, generative and circular urban planning is to design dynamic and non-stationary, circular and non-dissipative cities, generating values and non-erosive quality. Cities that consume less soil, that decrease greenhouse gas emissions, that do not erode natural and cultural resources, that pursue strategies that are more sensitive to the context and guided and implemented by the community. The city, understood as a place for enhancing the collective intelligence of its inhabitants, therefore invokes a paradigm shift capable of producing a new vision of its mission and its ability to generate an enabling ecosystem based on the hardware provided by the new quality of spaces and infrastructures and on software constantly updated by active citizens, but above all equipped with a new operating system consisting of urban planning and advanced urban policies, capable of responding to the changing demands of contemporaneity. In this regard, it is considered interesting to investigate a project of the National Research Council, which arises from the need to integrate and innovate urban planning disciplines with new digital methodologies (AI, Machine learning, IOT, Sensors). The goal is to support various urban development processes, including, knowledge of the state of the city, the natural and social environment, the virtuous management of urban and environmental transformation and regeneration processes, protection and care of urban centers, nature and culture of the territory and landscape. The highly innovative approach proposed is based on the development of the concept of the so-called Digital Twin for the city and its sustainable development. The construction of Digital Twins[2] applied to the entire urban community consists in the realization of integrated digital systems and predictive analytic techniques capable of virtually and integrally replicating a physical system, following and simulating its development and operational life, learning and predicting the collective behavior of urban agglomerations, but above all by articulating and combining all its components together. An Urban Intelligence capable of imagining wider horizons of knowledge and prediction, useful for urban planning and management, capable of constructing scenarios more suitable for restoring the complexity of urban life. In summary, the research aims to propose food for thought, in a perspective linked to the themes of Intelligence, on the city of tomorrow, with the scientific aim of identifying the different and multiple elements of knowledge, as well as predictive analysis.

2. An Urban Intelligence

2.1 Digital innovations. Space for participation and sharing

The city of tomorrow, increasingly smart, transformed by advances in technology and the diffusion of networks, and the related digital innovations represent a great opportunity for urban planning, both from the point of view of monitoring infrastructures and the environmental state of the urban environment, both from the point of view of modeling and knowledge of the urban object. A further opportunity is represented by the ability to view the changes resulting from certain projects and choices. Due to all these characteristics and the ease of collecting contributions and opinions, digital technologies also appear useful as tools for involving and participating in citizens. However, some precautions must be used: in the collection and use of data, in the construction of algorithms, and in the awareness that some issues will continue to slip through the mesh of digitalization. This is why it is important to continue to build public participatory moments in real space. Italian urban planning has been questioning its effectiveness and is trying to equip itself with methods for overcoming the operational limits of its tools. One of the problems that has recently emerged is that of the disconnection between the data used in drawing up the plans and the perception of the daily life of the inhabitants. Some of these data are

[1] Caligiuri M., (2019), Potere e sicurezza nelle smart city, Limes (5-19).

[2] Castelli G., Cesta A., Diez M., Ravazzani P., Rinaldi G., Savazzi S., Spagnuolo M., Strambini L., Tognola G., Campana E., F., (2019), Urban Intelligence: a Modular, Fully Integrated, and Evolving Model for Cities Digital Twinning. 2019 IEEE 16th International Conference on Smart Cities: Improving Quality of Life Using ICT & Iot and AI *(HONET – ICT)*, Charlotte, NC, USA, pp. 033-037.

obsolete, others distorted or in flux, while the questions that the plan should govern change at a rate at which the planning tool cannot respond quickly enough[3]. Others are data, which are not taken into account, because they have origins outside the limits of legality, in self-management, in self-organization as well as in abuse. Some practices of self-organization can fall within what Giancarlo Paba called public policies from below[4]. Practices of self-organization for the collective response to social needs, which can represent an important source of widespread urban well-being, through the activation of cultural and recreational spaces capable of responding creatively to the multiple demands of daily life (from the home, to the education, places of artistic expression, social inclusion, etc.) in ways that in some cases can be considered more public than the public[5]. One of the most interesting features of public policies from below is that of tune in subtly to the problems they have to deal with, adhering to the bodies of the inhabitants, to human, social and environmental contexts: they are intersectoral, multidimensional and adapt to the multiple demands of daily life[6]. On the contrary, planning often does not take these multiple dimensions into account sufficiently, as also highlighted by Sanchez de Madariaga[7] who brings back the concept of new daily life. Beyond the issues related to gender planning, it is nevertheless useful to welcome the critique of traditional functionalist planning, especially in a moment like the present one, in which work loses its predefined boundaries of time and space and work practices are spreading. agile or smartworking, modifying mobility and consumption habits. A knowledge of the urban and territorial object that is closer to the experience of the inhabitants from the point of view of temporality and complexity and multidimensionality therefore appears strategic for planning. For this reason, a great opportunity is represented by the use of digital technologies both in the collection and system of a large number of data, both in the context of decision support, and as a useful tool for participation. Data driven urbanism, urban planning based on data collected more or less automatically, opens up countless scenarios for more efficient city management. Data that may come from the transport system (use of public transport or smart mobility), from the use of air quality detection devices (monitoring units), from smartphones (in this case one of the experiences probably the most common is that of traffic detection in real time, which is displayed in the digital maps of apps such as google or other), to give some examples. This type of urban planning, oriented towards the best management of the city, finds its application in the monitoring and efficiency of urban infrastructures. These can be green infrastructures, as reported by Duarte F., De Souza P[8]., who talk about the use of algorithms to analyze the images of googlemaps, in order to control the distribution and health of the urban green in order to distribute the benefits of greening throughout the city. Analyzes of this type could respond even more effectively to the demand for public transport that cannot be satisfied through the current techniques of transport planning: the one that is defined as anomalous[9] because it is more articulated both in terms of routes (polygonal), both of the means used, of that of the only journey home-work or home-school and back. To this type of analysis can be added other possibilities of voluntary and / or participatory monitoring and data collection. The best known and most widespread case is represented by digital community mapping. The drawing of a map is not a technical operation, but rather it is the result of choices based on the system of values of the designer[10]. Maps, cartography, can say things and hide others. Having an active part in the design of a portion of the territory and expressing one's values and desires in the urban space through this tool is an important participatory operation, whose possibilities of collection, expression and understanding have been extended to the use of PPGIS (Participa-tory Public GIS). Mapping or self-mapping can be used in order to understand the entity and extent of the phenomena in which one participates. However, Urban Intelligence opens wider horizons of knowledge and prediction, useful for urban planning and management: data collected in an opportunistic or voluntary[11] way, allow to build more suitable scenarios to restore the complexity of urban life. A good dose of awareness in handling and possibly protecting data (big data) is also required in this field. it may happen that some

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cities outsource collection and management services, losing control over some processes and at the same time buying back the data produced by the city itself from the same companies to which they have entrusted them[12]. The data collected and made readable is therefore accompanied by a question on the actual well-being of inhabitants and city users, on the other hand the question of the democratization of sources, the construction of knowledge and decisions. Strictly speaking, a digital twin or digital twin is a faithful image of a physical process, modeled together with the physical process in question[13].

2.2 An urban digital twin

An urban digital twin is the most accurate and complex reproduction of an urban environment, a part of the city or all of it[14]. The goal is to collect and systematize as much data as possible about the city, in order to have a vision as complete as possible of the urban organism at a given moment and of its functioning. Given that the purpose of planning is the change of space and the quality of urban life, the digital twin also has the purpose of prefiguring some possible scenarios, as a consequence of the choices made and the projects implemented. The idea is placed in the context of urban intelligence, adding the urban component to the computerized approach of the smart city: the Senseable city. The sensitive city tends to build highly computerized cities, but at the same time questions the human side of the city and how to include it, overcoming the predominantly technological approach of the smart city. The urban digital twin allows to put together in a legible way, data coming from the automatic detection of phenomena related to so-called objective situations (air quality, greenery, etc.) and data closer to the experience of the daily life of people and consequently influence their behaviors. A digital twin is not a faithful representation of reality, but it must be enough to hold together sufficient data in order to discuss complex problems[15], bringing together economic and social processes with the built environment, and connecting physical and functional processes to the socio-economic representations[16]. Generally digital twin models can concern single infrastructures (water system) or areas (noise and sound pollution, air quality, heat islands, etc.). Only recently has this technology begun to be applied to the construction of advanced and experimental models, which could broaden the field to build a non-sectorial, but composite and global vision of the entire urban settlement, through the construction of different layers that cooperate with each other, in order to create an image not only of urban systems and subsystems, but also to understand inhabitants and city users and their interactions[17]. Therefore an urban digital twin represents a refined device of profound knowledge of the city, both from the material point of view, both from the point of view of flows, and social, able to hold together and organize data and information deriving from different sources: sensors able to monitor the quality of the environment, the levels of urban well-being, the state of the infrastructures, can be integrated and put into a system with the data actively provided by citizens through different channels of participation, both individual and collective, both through processes and through digital tools (Fig. 1: example of new generation digital platform). A case study, outside the technological and sensory fields, is represented by the *Cambieresti* project which took place in 2005 in Venice. The project aimed to spread sustainable lifestyles among the inhabitants of the lagoon, based on the awareness of their behavior and consumption (suppliers, waste production, etc.). Although the use of digital tools opens up new possibilities for communication, involvement, collection of opinions and decision making in the processes of involving the inhabitants, some precautions are necessary. Stephen M. Stigler points out in an article published in 2019 by Harvard Data Science Review that every data has a life cycle and that the way it is collected and the methods used to give it meaning are based on ideological values and views on reality. There will always be a portion of the population that is not tracked (more or less voluntarily) and some data could reinforce urban segregation and stereotypes. Not all social aspects of urban life can be translated into usable data by data science methods, and sometimes contemporary critical phenomena do not produce data that can be read by computers, but have social impacts, which may not be detected by models. digital. Although digital technologies open fascinating horizons of possibility of knowledge and prediction, the question of participation cannot be solved solely through dematerialized means of collecting individual

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[16] Batty M., (2018), “Digital Twins” Environment and Planning B: Urban Analytics and City Science, 45, 817-820.

[17] Ibidem castelli.

opinions. This type of process would correspond to a simple consultation. If on the one hand it appears to facilitate information and the collection of opinions of some segments of the population, on the other hand some aspects are not to be excluded. The first concerns the participation process itself, the outcomes of which are always unpredictable compared to the sum of the opinions of individual participants; the result of a process of participation is the result of moments of listening, information, mutual learning, of informal meetings, a kind of fermentation, to use the inspired words of Lidia Decandia[18]. The second concerns inclusion techniques, paying particular attention to those age groups at the beginning and end of life. In fact, the participation of the elderly can be a precious source of information and construction of symbolic and identity value within a community. The participation of boys and girls, on the other hand, appears to be strategic for building a more liveable city and for measuring itself against its playful, educational and social well-being dimensions[19]. For this particular group of inhabitants, it appears necessary to open spaces for participation that are accessible on the basis of the characteristics of their age: in fact, the little ones need to act in materiality, to understand the small dynamics and from there to come up with ideas and solutions capable of having long-term and wide-ranging[20] positive effects. This is why it is necessary to continue to build offline participation arenas, in which people can continue to confront, get to know each other, exchange points of view to build other shared ones. Public space is directly connected to the quality of democracy[21] because it is the space where people can meet and express their opinions in a free and evident way. Because it is the space of the unexpected, of serenity. The network still does not appear to contain these characteristics, on the contrary the infrastructures that manage to eliminate the disturbance which instead forms the basis of serendipity are considered to be better. Therefore, attention remains necessary on the physical and social accessibility of urban and public space.

3. Conclusion

As is known, the UN 2030 Agenda has included among its objectives the reorganization of the city in terms of sustainable development (Objective 11, Sustainable Cities and Communities). Furthermore, the sustainability of new urban development models is at the heart of the Green New Deal wanted by the European Commission led by Ursula von der Leyen. Finally, the urgency to achieve these goals has increased since the current socio-health emergency from Covid-19 and the reorganization of human settlements in a post-pandemic key is one of the fundamental themes of the new programs to relaunch the economy in view of the strategic use of the Recove-ry Fund. Undoubtedly the ancient city was better equipped to face the ephems, not only for the structural presence of the lazarets and sanatoriums, but for the same forma urbis which provided for human-sized distances and places of relationship also for neighborhood and neighborhood life. The wildfire expansion of the modern city and the connected polarization of services are undoubtedly the unstoppable effect of the new development dynamics connected to the industrialization process and the related economic boom, but the structuring of its form is attributable to the distorted application of the theories and points of doctrine of the Modern Movement (CIAM, 1928-1959; Athens Charter, 1933). Today, in the contemporary and post-modern city, the way of life, the way of understanding social relations and the very use of the modern urban structure have changed profoundly. The metropolisation of the urban settlement is no longer just a phenomenon linked to its size, but rather an inevitable trend connected to the disintegration of the endowments, their expulsion from the urban structure to be better connected to the mobility networks. But more than the city, its users have changed, no longer citizens but city users, newcomers, travelers, globetrotters, recently formed social figures pro-duced by the new functional paradigm of globalized settlement. Urban life, which is heading towards a convergence of physical and digital space, giving life to a new citizenship. The city of the future, which was born on the basis of an intersection between the digital and physical world. These arguments, on the future of cities, if contextualized at the historical pandemic moment, lead us to rethink territories and cities, for a civilization of care. History, in fact, sometimes presents unexpected crossroads, which under the surface of an apparent contingency are in reality the result of long-lasting processes which, beyond the intentionality of the actions that produce them,

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suddenly take shape, marking a watershed in history. It is perhaps early to say with adequate certainty, but the COVID19 epidemic and its consequences really seem to represent one of these events. The problems of an unsustainable development model, whose damage to the living environment some still believe they can underestimate or ignore, find on the part of many authoritative observers, the emergence of reflections on the consequences of the pandemic and on the fragility that it brings to light. Overcoming of the boundaries, not only functional ones, between anthropization and natural spaces, processes of planetary urbanization, unsustainable mobility of goods and people, the result of extractive economies and processes of destruction of regional know-how and productive cultures, consequences on emissions of greenhouse gases and human health, unequal distribution of resources and social imbalances are key factors, inductive not only of this crisis but also of the weight of its consequences. All of this naturally questions not only the domain of physical planning. The debate certainly involves the ways of conceiving and managing cities and territories but also their relations with development models and economies, with social practices, with the forms and requirements of a possible wise proximity to life, which knows how to take care of ecosystems, places and people. We also refer to governance models at different scales, especially in terms of a profound demand for return and regional and local empowerment that seems to emerge from this story. It is certainly early for hypotheses and structured arguments that require adequate decanting and observation times, however it is perhaps a propitious moment to solicit necessary, open, and transversal reflections, both on a thematic and disciplinary level, at a time when the urgency makes perhaps more sensitive, free and creative in grasping dramatic contradictions but also potential for the future.

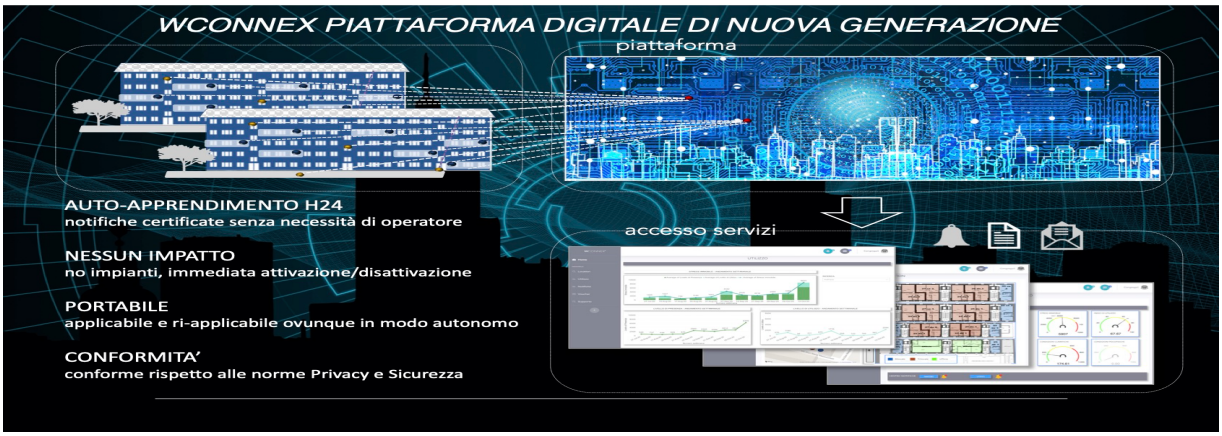


Fig. 1: example of Wconnex: new generation digital platform

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A Theoretical Contribution To Improve The Formation In The Historical Lisbon School Of Architecture - The Forgotten Dimension of the Technological Perspective

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Abstract

This article approaches the problem of the absence of the technology in the didactics of the Architecture´s Design, in the course of School of Architecture of Lisbon, as the subtitle of the article suggests - the forgotten dimension of the technological perspective. Despite of the course contemplates a relevant technological component, however, does not reflect, much less exponent the creative act of the Project. This is first of all a result of the organization, didactics and contents of the Project classes, and not so much, a lack of knowledge provided to the student in the technological disciplines, which are present in quantity in the curricular structure. The situation, analysed in this article, is a consequence of a blocking of the Project classes to the technology ones, which do not promote, nor allow, the necessary transdisciplinary articulation and integration between the act of designing and the application of technological knowledge, which is fundamental and intrinsic to the act of thinking and conceiving Architecture. The CAD / CAE / CAM digital tools have not only highlighted the fragility of this didactic process in the didactic context of the current teaching, but, in view of the potential of its operative process, impose the future reformulation of the Project's cognitive practice, integrating the component technology in the Design Methodology of the architect's teaching and praxis.

Keywords: Project Methodology, Creativity, Tectonics, Application of Digital Tools to Architecture, CAD/CAE/CAM.

1. Introduction

The architect graduated from the Faculty of Architecture reveals in his professional activity as designer and creator a metaphorical and poetic discourse, this way of communication is preponderant and decisive in his professional practice, result of his formation, programmatic contents and didactics adopted and implemented in the Project classes, which is focused on excellence of the formal creation, but forgetting of the other dimensions that occur in the construction - the project is reduced to drawing and is formal signification.

This creative but restricted context of Project classes, has a beaux-arts origin, which are the origin of the Architecture course of the Faculty of Architecture, taught until the early 1990s at the former Superior School of Fine Arts of Lisbon. This formative posture and consequently the generated discourse, is not understand process by the other players of. Architecture and Real Estate, but, above all, incomprehensible by the average citizen (the ultimate recipient of the architectural object - the primacy citizen's democracy).

As Alberti said: The Architect is above all a good citizen [1]. The elaborated, abstract and poetic metaphors used by architects to explain his creation, are examples of the absence of technological valence, and are sometimes interpreted as insecurity by the average citizen. This communication could be exemplified by the theories like (of full / empty; the energy of the void, or the power of the mass, etc.), that remove the architect from his ancillary rule, its importance as a technician, this behaviour hurts the

tacit social contract established between Architect and Community. The architect is above all a technician; Architecture has a function, so it goes beyond the narrow field of art [2]. The metaphorical discourse, should be complemented with tectonic objectivity, in order to support the conceptual decisions made in the creative act of the Project. Similarly, a conceptual process centred on formal aspects of design, where technological and economic realities are not present becomes abstract.
The abstract exercise of drawing, reduced to the poetic/artistic dimension, has a great disadvantage because forget and not consider the technological aspects, forgetting the material reality naturally increase problems and limits the success of the work. The issue is not the drawing; it is the vehicle, not the problem. In the formal/compositional approach, the mental process of creation does not reach the tectonic aspects, which is necessarily present in all the shape manifestation - producing implies materializing. The absence of this dimension hurts the ethics of aesthetics present in a solid conceptual process – form by form do not reach proficiency [3].
The issue of ineffectiveness is a result of the Project Methodology adopted by the architect, acquired in Project classes, which is also reflected in his work and the way he creates their Project.
The architect produces space to be habited, built with an ethic based on the values of economic, constructive, social and environmental sustainability, which must be present in architecture, which is often ignored.

2. Curriculum Status Of The School Of Architecture

The lack of constructive and structural knowledge express in the projects is not a result of the student formation, in the school of Architecture, this course has a large range and a strong component of technological disciplines (structures, constructions and materials). In particular, the architecture course of the school of Architecture has 23 technology subjects, out of a total of 36 subjects. Technology subjects represents 64% of the total course (structures, buildings, environment and materials). Being more precise, the course has 4 structural disciplines: Statics, Structures I, Structures II and Structural and Constructive Systems; It has 9 construction disciplines: Edification I, Edification II, Edification III, Edification IV, Materials, Building Physics, Technological Innovation and New Materials, Project Support Seminar and Recovery and Conservation Technologies; has 2 subjects in Thermal and Acoustics: Environmental Comfort and Energy Efficiency and Environment; It has 2 disciplines infrastructures communication: Urban Infrastructures and Routes of Communication and Transport; It also has a Mathematics subject, 2 Descriptive Geometry and 3 Computing subjects.
The science and technology component in the architecture course is quite high and cannot be considered inferior to engineering courses. It is a myth to think that the engineer holds more technological knowledge than the architect. The distinction between architecture and civil engineering courses is based only on the calculation expertise: the design of reinforced concrete or metal construction is not taught in the architecture course.

3. The Problematic

The issue mentioned in the introduction concerning low technology training, it is above all a result of the pedagogical and didactic context used in Project classes, which are the main core of the course, giving it its identity and nature. these subjects have biggest workload, and therefore highest of the final average grade, for these facts absorb the student's attention and focus. There are 10 Projects subjects in the architecture course (including the final Master Project in the last semester); one Project class in each of the 10 semesters of the course. In this Project classes is absent the syllabus and didactics, related to the material, in particular, structural and constructive issues. This absence deeply marks the student's cultural attitude and practice as an architect. As Project subjects are not dealt with the subjects related to the structural and constructive domains, and the teachers of technical subjects are not even present in the Project classes, the student relativizes the importance of these subjects and does not integrate them in their mental process of creation, which is fundamentally achieved in Project design, is in these subjects that student develops and creates his own methodological mental process - his cognitive design process. This is the fundamental problem in the formation of the architect at the Faculty of Architecture, resulting of the vacancy of technological knowledge in the mental and cultural training of the student. The learning and mental training for the Project is done through simulations, which aim to provide to the student a methodological praxis capable of addressing the complexity and demand of different functional programs. The training and learning exercise in the Project classes create the conceptual process and the cognitive mechanism to design Architecture, consequently, shaping the architect's individual methodology and Design culture. In the Project classes, the school shapes student’s spirit and builds its praxis, it is with the achieved operative axioms they will operates its creativity as a future architect. Its Project culture is acquired and shaped by the values carried by the Project subjects. That shapes their spiritual beliefs and aesthetic principles. The number of classes and the prominence of Project develops his mental process and the creative act of designing architecture. For the student of Lisbon School of Architecture, it is in Project classes where he finds the space of expression, he believing in the proficiency of the methods of creation and theoretical values learned in

these disciplines. Such, it would be true, if these Project classes were capable of framing in their pedagogical methodology a holistic view and treatment of the architectural phenomenon, where necessarily the tectonic question would have to be present, since this premise is fundamental to pass from the notion of formal project for Architecture. As Mahfuz says: the concept of architectural design is validated by the passage from the full concept to the full constructed [4].
The Beaux Arts model, in which it is believed that the important thing is to stimulate the student's creativity, not opposing barriers to his imagination, does not include the tectonic question, forgets that design is first of all an integrated and globalized synthesis, where everything converges and inform the creation of architectural artifact [5], [6].
Creativity is essentially exponentiated by the existence of vast, systematized and organized knowledge. Creativity and the mental process of projecting are not born in the cradle, do not stem from a family genetic heritage, nor result from magic or divine inspiration. It is the result of the individual work of systematization and organization of the acquired knowledge, and the ability to extrapolate it (as more knowledge the student acquires, as creative will be). Boosting creativity require lot of work: it is necessary to collect information, learn and exercise; it involves organizing and systematizing of the collected knowledge. Creative work feeds on the quantity and quality of acquired knowledge [7].
It is possible to conclude; it is not a lack of transmission and acquisition of technological knowledge presented in the theoretical disciplines of technologies. As mentioned, the question is another and, it emerges of the fact of these knowledge these subjects are not integrated and treated in the Project classes (global systematization and organization in the context of the project), where the student trains and develops his mental process of creation - his Project Methodology. The question is the absence of incorporation of technological knowledge in the development of the Project´s idea thought - shape thickness [8].
In the school of Architecture, the Project Methodology acquired and developed in Project classes does not contain unfortunately the structural and constructive dimension, so when the architect is designing builds his project without the gravitational component, but gravity is determinant to ensure the material existence of the idea. It conditions the existence and definition of the form designed and desired by the creator of the architectonic artifact.
The drawing or modulation with graphic digital software does not contemplate gravity or reflect the material beauvoir. Designing and constructing a space implies the definition of material and tectonic dimension of the architectural piece, that is, how to materialize the idea - the thickness of the form?
The form itself does not imply material. Geometry does not allow its self to move from the immaterial dimension, defined by surfaces (planes and lines) to the material dimension intrinsic to Form, which inevitably presupposes the existence of thickness [9]. To materialize a geometry is to give it thickness. This is the expression of the physical manifestation of form, which carry and determines its structural and constructive functioning. The shape defines the structural functioning, determines the plasticity and the performance of the architectural artifact during its useful life. Don't consider the thickness - the material, it's a methodological error often associated and practiced in Project Methodology acquired in the schools of beaux-arts tradition.
The student´s Methodological Process and future architect must extrapolate Drawing as a graphic expression of the architect's intangible thought. A material definition becomes indispensable, which drags the attribution of a thickness and its consequent gravitational effect. This mental and cognitive process implies the transition from a process of graphic composition, which only contemplates spatial organization, to a Compositional-Tectonic process, where drawing is informed and developed considering the constructive and structural implications carried by the generated shape. All form necessarily has a thickness, so it reiterates the gravitational character of form, that is, not to assume this earthly structural reality is completely unreal, and reveals a total ignorance of the phenomenon of gravity and, consequently, of what is the genesis of architecture [10].

4. The Proposal Education Solution

Objectively, the Project classes in the last two years of the course should be extended broader, integrating in their pedagogical and didactic process the subjects related to the design of structures and constructive elements, with the natural teacher participation of these technological subjects, monitoring and evaluation of the student. This is the great failure of the architecture´s course in Lisbon school of Architecture, the absence of the technological dimension in the development of student conceptual thought - its own Project Methodology.
In the Project classes, with the pedagogical approach based on a formal composition, lacks the synthesis and conceptual integration of technology, this Project Methodology does not respond to the Vitruvian triad, forgetting the structural and constructive systems, real, they are always present in the act building [6].
As mentioned above, the didactics of the Project classes neglects the constructive process in the student's cultural awareness, because in this pedagogically praxis student separates creative process of the technological needs, therefor he does not assimilate the interdependence and requirement of

integration when architecture hits the constructive level (formal and conceptual design and physical elements for materialization of form), thence student's creativity, trained in the Project classes, is restricted to formalism, relegating and forgetting the constructive aspects of the architectural artifact to build. The student is not trained to constructively express his idea, thus weakening his project and the way he communicates it.
The drawing culture reveals as one of the main characteristics of the given training, it is a vehicle for the student express his thought, the draw should be informed with knowledge acquired in the technology subjects, unfortunately this is not the common practice, and it results of the pedagogical and didactic inadequacy used in the Project, and also because of cultural rigidity of a few teachers of these disciplines.
Any exercise of spatial composition finds a structural response in a restricted set of basic structural typologies, capable of enabling the respective architectural form. The structural system emerges from this compositional process. To conceive space is to conceive of form, that is a material manifestation of geometry, therefore it has thickness. Form defines the structural system that makes the trilogy: space - form – material [11]. Therefore, the design of the structural system is so embryonic as the act of ideation of the space, it stems from an interactive and iterative process between space and form. This dialectic approach is called Integrated Design, carried out simultaneously in the methodological and cognitive plan. This methodology is crucial for the architect's structural efficiency and plastic expression, despite its purely qualitative approach, The Integrated Design improve the approach to form as structure - the structural form is the result of a formal manipulation that aims not only the structural optimization, but also bestow ethics to the aesthetics which result from the generation process.
This reality could be observed in the structural system designed in the Project classes for their exercises, although the student has acquired a vast knowledge about this subject in the structural disciplines, he does not consider it, in the materialization or concepts developed in the Project. this theme is consistently ignored in the conceptual process of these disciplines. The technological aspects (structures, constructions and economics) is not incorporated by Project teachers, this way the student does not enhance and develop the structural in his design language or plastic expression of his architectural artifact, idealized and projected in Project disciplines.
This is the great pedagogical gap in the architect's education, only be overcome with the reformulation of the teaching didactics of the 4th and 5th years, that involve the presence of the Structural and Construction Teacher in Project classes, bringing the technology dimension to the training and development of the student's Project Methodology. It is especially important for the student to understand the structural phenomenology intrinsic to the conceived form and to know how to manipulate it according to its design purposes, but with the current pedagogy and didactics this goal is not achievable.

5. Building´s Economic Dimension

Other situations in the architecture course, which reveals lack of objectivity, is also the lack of awareness in the student' training that the architect whenever he designs and builds is producing heritage, creating value and wealth. That is something he usually does not care, but should be part of the conceptual strategies of the architect when he elaborates when he starts his Project, as an author. It is the cultural rigidity followed in the Design classes is the major obstacle to the consideration of economic and financial aspects in the mental and cultural formation of the architect. It is urgent to make the student aware of the patrimonial dimension of the building - the real estate value of the building.

6. The Future Of Digital In The Integrated Project

The actual development of digital technology has replaced the interdependence and articulation of the different moments of architecture design: shape modulation, tectonics and fabrication (CAD / CAE / CAM) [12]. Nowadays, the digital tool already makes it possible to overcome the limitation of mathematical calculation, but nevertheless, the knowledge of structural phenomenology remains essential and fundamental to the creation of form. Every built form necessarily has a structure - the structural shape [11]. To conceive a form, even in the strict ambit of the formal design, the architect must understand the catalogue of typologies of basic structural forms at his disposal, in order to be able to materialize his projected work. It is important to accentuate this is not about calculus, we are considering and expressing another concept: typologies of basic structural shapes. It is a new doctrine in the structural field specific to the formation of the architect. A new formative space to consider in the formation of the student, and future architect.
The drawing act by itself is not enough, for the full development the conception the architect, the architect who creates the form needs to know and master the catalogue of typologies of basic structural forms, their characteristics - the form cannot be any one. It is a gravitational reality still ignored in the conceptual plane by the Theory of Architecture.

The use of the BIM digital tool, in the process of developing the space design, it joins simultaneously the volumetric/shape and structural design, its calculation´s plug-in, allows the establishment of a bridge between architecture and structural calculus [13].
The absence of aspects technological issues in the Project classes are naturally resolved with digital tools, increasing dialogue and integration between conceptual and scientific aspects; increasing the quality, plastic and diversity of the architectural object and consequently of the architectural space.
CAD/CAE/CAM digital tools generate a profound change in the architect's cognitive and conceptual processes, thus open new formal and plastic fields for architecture. The conception process is no longer sequential, but rather simultaneous, interactive and interdependent process, in this integrated approach the different cycles of the project participate simultaneously in the synthesis process [14].
This requires in the formation of the student, and in the Project classes, not only new syllabus, as well as new methodologies and didactics capable of approaching knowledge and conception in an integrated, interactive and interdependent way, developing in the architect's mind a new process, of project thinking - the Integrated Project [15], [8].
In the present architecture course of Lisbon School of Architecture, the aggregation in Project of structure and constructive elements is still absent, the future innovation of the course's pedagogy and didactics due to the evolution of the life outside the school itself will inevitably determine the course of the future of the course, leading to the integration of the Formal Project with the Design of Structural and Construction Systems - the Holy Grail of the Integrated Project. It may take time, but it will be inexorable in future to be taken over by universities. Future architecture courses will necessarily evolve, preparing students and their professional context for the reality and potential arising from the application of digital tools to architecture.

7. Conclusion

The role of the University in society as a critical a cultural space, able to anticipate same of the answers that the community needs, but same times even do not release, and therefore not posed; that is the role of research and experimentation which the University must develop. In parallel of teaching, the University must also produce knowledge through research of teacher and students.
The instrumental frame formed by the digital tools (CAD/CAE/CAM) [16] highlights the need for evolution of the beaux-arts methodological models. In view of this reality, which is already present today in the product industry (automotive, aeronautics, naval) [17] makes it imperative that University within provides the condition to create a new operative paradigm able to response to digital reality.
This compel the inclusion of the technological dimension in the moment of conception, it is the tectonics and the analysis of the architectural artifact, that validate of the idea and the development of architectural concept. This practice breaks with the sequential logic of projecting that process tends to ignore the material, performance, and technological a of aspects of architecture.
It is urgent to find new methodological concepts, a new operative paradigm that form the new generations of architects. The reality that will support its practice requires a cognitive paradigm, capable of producing a conceptual synthesis, contemplate shape, future performance, production and construction of the architectural object. This implies that technology informs and participates in the act of conception since the first moment.
Future architecture courses will necessarily evolve and integrate this emerging reality - integrated design, preparing students and their professional context for the reality and potential arising from the application of digital tools to architecture.

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The amphitheatre of Dyrrachium

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Abstract
Albania is located in the heart of the ancient world. Nevertheless, the perception of the common European legacy of antiquity does not have the same status in Albania as in most other Central European countries. A particularly prominent building of antiquity was the amphitheatre in Dyrrachium, now Dyrrachium. On the one hand, because there were only a very modest number of amphitheatres on the eastern coast of the Adriatic Sea compared to the western coast anyway, but on the other hand, because Dyrrachium forms one of the two bridgeheads on the main trade route between the centre of the Western Roman Empire and the Eastern Roman Empire, between Rome and Byzantium. Coming from Rome via the Via Appia, the amphitheatre, well and widely visible from the sea, formed the continuation of a range of hills on this legendary road in the Balkans and the beginning of the Via Egnatia. But this is not its decisive unique feature. For unlike practically all other amphitheatres of antiquity, the building did not use the topography symmetrically. It did make use of the slope in order to reduce the cost of the new structures to be created and to place the cavea on the slope. But unlike usual, it was placed in the slope in such a way that neither construction nor development could be symmetrical. This is already conveyed by the few preserved finds. Funded by the private Gerda Henkel Foundation for Humanities, the project brings together the results of more than ten years of archaeological research.

Keywords: Visualisation, Architecture, Archaeology, Knowledge, Hypotheses

1. Introduction
A visualisation of a hypothesis is profoundly different from a virtual reconstruction. The difference lies in the understanding of what is to be shown in the face of what can be expressed scientifically. Reconstruction claims that it is possible to rebuild a lost building. That may be possible in some cases. In the case of ancient buildings such as this amphitheatre, where the findings are less than sparse, this is quite impossible. This is why we developed our method of visualisation of hypotheses. It emphasises that archaeological knowledge consists of a wide range of uncertainty including contradictions rising from multiple equally valid scientific assumptions. Instead of pure diagrams we work with subtle indications, mainly through versatile geometric abstraction. Contrary to the literal meaning this does not mean leaving things away but designing new and evident shapes of representation. Abstract shapes are then compensated by virtual architectural photography. The visualisation of hypotheses does not only depict what is already known, it furthermore acts as a catalyst, as the three-dimensional synthesis of the archaeological sources regularly leads to the discovery of missing parts, which turn out to be in the interest of archaeology. But not only that, the results of virtual photography, i.e. perspective projections from spatial positions that were possible in antiquity are also raising new research questions. The display of architecture, actually of the architectural design idea, is the substance of these visualisations. It is precisely this abstraction, combined with the absence of people with their clearly antique attributes from clothing to weapons, but also of traces of use and missing technical equipment, that furthermore allow a comparative view of the visualisation with our own perception of architecture.

2. Dyrrachium

Dyrrachium – in today's Albania called Durrës – is a harbour city on the important main road between Rome and Constantinople, Via Appia and Via Egnatia. The particular feature of its amphitheatre is that the construction of the amphitheatre the construction confuses the otherwise familiar alignment with the topography. The axes of the amphitheatre are actually turned in relation to those of the slope.
Antic amphitheatres generally follow common principles in order to provide a common external appearance. Dyrrachium followed this regarding the principal external views, but deviated in its construction and access system and required new solutions for both, construction and access.
An amphitheatre that was built shortly before in Pula north of Dyrrachium, which has very similar dimensions, was used as a reference, as a starting point, in the assumption that it must also have served as a reference for the builders and architects of Dyrrachium at that time. Pula, however, has symmetrical embedding in the topography, but also unusual features such as exterior staircases, for which there is no evidence in Dyrrachium. Consequently, while Pula forms the historical reference, its idealised version, i.e. the hypothetical principal disposition of Pula, forms the starting point for Dyrrachium (fig. 1).

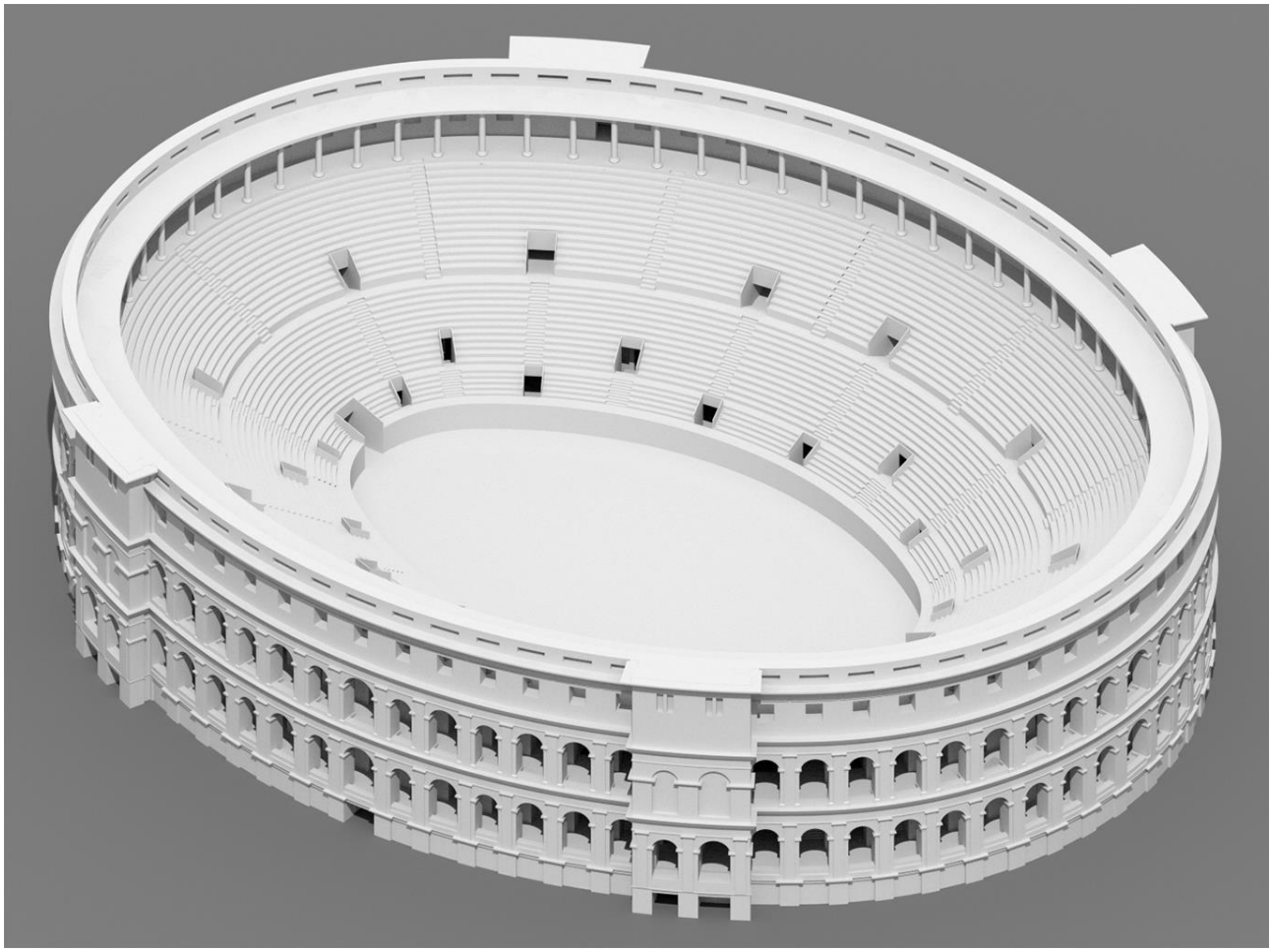


Fig. 1: The amphitheatre in Pula in its idealised form, that is fully modularised and twofold symmetrical.

3. Special features

Dyrrachium deviated from the usual path and did not position the amphitheatre in the terrain in such a way that a symmetrical construction was possible, instead oriented it to the urban street grid. Why this was done is not documented, but it required new solutions for construction and access. The findings are too rare to build a certain reconstruction upon. Still, the findings suggest that there must have been a special and individual solution, principles that pursue the single goal to provide an appearance and a functionality as similar as possible to the other amphitheatres (fig. 2).

The development of a consistent spatial hypothesis could only be done in virtual space, as a digital three-dimensional model clearly reveals voids and contradictions. Therefore, the first challenge was to coordinate the existing planimetric hypotheses with each other on the basis of the measurements. However, the measurements were limited to georeferenced drawings. Due to a covering of the finds

with concrete during the 20th century, three-dimensional scans would only be possible in the few preserved vaults; their overall extent would not have justified the effort. Moreover, the details that could have been gained through this were not relevant to addressing the question of this research project.

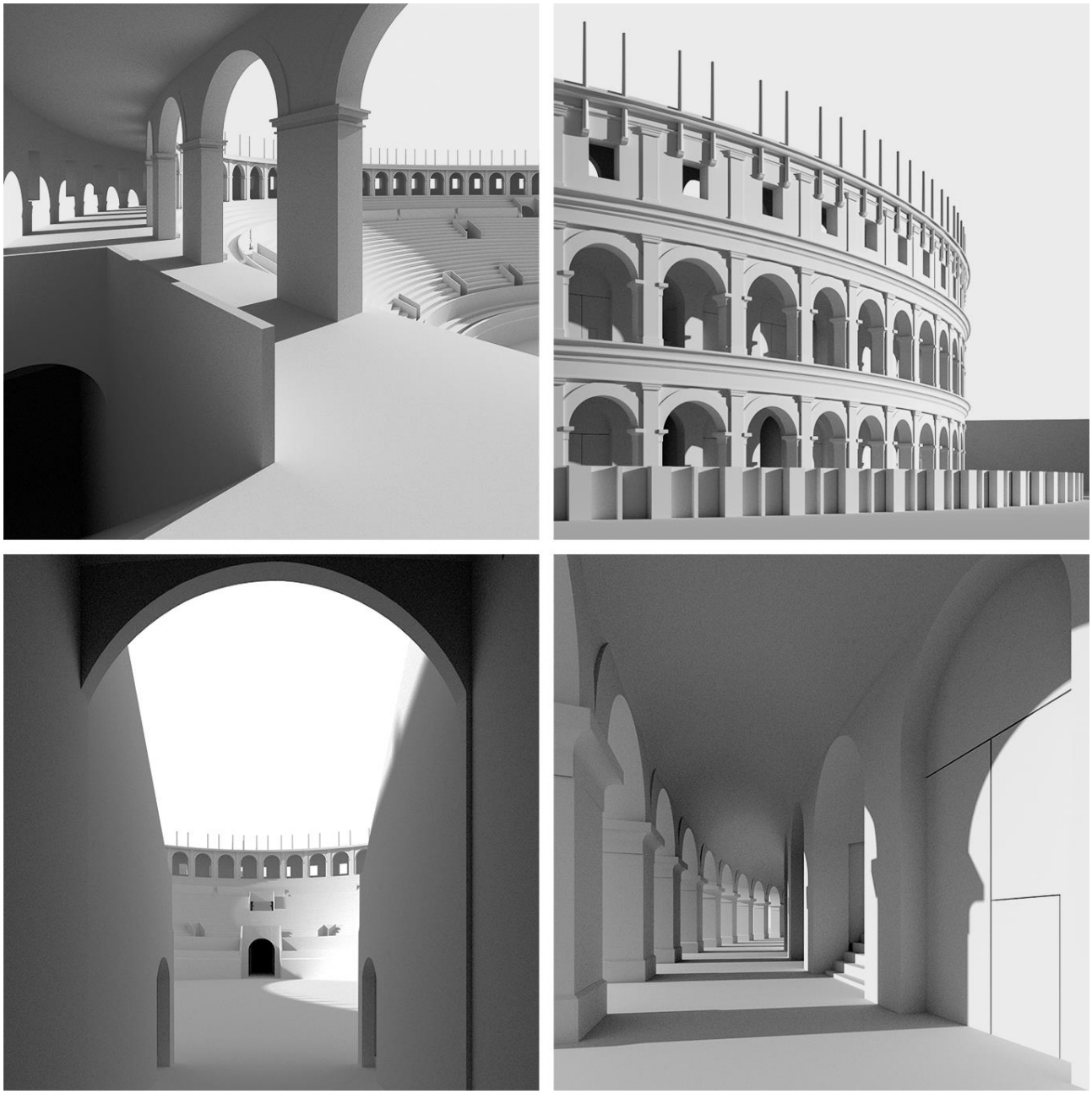


Fig. 2: For visitors, the external appearance should meet expectations and appear to be a matter of course.

While further coordination and clarification were already necessary here, it was above all the missing parts that became apparent and that had not yet been dealt with in the previous investigations. It became apparent that the architectural claim to actually spatially complete a building design - which here stands, analogously, for the development of an architectural hypothesis. Even such elements of an architectural development as the composition of the façade, which was initially not in focus from an archaeological point of view, had to be clarified in principle, at least in the sense of a first hypothetical approach.

Scientificity as a guarantor against a random or even merely artistic freedom in the architectural composition was always at the centre of attention. It was by no means a question of developing an ideal of an amphitheatre that corresponds to our present-day tastes, but rather of developing such an ideal whose components are covered by scientifically founded hypotheses. Thus the task was

essentially to combine three different types of foundations of a scientific nature. In addition to the finds on site, even these not incontrovertible, since they too are to be dated and thus the result of scientific interpretation, there were concrete reference buildings, analogies, here above all the amphitheatres of Pula and Salona, which are close in time and space, as well as the known and preserved compositional principles of other preserved amphitheatres up to and including the Colosseum in Rome. In some difficult cases resulting from the findings, overlaps of vaults in the development system were taken into account in order to anchor also these solutions scientifically. Throughout, an attempt was made to answer all open questions by analogies with better preserved buildings. Thus, the starting point of the investigation, namely the unique deviation of the alignment from the topography, is also based on analogies with other amphitheatres. Here, too, it became particularly clear how easy it is to describe precisely uncertain information linguistically without the spatial difficulties becoming apparent. In some cases, the verbal description of intersecting vaults, for example, promised an obvious solution, while only the concrete arrangement in the space revealed which architectural challenges were posed in detail. Once again, the translation of language into geometry turned out to actually increase knowledge.

All geometric elements from this translation are, above all to emphasise the hypothetical character, only detailed to the extent necessary for the spatial assemblage of the elements to each other. For vaults in particular, this means that only the diameters of the aisles in rectangular cross-section with the actual vaults running above them in circular cross-section are reproduced in their essentially straight form. The details of the structure, i.e. individual stone blocks or wall structures, which is irrelevant for solving the spatial compositional challenges of development and construction as a whole, are excluded here. Not only because they are not relevant, but also because the few finds would have meant a broadly speculative formulation that could have almost obscured the relatively high scientific quality of the statement about the spatial disposition. It is another level of hypothesis, but without repercussion on the central scientific question of the spatial disposition. Also, in order to visually emphasise this, subordinate levels of detail have been omitted. Even further, obvious small-scale irregularities that could not be attributed to any traceable intention were equalized and idealised.

The visualisation, which rather resembles a design concept, is supplemented by diagrams that do not illustrate the geometry of the building in an abstracted way, but completely exclude the building as an object in order to refer entirely to the circulation of paths or the stability of the building. In this way, the changes to the terrain are explained as a diagram (fig. 3). The result is a hypothetical structure for an amphitheatre that could serve as a design idea. It is a first offer, a single one of the infinite number of possible solutions, a basis for further research that will have to face the questions of further findings that may come to light in future excavations.

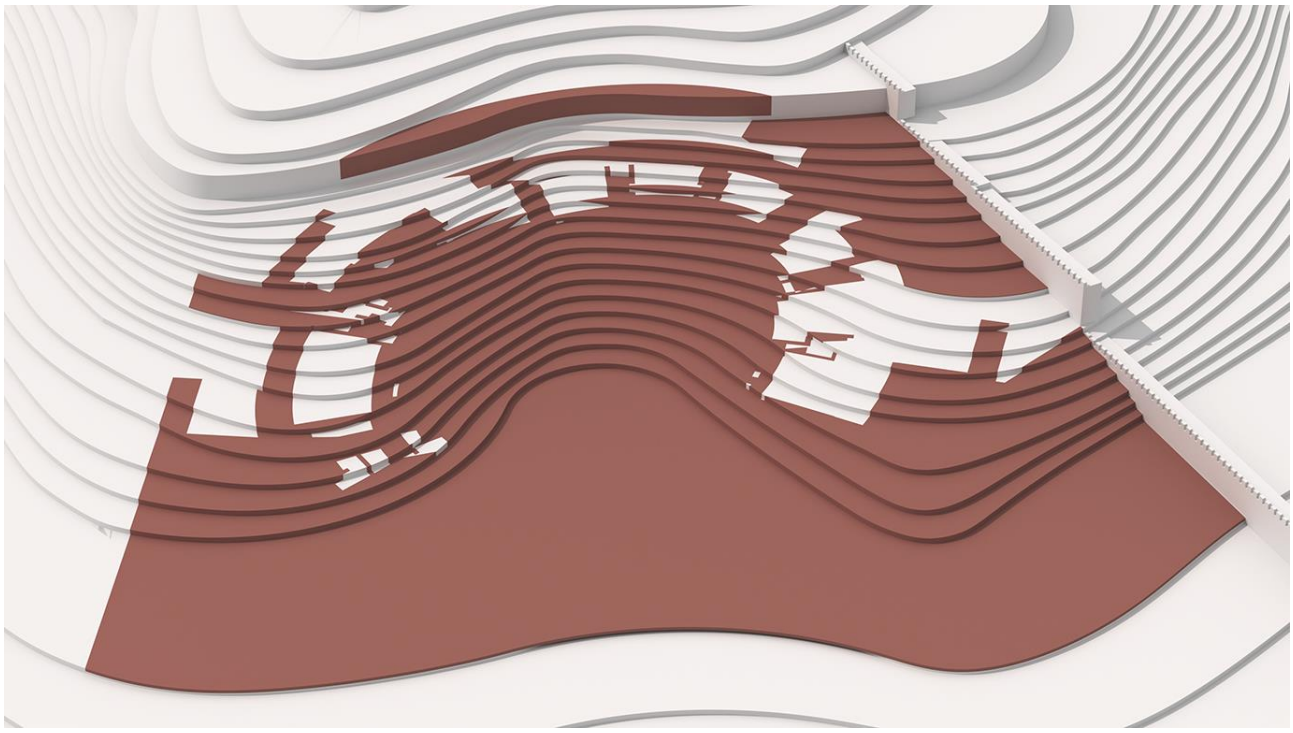


Fig. 3: The site as it probably has been before the construction of the amphitheatre, with the excavations marked.

4. Conclusion

This project demonstrates how a complex geometrical system has been analysed and re-synthesised and is being communicated visually by a set of complementary visualisations of different pictorial methods and architectural segmentation. As the project is a joint research project between architecture and archaeology, the result promised deep insights and an important outcome not only for the scientific community in archaeology but also for the community of visualisation in scientific cooperations in general. Furthermore, the participation of architecture as discipline provides a result that also meets the expectations in terms of spatial and visual design.

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20th World Heritage and Ecological Transition
XX INTERNATIONAL FORUM NAPLES 16 - CAPRI 17|18 JUNE 2022
WORLD HERITAGE and ECOLOGICAL TRANSITION
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Mosul Unesco heritage site.
Rebuilding the Al Nouri complex and cultural center.

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Abstract
This proposal focus on Contemporary architecture as answer for post-war urban and rural places and is inserted in *Contemporary Architectural and Urban design relationship with tradition and identity of Places* research carried out by the author.This objective is pursued working onarchitecture of museum typology, its variation over time, and with both theoretical and operative aspects.
Some of the Places that have been investigated by the research have as a common condition of post-war sites and some of themhave been recognized and protected by UNESCO in the Near East including Aleppo, Baghdad, Bamyian, Kandahar and Mosul.
This proposal, prized with first honorary mention and exposed during Venice Biennale in 2021, presents the project for the reconstruction of the Al Nouri cultural and religiuos center in Mosul, promoted by an international competition started by Unesco in 2020. The process that drove the design team is the core of this essay. Research work have been carried out trying to establish a deep bond with this far away and high emotional Place recognized as cultural heritage context.
That part of the research has been focus on critical redraw of places and its main built architectures, in order to learn and understand natural and anthropic rules and traditions, to discover hidden metrical rules and space declinations, to unearth stratigraphy proportions and traces of landscape identity.

Keywords: Memory, Archeology of war, Site Specific, Mosul, Cultural Heritage, Unesco sites.

The 2019 Film *Mosul* directed by Mattew Carnahan opens with a terrifying war scene in the historic center of the city, at the foot of the ruins of the Al Nouri area, the first and central mosque and religious center of the Iraqi city. The devastation that transformed the city into an extensive expanse of ruins, often leaving the buildings in open sections as evidence of the tragically disappeared living spaces, form the backdrop for the film. The sequences tell a current reality that the sight would not want to recognize as real. The city of Mosul birth around half of VII century is located about four hundred kilometers north of the capital Baghdad on the left bank of the Tigris River and very close to the archaeological remains of the Assyrian city of Nineveh.
Already involved in the war actions of 2003 and 2004, the recent war events after 2014 unfortunately saw the almost complete destruction of the historic center of the city which currently appears, albeit partially cleared of the prevailing rubble due to the destruction of the buildings, an expanse of ruins resulting from of a recent war-archeology.
In this delicate situation as part of the *Revive the Spirit of Mosul* initiative the Unesco Iraq office in Baghdad launched an international call in the second half of 2020, in coordination with the Ministry of Culture and Sunni Endowment in Iraq and The United Arab Emirates for the reconstruction of the Al Nouri area.



Fig. 1: Aerial photo as 2020

The Al Nouri complex, since its construction in the second half of the XII century, has been one of the main central site in the urban life and development of the City of Mosul. In fact, during the main historical transformations of the city the complex, it has been influencing the different urban layouts and nets. Located in the north-eastern sector of the Old City, the Al Nouri complex included main landmarks, such as the Al-Hadba Minaret and Al Nouri Prayer hall, some archeological remains like tombs, and other buildings and facilities.



Fig. 2: Orthographic photo as 2020

The Al Nouri complex has been severely damaged in 2017 intentionally. Fortunately a wide series of direct surveys were conducted on the main building with digital tools and methods that now are able to guide a full reconstruction in all the details. Even the post-damage configuration of buildings and ruins has been fully measured and described by some accurate surveys; also systematic stability actions were made to preserve the ruins from falling down or from further damages.
The competition goals were to rebuild the complex and its main building as the prayer hall and the minaret including a school, some museum spaces, some othere facility buildings. The aim of the reconstruction programme was also to mantain the memory of the events and not to delete it; for this specific reason some damaged ancient buildings were thinked to be mantained even in the new reorganization of the area.
The project here described has been developed by a research group at the University of Florence headed by Riccardo Renzi with Elena Ceccarelli and Gabriele Marinari and with the collaboration of Antonio Ciracì, Francesca Cantale, Giacinto Cicatiello, Diego Betti, Virginia Vivona and Jovana Markovic. The proposal has been prized as First Honorary Mention and exposed during XVII Biennale di Architettura in Venice at Palazzo Zorzi, Unesco building.
The project for the Al Nouri complex in Mosul is configured as a set of actions aimed at restoring the original spatial and geometric settings by inserting the buildings, spaces and activities required by the design notice into the lot and area. The entire complex, comparable to an archaeological area both for the historical parts and for the parts destroyed by war events, has its own material identity and expresses a clear hierarchical order among the elements that make up the current state of the project area. From these considerations the theme of the work concerns the contemporary project in relation to the traditions and identities of the places.
The first operation that guided the development of the new project proposal was to understand the relations of the built fabric of the city of Mosul, in relation to time, in relation to the war transformations, in relation to the presence of the Al Nouri complex.



Fig. 3: Urban map and geometrical rules of design

For this reason, the entire plan of the city was redesigned with a critical approach and the built systems were highlighted. This study method made it possible to clearly identify the hierarchies in the fabric and to establish the central position, also in relation to alignments and grid positions, of the Al Nouri complex.In this delicate situation, the project area revealed its main urban role in the construction of the fabric also thanks to its north-south orientation.
The project proposal has as its objective the precise reconstruction of the mosque and the protection of the original elements indicated in the project announcement with a compact and high perimeter to protect the Al Nouri area. The project includes a new open courtyard with perfectly square covered paths. This system fits into the front of the mosque and arises from the geometric and proportional interpretation of the construction space of the original building.

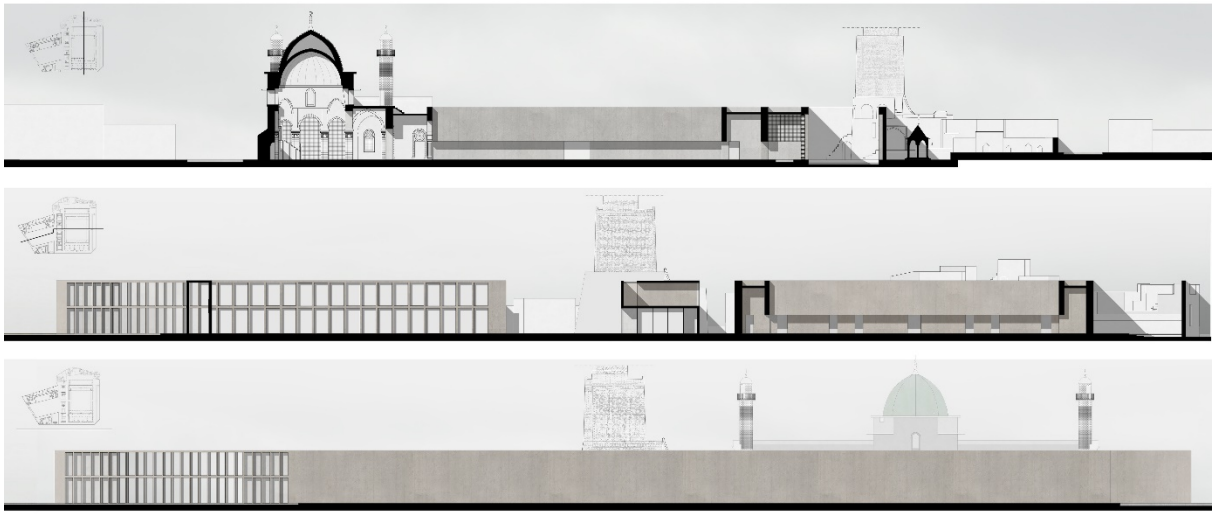


Fig. 4: Main sections

The courtyard in a symmetrical way hosts the building for the ablutions and the sanitary facilities of the mosque. Behind this building there is a museum promenade with some rest sessions and behind which the original temple for ablutions is positioned close to the minor buildings that are thought to remain as ruins of the war events to constitute a permanent structure of memory. This approach is also used for the three ruined buildings located in the area to the left of the mosque. The project envisages that the complex also hosts a high education and training center which consists of a long two-storey building set parallel to the courtyard of the mosque; this building is also thought to be a filter between the mosque area and the square area on the left side.

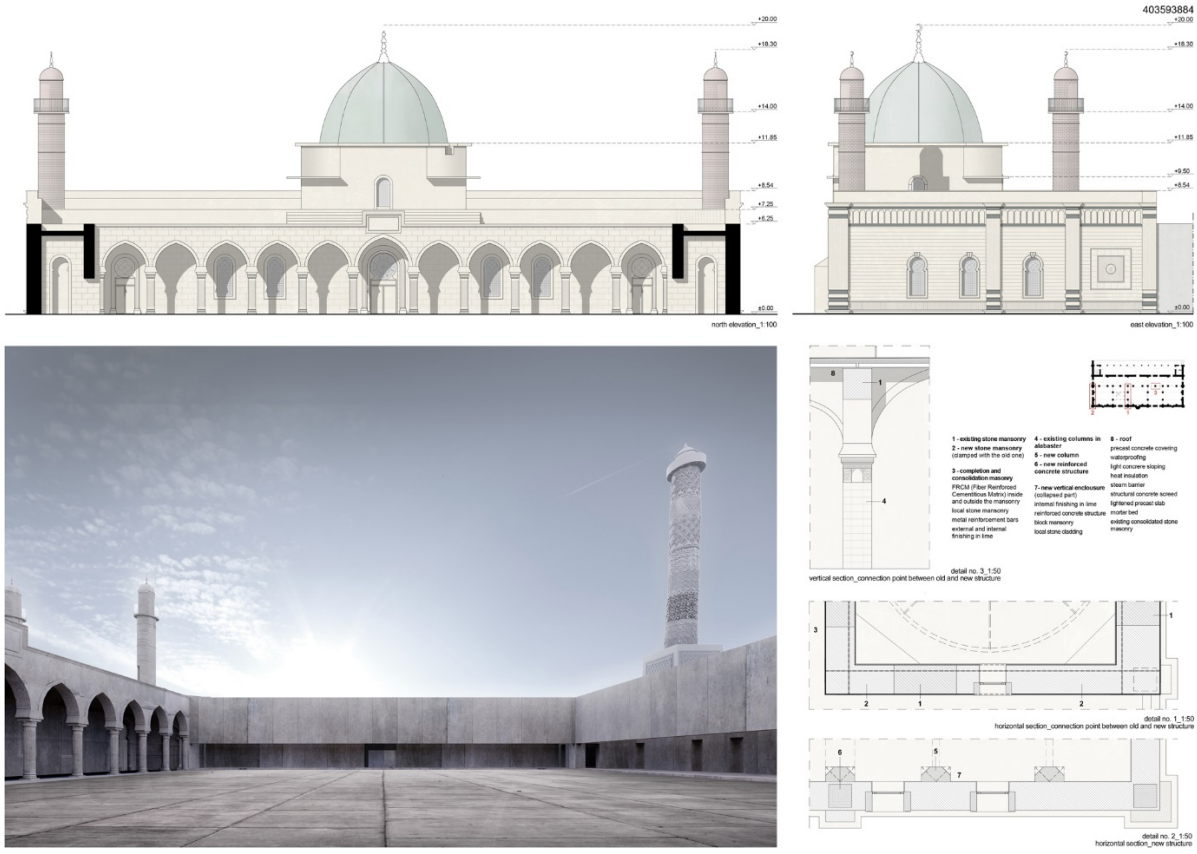


Fig. 5: Prayer Hall rebuilding and courtyard design



Fig. 6: Prayer Hall Service building interior view

In the area, circulation occurs gradually. Entering from the portico on the left side you enter the square where you can enter the shop, the theater, the school, the covered area for sports. From the back of the square it is possible to enter the building for higher education and from here, continuing it is possible to enter the courtyard of the mosque. A large square is conceived as a very regular shape whose buildings (theater, shops, school, sports) look out in parallel trying to regularize a very complex space in its current state. This large square space is accessed through a porch on two levels that allows you to filter the accesses to the area from the outside and at the same time reveal the language of the buildings to the city on the main road as well.

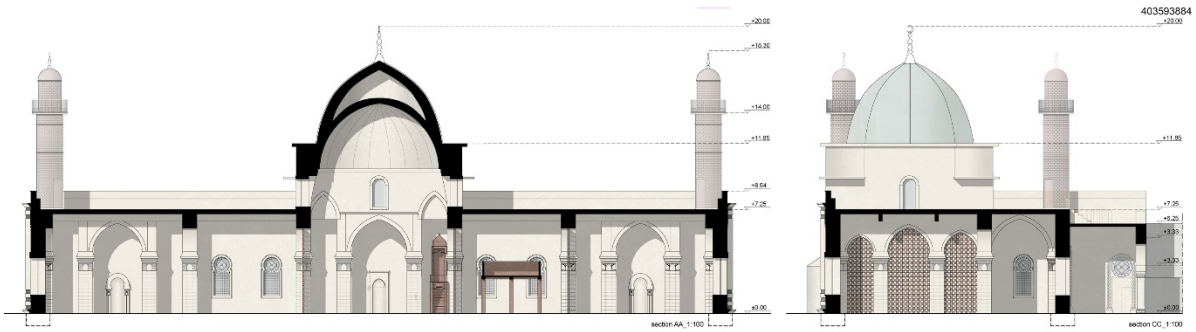


Fig. 7: Prayer Hall main sections



Fig. 8: Prayer Hall details and interior view

The language that characterizes the buildings (school, sport, shop, theater, high education) is sober. This is defined thanks to a clear and rational layout, linked to constructive simplicity and formal simplification that leaves the mosque the leading role by hierarchy and respects its main vocation in the area. The language of the new buildings is based on the concept of structural clarity. In fact, each window is the reminder of a frame system that makes up the backbone of the massive buildings that reveal clear and strong volumes.

The reconstruction of the mosque building respects the most advanced techniques for the restoration of historic buildings that are most critical for the walls, structures, decorations and waterproofing. The principle of protection and respect that governs the reconstruction of the building is based on some fundamental concepts including: consistency with the original building for the exteriors, for the structures, for the original parts still present and inserted in the context; the respect of the architectural elements that allow a clear correspondence with the typology of the mosque; the static and seismic improvement of the building compared to the previous situation; the use, where possible, of solutions compatible with energy efficiency and lower energy consumption for proper operation. The mosque building is designed to adhere to these concepts with few interventions and without these being actually visible.

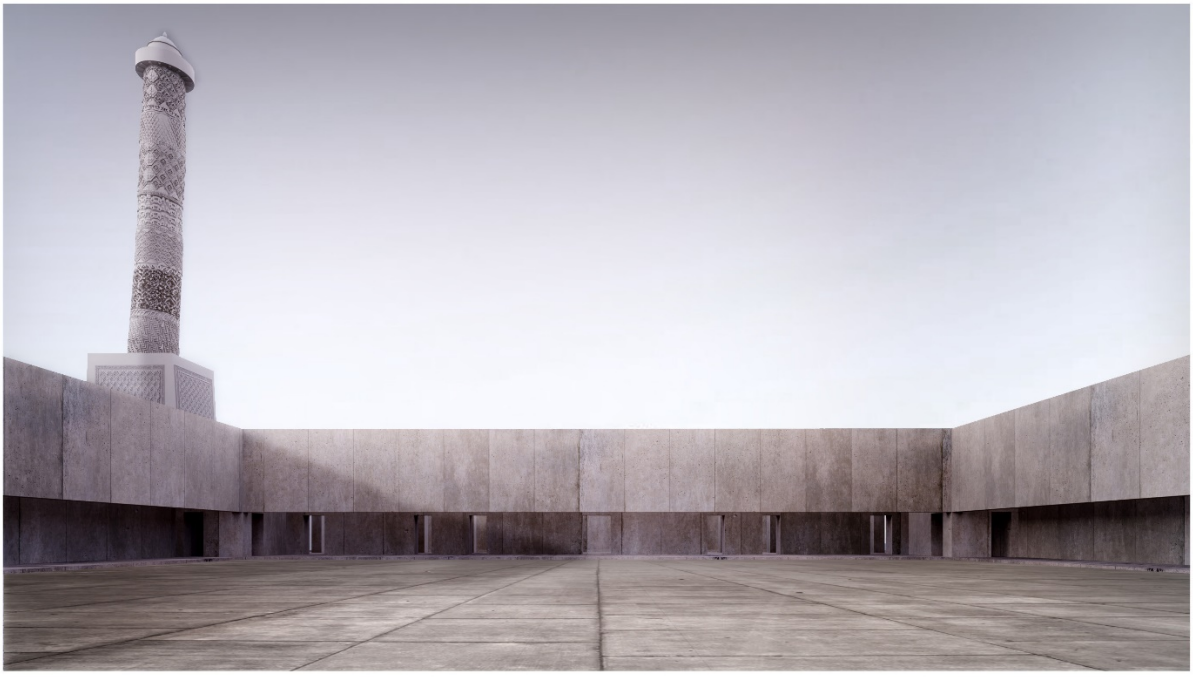


Fig. 9: Courtyard view

The new project for the Al Nouri complex is a complex balance between function and form, relaunching the concept of harmony between volumes and languages and sets itself up to be a new center, contemporary with historical roots, in a highly fragile fabric such as that of city of Mosul.

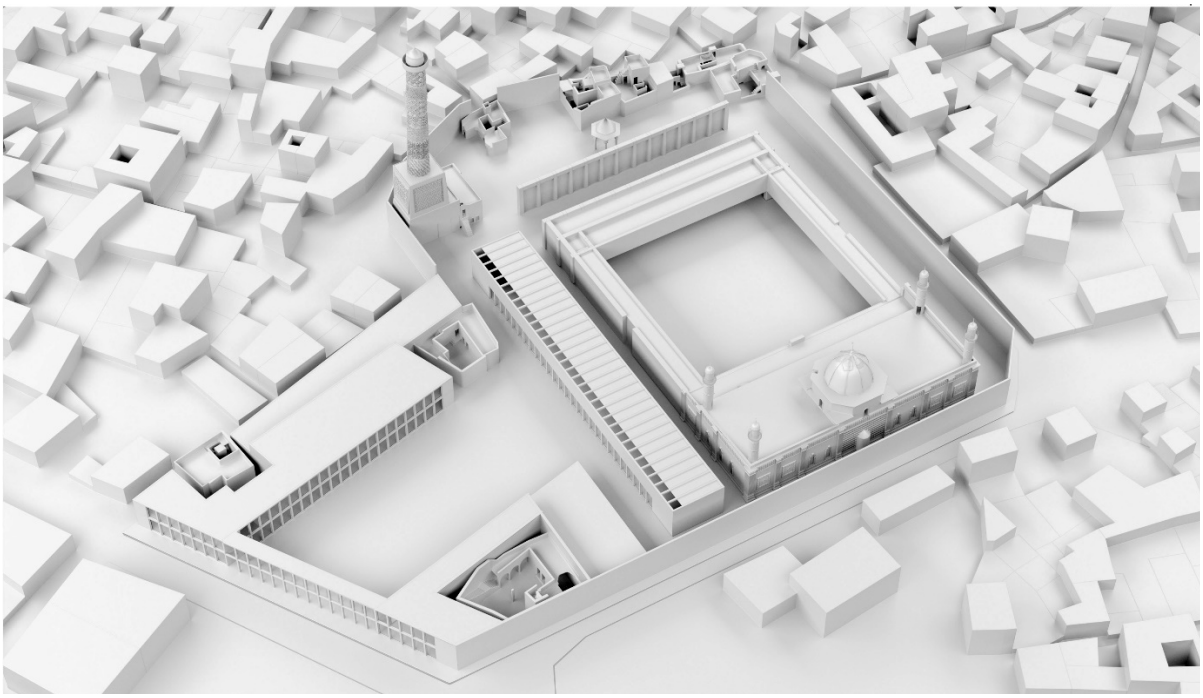


Fig. 10: General view of the model

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URBAN HEAT ISLAND PHENOMENON AND ECOLOGICAL INDICATORS: THE CASE STUDY OF THE HISTORICAL TOWN CENTER OF AVERSA (CE)

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Abstract
Climate change has reinforced the importance of the green component, especially in its thermal mitigation functions. The theme of the renaturalization of the city [1], through initiatives of structural integration of greenery with the anthropized environment, represents an important objective of urban and territorial planning. It is necessary to assign to green, functions capable of satisfying real needs; in fact, if the Grey Infrastructures constitute the built capital of our cities and are necessary for the economic development of a territory, the Green Infrastructures [2], represent its natural capital and are necessary to guarantee environmental sustainability [3]. In the case of the compact city, where the urban form is largely established, it is difficult to create significant green spaces. Green infrastructure represents a new approach to the problem: street trees, green construction along railway lines, green roofs and facades are seen as solutions that are easy to implement and suitable for building links with nearest green spaces. There is therefore a need in the drafting of urban planning instruments to plan actions aimed at counteracting the effects of climate change. To this end, it is important to analyze the experiences of cities that, through the introduction of regulations and planning indications, have succeeded in limiting effects of overbuilding and the urban heat island, and the urban heat island, identifying shared solutions between public administrations and citizens, who, synergically, contribute to the reintroduction, management and maintenance of new green areas within the city. The research methodology can be framed within the domains of literature review and the strategy of case-study and correlational research [4]. The paper proposes a reading of some ecological indicators used at the international and national level for measuring/quantifying the value of ecological performance and/or compensation of green in urban/anthropized environments. The fundamental objective is to analyze these indicators to verify their limits and potential to assess their technical transferability in urban planning regulations. Special attention will be paid to Biotope Area Factor also through the application to the historical town center of Aversa to test this indicator in a stratified urban environment characterized by a low incidence of green areas, a recurring characteristic in Mediterranean historical town centers.

Keywords: Eco-Planning, Urban Sustainability, Urban Planning Techniques

1 - Climate change and heat island phenomenon

Beginning in the 1970s, environmental protection became more relevant to issues involving the international community, which recognized its global significance. Awareness emerged that the Earth's natural resources must be protected and that nature conservation plays a fundamental role in the lives of communities. The environment is a finite resource, only partly renewable: it has a limited carrying capacity [5], ie it is able to absorb a limited amount of pollutants, compensating for the damage suffered, once a certain limit is exceeded; environmental damage [6] can no longer be reabsorbed in a reasonable time and the effect is irreversible. Sustainable development is almost an oxymoron from an etymological point of view, as sustainability refers to the idea of maintaining/preserving existing conditions over time and the ability to guarantee support, sustenance, without producing degradation,

while development suggests modification/transformation of the status quo. When considered individually, these concepts prove to be in conflict, but the synthesis between the two - the goal - lies in proposing the idea of an improvement/mitigation/adaptation/evolution for a better quality of life for settled communities that is durable over time. To this end, sustainable development must integrate environmental protection, economic development and social responsibility. Environmental issues immediately appeared to be the most contradictory with sustainable development and, among these, urban and territorial greenery plays a non-marginal role; infact it is included in multiple indicators to assess urban sustainability. The balance between nature and artifice thus becomes the fundamental requirement of the ecological vision of the city, even though, until now, the city has been planned, designed and managed with nature as a marginal, if not an obstructive, element. Among the greatest environmental, as well as social and economic, threats to the life of the entire planet is climate change. Over the years, the awareness that massive anthropization influences climate change, and the perception that this can lead to harmful consequences for human wellbeing and all natural ecosystems, has become firmly established. Climate change has a strong impact in different areas of the globe and causes economic, social and environmental damage [7-8]. Analyses and research describe the changes that have occurred in ecosystems, while extreme weather phenomena are becoming more frequent in all parts of the planet with significant impacts, especially in heavily anthropized areas. The European Union has defined a strategy for adapting to climate change, which all countries are called upon to implement. It is the heavily anthropized areas that are most likely to pay the prevailing economic and social costs of global warming; for these reasons, specific attention to climate adaptation strategies appears increasingly urgent [9]. The environmental problems linked to the increasing pollution of primary environmental assets (water, air and soil) determine significant impacts in anthropized areas; the picture of weather-climate phenomena is complex and is not confined to a specific and limited area but takes on global and local aspects. Climate is influenced by humidity, winds and temperature, factors that depend, in turn, on latitude, altitude, distance from the sea and so on. The rise in average temperature, which reached considerable values in the 20th century, should be interpreted as the most obvious indicator of climate change. By dwelling on the microclimate, a climatic configuration that refers to a specific and limited site or habitat, and analyzing that which affects urban areas, it is possible to see how much the urban configuration influences both climatic and environmental factors. The thermal characteristics of the materials present in the city (cement and bituminous conglomerates, bricks, glass) differ considerably from those present in the external areas (agricultural soils, green areas pertaining to residences, bare soil), thus contributing to heat storage and determining conditions of thermal discomfort within the urban area. The average air temperature in cities is 2-3 °C higher than in rural areas, up to 5-6 °C higher in summer, generating a phenomenon known as the **U**rban **H**eat **I**sland - UHI. Cities play a decisive role in combating climate change and its consequences (Fig. 1).

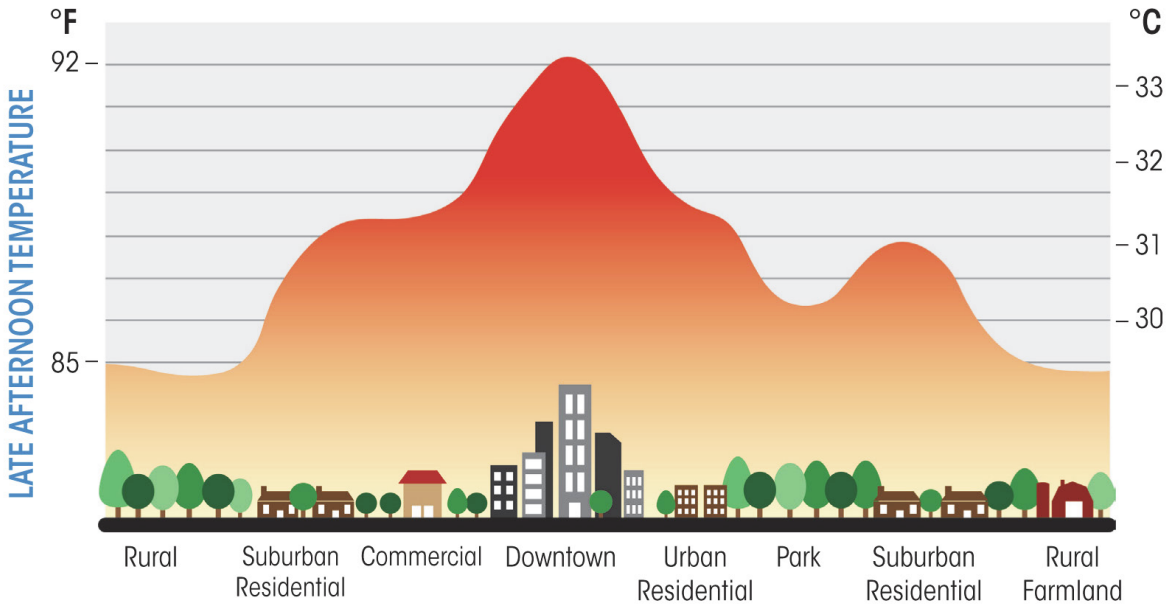


Fig. 1: Temperatures recorded in different area types - Source http://www.c3headlines.com/urban-heat-island-impact.html

2 - Ecological indexes: RBI, GSF and GF

The need to introduce into town planning and building regulations the improvement of environmental

sustainability has led, in recent years, to the development of new indexes that flank those employed by traditional town planning techniques or innovate them or replace them altogether. In this section we will discuss three ecological indicators aimed at quantifying/qualifying the ecological performance of a land transformation. In 2002 the Municipality of Bolzano commissioned a study to obtain an overview of the problems and possible environmental mitigation and compensation measures based on some landscape [10] ecology [11] indexes. In 2007, a ratio called **R**educed **B**uilding **I**mpact - RBI was defined, to be applied to the building plot to certify the quality of the building intervention (renovation or new construction) with respect to soil permeability and the presence of greenery.
The RBI is calculated as the ratio between:

$$\mathbf{RBI} = \frac{\sum_{i=1}^{n} S_{v_i} \cdot \frac{1}{\Psi_i} + (S_e)}{\sum_{i=1}^{n} S_{v_i} + \sum_{j=1}^{m} S_{i_j} \cdot \Psi_i}$$

S_v = i−th green−treated permeable, waterproofed or sealed surface (tabulated)
S_i = j-th permeable, waterproofed or sealed no green surface (tabulated)
Ψ = runoff coefficient (tabulated according to the type of surface)
S_e = tree surfaces equivalent

The weight of the different surface types is assigned by multiplying, at the numerator, the sum of the surveyed surfaces by the reciprocal of the runoff coefficient (1/ Ψ) [12] and, at the denominator, the same sum by the runoff coefficient (Ψ). The trees, divided into three size classes, are assigned an Equivalent Surface Area (S_e) to be added to the numerator. The RBI can vary from 0 to 10, it is close to zero when the lots have completely waterproofed surfaces and no greenery, while a value of ten corresponds to lots completely treated with greenery, with no waterproofed surfaces, intermediate values are found in urbanized lots characterized by built-up areas with different types of surfaces present, depending on their greater or lesser permeability, defined by the runoff coefficient and the greater or lesser presence of greenery. The higher the RBI, the better the environmental performance, both in terms of environmental well-being benefits and from the building point of view, in relation to sustainable stormwater management. In the case of partial or total renovation, the municipality has established that the RBI must be higher than the RBI of the existing state. In the case of new construction, the RBI will have to reach certain established thresholds (Fig. 2).



Fig. 2: On the left RBI = 10 corresponds to completely green-covered plots, free of waterproofed surfaces. Surfaces capable of providing maximum performance in terms of water regulation, groundwater repaving and improvement of the urban microclimate. On the right RBI = 3,95 corresponds to urbanized lots characterized by medium RBI, between the minimum and the maximum, depending on the built-up area, the type of surfaces present, their greater or lesser permeability, defined by the runoff coefficient and the greater or lesser presence of greenery.

The **G**reen **S**pace **F**actor - GSF [13] was first applied in Malmö, in an experimental form in 2001, for the competition of the European Housing Expo - Bo01 (City of Tomorrow). The area of approximately 30 ha, located west of the harbour (Västra Hamnen - Western Docks), was characterized by the presence of dormitory neighbourhoods, large industrial buildings, environmentally degraded conditions and an unfavorable local microclimate. The project envisaged the redevelopment of the area, with the preservation of the biodiversity that characterized it, to make it attractive to live, work, study and spend free time in this area and to transform it into a piece of city with diversification of uses (residences, commercial offices and services) and with considerable attention to the green system integrated into the neighbourhood and buildings. For the definition of the optimal endowment of green areas and elements to strengthen the local ecological network, the GSF is set, which can vary from 0 to 1; for the Bo01 neighbourhood redevelopment project, the target GSF is set at 0.5. The GSF is calculated by

means of a ratio that presents in the numerator the sum of the product of the areas affected by the transformation by a multiplier factor and in the denominator the sum of the same areas.

$$\mathbf{GSF} = \frac{\sum_{i=1}^{n} A_i \cdot F_{A_i}}{\sum_{i=1}^{n} A_i}$$

A_i = i-th area

F_{A_i} = i-th assigned factor varying from 0 (sealed areas) to 1 (permeable areas in contact with the aquifer)

The factors associated with the different surface types range from 1 for vegetation that is in direct contact with the soil to 0 for sealed areas to values from 2 to 20 for shrubs and trees.

The Seattle **G**reen **F**actor - GF. In 2007, Seattle became the first city in the US to have a GF programme [14] aimed at green infrastructure standards. The GF is a designed landscape requirement aimed at increasing the quantity and quality of planted and permeable surfaces through the creation of extensive green areas, permeable pavements, green roofs, vegetated walls, trees and layers of vegetation along streets. Planners can introduce the different elements and calculate the GF score, which can range from 0 to 0.8 using a spreadsheet. The City of Seattle has set a minimum score that must be achieved to obtain planning permission for each type of intervention. The spreadsheet [15] requires entering the number and/or square metres of articulated landscape elements. The three GF priorities are: 1) Livability: it aims to improve not only aesthetics but also the quality of life through spaces on a human scale. 2) Eco-system services: another objective is to manage rainwater, improve air quality, increase the energy efficiency of buildings and provide habitat for birds and insects. 3) Climate change adaptation: build a more resilient city that mitigates the urban heat island phenomenon and reduces flooding. Seattle's Comprehensive Plan identifies areas for urban villages directs the growth of these areas, quantifies and frames several characteristic landscape elements through GF scoring. It includes conventional landscape elements such as green roofs and walls, permeable pavements, tree preservation and water-related characteristic elements. The GF is mandatory for new commercial districts consisting of more than four dwelling units or more than 4.000 square meters of commercial area or more than 20 new parking spaces; in these cases, it is mandatory to green 30% of the lots through the application of vertical gardens and plants that provide ecosystem benefits, such as permeable pavements, rain gardens and green roofs (Fig. 3).

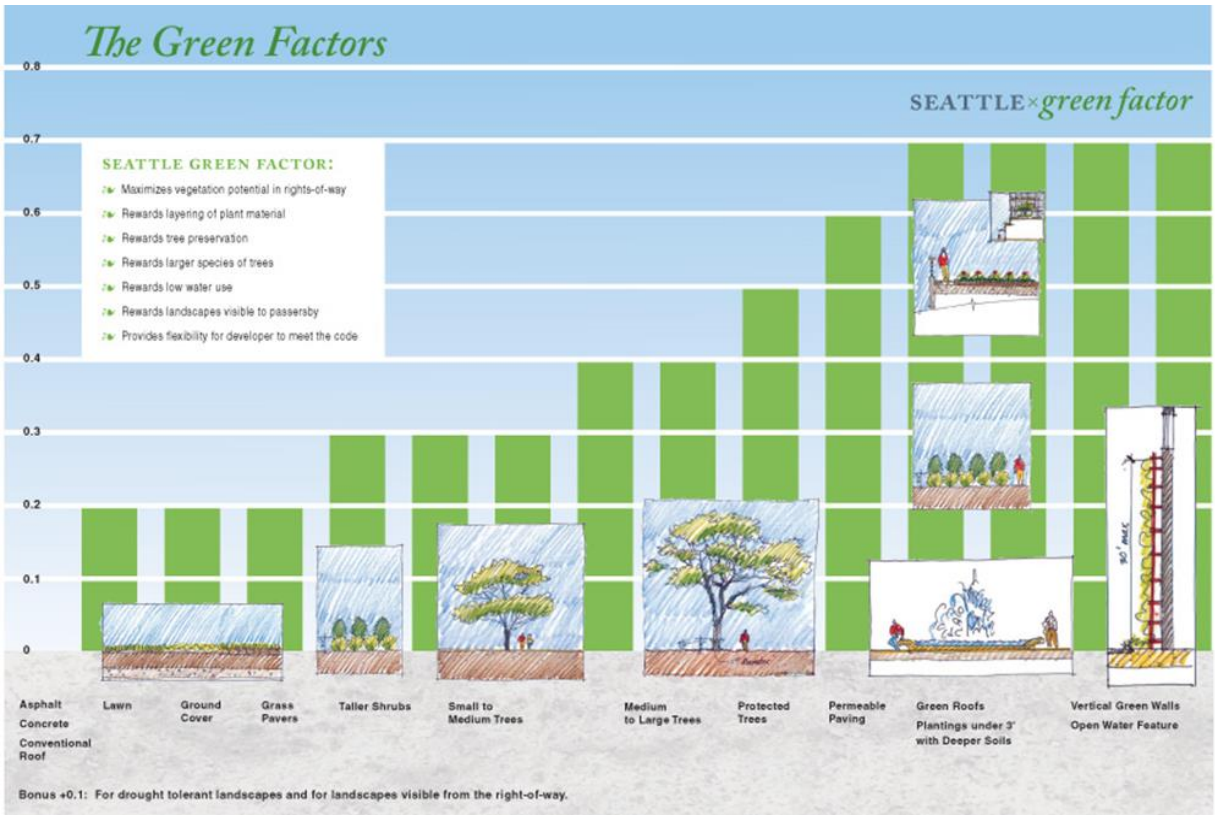


Fig. 3: Seattle's Green Factor establishes a score for different types of green infrastructure; properties must meet a minimum score tied to the lot's zoning **-** Source: https://developingresilience.uli.org/case/seattle-green-factor/

3 - The Biotope Area Factor

The BAF was first applied in Berlin (Biotopflächenfaktor - BFF) in 1994 with the aim of achieving certain levels of environmental compatibility in building activity. The BAF came into force in 2000 and sets a minimum ecological standard that new construction or redevelopment must guarantee. In contrast to other indicators, such as the level of soil sealing or the amount of private greenery, the BAF takes into account not only the areas covered exclusively by vegetation on non-sealed soil, which are indispensable for the protection of the ecosystem, but also the contribution of those surfaces that have a different permeability value, provided they at least allow water to pass through the semi-permeable surface, even if only partially; paved surfaces are also included, as well as roofs and external green walls. To calculate the BAF, it is first necessary to classify the surfaces that are present on the site in relation to their positive effect on the ecosystem. This classification is done using weighting factors, which consider the ecological potential of each type of surface. The BAF uses an abacus (Fig. 4) that considers six surface types and associates with them a coefficient ranging from 1 (total permeability) to 0 (absolute impermeability).

BIOTOPE AREA FACTOR - TARGET VALUES		
Transformation of existing built zones Construction of additional residential areas or increasing of the coverage ratio		**Project of new built zones**
Territorial Degree of Coverage	**BAF** Existing zones	**BAF** New zones
Housing Residential and mixed use only, no commercial space		
Up to 0,37	0,60	0,60
0,38 - 0,49	0,45	
More than 0,50	0,30	
Commercial Commercial and mixed-use only		
	0,30	0,30
Executive Commercial, services and administrative structures		
	0,30	0,30
Public facilities for social and cultural activities		
Up to 0,37	0,60	0,60
0,38 - 0,49	0,45	
More than 0,50	0,30	
Schools Education, Religious Centers, Multipurpose Complexes, Outdoor Sports Facilities		
	0,30	0,30
Nursing Schools and Care Centers		
Up to 0,37	0,60	0,60
0,38 - 0,49	0,45	
More than 0,50	0,30	
Technical facilities		
	0,30	0,30

Fig. 4: BAF target values abacus for existing and project areas according to land use and coverage ratio - Source: http://www.stadtentwicklung.berlin.de/umweltllandschaftsplanunglbfflindex en.shtml

Given a certain area, composed of various surface types, it must be broken down into homogeneous polygons with respect to the BAF coefficient. For each of these, the **E**cologically **E**ffective **S**urface **A**rea - EESA must be calculated, given by the product between the area understood in the geometric sense and the corresponding weighting factor. The total BAF of the area is obtained from the quotient

of the summary of the various EESAs with the total area of intervention and may vary between 0 and 1.

$$\mathbf{BAF} = \frac{\sum_{i=1}^{n} \mathbf{A_i} \cdot \mathbf{W_i}}{\sum_{i=1}^{n} \mathbf{A_i}}$$

A_i = i-th surface
W_i = i-th weighting factor

The ecologically effective areas are provided for in a specific schedule and a weighting factor is fixed for each of them, ranging from 0 for waterproofed areas to 1 for areas with structured vegetation on the ground [16]. The target BAF range varies between 0.3 and 0.6 according to the settled function (residential, commercial, infrastructural), the different types of intervention and in relationship to the land or land cover ratio of the intervention area.

4 - BAF of Aversa Historical town center

The Aversa conurbation, located north-west of the city of Naples, is made up of 19 municipalities with a land area of 198.8 square kilometers and a resident population of 284.777 inhabitants in 2020 (Istat - 31/12/2020) [17]. It extends over a flat territory with densities ranging from 5.800 inhabitants per square kilometer in Aversa to 194 inhabitants per square kilometer in Villa Literno; the city of Aversa alone has 50.340 inhabitants (Istat - 31/12/2020) and a land area of 8.73 square kilometers. A reading of the configuration alone reveals a conurbation divided into a main core, a secondary core and a satellite core [18]. Only in the municipal territory of Aversa do we find a high concentration of population. Although the Aversa conurbation occupies a territorial surface area equal to 7.5 per cent of the province of Caserta, it accounts for about 29 per cent of the resident population, with 18 per cent of the total number of municipalities, more than half with a population of between 5.000 and 15.000 inhabitants. The hegemony of the city of Aversa, compared to all the centers gravitating around it, is highlighted in services to families and businesses. In the higher education sector, the city of Aversa also plays a key role with the presence of no less than 19 high schools out of a total of 22 in the conurbation. One of the relevant peculiarities of the historical town center of Aversa is represented by the permanence within it of the original urban matrix that, despite the building alterations it has undergone over about a millennium of history, still stands out clearly as a characteristic territorial mark. The radio centric model transplanted by the Norman conquerors also has the character of rarity, since there are no coeval counterparts in Campania or in the whole of Italy. In Italy, however, interesting analogies, at least as far as its overall organization is concerned, have been found with Melfi (Lucania) and Putignano (Apulia), vice versa relevant reference examples can be found in France as in the cases of the towns of Bram and Brive. Of no less value are the existing relations between the afore mentioned layout and those of the late-medieval north and south-western expansions of the 17th and 19th centuries, on the one hand, and the ancient orthogonal scheme of the Roman centuriation, recognizable in some of today's main and secondary town streets, on the other. The latter connections appear to be very significant, since the Normans chose, as a settlement area, the square of the centuriation, falling today within the Aversano countryside, of greater strategic role. This area constituted a delicate junction, located as it was at the meeting point approximately of the roads that, from Capua and S. Maria Capua Vetere, led to Naples and Pozzuoli and, precisely here, crossed the route coming from the coast through Villa Literno. Aversa has a PRG and PdR of the historic town center approved in 2004. The area considered for the BAF calculation falls within the zones A1, A2 and A3 of the municipal urban plan and has a territorial surface area of 784.000 square meters, is made up of 425.435 square meters of covered surface area, 40.840 square meters of private gardens, 87.500 square meters of courtyards, 102.291 square meters of roads and 128.334 of areas destined for urban standards (37,300 square meters of compulsory schools, 7,300 square meters of car parks, 33,894 square meters of equipped public green areas and 49,840 square meters of common interest), attributing to each area the corresponding weighting factor W_i and applying the formula shown:

$$\mathbf{BAF}\ (\text{existent}) = \frac{90.640\ \text{mq}}{784.400\ \text{mq}} = 0{,}11$$

in the top of the page, a BAF=0.11 is obtained, indicating the value of the actual state. To identify the target BAF, the abacus (Fig. 4) should be used, which requires the calculation of the Territorial Coverage Ratio.
As the Territorial Cover Ratio of the historical town center is higher than 0.50 from the reading of the BAF target values abacus (Fig. 4) it can be deduced that the target BAF value will be 0.30.

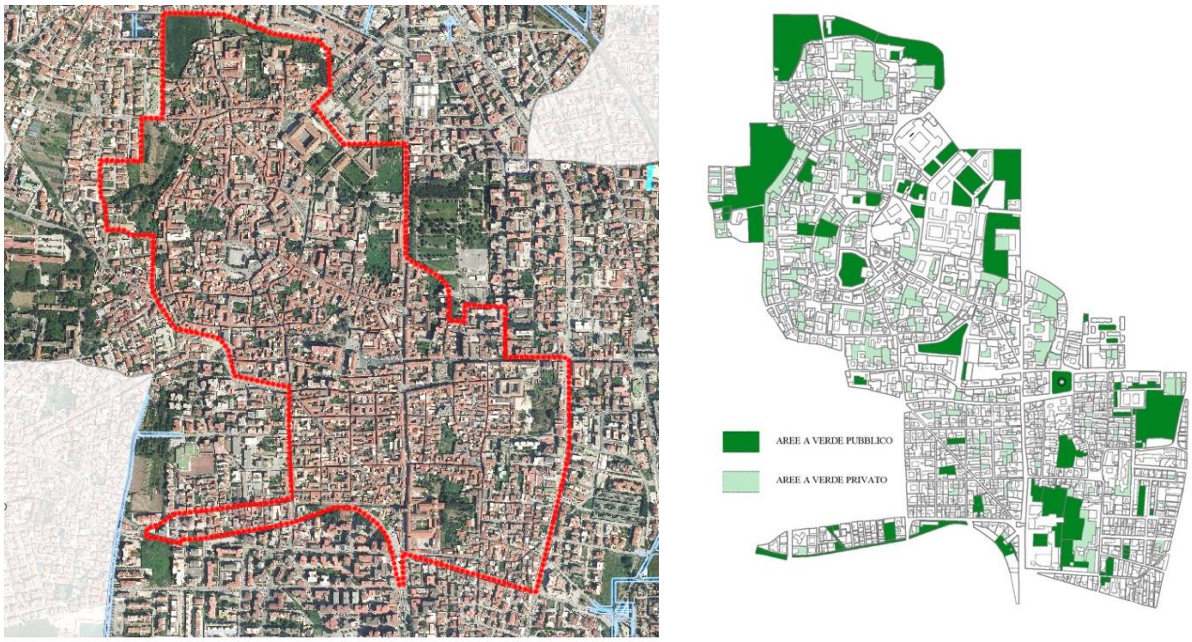


Fig. 5: On the left historical town center of Aversa boundary in red. Source: Google Earth Pro. On the right thematic map of the historical town center of Aversa tracing private and public green areas. A hypothesis for reaching the BAF target. Source: our processing

To reach this value it will be necessary to reduce the areas with a weighting factor close to zero and increase those that are close to one through the application of mitigation techniques that increase the areas with vegetation and green roofs that have proven effective in combating the heat island phenomenon. By acting on public areas and, in particular, on the areas destined for urban standards, ie schools, car parks, squares and external arrangements, on facilities of common interest by increasing their permeability and green areas (Fig. 5) and assuming that 90.000 sq meters of covered surface area out of 425.435 sq meters ie about 21% of the total, is transformed into roof gardens, with extensive and intensive coverage of the roofs with vegetation, the BAF rises to 0.30, which reaches the target value recognized as correct for this type of settlement.

5 - Concludings remarks

In urban planning, nature has almost always been introduced for decorative purposes, often underestimating the benefits it has on the city and its inhabitants. In recent years, the climate discomfort, increasingly felt in urban environments, has reinforced the importance of the green component. It is necessary to recognize the functions of greenery in meeting real needs and to include it as a priority element in the city's plans. Ensuring that grey and green infrastructures function properly, guarantees healthy and sustainable urban environments, as both play a vital role, in maintaining the quality of life, of our cities. New tools need to be developed to introduce the climate aspect into the plan design process [19], translating this information and the results into climate guides for politicians and urban planners [20]. Permeable surfaces and green roofs have a considerable absorption power of rainwater, which can reduce the load in sewers by up to eighty per cent. Increased permeability of soils also brings other numerous benefits, such as lowering the temperature in urban areas and thus mitigating the heat island, improving the microclimate and providing greater thermal insulation for homes where there is a green roof or wall. Nations such as Germany and Sweden, which have always been focused on environmental issues and the ecological, economic and social benefits that the urban landscape provides, were the first to develop urban environmental quality indicators to safeguard and improve the urban environment, natural habitats, microclimate, soils and water balance. The applicability of the BAF and its ability to adapt to different urban situations are testified by the diffusion it has had and the integration of the abacus with naturalistic and eco-systemic factors (eg the case of Seattle). It is enough to refer to the experiences of Paris with the Coefficient de Biotope par Surface - CBF, Malmö with the Green Space Factor - GSF, Southampton with the Green Area Factor - GAF and Seattle with the Seattle Green Factor - GF but also the Reduced Building Impact Ratio - RBI applied in the municipalities of Bolzano and Bologna. An effective indicator must be characterized by sufficient generality to be applied in several contexts and to leave room for the implementation/planning phase. The case of the historical town center of Aversa makes it possible to state that in most Italian historical centers, especially in the Mediterranean area, the improvement of environmental performance and the consequent reduction of the heat island effect

is possible even for urban morphologies characterized by stratified, compact settlement fabrics, with high land cover ratios and low presence of green areas through the intervention on public spaces, present in non-negligible quantities in these parts of the city. The importance of green areas is recognized by the Territorial Plan of the Province of Caserta, approved in 2012, both in the structural directives referring to the Natural Landscape Elements, the Rural Open Territory and the Provincial Ecological Network, and in the programmatic provisions regulating the use of the Denied Territory with environmental potential without, however, resorting to specific environmental indicators that, in the vast area, would have encountered not a few application difficulties, but deferring to the municipal scale the implementation of the plan's provisions with the use of the most appropriate urban planning techniques.

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[5] Carrying capacity is defined as the maximum load, imposed by the population of a certain species, that a given territory can support without permanently compromising the territory's productivity. Researchers are therefore interested in investigating the relationships that exist between natural systems and the human species to understand how an equitable and sustainable society can be achieved. Over the years, various researchers from different disciplines have explored this concept and suggested ways to measure, monitor and implement sustainability (Aguirre, 2002; Kates et al, 2005; Hasna, 2007; Boulanger, 2008).

[6] The institution of compensation for environmental damage was introduced into the Italian legal system by Law 8/7/1986 no. 349, art. 18, previously jurisprudence had not referred to specific norms or had invoked the general principle sanctioned by the Italian Constitution on the right to health, considering that the environment, in its unity, guaranteed this right. Article 18 of Law 349/1986 defines environmental damage (paragraph 1): any intentional or negligent act in violation of provisions of law or measures adopted based on law that compromises the environment, now causing damage, altering it, deteriorating it, or destroying it in whole or in part, obliges the author of the act to pay compensation to the state.

[7] https://www.ipcc.ch

[8] STERN N. (2006), The *Stern Review on the Economics of Climate Change,* London, HMTreasury

[9] https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0147:FIN:EN:PDF

[10] Landscape ecology studies the ecological origins and consequences of spatial patterns (distribution patterns) in the environment, highlights the ecological effects of pattern on large spatial scales (extended areas or regions) (Turner, 1989), deals with the effects of the spatial configuration of mosaics on a wide variety of ecological phenomena (Wiens et al., 1993), promotes the creation of models and theories of spatial relationships, and the collection of new types of data on spatial patterning and spatial dynamics at scales rarely considered in other branches of ecology (Pickett and Cadenasso, 1995).

[11] FORMAN, R. T., GODRON M. (1986), *Landscape Ecology*, John Wiley and Sons Inc., Hoboken - USA, ISBN: 9780471870371

[12] The runoff coefficient is given by the ratio of the volume (equal to the effective rainfall) drained from the basin in each time interval to the relative inflow consisting of the total rainfall.

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[16] http://www.stadtentwicklung.berlin.de/umwelt/landschaftsplanunglbfflindex_en.shtml

[17] LOSCO S. (2019), *Metropolitan Areas and Homogeneous Sub-Areas: A Structural Land Use Plan Proposal for Aversa Conurbation Planned as a Metropolitan Municipality* in: Laborest n. 19, Laruffa, Reggio Calabria, ISSN 2421-3187

[18] The main conurbation core consists of the municipalities of Aversa, Lusciano, Trentola-Ducenta, San Marcellino, Frignano, Casaluce, Teverola, Carinaro. The secondary conurbation core includes Villa di Briano, Parete, Gricignano d'Aversa, Cesa. The first satellite centre includes the municipalities of Villa Literno, Casal di Principe, San Cipriano d'Aversa, Casapesenna. The second satellite centre includes the municipalities of Sant'Arpino, Orta d'Atella and Succivo.

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Philosophy physics and math in architecture

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Abstract
The scientists studied the effects of technology in the social field, in the possibilities offered by new technologies and in the setting of knowledge.
The architect must demand an extremely precise and meticulous attention in the composition of each image, in the meticulous definition of the details, in the choice of objects, light and atmosphere to get to the desired vagueness.
The way of globalization and standardization leads to an impoverishment of forms of life, because it is necessary to take into account the great diversity of forms of living and places of life, in order to enhance their environmental specificities, anthropological and artistic in a new perspective capable of creating a deep bond between the richness of local singularities and the meaning of universal values.
The future of planet earth is linked to our ability to respond to global challenges, to the now unliveable of many cities, to resources depletion and to the ever faster loss of biological and cultural diversity, the pollution and overheating of the planet itself.
In this paper we study the classification of architectural styles from great scale to ordinary scale and the three laws of the structural order characterize historic buildings around the world through more than four millennia of civilization until the 20th century.

Keywords: architectural styles, physical laws, environment.

1. Introduction
The history of humanity is linked to the history of the "techne", in the Greek sense of the term, that is, the relationship of man with the world, in the elaboration, in the transmission of conceptual instruments, institutions and artifacts, which are born from culture and become part of it.
The technique initially frees man from the constraints imposed by his physical conditions and adapts man to the environment, constituting an intermediary, mediating between himself and nature, in social and daily needs.
Later the transformed industrial organization used the technique for the new needs, induced by the well-being and the economic policy.
The Polytechnic studied the effects of technology in the social field, in the possibilities offered by new technologies and in the setting of knowledge.
In addition to the more advanced technological aspects, the school in Frankfurt thought that there was a need for an ethical guide to technological development.
The new systems, in fact, offer wide opportunities to maintain the requirements of comfort for human life, without neglecting the already severely compromised environmental conditions.
Effective product matching is necessary for the connection between technology and social needs. A cultural and social orientation is necessary so that technology does not become an end in itself, that is, it does not develop deviating from the social goals. Construction techniques have been the means to create human settlement, after the nomadic phase, after the technology of agriculture and fireworks. For the technique, the subjection of nature by man, linked to architectural activity, poses problems at the environmental level, related to the impact on the ecosystem.

Ethical problems arise with regard to the response of architecture to social needs, building culture and socially recognized models, also with a view to innovation.
The response of a sustainable and bioclimatic architecture, working with nature and not against it, seems to address the problems identified. It is necessary to understand how man is indissolubly linked to his environment and his life depends in an unavoidable way on the health of the world in which he lives.
Technology, as an intermediary between man and nature, is the instrument guided by reason and ethical principles of man, in the relationship between man and environment that must necessarily be realized because of the current emerging problems.
Through technical means, man has shaped the environment through two approaches, conceptually very different, and definable constructive and energetic.
The constructive approach (conservative-selective or natural approach) conceives the defense and the environmental selection mainly through static and stable systems or through the structural parts of the building.
The energy environment (regenerative or artificial) uses resources that need constant renewal, more dynamic systems that allow greater flexibility in design and environmental control and that are referred to as energy. Through the analysis of systems and solutions applied at a morphological and technological level, it is possible to evaluate their suitability and applicability, keeping in mind the objectives of sustainability and reduction of the environmental impact of buildings.
In this way it is possible to analyze and imagine the possibility of an energetically valid response in climate environments with different types of construction, defining a technical culture in the context of sustainable development applied to construction. It is necessary to understand the concept of sustainability through an approach that takes into account the complexity of the task of today's architecture that in the design must include the environmental problem as a founding premise.
As Varis H. Bocalders, a professor at the Stockholm School of Architecture, "The premise of the design of a sustainable building is a deep awareness of the environmental effects of the building and the aspects on which to intervene to avoid the occurrence of such problems.
The next step is to put together all the individual elements of the project, having verified that each is, in itself, free from environmental contraindications. This means having a holistic approach to the design problem that needs to be addressed, an approach based on an understanding of the concept of sustainability. A seemingly simple way of working that, applied to a complex organism, like a building, offers the designer a task far from easy".
The need for objective assessments relating to sustainability and the possibility of introducing renewable sources in the energy construction sector and all solutions related to energy saving is confirmed by regulatory instruments and initiatives taken to Italian and European level.
It is necessary to identify solutions and possibilities, define physical and technical parameters, plant methodologies, methodologies of design approach and analysis of the project, essential to enhance energy performance-for the benefit of architectural design, too often identified with the aesthetic quality of technological solutions and material research for the image of the built, at the expense of a scientific approach to support these choices. The architecture of the international image often approaches sustainability, which is a prerequisite for the design choices. The dissemination of information, including in international journals, by renowned architects, is a means of spreading principles to which reference should be made on a large scale.
It is necessary to understand and clarify how sustainability can and should effectively represent a fundamental principle for the architectural production of the immediate future, and that it would be even harmful to identify it with specific types of construction or technological elements, separated by an overall view.
It is above all important to avoid that the phenomenon of uncritical imitation of the architecture of the image leads to the multiplication of buildings that hide their poor quality behind an empty stylistic language easy to understand, but that distort the concept of sustainability.
The basic criteria of the utility and functionality of the building, which have also become typical of modernism, lead to the use of materials and building systems subordinated to the primary need to connect architecture and urbanism.
Another important criterion gives space to a structuralist vision of the building and of the dwelling, which leads to privileging the structure on the form, conceived as an expression of the deep link between individual and collective needs and landscape characteristics, aesthetic and cultural. of the place, even if the person, with his perceptive and emotional sphere, has no place in this type of conception of architecture, as in the definition of Le Corbusier according to which «A house is a machine for living in».
In particular, the German philosopher Heidegger develops his critique of the idea that building is an antecedent moment and therefore hierarchically fundamental to that of living, in which he recognizes a symptom of the contemporary technical environment and proposes an inverse order. The original dwelling is a way of being in the world from which other practices derive and reflects the way in which the human being establishes a physiological, anthropological and cosmic link with the earth, and is

therefore the building that comes from living and the second gives meaning to the first, and not vice versa, as Giacomelli comments.
The ontology of being is based on the way we live in a home and live in a place, and living is a moment, an essential process of human existence and of our equally essential relationship with the world of nature and culture. In particular, man places himself "before" the world, outside and above it, almost ignoring the relationship that binds him to nature.
In this regard, Rilke observed: "The common man, who lives with other men, knows nature only to the extent that it is connected to his interests; he looks rather outside of the things he has put together with the work of centuries and is thus led to believe that the earth, insofar as it is possible to cultivate a field, thinning a forest, making a river navigable, participating in some way in this work. His eye, fixed almost exclusively on men, looks at nature without dwelling on it, as something implied and already existing that must be exploited as much as possible».
The separation between the 'skeleton' and the 'skin' of the buildings is by Leon Battista Alberti (1404-1472), that is, between the structure, which we begin to conceive in itself, and their external surface, seen as a decoration that must be added to the structure without affecting its conception and realization. Even the language of architecture would acquire an artistic and poetic meaning if it allowed itself to be contaminated more by a vagueness, an imprecision.
The architect must demand an extremely precise and meticulous attention in the composition of each image, in the meticulous definition of the details, in the choice of objects, light and atmosphere to get to the desired vagueness. For example, the way light penetrates the streets and houses, or illuminates certain objects like a wall or a tree, the way it hides the secrets of places, or creates an atmosphere, are all situations that allow us to grasp the beauty and the sense of the indefinite and indeterminate. This sensitive and singular perception is an important condition for being able to live fully and empathetically a house, a city, a place.



Fig. 1: LIGHT AS AN INSTRUMENT AND MATTER OF ARCHITECTURE

2. Architecture, mathematics and philosophy

Mathematical space, as Heidegger says, cannot be the foundation of inhabited space. The reduced space of numbers or simple measurement ratios cannot contain places in itself. Inhabited spaces differ from purely mathematical spaces in that they acquire shape and meaning thanks to places, which have at the same time an aesthetic, anthropological and symbolic value, and buildings must belong to the places from the moment they aspire to be a true foundation of living practices.
All this leads to a reflection on the relationship that unites man with space on the biological, phenomenological and cognitive levels and therefore man and space are no longer separable, in the sense that houses must be conceived as organic formations of living organisms so only if the space is lived by man, the latter is then inhabited.
The notion of structure, as the main criterion of architectural functionalism, will become the dominant idea of modernism in architecture: an idea that clearly supports the separation between the interior and

the exterior of a building, heralding another separation, that between the building, understood as construction and place where it arises, or even between being as 'object' enclosed in a limited volume of space and being-in-the-world, which determines a dynamic and vital relationship between the living being and the world to which it belongs.
However, he does not believe in the redeeming virtues of unlimited construction and occupation of space or in the need to industrialize construction, because at the same time environmental, social, cultural and ethical reasons require a radical change of course and model. The reductive and dualistic notions of 'constructive truth' must give rise to a conception in which the act of living. Belonging to a place and the construction of individual and collective identity through the discovery of one's own living environment are part of an integrated vision of living and thinking.
The way of globalization and standardization leads to an impoverishment of forms of life, because it is necessary to take into account the great diversity of forms of living and places of life, in order to enhance their environmental specificities, anthropological and artistic in a new perspective capable of creating a deep bond between the richness of local singularities and the meaning of universal values.
Architecture cannot be inspired only by criteria of instrumental utility and mechanical precision, but must incorporate the element of humanity, freedom, possibility, vagueness in the literary sense of the Leopardi language.
The anthropologist Tim Ingold, taking up this theme, stressed that houses are "living organisms".
Like trees (houses inhabited by foxes, owls, squirrels, ants, cockroaches and many other creatures), buildings "have life stories that consist in opening their relationships with the human and nonhuman elements of their environment".
It is, in other words, a question of redefining the very notion of 'inhabiting' a city, a place, a space in contrast to what happens in modern architecture that seems to have repudiated the ontological link between place and being, between living and existing , in favour of a purely technical vision of the building. In this sense, the house becomes the house of being, a universe in which the geometric, artistic and human dimensions are harmonized, a world in which the inside and the outside form a whole. For the conception and construction of inhabited spaces, architecture must seek an important source of inspiration in the study of physical and human morphology, anthropology, art and geometry.
In particular, geometry can really suggest models of dynamic and creative forms, some of which are also the basis of a certain natural order in the animal and plant world and many great artists-Architects were deeply inspired by them to give the public and private places and buildings an extraordinary variety of forms.
Gothic art developed the imaginative virtues of some geometric forms and constructions before they were formally introduced into mathematics; this suggests hyperbolic and spherical geometries and other geometrical structures quite unusual at the time, and this did not obtain decorations that captured the attention of the observer or the man of faith, but creates a deep harmony between the movement of certain geometric shapes and the sensitive perception that rises towards the search for a sublime experience, and not transcendent, therefore capable of arousing new emotions.
The geometry of the spaces allows to generate a rich variety of shapes and patterns (hyperbolic, spherical, symmetries and transformations, minimal surfaces...), which in addition to having good properties of stability and flexibility, represent a source of inspiration for developing abstract diagrams, which enriched with certain artistic and architectural content, become models of various concrete spaces, such as houses, cities, squares, streets, courtyards, pergolas, etc.
Art and architecture meet on the condition of rediscovering the multiple dimensions of reality, plurality and perceptual dynamics, the profound reasons for the complexity of life forms and new spaces of creativity, freedom and play. generating a deep transformation in the way of conceiving relationships with nature, places and living beings.
The future of planet earth is linked to our ability to respond to global challenges, to the now unliveable of many cities, to resources depletion and to the ever faster loss of biological and cultural diversity, the pollution and overheating of the planet itself.
To achieve this goal a completely different conception of the environment is needed, a different idea of its role with respect to the spaces inhabited by living organisms and in particular by man, according to the psychologist James J. Gibson, who states: "I mean, instead of a geometric point in abstract space, a position in ecological space, in a medium instead of a vacuum. It is a place where an observer can stand and from which an act of observation could be made.
While abstract space is made up of points, ecological space consists of places: places or locations. A clear distinction will be made between the environment at an unoccupied vantage point and the attitude at a location occupied by an observer, human or otherwise. When the position is occupied [by an observer], something very interesting happens to the environment [that is, in the organization of the environmental space]: it contains [acquires] information about the body of the observer".
According to J.J. Gibson, the environment is a function of the perception of which observers are involved: one is led to think that the environment is made of objects in space and of shapes with closed

contours, or of "figures in the background", to each object of space would correspond to a shape in the optical order, that is to put the problem in radical terms, the environment is not made of objects.
"The environment consists of the earth and the sky, with objects located on earth and in the sky, mountains and clouds, fires and sunsets, pebbles and stars.
Not all of these are objects distinct from each other, and some are nested in each other, some move, some are animated. But the environment [meaningful to the observer who perceives the world] is all these various things - places, surfaces, layouts, movements, events, animals, people and artifacts - that structure light at the observation points. (Gibson 2007)
In the last two centuries, architecture has become an increasingly rationalistic idea and gradually less artistic and poetic: functional logic prevails over the metaphorical dimension of architectural thought, just as the construction of architectural form overpasses technology.
The design process is now completely based on the computer and its final result is entirely determined by the type of software; but this implies the refusal to develop the project through drawings and models, to give shape to an idea thinking and meditating with sketches drawn by hand, that is, with living and moving images or details of particular spaces and materials.

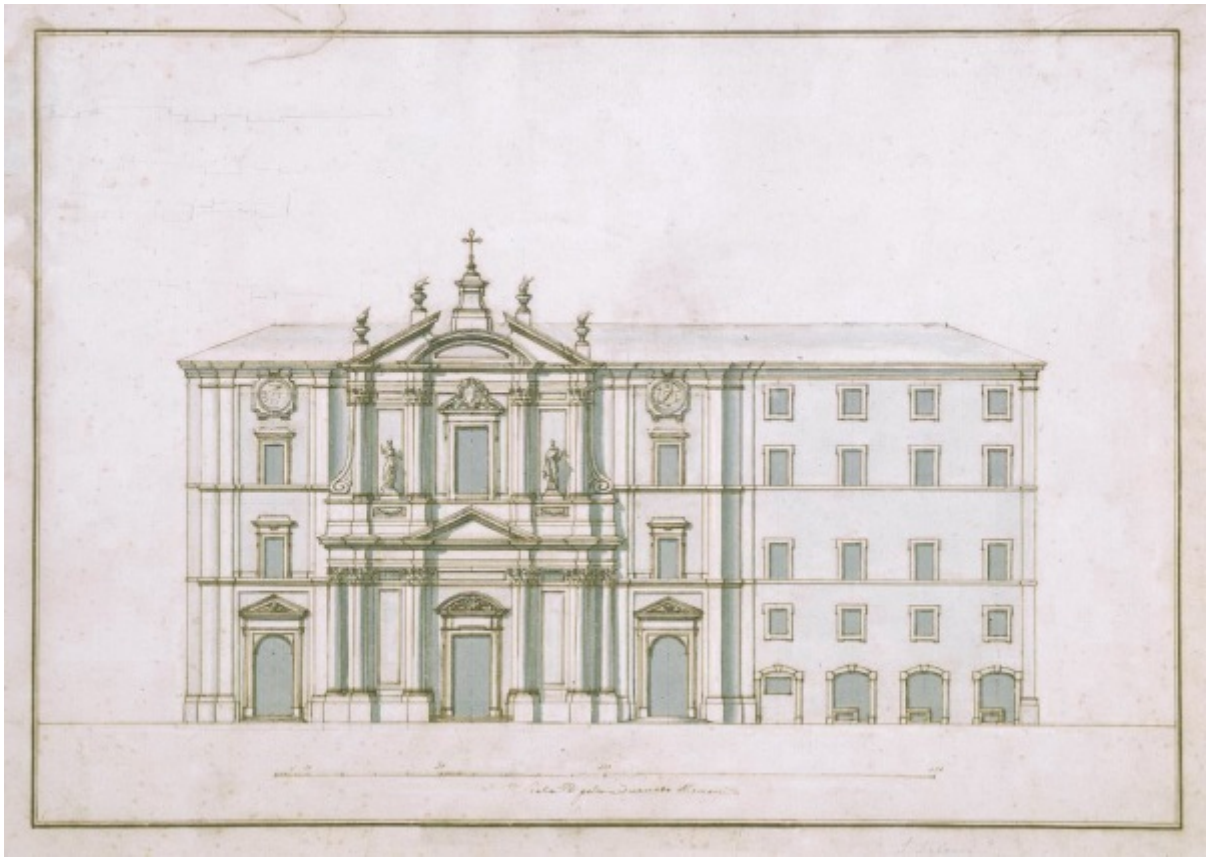


Fig. 2: Ferdinando Fuga: Sant'Apollinare's Church 1741

3. Architecture and physics

In the architectural order there are three laws similar to the basic physical principles, applicable both to natural systems and to man-made structures.
They are consistent with all the architectures present in every part of the world: classical, Byzantine, Gothic, Renaissance, Baroque, Islamic and Eastern but not in many architectural forms of the last seventy years: they seem to contradict some structural and constructive rules of order. There is still no clear and shared formulation of how the structural order can be achieved in architecture.
Since architecture affects man, through the built environment, more than any other discipline, however, our knowledge of the mechanisms that create the structural order is limited, since we are dealing with understanding the natural, biological and inanimate structures, rather than natural structures. Systematic patterns reflected in our constructions.
We expect that the structural laws, underlying physics and biology, will also apply to architecture. As in electromagnetism and gravity, so volumes and surfaces apparently interact as elementary particles, and thus architecture governed by a set of rules linked to physical laws.

The structural order concerns the perceived form and therefore two components of architecture: the tectonic structure and the design of the surfaces.
The structural order is conditioned by human perception and therefore is not evaluated with abstract formal criteria, just as in physics the observer becomes part and therefore influences the behavior of a quantum system: architecture exists in the universe of human beings and "She" is not in its own abstract realm.
The three laws of the structural order:

1. order of the smallest scale, based on contrasting paired elements, existing in a balanced visual vision;
2. the large-scale order, achieved when each element relates to each other at a distance that reduces entropy;
3. the small scale order, which was linked to the large scale by a hierarchy of intermediate scales.

The small scale consists of paired elements with "opposite characteristics" linked together. The bond is the result of complementarity, the coupling keeps the opposites close to each other, but does not allow them to overlap, which would cause the cancellation.
Their close separation creates a dynamic tension, which would not manifest itself in elements of the same type, close together. The structural order is a phenomenon that obeys its own laws, the smallest perceptible differentiations of color and geometry.
As in the atomic nucleus, where protons and neutrons are bound by a strong force, a neutron is able to become a proton. This inversion is what strongly binds both to form the nucleus, in fact it is difficult to separate the proton from the neutron inside the atomic nucleus, since it is impossible to say which is which or the other of the two.
In design, a fundamental pair of fundamental and opposing elements must possess the same duality: an object and its surrounding space must connect with a opposing pair, have the same degree of structural integrity and each component of a opposed pair has the same degree of consistency and complexity.
In the case of one object and its environment, each gives shape to the other by providing it with complementary qualities. In the case of a building, the union with the external space is not through a continuous facade but through the geometry of its plan. It is designed to create the outer space as an urban space.
As for the large scale, in physics if non-interacting objects approach, any phenomenon may occur. The interaction produces a reconfiguration, determines a greater order for large structures and therefore, there is a reduction of entropy (disorder).
The organizational process generates similarities and symmetries between the different sub-regions and it is this aspect; if we use it in architecture it would lead to the connection of all the small-scale elements in a harmonious whole. According to law 2, large-scale order is obtained when each element relates to each other at a distance that reduces entropy. This fundamental rule generates large-scale order in both color and geometry.
Long-range interactions determine, through the orientation and similarity of separate spatial units, the structural order, not only of surface decoration, but also of tectonic elements.
The small-scale order arises when units touch each other, while the large-scale order arises when units do not approach. The reason for the reduction of entropy is the way humans perceive a structure: it’s much harder to understand what is disordered. The complex structure perceives it if made coherent by relationships and symmetries that allow to conceive. In architecture, the structural order is inversely proportional to the entropy of the interacting elements.
The second law allows us to understand the visual interaction between two close but separate objects as we see in optical illusions. The brain creates connecting lines; it unites the geometries of the two units together. The entropy of a model ("design": object, project, model, structure) perceived by our innate ability to visualize links. The main spaces of each building and their relationships with all the others regulate the relationships between all the walls and every other structural element.

4. Classification of architectural styles

The three laws of the structural order characterize historic buildings around the world through more than four millennia of civilization until the 20th century.
Architects, throughout history, already had an intuitive knowledge of the three laws.
The buildings of the twentieth century minimize some components of the structural order, with an impressive general symmetry.
There may be no differentiation in spaces and the contrast between exterior and interior or the contrast between areas in most components of a building may exist in isolation without any interaction between them. Connections between regions can appear visually disconnected, with no thick edges, bezels, or connective boundaries when surfaces are smooth with straight edges and sharp corners.

Finally, the buildings destroy any natural or pre-existing order and reduce the possibilities of connection with the surrounding environment are reduced.

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Energy as a paradigm of urban planning. Towards an ecological transition.

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Abstract
The debate in recent years has been characterized by the experimentation of a different form of piano in its various choices and denominations. It is no longer a question of regulating urban expansion but there is a need to address new needs of the urban system such as: limiting urban expansion to safeguard the soil as a resource; guarantee the environmental compatibility of the choices relating to the settlement and infrastructural system; principles of environmental improvement to the new urban transformations defining at the same time the rules of; avoiding the consumption of renewable resources, obviously including water and energy. Today there is the necessity to intervene to achieve the sustainability of local territorial system. This means that the municipal land is the unity on which to intervene with appropriate planning instruments to support sustainable actions. It's not enough deal energy issues only at the sectoral level, but is necessary that is an integral part of the Municipal Structural Plan from the phase of settlement's knowledge resources, environmental and infrastructure to the implementation of policies.This approach allows of to structure a new urban system based on the integration of the different segments that determine the energy self-sufficiency. The only way to ensure sustainability in urban development policy focused on the enhancement is the optimization of energy resources.

Keywords: integration, enhancement, sustainability.

1. Una nuova *forma* di piano nell'epoca delle trasformazioni

La pianificazione, nel corso della storia, ha affrontato le problematiche legate al territorio e alla città attraverso l'utilizzo di strumenti grazie ai quali, in funzione di determinati obiettivi, si è tentato di garantire coerenza nello *spazio* e nel *tempo*. Ciò significa che, in ciascuna fase della vita di una determinata Società, in riferimento ad una scansione del tempo in periodi discreti, sia garantita una coerenza territoriale (fisica e funzionale) alle trasformazioni che avvengono in quella fase. Nella pianificazione tradizionale per molto tempo si è ignorato questo aspetto, che si è cercato di risolvere in Italia, con l'introduzione del "programma pluriennale di attuazione", aggiungendo al piano generale una collocazione temporale della sua attuazione. Possiamo quindi considerare la pianificazione come un processo continuo e sistematico nel quale le fasi canoniche (analisi, scelte, attuazione, monitoraggio e verifica, ecc.) ciclicamente si susseguono. In questo quadro diventa possibile distinguere, nelle scelte di pianificazione, quelle cui è necessario attribuire una durata maggiore (invarianti, condizione alla trasformazione, scelte strategiche) da quelle cui è necessario attribuire una durata minore (scelte programmatiche), definendo così in modo del tutto nuovo il rapporto tra pianificazione e tempo. Negli ultimi anni si è presa coscienza che per poter dare una risposta efficace alle esigenze del territorio, che cambiano repentinamente, bisogna affiancare alla pianificazione ordinaria quegli strumenti specifici che si occupano di indagare i diversi aspetti che determinano, nel breve e medio periodo, la complessità della realtà. Questo perché il piano generale, anche se profondamente innovato, non è in grado di affrontare e di gestire da solo tutti gli aspetti trasformativi della realtà territoriale, in quanto non riesce a tener il passo con le trasformazioni legate alla mutevolezza dell'organismo città-territorio, non solo collocabile nella sua dimensione fisica. Anzi, le maggiori e più importanti *trasformazioni* spesso interessano fenomeni riconducibili ad una dimensione qualitativa piuttosto che quantitativa del territorio:

l'insieme delle relazioni sociali, delle funzioni antropiche, delle risorse naturali e paesaggistiche, delle identità che in esso coesistono e che concorrono a determinarne un'immagine che spesso non corrisponde all'idea di città che il piano si è dato. Il territorio è un'entità in costante trasformazione che interagisce, come ogni organismo vivente, con una molteplicità di fenomeni, ed è lo specchio della Società che lo abita, con le opportunità, i problemi, le attenzioni le risorse, e così via. In tale contesto i tradizionali strumenti tecnici vengono, o dovrebbero essere, affiancati da strumenti specialistici, che approfondiscono determinati aspetti della realtà avendo bisogno di un'attenzione mirata e specializzata, coinvolgendo competenze tecniche e responsabilità diverse dalla pianificazione ordinaria, implicando un'integrazione orizzontale tra i diversi strumenti "trasversali" alle diverse scale.

1.2 Ripensare il piano urbanistico nell'ottica della sostenibilità ambientale

Sulla base di tutto ciò è necessario, oggi, ripensare il piano nella sua capacità di dialogare con la città e il territorio, attraverso un approccio integrato e sostenibile dei fenomeni in gioco. Ripensare la pianificazione urbanistica e territoriale riponendola al centro delle azioni di governo, soprattutto nella prospettiva del Next Generation EU e delle ingenti risorse che esso mobilita per il nostro Paese. In questa nuova accezione, l'ambiente diviene non solo una componente di qualità della vita ma una imprescindibile dimensione nel buon funzionamento dell'ecosistema città. La questione ambientale entra dunque nelle logiche di piano e lo fa attraverso il filtro del concetto di *sviluppo sostenibile*, permettendo di tener intrecciate e interagenti le problematiche del sistema ambientale con quelle territoriali degli ecosistemi urbani, attribuendo alla dimensione ambientale quella trasversalità rispetto alle scelte della pianificazione che è caratterizzata principalmente dall'approccio integrato. Essa consente inoltre di focalizzarsi sui modelli si sviluppo urbano, ampliando così l'attenzione disciplinare dalle tradizionali componenti del territorio extraurbano alla compatibilità e sostenibilità del sistema urbano, ossia fin dove si manifestano più intensamente le problematiche di spreco, inquinamento e dissipazione delle risorse; spostando quindi l'interesse verso gli ambienti urbani e riconoscendo la stretta dipendenza esistente tra modi d'uso, trasformazioni territoriali e livelli di qualità ecologico-ambientale. Come è evidente, l'obiettivo dello sviluppo sostenibile impone la costruzione di politiche urbanistiche nel lungo periodo in cui si declinano spazialmente e temporalmente le interazioni tra le sfere sociali, economiche ed ecologico-ambientali che hanno a che fare con il territorio.
Nelle più recenti esperienze di pianificazione europee sono rintracciabili alcune strategie di sostenibilità ambientale:
- evitare il consumo di risorse rinnovabili a ritmi superiori alla capacità del sistema naturale di ricostruirle;
- limitare al minimo il consumo di risorse non rinnovabili;
- evitare di emettere inquinanti in quantità tale da accedere le capacità di assorbimento e trasformazione di aria, acqua e suolo;
- mantenere la qualità dell'aria, dell'acqua e del suolo a livelli sufficienti per sostenere la vita ed il benessere dell'uomo.

Adottare queste strategie significa parlare di rigenerazione ecologica della città e articolare su questo concetto le scelte di piano. Si può affermare che da un primo momento in cui la questione ambientale è stata introdotta all'interno della sfera disciplinare urbanistica si è arrivati, ormai a guardare in un'ottica ecologia l'intero territorio urbano e a inserire di diritto la componente ecologica nella pianificazione. L'obiettivo è quello di garantire una corretta fruibilità delle risorse territoriali tanto alle presenti, quanto alle future generazioni, cercando di collegare ogni trasformazione urbanistica a concreti interventi di miglioramento qualitativo delle risorse ambientali, affinché sia garantito un processo naturale di rigenerazione o di autorigenerazione delle risorse stesse. Le nuove politiche a livello internazionale e a scala nazionale spingono a immaginare una Società orientata verso nuove forme di consumo delle risorse e verso l'uso sempre più consistente di fonti di energia rinnovabile, puntando alla costruzione di nuovi scenari della produzione e del consumo di energia. Nell'ambito della transizione ecologica c'è da tenere in seria considerazione che le politiche climatiche comportano sacrifici economici che richiedono un coinvolgimento diretto della popolazione anche a fronte di un impatto negativo sul mercato del lavoro. Per prevenire e limitare i costi economici della transizione ecologica, si parla da tempo di **transizione giusta,** un concetto che compare già nell'accordo di Parigi del 2015 e in diversi framework internazionali (come la Convenzione Quadro sui Cambiamenti Climatici, l'Agenda 2030 per lo Sviluppo Sostenibile e l'Organizzazione Internazionale del Lavoro), per rimarcare l'intenzione di **integrare in modo sistematico all'interno delle politiche climatiche considerazioni volte a minimizzarne gli impatti negativi sull'occupazione** e sulla società. La capacità di costruire una pluralità di immagini di futuri, tutti possibili, che muovendosi lungo l'asse del tempo si modificano, stabilendo nuove relazioni tra le parti, e la capacità di indagare sui processi fanno dello scenario un efficace strumento cognitivo. La costruzione di scenari energetici parte da alcune ipotesi e tenta di valutarne gli effetti sul territorio, di problematizzare, di costruire una mappa dei conflitti e delle sinergie derivanti dall'applicazione di un nuovo modello energetico alla città. L'energia è una delle risorse da preservare in previsione di una mitigazione degli impatti presenti e futuri, la quale presenta uno dei campi più importante cui puntare per il miglioramento della qualità della vita per le popolazioni locali. La

realizzazione di tale obiettivo generale può esser raggiunto attraverso la messa a punto di una strategia che articoli per il breve, medio e lungo periodo, gli interventi e le scelte in grado di affrontare una certa sicurezza e autonomia delle fonti energetiche, il controllo tecnologico delle medesime, il controllo dei consumi energetici, sulla qualità della vita, assumendo i concetti di efficienza e di risparmio energetico come variabili imprescindibili nelle strategie di sviluppo urbano. In sostanza, il punto di incontro tra il processo di programmazione in campo energetico e quello in campo ambientale si concretizza nel Piano Energetico, che integra il fattore "energia" nella pianificazione, individuando le scelte strategiche per migliorare lo stato ambientale della città e promuovere l'uso razionale delle risorse, nella direzione di uno sviluppo sostenibile. Tale strumento ha tra i suoi principali obiettivi lo studio degli indirizzi per attivare interventi di razionalizzazione nell'uso dell'energia e lo sviluppo delle fonti rinnovabili, integrandosi e collegandosi perfettamente agli altri piani di settore. Rafforzando così i rapporti tra intensità energetiche e paesaggi urbani, rendendoli più chiari, costruendo un codice e un linguaggio che rendano più esplicito e diretto il rapporto tra energia e città; dando forma riconoscibile all'energia. Da quanto detto si può evincere come, sempre più, la politica energetica e quella ambientale, che nel passato sono state affrontate separatamente, tendono a relazionarsi e a rendersi complementari, allo scopo di ridurre al minimo gli impatti negativi sull'ambiente causati dal ciclo dell'energia; pertanto, ogni azione in campo energetico deve esser subordinata alle esigenze della protezione e della salvaguardia ambientale.

2. Pensare globalmente ed agire localmente

La forte dipendenza dei sistemi attuali dalle fonti fossili, quali fonti limitate nel tempo, oltre a rappresentare il primo fattore di impatto sui cambiamenti climatici e sull'ambiente, allo stesso tempo rappresenta un limite per lo sviluppo economico locale incidendo sulla qualità della vita. Ciò ha spinto negli anni i governi nazionali a cooperare per definire strategie di sviluppo energetico basate sulla massimizzazione dell'efficienza energetica e la produzione diffusa di energia da fonti rinnovabili al fine di ridurre le emissioni di gas climalteranti. A livello locale, il perseguimento e l'attuazione concreta dello sviluppo sostenibile ha richiesto sempre più la ridefinizione di percorsi di pianificazione mirati a sviluppare modelli energetici sostenibili, funzionali alle reali esigenze dei territori ed in grado di trovare in questi le risorse disponibili (sole, vento, biomasse, ecc.) per far fronte ai fabbisogni energetici delle comunità locali. Per raggiungere tale obiettivo è importante che ci sia alla base un rinnovamento nei modelli di gestione e governo del territorio dal basso in quanto sono "le azioni locali o comunque, pur se comuni a vaste aree del pianeta, localmente attuate, quanto determina l'effetto globale. Quindi la dimensione territoriale dei consumi assume pregnanza e sembrerebbe dover acquisire attenzione. Registra se non altro le buone intenzioni il motto dell'epoca "Pensare globalmente e agire localmente"[1]. Quanto detto ci fa capire come c'è la necessità di intervenire sul locale per ottenere dei risultati sperati e significa che il territorio comunale rappresenta *l'unità* sulla quale intervenire con strumenti urbanistici di governo del territorio adeguati a supportare le azioni sostenibili e incentivare l'iniziativa pubblico/privata nel settore energetico. Richiede soprattutto un salto culturale che investa l'intera collettività, nei comportamenti quotidiani e nel ripensamento delle abitudini e degli stili di vita. Quindi non basta trattare la tematica energetica solo a livello settoriale e per i comuni con una popolazione superiore ai 50.000 abitanti, soglia per la quale la legge n° 10 del 1991 prevede il piano energetico comunale (PEC), ma bisogna che le energie rinnovabili facciano parte integrante dello strumento principe per il governo del territorio a livello comunale, rappresentato in molte regioni dal piano strutturale comunale (PSC), grazie al quale si potranno individuare le risorse energetiche presenti sul territorio, incentrando lo sviluppo di un sistema ecosostenibile, indicando indirizzi di utilizzazione di tali risorse per ciò che esiste già sul territorio e ciò che verrà realizzato attraverso le trasformazioni che *l'organismo* si presta ad accogliere. Solo così si può pensare di dare un contributo concreto per la strutturazione di un nuovo sistema urbano/territoriale che fa rete insieme agli altri, andando così a creare un unico organismo costituito da un fattore comune a tutti, rappresentato dall'autosufficienza energetica, declinando sempre più i contenuti della sostenibilità ambientale, del risparmio energetico, e dell'efficiente acquisizione di risorse rinnovabili, nelle loro politiche di sviluppo urbano e di riduzione degli impatti sul clima. L'assenza di normative adeguate non consente di affrontare in maniera sistemica ed efficace la problematica energetica, rendendo ancora molto difficoltoso il trasferimento su scala locale delle strategie e degli obiettivi generali. Per poter rendere l'energia protagonista della pianificazione territoriale bisogna conoscere e valutare le caratteristiche dei sistemi energetici locali, attivando iniziative dal basso, elaborate dagli Enti che più direttamente possono interpretare le esigenze

[1] De Pascali P., *Città ed energia*, Franco Angeli, Milano 2008, p. 12.

di sviluppo e di razionalizzazione dei sistemi energetici locali in relazione alle esigenze e alle caratteristiche dell'utenza. Tutto ciò offre ai Comuni l'opportunità di integrare il fattore energia nelle scelte di qualificazione e di miglioramento dell'ambiente urbano e della qualità della vita, iniziando a utilizzare in modo coordinato e finalizzato spazi e strumenti di cui essi già dispongono. Affinché ciò avvenga bisogna strutturare lo strumento urbanistico comunale secondo criteri di sostenibilità, pensandolo come uno strumento capace di accogliere e veicolare le proposte e i suggerimenti dei portatori di interesse, integrandoli nelle strategie di pianificazione locale e nelle azioni di sviluppo sostenibile, andando a delineare un orizzonte di intervento che comprenda azioni per favorire lo sviluppo delle fonti rinnovabili, nonché per sensibilizzare gli utenti all'uso razionale dell'energia e adeguare il piano ai principi del consumo intelligente e sostenibile delle risorse energetiche. Attualmente si fa riferimento ad un piano energetico urbano a largo spettro, finalizzato al perseguimento dell'uso razionale dell'energia. Ad oggi è stata riscontrata la difficoltà nell'associare qualità della vita e sviluppo sostenibile con gli strumenti non attualmente a disposizione dell'urbanistica, mettendo in evidenza la debolezza strutturale del piano energetico nell'incidere sui processi reali in modo sostanziale. Questa carenza è stata causata dal fatto che lo strumento previsto dalla legge n°10 del 1991 è stato interpretato esclusivamente come un piano prettamente settoriale, dotato di autonomia rispetto alla pianificazione urbanistica comprensiva. Attualmente, i PEC sono costituiti essenzialmente da bilanci e previsioni macro, ma sprovvisti di analisi a livello territoriale e sui vari sistemi (insediativo, ambientale e infrastrutturale) che compongono l'organismo urbano. L'errore fatto fino ad oggi è quello di non aver messo al centro del piano il territorio con le sue potenzialità, intorno al quale costruire le strategie energetiche. Il piano urbanistico comunale considera ancora molto marginalmente la valenza energetica. Molto spesso verifichiamo che la tematica energetica viene trattata esclusivamente nel regolamento edilizio ed urbanistico (REU), commettendo l'errore di pensare di raggiungere l'efficienza energetica focalizzandosi prevalentemente sul settore edilizio, senza valutare le reali vocazioni e potenzialità territoriali. E' bene tenere sempre presente che la città è un organismo in evoluzione le cui parti interagiscono tra di loro attraverso una scambio continuo. Ciò implica che è necessario che si intervenga su tutti i settori che compongono il sistema allo scopo di consumare meno energia. Sul piano concreto stiamo assistendo però ad una progressiva tendenza del PEC ad allontanarsi dal PSC, in quanto il primo trova difficoltà ad affermarsi nei confronti della pianificazione urbanistica, diventando un piano autonomo indipendente dalle azioni territoriali. La strada verso l'efficace apprezzamento della componente energetica nella pianificazione urbanistica e territoriale passa attraverso l'inserimento della componente energetica nella pianificazione generale capace di collegare l'assetto insediativo e territoriale agli effetti energetici e ambientali. Tutto questo per poter raggiungere uno sviluppo sostenibile basato sul risparmio energetico e l'impiego di fonti rinnovabili: "d è per questo che oggi, nasce l'esigenza di costituire un unico piano di assetto territoriale che sia sommatoria di tutte le valenze settoriali, tra le quali quella energetica"[2].

3. La necessaria integrazione della sostenibilità energetica nel piano urbanistico comunale

La formazione di un nuovo strumento urbanistico non può prescindere dalla conoscenza dei principali sistemi che influenzano i processi di trasformazione dell'organismo città/territorio, come non si può non considerare la sostenibilità ambientale delle azioni individuate dallo strumento stesso. Perché ciò avvenga in maniera operativa è importante che l'urbanistica metta al centro delle sue azioni l'uso razionale delle risorse rinnovabili, utili per il raggiungimento della sostenibilità energetica attraverso la costruzione di un territorio meno energivoro. Oggi nasce l'esigenza di leggere i sistemi con più chiavi e da più punti di vista, nel tentativo di relazionare di più i loro caratteri morfologici con le ragioni che li stanno determinando e modificando. E' per tale ragione che diviene sempre più importante introdurre all'interno del sistema ambientale la tematica delle fonti rinnovabili e in generale la tematica energetica che va a intrecciarsi inesorabilmente con gli altri sistemi energivori (insediativo e infrastrutturale). Il riconoscimento delle risorse energetiche locali (sole, vento, biomasse ecc.) che, in diversa misura, caratterizzano ogni luogo, rappresenta il primo passo verso la costruzione di un percorso incentrato sulle fonti alternative, viste come motore per la costruzione di un scenario più sostenibile. La variabile energetica ha come premessa fondamentale lo sviluppo di un quadro conoscitivo del territorio che

[2] L'evoluzione della legislazione e pianificazione energetica in Italia, punto 14.8, in "Verso un modello energetico sostenibile, Considerazioni introduttive alla Conferenza, Conferenza Nazionale Energia e Ambiente, Roma 25-28 novembre 1988", ENEA Fabiano Editore, 1999.

consenta di individuare i consumi di energia, l'offerta esistente e quella potenziale da fonti energetiche rinnovabili. Considerata l'importanza della fase di raccolta dati, è evidente che l'indagine non deve esser limitata al solo aspetto del fabbisogno energetico del territorio, ma deve includere tutte le informazioni utili a delineare un quadro conoscitivo completo del territorio in esame: inquadramento energetico: analisi del fabbisogno energetico del territorio e della produzione locale di energia; inquadramento ambientale: valutazione della disponibilità e della potenzialità delle risorse rinnovabili presenti; inquadramento normativo: analisi del contesto normativo, principalmente di tipo urbanistico ed energetico. Inoltre è importante che le basi conoscitive su cui si vogliono configurare i contenuti di qualsiasi strumento utile alla valutazione e all'indirizzo della pianificazione territoriale e urbana, siano le stesse che definiscono il quadro conoscitivo generale e le sue interpretazioni (indispensabili per le scelte della pianificazione), relazionando questi aspetti con i problemi, le criticità e le risorse che derivano da una lettura integrata dello spazio territorio/città e della sua vocazione alla trasformazione. Il quadro conoscitivo, quale elemento costitutivo del piano strutturale comunale, provvede alla organica rappresentazione e valutazione dello stato del territorio e dei processi evolutivi che lo caratterizzano, rappresentando il riferimento necessario per la definizione degli obiettivi e dei contenuti del piano, per la valutazione e per il monitoraggio della sua attuazione. Esso quindi può essere considerato come la memoria del processo di pianificazione, costituita da una raccolta di informazioni strutturata e relazionata agli obiettivi della pianificazione. La sostenibilità energetica, dunque, muovendosi su piani diversi, permea e si integra progressivamente alle azioni del PSC. Gran parte delle scelte del piano in riferimento all'ambiente, ai trasporti e alla qualità insediativa diffusa, riflettono questa fondamentale prospettiva, influenzando allo stesso tempo altre scelte che troveranno specifica traduzione nei piani attuativi unitari (PAU) e nel Regolamento Edilizio ed Urbanistico (REU). Ne consegue la riqualificazione del patrimonio edilizio esistente all'insegna del risparmio energetico, la realizzazione di nuovi edifici caratterizzati da elevate prestazioni in termini di efficienza energetica e di benessere, l'integrazione in ambito urbano di fonti energetiche rinnovabili e il ripensamento della mobilità in termini sostenibili, grazie all'incentivazione dei mezzi di trasporto pubblico a fronte di quelli privati. L'obiettivo è quello di integrare l'energia nelle linee guida del piano urbanistico comunale, al fine di orientare i processi di trasformazione e riqualificazione urbana alla riduzione dei consumi energetici finali e delle corrispondenti emissioni climalteranti. Questa integrazione consente di subordinare gli interventi di trasformazione urbana alle seguenti condizioni:

-realizzazione di infrastrutture di produzione, recupero o distribuzione di energia da fonti rinnovabili;
-riqualificazioni o realizzazione di dotazioni energetiche di interesse pubblico;
-definizione degli standard minimi di performance energetica nella progettazione di nuovi insediamenti o di riqualificazione di edifici. Il Piano dovrà creare l'opportunità di applicare le tecnologie per l'utilizzo delle energie rinnovabili, adottando strumenti normativi (a partire dal REU) per l'applicazione su larga scala delle fonti energetiche, introducendo indici prestazionali specifici per la promozione delle energie rinnovabili. Quanto detto ci rende sempre più consapevoli rispetto alla necessità di integrare le politiche energetiche con quelle ambientali ed urbanistiche convergendo verso un'unica direzione al fine di tutelare e salvaguardare il territorio. La strada da percorrere per il raggiungimento di tali obiettivi è da ricercarsi in una corretta gestione politica che individui gli input necessari per promuovere l'efficienza energetica e la conservazione di questa. La possibilità di effettuare interventi agendo sui flussi energetici che interessano la città, modificandone ed adattandone la sorgente può rappresentare una opportunità in grado di consentire una riqualificazione ambientale della città anche in un'ottica di sviluppo sostenibile. I risultati attesi da queste politiche energetiche locali saranno individuabili nella realizzazione di una pianificazione urbanistica ed edilizia che contribuisca ad un miglioramento delle prestazioni energetico-ambientali dell'intera città. In tutto questo le caratteristiche dell'insediamento ricoprono un ruolo di fondamentale importanza, in quanto grazie ad alcuni aspetti, quali la densità insediativa, si possono diminuire tutti quei fattori che incidono sulla sostenibilità. Da studi effettuati è stato dimostrato come i processi dell'insediamento disperso generino maggiori costi ambientali, sociali e finanziari rispetto alle tradizionali forme accentrate, rappresentando un ostacolo a uno sviluppo sostenibile del territorio. Tra gli effetti prodotti dalla dispersione insediativa possono tramutarsi in maggiori consumi energetici urbani (spostamenti di merci e persone, climatizzazione degli edifici, illuminazione pubblica, raccolta e trattamento dei rifiuti, ecc.). Un altro settore energivoro è rappresentato dal sistema dei trasporti che è strettamente collegato al fattore densità insediativa, rappresentando uno dei punti critici energetici legato alla dispersione urbana. Questo è dovuto al fatto che le lunghe distanze determinano l'utilizzo dell'automobile privata con il conseguenziale maggiore consumo rispetto all'insediamento concentrato. Un altro aspetto importante è rappresentato dal perseguimento del *mix* funzionale delle diverse aree urbane esistenti, sempre in un'ottica di riequilibrio,

invertendo la tendenza alla specializzazione funzionale fino ad oggi perseguita, distinguendo tra densità abitativa relativa alle residenze e densità di altro tipo (posti di lavoro nel terziario, attrezzature collettive, servizi pubblici, ecc.), orientando gli spostamenti verso l'utilizzo de mezzi pubblici e permettendo allo stesso tempo, le percorrenze alternative a piedi e in bicicletta. In quest'ottica, i vari quartieri dovrebbero esser considerati delle "microcittà", per i quali il piano urbanistico dovrebbe assumere un ingrediente strategico del progetto strutturale, andando a individuare interventi specifici volti a migliorare l'abitabilità di questi luoghi. Inoltre lo strumento urbanistico comunale dovrebbe considerare di primaria importanza alcuni requisiti dei singoli interventi, affidandone la specificazione al REU: per le attrezzature e le dotazioni delle reti tecnologiche, in particolare volte al risparmio energetico; per le aree verdi con l'obiettivo della valorizzazione della dimensione ecologica e ambientale.

4. Le opportunità del Pnrr. Verso la transizione ecologica

La formazione del PNRR è un processo che ha invitato da subito a riflettere sul ruolo dell'urbanistica assumendo una consapevolezza secondo la quale risulta necessario mettere in campo una progettazione innovativa, integrata e sostenibile, accompagnata da una governance e una capacità attuativa diversa rispetto al passato in grado cioè di attualizzare una sistematica territorializzazione degli investimenti e una messa in coerenza del nuovo ciclo dei fondi strutturali 2021-2027. I dati illustrati nel Rapporto Asvis mostrano come la situazione del nostro paese sia critica e se non interverranno cambi di passo decisi l'Italia non conseguirà gli obiettivi dell'Agenda 2030 nei tempi concordati in sede Onu, con conseguenze gravi. Lo sforzo da compiere verso un futuro più sostenibile comporta rischi e opportunità ma vuole essere giusto e all'insegna di un principio fondamentale: "nessuno deve essere lasciato indietro". Le azioni da intraprendere per proteggere, conservare e rafforzare il capitale naturale del Paese e dell'Europa, e quelle per salvaguardare la salute e il benessere dei cittadini dai rischi legati al deterioramento delle condizioni ambientali devono tenere conto della delicata situazione economica e sociale che si è creata negli ultimi anni. Per dare impulso alla sua azione proprio di recente il Vertice Sociale di Porto ha fissato tre obiettivi da raggiungere entro la fine del decennio: piena occupazione di almeno il 78% dei cittadini europei tra i 20 e i 64 anni; la partecipazione di almeno il 60% della popolazione adulta a corsi di formazione ogni anno; la riduzione del numero di persone a rischio di esclusione sociale o povertà di almeno 15 milioni, di cui 5 milioni di bambini. Il Green Deal, da parte sua, prevede uno strumento finanziario concreto – il Just Transition Mechanism - capace di mobilitare risorse fino a 100 miliardi di euro e mirato proprio al supporto di cittadini, imprese, regioni e settori che saranno maggiormente interessati dalla transizione verso un'economia verde, perché focalizzati su combustibili fossili o lavori e produzioni energetiche più carbon-intensive. L'obiettivo, in questo caso, è quello di sostenere cittadini e lavoratori nella formazione e nella ricerca di opportunità in nuovi settori, oltre che di investire nella lotta alla povertà energetica e nell'efficienza energetica delle abitazioni; di aiutare imprese, settori industriali, regioni e Stati membri nella transizione energetica, creando condizioni finanziarie e di investimento attraenti. L'esigenza di assicurare un processo di transizione ecologica veloce, oltre che equo e giusto, è strettamente connessa a quella di disporre di procedure amministrative trasparenti che permettano l'implementazione di piani e programmi da parte dei soggetti pubblici impermeabili a episodi di infiltrazione della criminalità. Come richiamato nell'ultimo Rapporto dell'Agenzia Internazionale dell'energia, per passare dalle attuali 51 miliardi di tonnellate di emissioni climalteranti allo zero netto nel 2050 bisognerà mettere in campo tutte le tecnologie presenti e future[3]. La ricerca e lo sviluppo tecnologico giocheranno quindi un ruolo decisivo per accelerare le transizioni, oltrepassando i limiti attuali. È importante che i programmi nazionali e europei si concentrino sulla generazione di nuove conoscenze e lo sviluppo di nuove tecnologie e soluzioni di innovazione non incrementale. Lo sviluppo di nuove batterie riciclabili basate su materie prime più ubiquitarie, per esempio, sarebbe un cambio paradigmatico e accelererebbe la transizione[4]. Inoltre, le materie prime di valore strategico per il Paese devono essere disponibili all'industria nazionale (sicurezza o diversificazione di approvvigionamento) oppure uno sforzo dedicato di ricerca e sviluppo è opportuno, come è il caso delle cosiddette terre rare. E' dunque necessario dedicare e indurre più risorse per ricerca scientifica nel campo della transizione ecologica, avere un numero congruo di ricercatori e infrastrutture accessibili e diffuse sul territorio[5]. Risulta importante orientare il Piano di transizione ecologica con una

[3] Net zero by 2050. A roadmap for the global energy sector. IEA, 2021.

[4] Da ricordare a livello comunitario l'attività del Gruppo dei "Chief Scientific Advisors" e del "European Group for Ethics and New Technologies" che vengono incaricati di dare pareri con impatto sulle scelte future così come il ruolo del Comitato economico e sociale dell'UE.

[5] Con il nuovo Programma Horizon Europe (2021-2027) l'Europa si dispone a investire circa 100 miliardi di euro in ricerca e innovazione, dei qualialmeno il 35% dovrà essere investito in ricerca collegata ai cambiamenti climatici. Altrettanto dovranno fare i Paesi membri. L'Italia, che storicamente ha dedicato poche risorse alla ricerca

attività di prospezione delle tendenze future (foresight) in modo da pianificare azioni di breve termine a partire da visioni e prospettive di medio-lungo termine. Il foresight non intende prevedere il futuro, ma lo esplora tracciando i possibili percorsi di transizione necessari a trovare soluzioni alle problematiche del nostro tempo e dare contemporaneamente forma al futuro che vogliamo per le nostre società. La Commissione Von der Leyen, in accordo con la Presidenza tedesca 2020, ha assegnato al foresight un ruolo centrale nel processo decisionale dell'Unione come strumento necessario alla definizione del percorso europeo verso il raggiungimento degli obiettivi identificati. All'interno della Commissione europea, gli attori sono sostanzialmente la Direzione generale Ricerca e Innovazione, il Centro Comune di Ricerca e l'Unità del Segretariato Generale denominata "Foresight and strategic communication". In Italia sono attive diverse attività di foresight che mirano a definire visioni di medio e lungo periodo (da 5 a 30 anni) partendo da sfide sociali relative a settori quali ambiente, salute, alimentazione, energia, successivamente integrati con tematiche trasversali quali materiali intelligenti, big data, scienza dei dati, della complessità e dell'incertezza. Occorre prendere atto che lo scenario che tende a delinearsi rappresenta una sfida inversa alla complessità e, al tempo stesso, alla semplificazione. Se da un lato l'apparato pubblico è chiamato a ricostruire la sua capacità operativa - che nell'ultimo decennio è stata oggetto di reiterati interventi di de-potenziamento (tagli del personale, blocco delle carriere e dei trasferimenti, precariato e provvisorietà, contrazione degli investimenti per la formazione e l'innovazione tecnologica) - dall'altro non sembra più rinviabile un intervento deciso a favore della sburocratizzazione e dello snellimento procedurale. In conclusione c'è da ricordare che nel 2018 a livello europeo sono venuti a compimento i lavori per l'aggiornamento al 2030 ("Framework 2030") degli obbiettivi energetico-climatici. Si sono così stabiliti nuovi obbiettivi di efficienza energetica, riduzione delle emissioni di CO2 e diffusione delle fonti rinnovabili nel complesso molto più ambizionsi del passato. Gli obiettivi chiave del Framework 2030 sono:

-Una diminuzione delle emissioni di gas serra del 40% (rispetto al 1990)
-L'aumento al 32% della quota di fonti rinnovabili sul totale;
-Il miglioramento dell'efficienza energetica del 32,5 %

Per la diminuzione delle emissioni di CO2 l'obiettivo del -40% rispetto al 1990 è articolato in
-Una diminuzione del 43% (rispetto al 2005) per i settori rientranti nell'EU ETS;
-Una diminuzione del 30% (rispetto al 2005) per i settori non ETS; tale obbiettivo europeo è stato traslato a livello dei singoli Stati membri in obbiettivi singoli: per l'Italia lo sforzo è rappresentato da una diminuzione del 33% (vedi ALLEGATO I del Regolamento (UE) 2018/842 "Effort sharing").

Un importante esito dei lavori del "Framework 2030" è stata l'approvazione del REGOLAMENTO (UE) 2018/1999 sulla governance dell'Unione dell'energia e dell'azione per il clima. Il Regolamento, che modifica ben 12 atti legislativi europei fra regolamenti e direttive, inaugura un sistema di governance trasparente e dinamico di gestione degli obbiettivi energetico-climatici al 2030 e prevede, fra l'altro, per tutti gli Stati membri l'obbligo di redazione ed invio alla Commissione europea di un piano nazionale integrato per l'energia e il clima da aggiornare biennalmente. Il piano, da predisporre in attuazione del regolamento europeo sulla governance dell'unione dell'energia e dell'azione per il clima costituisce lo strumento con il quale ogni Stato, in coerenza con le regole europee vigenti e con i provvedimenti attuativi del pacchetto europeo Energia e Clima 2030, stabilisce i propri contributi agli obiettivi europei al 2030 sull'efficienza energetica e sulle fonti rinnovabili e quali sono i propri obiettivi in tema di sicurezza energetica, mercato unico dell'energia e competitività.

(1,4% del Prodotto interno lordo contro una media europea del 2%), dovrà elevare il suo livello di ambizione anche in questo settore, se non vuole dipendere anche dal punto di vista tecnologico da Paesi che hanno ormai superato la soglia di investimento del 3-4%, come Germania, Israele e Corea del Sud. Il nuovo Programma nazionale per la ricerca (2021-2027) si accorda in questo alle missioni in cui si articola Horizon Europe e dedica un'attenzione particolare a temi quali clima, energia, mobilità sostenibile, bioeconomia, agricoltura e biodiversità.

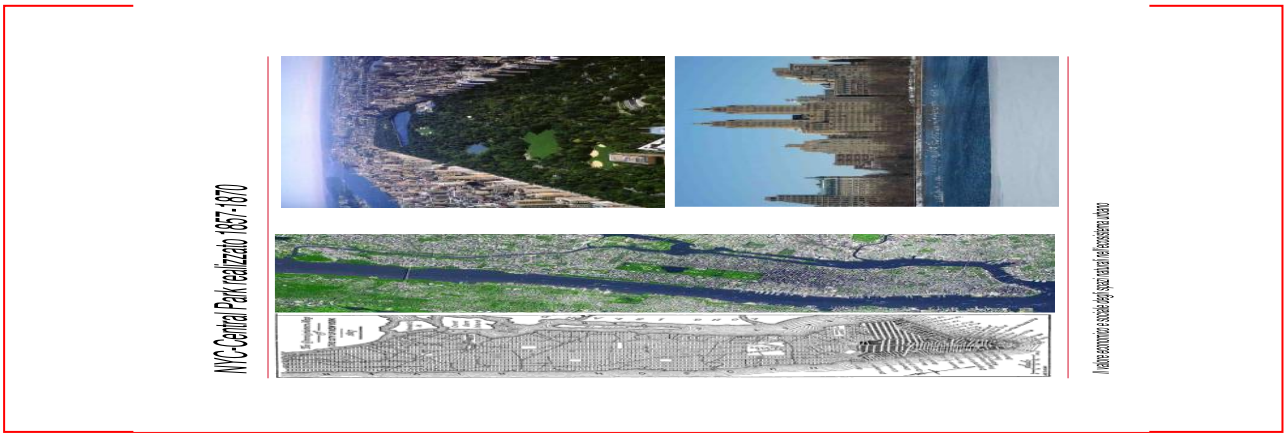


Fig. 1: il valore economico e sociale degli spazi naturali nell'ecosistema urbano

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From horizontal to vertical. Advanced food production in urban areas though vertical farming projects

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Abstract
Vertical farming projects are increasing in number all over Europe, industrialized Asia, and the United States. In a period of great uncertainties after the Covid-19 pandemic where our western society has, for the first time, stopped giving our food for granted, the possibility to produce high yield and high quality food within the cities' borders has receiving increased attention. Furthermore, Vertical Farms can be a way to refurbish the empty or under-used buildings in urban areas, adding new value to our abandoned heritage. Nonetheless, indoor food production in warehouse facilities require high investment costs and high energy inputs that still are hindering the development of vertical farming. In this sense, this paper explores the design requirements that a Vertical Farm should have to produce food in a sustainable manner, assessing advantages and disadvantages of a new, highly technological and digitalized food production.

Keywords: Vertical Farms, Urban Agriculture, Technological Development, Green Buildings

1. Introduction

With the majority of the world's population already living in cities and the urbanization trends confirming the increasing curve over the next 30 years, cities are at the core of the fight against climate change. The important role of cities in achieving sustainable development is reflected across SDGs, and mainly in SDG 11 *Make cities inclusive, safe, resilient and sustainable*, where most targets are directly linked to greenhouse gas (GHG) emission reductions, focusing on the implementation of sustainable transportation systems, green buildings and the reduction of cities' environmental impact. In this context, current food systems will have to adjust to satisfy the rising food demand for an increasing urban population, while productive land is constantly decreasing. According to FAO, it is projected that food production will increase by 70 percent in the world and by 100 percent in the developing countries. However, water resources are finite and already under heavy stress, and, therefore, future agricultural production will need to be more productive and more sustainable at the same time [1]. Indeed, the environmental impacts of modern industrialized agriculture are proven to be unsustainable. Ecologically, industrial agriculture is creating vast, mono-cultural surfaces, where large amounts of synthetic herbicides and pesticides are often applied, causing the desertification of agricultural soils, the depletion and pollution of important water resources

and the loss of biodiversity. The environmental effects of these practices are devastating, and it is possible to see their impact in the four ecological pillars of the food system: soil, water, biodiversity, and climate [2].

1.1 A paradigmatic shift in global food production: from horizontal crops to high vertical spaces in buildings

The fact that the global agricultural system is in crisis is undeniable, and today it is possible to understand the deep contradictions of an industrialized system that lives in the paradox of nurturing humans while consuming the earth. Thanks to the technological advancements and their widespread use in agriculture, agricultural production more than tripled between 1960 and 2015 [3]. This caused a significant expansion in the use of land, water and other natural resources for agricultural purposes [3], followed by the constant lengthening of the food supply chain dramatically increasing the physical distance from farm to plate. Thus, the expansion of the food production system and its consecutive economic growth have had a heavy impact on the natural environment: almost one half of the forests that once covered the Earth are gone, leaving the place to monocultural agriculture fields; groundwater sources are being depleted rapidly; biodiversity has been deeply eroded; agricultural CO_2 emissions rose year after year, massively contributing to global warming and climate change [3]. These trends are an actual threat to our possibility of producing enough food in the future for a growing population. The depletion of soils together with the scarcity of land and a reduced capacity of fresh water reservoirs mark the necessity for a transition towards more sustainable and fair production systems. In this scenario, even if it is a consensus opinion that the modern agro-business will be able to produce enough food for a growing population [4], it is also acknowledged that it won't be able to do so in an inclusive and sustainable manner [3]. Several solutions have emerged that promotes a shift towards more sustainable food production practices, often complementary to each other. In this context, the possibility to produce vegetable crops without the constraint of the soil, vertically, inside urban and peri-urban buildings, is becoming a consolidated practice thanks to the technical and digital advancements that allow vertical farmers to reduce the initial investment costs. Accordingly, the objective of this paper is to understand complexities and potentialities of a new vertical agriculture located inside our cities' boundaries that can potentially add a new value to abandoned or underused buildings, fostering their refurbishment.

2. What is a Vertical Farm (VF)?

The vertical farming is a growing phenomenon taking place all over the industrialized world. Existing examples can be found in industrialized Asia, northern Europe, and the United States [5]. Vertical Farms are indoor farms that allow to grow food in indoor, airtight facilities thanks to the use of artificial lights and precise indoor climate control technologies. For this reason they can also be found under the name of Plant Factories with Artificial Lights (PFALs). Accordingly, a VF is a closed production system where the enclosure is designed to maximize production density, productivity and resource use efficiency [6]. High productivity can be achieved by creating indoor climate conditions that favor plants' growth. Thus, the use of technical devices is fundamental to uniform lighting, temperature and relative humidity [6]. In order to reach perfect indoor climate conditions, it is crucial to minimize interactions with the exterior climate. Limiting these interactions can also benefit the efficient use of energy, water and CO_2 [7]. Due to its characteristics, indoor farming is particularly suitable for dense urban areas, as it can maximize production capacity in relatively small urban spaces. In addition, VFs offer new design solutions for the retrofitting of abandoned buildings, repurposing them creating new job opportunities. For these reasons, this growing method has seen an increasing interest in the past years. However, as vertical farming practices are growing, so are the conflicting opinions of practitioners and researchers that claim unsustainable the highly technical food production occurring in the Vertical Farms [8]. Indeed, there is still some resistance to indoor farming, as most opponents of vertical farming initiatives tend to stress the limitation of a system that only uses artificial lights to grow plants, arguing that this will result in an unsustainable use of resources with a worst carbon footprint than traditional agriculture. Furthermore, a diffuse skepticism is connected to the high investment and labor costs required to start a PFAL that may result in zero or very little profits for urban growers, possibly discouraging young entrepreneurs to undertake similar initiatives. However, indoor farming is constantly evolving and new projects are quickly outweighing the disadvantages of the absence of solar energy. For instance, experiences like the SkyGreens in Singapore

seem to have reached economic viability with the development of technically sophisticated, highly productive, energy-efficient, and reasonably priced LED grow lights [9]. Here, Table 1 reported the most commonly discussed advantages and disadvantages of indoor farming.

Table 1: Advantages and disadvantages of indoor farming

Type	Characteristics	Advantages	Disadvantages
Vertical Farm	Air-tight, highly insulated structures that have no relationship whatsoever with the external environment.	Stable production all-year-round that can guarantee 10-20 yields per year. Easy to integrate in existing buildings, with the possibility to create new profits and generate new job opportunities. Good design and the implementation of renewable resources use may result in high yield with minimum carbon footprint.	High investment and labor costs. High energy consumption which may result in unsustainable practices. Limited production to leafy greens. Uncertain revenues.

In this scenario, researchers have identified six conditions that, if satisfied, would make VF sustainable [8]:

1. The entire food chain, from production to consumption, should be resource saving and have low CO_2 emissions;
2. Use of water must be reduced as well as the use of chemical pesticides and of fossil fuels for heating and cooling, minimizing the release of environmental pollutants;
3. Resource use efficiency must be optimized, with initial investments on renewable energies;
4. Production stability must be implemented and deliver high quality crops and high yield all year round;
5. Must foster social inclusion creating new employment opportunities;
6. International technology transfer must be facilitated through the development of standardized systems.

The design of VFs enclosure and the chosen system components should aim to satisfy these conditions, providing growers with production spaces that are easy to manage, completely insulated from the exterior climates and adaptable to environmental and social changes. In order to achieve the above mentioned conditions, the design process of a Vertical Farm should take into consideration some basic principles that would maximize the indoor farming performances [10]:

1. The production spaces must be air-tight. The envelope must be thermally well insulated and the structure covered with opa
2. que walls.Multilayer hydroponic culture beds should be disposed in a way to occupy the internal space in the most efficient way to maximize production surfaces. Every layer must be equipped with LED light sources, directly illuminating each culture bed.
3. Heat pumps should be used mainly for cooling and dehumidification, in order to mitigate the heat generated by the growing lamps and eliminate the vapor produced by the plants. Fans for forced air circulation should be provided to achieve uniform air distribution.
4. A CO_2 delivery unity should always be provided in order to reach CO_2 concentration between 800 and 1200 ppm in the growing room, favoring plants' photosynthesis processes, maximizing the production.

5. A fertigation system able to efficiently deliver nutrients to the plants must be installed.
6. A climate control room should be designed in order to always keep indoor environment to optimal growing conditions. It is important to integrate the climate control room with a technical chamber that can constantly monitoring water pH, electric conductivity (EC) and nutrient contents in the nutrient solution.

2.1 Vertical Farms and Hydroponic Greenhouses. A comparison

Another system that has been highly catching on in urban areas is to produce food on top of buildings or in public/private squares or courtyard thanks to the installment of hydroponic greenhouses, that, similarly to VF, use off-soil advanced technologies to maximize yields in limited urban spaces [11]. Greenhouse horticulture is considered a (semi-)controlled environment. Contrary to VF, Greenhouses mainly use solar energy for photosynthesis [6]. Passive strategies can be used to heat the greenhouses through solar radiations and to cool them down through ventilation. In more advanced systems, heating and cooling devices can be used to achieve a fully controlled environment. The main characteristic of all greenhouse typologies is the translucent design, which allow thermal exchange with the exterior climate. In this regard, the relation between the costs (heating and cooling) and benefits (solar radiation) of greenhouse production largely depends on the latitude and external climate conditions of the site [6]. Today, the most commonly used type of hydroponic greenhouse for urban food production are Rooftop Greenhouses (RTG). This type mostly refers to high-tech greenhouses built on host buildings, and can be applied both in retrofitting and new construction projects. In recent years, rooftop greenhouses have seen an increasing success which is primarily connected to the high land costs in urban settings, which brought urban farmers to look for unused spaces within cities. For instance, connecting a greenhouse to an existing building is one possible strategy to revitalize underused spaces and provide locals with fresh food production. RTGs require specific energy inputs to control their indoor climates and improve environmental performances to facilitate effective and economical plant cultivation [12]. However, opposed to VFs, greenhouse operations largely take advantage of passive systems such as natural light and ventilation. Nonetheless, supplementing naturally available energy and resources, such as sunlight, heat, and CO_2 may be optional but will surely boost yields, especially during darker, cooler winter months, allowing for year-round production [9]. In this sense, while the set-ups for RTGs can benefit from passive systems to enhance plants' growth, in Vertical Farms the inputs for production must be generated artificially. Indeed, plant factories are located in air-tight warehouse structure, completely secluded from the external climates. This means that even natural light is forbidden to enter the structure, and it must be substituted by artificial light to start plants' photosynthetic processes. Furthermore, all other natural inputs that contribute to plants' growth need to be completely replaced artificially. Thus, specific technologies, as well as digital climate control systems, are required to properly operate plant factories in order to create the favorable conditions to maximize yields.

2.2 Vertical Farm technologies fostering advanced food production in buildings

As previously mentioned, when talking about hydroponic greenhouses it is important to balance between the technologies that can maximize production, reducing the spatial footprint of the hydroponic systems, maximizing passive strategies that could allow for a lower consumption of resources. Indeed, urban food production needs to respect and protect people's health, increasing the sustainability of local food systems, helping lowering carbon emissions coming from buildings. On the other hand, VFs rely primarily on mechanical systems, which make them independent from external climate conditions, but that require high energy inputs. For this reason, to be viable VFs need to properly integrate the most advanced lighting, hydroponic, and climate control technologies, as their cost can only be justified by a higher production that maximize land surface efficiency, reducing the energy inputs required to produce 1 kg of fresh weight produce [5]. To do so, it is important that all components are designed to achieve maximum productivity:

1. *Production methods:* Maximizing yields while dramatically reducing their spacial footprint is the main objective of Vertical Farms. In this regard, plants can be stacked on multilayers trays, this way, production per square meter can increase exponentially depending on the number of layers in which plants are cultivated. For this reason, growing methods

should have a relatively low weight and require minimum heights. In this sense, growing beds, deep flow technique (DFT) and aeroponic production are the recommended and most used growing methods in plant factories (Fig. 1).

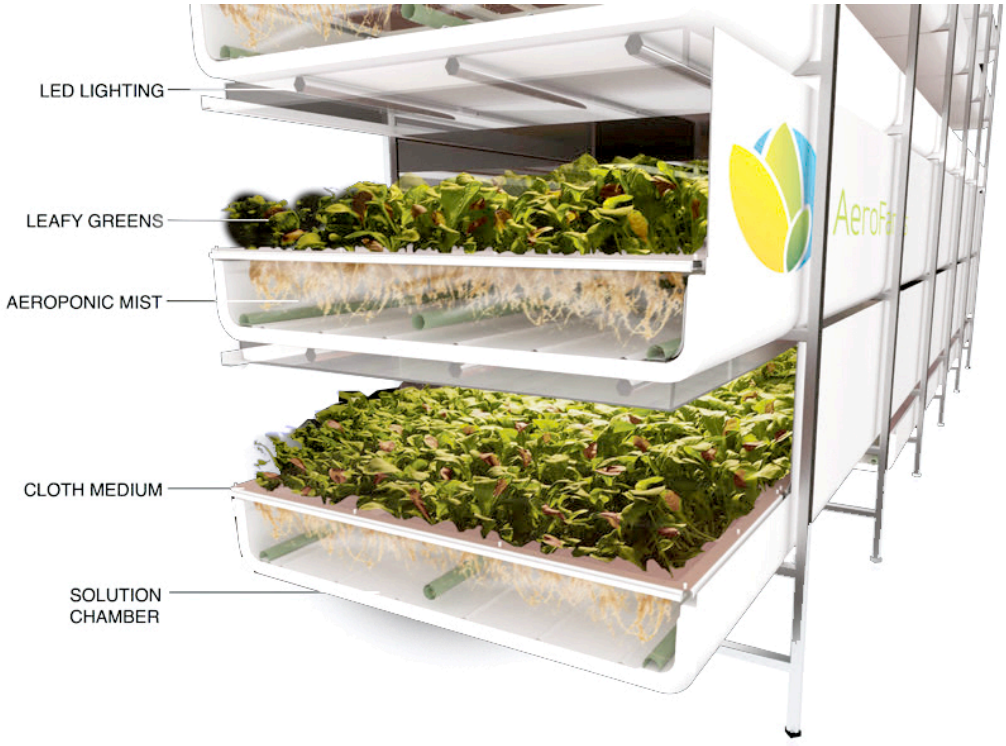


Fig. 1: AeroFarms aeroponic system for vertical farming.
Credits: AeroFarms ® (https://www.aerofarms.com)

2. *Ventilation:* While greenhouses can benefit from natural ventilation, indoor facilities need an automated forced ventilation system. Outdoor ventilation is not encouraged due to the reduction of CO_2 use efficiency and the potential introduction of pests and pathogens from outside [13]. Indeed, within air-tight warehouse facilities, high planting density causes CO_2 concentration to drop below outdoor values, limiting photosynthesis and plant growth (Gómez et al., 2019). Thus, forced ventilation systems should use extractor fans that pull exhaust air out of the growing spaces, providing constant optimal levels of ventilation in the warehouse structures.

3. *Indoor climate control:* Indoor climate in plant factories is automatically controlled to keep steady indoor temperature and humidity. Indeed, microclimate control management is fundamental to guarantee a proper plant development [5]. The typical airtight structure of VFs calls for continuous dehumidification to avoid relative humidity level due to evapotranspiration [5]. Dehumidification can be obtained by using heat pumps that manage the climate control [5]. Moreover, temperatures also need to be uniform inside PFALs to obtain uniform growth [13]. In this sense, air fans that can guarantee homogenous air recirculation inside the PFAL are needed [13]. Commonly adopted strategies for dehumidification in PFAL use heat pumps to manage climate control. Both heat pumps and air fans need electricity-energy, whose costs, summed with those consumed by the artificial lighting system were estimated to account for around the 30% of the total operation costs of a PFAL [14]. In this regard, the use of systems that can maximize energy efficiency are recommended. In a recent article, Yokoyama et al. (2019) [15] reported that conventional heat pump systems can be substituted by co-generation (HVAC) and even tri-generation

equipments. Using the latter would, in fact, allow the production of heat, electricity and CO_2, saving up 30% of the costs connected to climate control management.

4. *Lightening:* In VFs, electric lighting is used in substitution of solar radiation, artificially generating a light/dark photoperiod of generally 16/8 hours daily [13]. However, supplying VFs with artificial light is raising concerns on the environmental and economic sustainability of the system [16]. Lighting system, in fact, contributes to 50-55% of the total operating costs of a VF [15]. Furthermore, it accounts for almost two third of the total energy consumption [6]. Nonetheless, the technological advances made in the lighting sector developed new solution such as light emitting diodes (LEDs), which resulted in highly versatile and energetically efficient lighting systems for paint cultivation [17]. In indoor conditions it is possible to give plants the best light recipe for growth and development [18]. In this sense, LEDs provide the great opportunity to fulfill the light requirements at any cultivation stage, thanks to their capability to emit light in narrow bandwidths [17]. Furthermore, due to their easy adjustability, LEDs lighting systems enable to modulate the quality, intensity and photoperiod of the emitted radiation, leading to an optimization of plants growth in terms of yield and quality [29]. Accordingly, several researches on the application of LED technology for indoor plant cultivation focused on the study of the effect of red (R) and blue (B) light on growth, morphology and physiological responses of plants or toward the identification of the optimal RB ratio within the spectrum. On the other hand, the most claimed weakness of LED lighting technology is the initial cost [17], which resulted 5 to 10 times higher than HPS lamps (Fig. 2). However, when compared to more traditional lighting systems, the capital investments may be counterbalanced by the longer lifespan and greater efficacy of LEDs.



Fig. 2: Use of Blue and Red LED Lights in the Alma VFarm at the Department of Agricultural and Food Sciences of the University of Bologna
Credits: Laura Carotti

5. *CO_2 Enrichment:* The configuration of VFs, which makes them secluded from the exterior climate, prevent outer inputs to enter the warehouse structure. In this sense, PFALs are sealed and, as written before, natural ventilation is highly discouraged. In this sense, in absence of natural ventilation, the high density of plants contained in PFALs rapidly absorb all the CO_2 present in the environment, causing a quick drop in CO_2 concentration that would impede plants' growth. In this regard, the only way to keep optimal CO_2 levels inside the PFAL is with CO_2 enrichment processes. They can be generated by the tri-generation system, together with electricity and heating [15], or through the burning process of natural gas in a gas tank. CO_2 enrichment allows to keep a constant carbon dioxide concentration to at least 800 ppm through the whole stages of production.

3. Conclusion: concerns of integrating vertical farming projects within abandoned or vacant urban buildings

The recent pandemic crisis and the Ukraine war has made us reflect on how little we know about food production and food supply chain in our cities. Urban dwellers in western societies were used to give their food for granted [19], until it wasn't. Recently, the idea of bringing part of the intensive production back within the cities' margins has seen a growing interest ant application. In Asia the number of Vertical Farms has exponentially grown in the last three year. A similar growth was experienced both in the United States and in Europe, where always more young entrepreneurs are building warehouse or retrofitting abandoned buildings to set-up their urban indoor food production. Even universities and research institutions are investing in Vertical Farming projects to foster their research on the matter. An example is represented by the University of Bologna, that in 2019 organized the first UrbanFarm Student Challenge, where students from different backgrounds were called to design integrated urban farming systems in post-industrial, abandon areas. The challenge aimed at tackling the current need for cooperation between different disciplines by bringing together students from different fields of study into international teams specifically addressing the regeneration of three vacant urban spaces [5]. In this sense, as the awareness on the topic is raising, so are the number of researches on Vertical Farming. For instance, inside the Department of Agricultural and Food Sciences of the University of Bologna, it was installed one of the first research facility for vertical farming in Europe (Fig. 3).



Fig. 3: Alma VFarm**.** Experimental Vertical Farm in the Department of Agricultural and Food Science (DISTAL) - University of Bologna
Credits: Ph. Michele D'Ostuni and Leonardo Zaffi

Here, researchers and students have the possibility to evaluate the impact of vertical farming over water consumption, energy, and CO_2 emission compared to the amount of fruits and vegetables that is produced, assessing the best recipe of lights, nutrients, and indoor climate control to minimize resource consumption and maximize yields. The VF was built underground, integrated in the vast parking area of the Agricultural Sciences and Technologies campus. The sample design of the University of Bologna VF offers important design considerations concerning the integration of similar systems in existing buildings:

1. *Insulation*: as repeatedly mention in this paper, it is crucial that Vertical Farms are highly insulated and completely secluded from the exterior climate. However, when integrating VF systems within existing buildings it could be challenging to achieve the required insulation standards. For this reason, it is possible to design a climatic chamber that can be positioned inside the existing buildings, as a sort of “box in a box” concept. The climatic chamber should therefore be designed to maximize the indoor climate control potentiality of the Vertical Farm. In this scenario, existing buildings can literally host a new urban food production, taking advantage of the economic value that can come from selling food and food derivates right where they are produced.

2. *Spatial constraints*: When integrating vertical farming space inside buildings it is important to consider that the architectonic characteristics of the buildings might not be easily adaptable to plants’ growth. For instance, one of the main constraints is represented by the building’s structure and the distribution of the vertical structural elements. Pillars, in fact, may interrupt the continuity of the production spaces, especially when practitioners are forced to design the climatic chambers. Climatic chambers are closed structure that cannot integrate the existing pillars within their structure. In this sense, the climatic chambers must be located within the pillars’ spans, with the consequence of interrupting the continuity of the production spaces, inflating costs and possibly reducing yields. Another constraint is represented by floor’s height. VFs highly benefit from producing vertically on multi-layer trays. In existing buildings, the production height might be limited by the structural height of the slabs, with the consequence of reducing even further the potential yields of the system.

3. *Structural concerns:* As previously mentioned, it is important to chose production systems, such as aeroponic of DFT, that reduce the amount of water that is used during food production, limiting the weight of the system. However, on high multi-layer steel trays, the weight of the material combined with the weight of the produce and of the water might arise structural concern in abandoned buildings. Indeed, they often present structural damages, and structural analysis or structural reconstruction might increase dramatically the initial investment costs.

4. *Accessibility*: With the objective of bringing back to the city an intensive food production, VFs must guarantee very high yields to be profitable and sustainable with the consequence of having to stock and transport high amount of food, tools, and other processed food products. In this regard, integrating VFs inside buildings in highly dense urban environments might arise serious problems concerning access and transportation. VFs should, in fact, grant easy access to trucks to load and unload the inputs (seedlings, substratum, tools, etc.) and the outputs (packaged food and processed food) of the food production. Furthermore, trucks would come and go daily to collect the produced food and deliver it to the markets and other selling points, resulting in a possible increase of traffic and CO_2 emissions in the area where the VF has been designed.

All these concerns and considerations must be taken into account when designing a VF inside urban areas. This is the reason why most VFs are located in the peri-urban fringe of our cities. However, since VFs could help bringing numerous ecosystem services to our cities (Orsini et al, 2020), as well as profitable diversified business plans that can spark a new economy of food in urban areas, it is crucial to fine design strategies that may limit the above mentioned problems and may be able to take advantage of vacant buildings to foster a new, sustainable and green urban renovation.

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New Results of Industrial Noise Monitoring and Reduction on the Example of Samara Region of Russia

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Abstract

Presently industrial noise in town's conditions is growing with every year. Serious problems of increased industrial noise impact are caused by power plants (compressors, pumps, ventilation systems, combustion engines etc.) generating high levels of low frequency noise.
Methods of analysis of industrial noise in Russia are considered. New results of of industrial noise monitoring and reduction in conditions of Samara region of Russia are presented. Measurements of low frequency noise in day and night time are showing that for the number of points of urban territory the results of measurements are not fitting to the normative requirements. Measurement results of noise characteristic directly in the territories of industrial enterprises are showing that the main noise sources, especially in low frequency range, are power plants. According to results of experimental researches of acoustical characteristic of opposed piston compressor in real industrial conditions it is possible to conclude, that maximal values of sound pressure level were measured in low frequency range. On the main frequency of compressor operation 125 Hz sound pressure level is maximal.
Methods and technical solutions of industrial noise reduction are discussed. Several new technical solutions of industrial noise reduction were developed. One of them is combined device of power plants low frequency noise and pressure oscillations reduction.
In total, the most efficient industrial noise reduction in urban territories may be achieved by provision of complex administrative-organizing, technical, urban development, building-acoustic and the other measures.

Keywords: Industry, Noise, Monitoring, Reduction

1. Introduction

Presently industrial noise in town's conditions is growing with every year [1-5, 7-13]. Studies have shown that there are direct links between industrial noise impact and health damage. More than 60% of population of large cities are living in exceeding noise conditions [1, 2, 5]. Damaging influence of intensive noise to the human's health is not restricted only by impact to ears. It is known, that noise is affecting to the human's central and vegetative nervous systems, influencing to the human's psychological condition etc.
Serious problems of increased industrial noise impact are caused by power plants (compressors, pumps, ventilation systems, combustion engines etc.) generating high levels of low frequency noise. Analysis of inhabitant complaints confirms it [3]. Low frequency noise is spreading for a long distances without significant decay.
This paper is devoted to the description of new results of industrial noise monitoring and reduction in conditions of Samara region of Russia.

2. Methods of Analysis of Industrial Noise in Russia

There are legal, normative and technical documents, determining the procedure of research of acoustic pollution by industrial noise impact in conditions of urban territories [1-5, 7, 8, 9-12]. There are international and national standards of environmental noise assessment. In Russia noise levels in living area are evaluated according to hygiene requirements, stated by valid Sanitary Norms, Russian State Standards, Building Norms and Rules etc. Normative parameters for unstable noise are equivalent sound levels L_{Aecv} and maximal sound levels $L_{A\max}$, dBA. There are two periods of evaluation: day (7.00-23.00) and night (23.00-7.00). If noise level is measured inside of building, the permitted value of L_{Aecv} is no more than 40 dBA (day) and 30 dBA (night), the permitted value of $L_{A\max}$ is no more than 55 dBA (day) and 45 dBA (night). It should be noted that Russian noise standards are differing from the European standards [2].

Industrial noise is unstable, oscillating in time. For this kind of noise there are some main requirements to carrying out the measurements:

- Time of noise evaluation T in dwelling houses, public buildings and in living territory should be accepted in the day-time - continuously during 8 hours, at night - continuously during 0,5 hour (in the most noisy periods of day).
- Measurement of unstable noise should be carried out at the periods of time of noise evaluation T, which include all typical variations of noise regime in evaluated point. Duration of every measurement of unsteady noise T_m in every point should be at least 30 minutes.
- Reading of sound levels of interrupting noise, which are remaining stable in the intervals with duration less than 0,5 minute, and also of oscillating and impulse noise should be carried out with intervals from 5 to 6 seconds. In every point during the period of noise T_m should be conducted 360 readings of sound levels etc.



Fig. 1. General view of opposed compressor mount of in shop N4 of “KuibyshevAzot” public joint stock company

Measured values of noise level are rounded to the nearest whole number and are considered to be reliable during the difference in readings no more than 2 dBA. If the difference in readings is more, the measurements are repeated. Result of measurements is maximal reading of sound level meter, fixed during performing test cycles, which is comparing with admissible noise level. Measurements are considered to be valid if background noise is no less than 10 dBA lower than the level of measured noise.

3. New Results of Industrial Noise Monitoring in Samara Region of Russia

Measurements have been carried out both in industrial zone on the territory of industrial enterprises and outside in dwelling zone situated near to the industrial enterprises.

In real industrial conditions in chemical enterprise “KuibyshevAzot”, Russia, acoustical and vibration characteristic of opposed piston compressor “Mannesmann – Meer” were done. General view of “Mannesmann – Meer” compressor mount in shop N4 of “KuibyshevAzot” public joint stock company is shown in fig. 1. Third-octave spectrum of sound pressure level measured during operation of opposed compressor mount of in shop N4 of “KuibyshevAzot” public joint stock company is shown in figure 2.:

As example of noise measurements results in industrial sites, on the figure 3 the diagram of spectral characteristic of equivalent sound levels (octave and 1/3 octave ranges) for industrial site of “KuibyshevAzot” company of Togliatti city of Russia is shown. We may see significant noise values in low frequency noise spectrum.

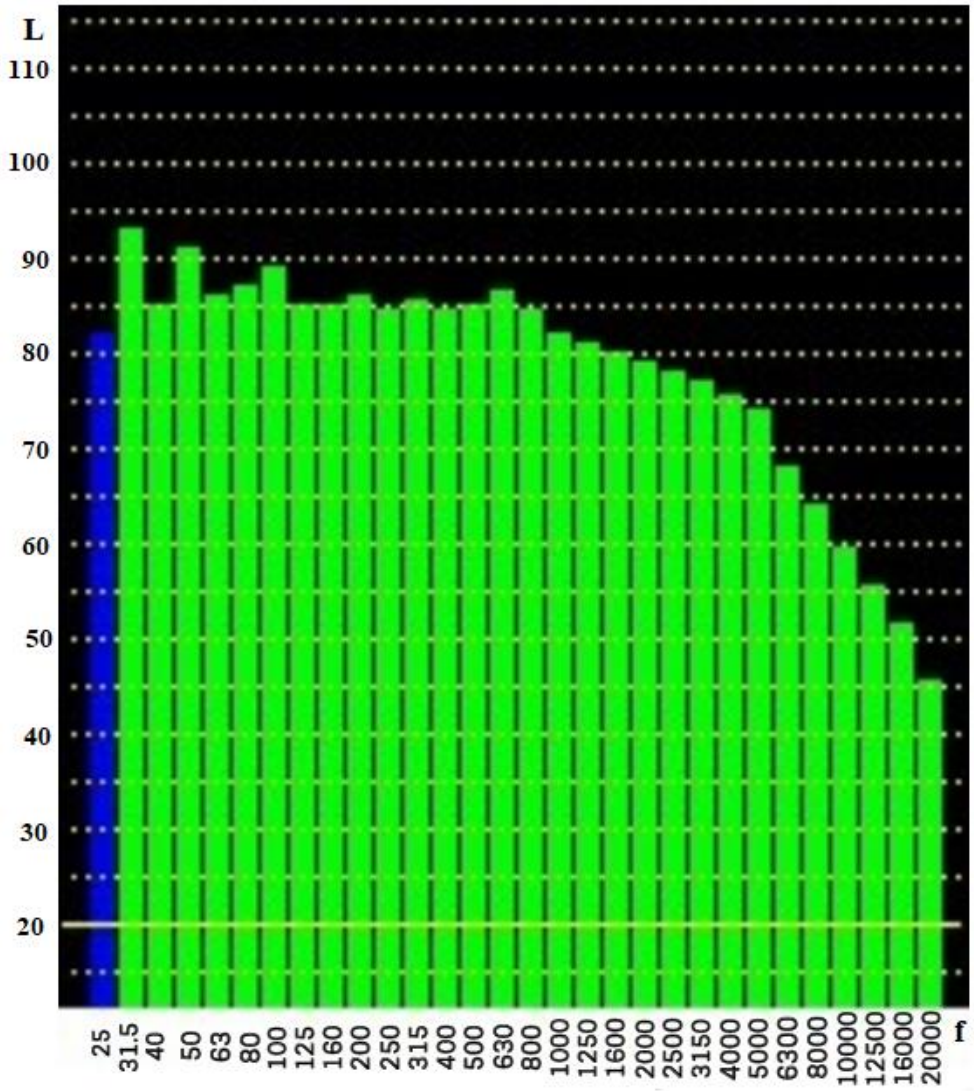


Fig. 2. Third-octave spectrum of sound pressure level measured during operation of opposed compressor mount of in shop N4 of “KuibyshevAzot” public joint stock company:
Vertical axis: sound pressure level L, dB;
Horizontal axis: frequency f, Hz

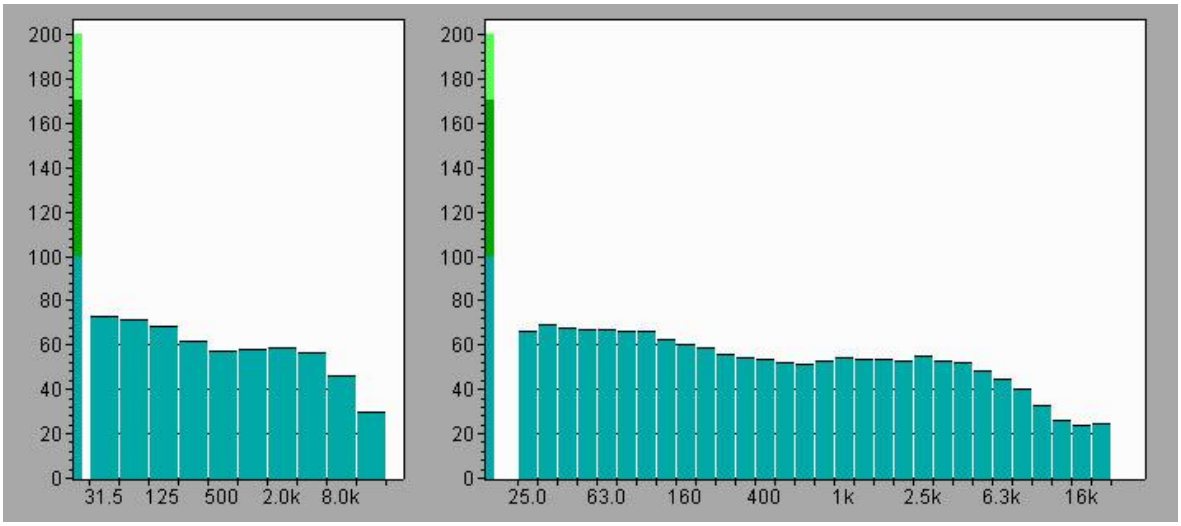


Fig. 3. The diagram of spectral characteristic of equivalent sound levels (octave and 1/3 octave ranges) for industrial site of shop 38 of "KuibyshevAzot" Company of Togliatti city of Russia
Vertical direction - equivalent sound levels, dBA;
Horizontal direction - octave and third-octave frequency spectra, Hz

Analysis of results of experimental researches was carried out. Measurement results of noise characteristic directly in the territories of industrial enterprises are showing that the main noise sources, especially in low frequency range, are power plants (compressors, ventilators, pumps etc.). According to results of experimental researches it is possible also to conclude, that maximal values of sound pressure level were measured in low frequency range. On the main frequency of compressor operation 125 Hz sound pressure level is maximal which is in correspondence with measurement results on the laboratory compressor mount.
Noise estimation and monitoring of industrial enterprises of Samara region of Russia have been also carried out. Measurements have been carried out in daytime in weekdays mainly in rush hours and during the lunch-time; and in night time (since 23.00 till 6.00). Results of measurements in every point have been presented as measurements registration forms, which including date, time and place of measurements carrying out, measuring point number and digital data of readings of noise levels in measured point.

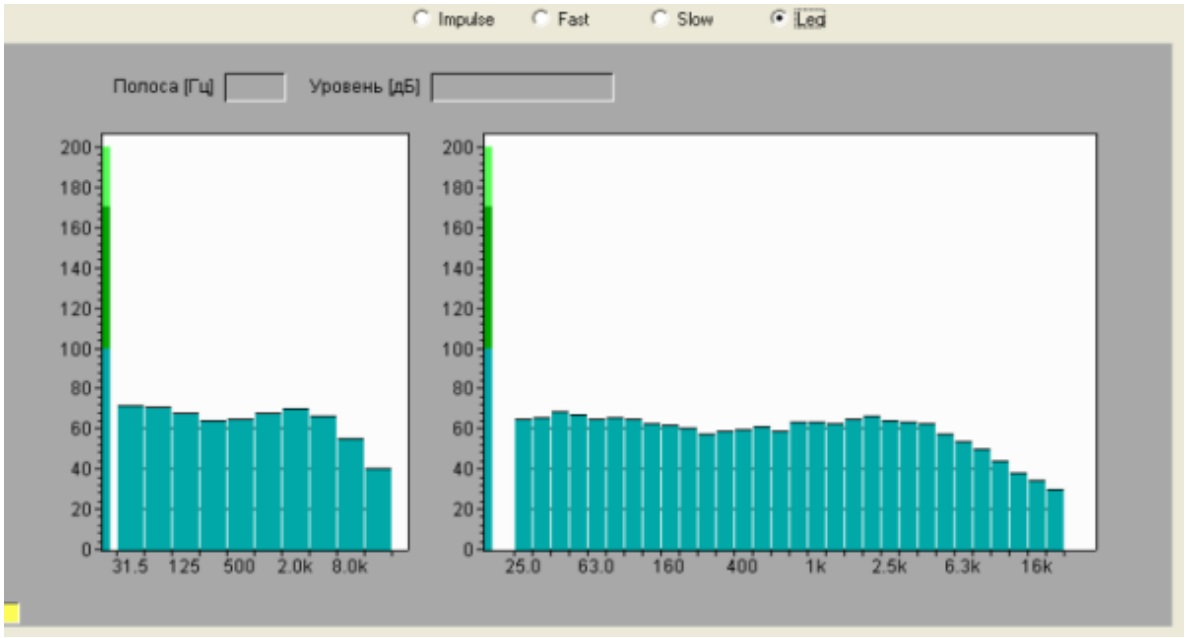


Fig. 4. The diagram of spectral characteristic of equivalent sound levels (octave and 1/3 octave ranges) on the border of the sanitary protective zone of North industrial unit zone of Togliatti city of Russia

The results of measurements of sound levels in some points of North Industrial Unit zones of Togliatti city are showing that in all measuring points there are some exceeding values compared with Sanitary Norms requirements (65 dB). The most significant values of equivalent and maximal noise level are in the points of measurements situated near to the Larina and Novozavodskaya streets of the Central district of Togliatti city.
The diagram of spectral characteristic of equivalent sound levels (octave and 1/3 octave ranges) on the border of the sanitary protective zone of North industrial unit zone of Togliatti city of Russia during COVID-19 period is shown if figure 4. We may see that again significant noise values were obtained in low frequency noise spectrum.

4. New Technical Solutions of Industrial Noise Reduction

Reduction of industrial noise and of it propagation in living territories of urbanized complexes up to admitted hygiene requirements presently may be considered as difficult scientific-research problem, which may be decided only by complex measures [4, 6].
All measures of industrial noise reduction may be subdivided into several big groups:
1. Industrial noise reduction in the sources of noise generation: reduction of noise of power plants of industrial enterprises, reduction of noise of industrial equipment etc.
2. Urban development and building-acoustic methods of noise control: rational acoustic planning, industrial enterprises and highways, erection of noise-protecting shields, noise-protecting planting trees and shrubs, increasing of sound-insulating qualities of buildings, development of noise-protecting screens constructions, foaming of the systems of settling groups on the basis of mass velocity passenger transport with definite functional zoning of the territory, removal of dwelling areas from intensive noise sources, using of compositional grouping of buildings etc.
3. Administrative-organizing measures of noise reduction: noise levels reduction due to decreasing of intensity and noise of transport flows; improvement of roads quality, using of road surface with lower noise; provision of rational velocity of movement; provision and even exclusion of automobile (especially lorry) transport traffic in central parts of town and in living area streets etc.
4. Legal acts, technical norms, prohibitions of noise generation in living zones etc.
5. Using of the technical means and solutions of acoustical radiation reduction (noise barriers, noiseless road surfaces etc.).
Several new technical solutions of industrial noise reduction were developed by the author. One of them is combined device of power plants low frequency noise and pressure oscillations reduction. This device is having the following peculiarities. Bellows compensator is installed into the cut-out section of the pipe, after which the active part of device is fixed. It consists of a perforated insert installed on the guides which are rest against rubber inserts for the purposes of reduction of vibration. Additionally pusher guides and rods are fixed from displacement by a guide washer and are sealed with a sliding insert. The insert has a paraboloidal shape. The diameter of its holes decreases from the entrance to the exit, what increases the efficiency of the operation of the device by equalizing the speeds of the elementary jets of medium flow on the canal area. The perforated insert is supported by its flange on the elastic elements in the form of springs. The operating elements of the damper are moving along the guides between the support and pressure rings. They are set in motion due to the retraction and ejection of the rod by magnetic vibrators fixed on the weighted washer of the support flange. Control of the damper frequency and amplitude is carried out by the electronic controller taking to account the results of measurements of acoustic parameters of operating medium flow by the microphones and vibration sensors.
In total, the most efficient industrial noise reduction in urban territories may be achieved by provision of complex administrative-organizing, technical, urban development, building-acoustic and the other measures.

5. Conclusions

Analysis of measurement results of industrial noise levels in living territory of Samara region of Russia is showing that there are noise dangerous zones of dwelling territory.
Measurement results of noise characteristic directly in the territories of industrial enterprises are showing that the main noise sources, especially in low frequency range, are power plants (compressors, ventilators, pumps etc.).
According to results of experimental researches of low frequency gas dynamic pressure pulsations in pipeline of compressor mount and caused by it noise and vibration in real industrial conditions it is possible to conclude that:

- For compressor mount for all measurements the maximal values of gas pressure pulsations were observed on the main frequency of compressor operation;
- Intensity of discrete components of gas pressure pulsations in depending on discharge pressure. The more high discharge pressure, the more amplitude of pulsations;

Results of noise measurements in the zone of North Industrial Unit during enterprises operation of Togliatti city of Russia are discussed. Practically in all measuring points there were exceeding values compared with Sanitary Norms requirements.

Reduction of industrial noise and of it propagation in living territories of urbanized complexes up to admitted hygiene requirements presently may be considered as difficult scientific-research problem, which may be decided only by complex measures. Several new technical solutions of industrial noise reduction were developed by the author. One of them is combined device of power plants low frequency noise and pressure oscillations reduction.

In total, it is possible to make a conclusion about the existing of real problem of increased noise impact of some industrial enterprises to the population of Samara region of Russia. The most efficient industrial noise reduction in urban territories may be achieved by provision of complex administrative-organizing, technical, urban development, building-acoustic and the other measures.

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Environmental Control of Toxicity of Water Reservoirs During Pollution by Toxic Substances

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Abstract

Toxicity is one of the most dangerous sources of pollutions of urban territories, especially of water reservoirs. Analysis of kinds and sources of toxicity of urban territories shows that the main of them are different waste components, especially oily waste.
Methods of control of toxicity of urban territories are considered. Main stages of complex estimation of toxicological pollutions of the biosphere are described. Peculiarity of suggested approach to environmental control of toxicity in comparison with existing methods is complex consideration of the main toxicological values of toxicants (e.g. oily waste) on the basis of it point-rating ranging.
Directions for further improvement of methods and approaches to estimation and improvement of environmental control of toxicity of oil and oily wastes are suggested, including the investigation of the territory of Volga basin of Russian Federation with the purposes of identification of the nature, scale and levels of pollution of Volga basin by oil and oil-containing waste, arrangement of ground-based ecological expeditions for study of ecological parameters in the areas of the oil and gas fields development etc.
In total, implementation of the system of complex ecological monitoring and estimation of negative impact of the oil and oil-containing waste to the man and biosphere will allow to reduce their negative impact, to reduce ecological risk for territories and water objects, to improve the state of environment and the health of population.

Keywords: Toxicity, water, pollution, impact, biosphere

1. Introduction

Presently the problem of water resources pollution became the most urgent [1-4, 7, 9-13]. Toxic components, like oil and oil products, are one of the main sources of water pollution.
Toxicity is one of the most dangerous sources of pollutions of urban territories. Analysis of kinds and sources of toxicity of urban territories shows that the main of them are different waste components, as industrial as domestic. For example, oil and oily components may penetrate into water reservoirs and into ground water and cause significant damage to environment and to the man's health [5, 6, 8].
Environmental impact of toxicants is tend to be focused on degradability, bioaccumulation and aquatic toxicity. E.g. penetrating of toxicants into ecosystem leads to it propagation in atmosphere, water, soil, food and for further pollution. Evaporation of toxicants may cause its penetration into large distances. Thus, a significant part of urban territory may be polluted.
The sources of toxicity of urban territories generally may be subdivided to three main types: chemical, biological, and physical.
Chemical toxicants include inorganic substances (e.g. lead, mercury, asbestos, hydrofluoric acid, chlorine gas), organic compounds (oil, organic waste etc.) and poisons from living things.

Biological toxicants include bacteria and viruses that can induce disease in living organisms. In many cases biological toxicity can be difficult to measure because the "threshold dose" may be a single organism. Theoretically one virus, bacterium or worm can reproduce to cause a serious infection. However, in a host with an intact immune system the inherent toxicity of the organism is balanced by the host's ability to fight back; the effective toxicity is then a combination of both parts of the relationship. A similar situation is also present with other types of toxic agents.
Physical toxicants are substances like coal dust, asbestos fibers etc. Due to their physical nature, physical toxicants interfere with biological processes.
Among of the most significant sources of toxicity of urban territories are oil and oil contaning waste have negative impact to the biosphere, especially to water reservoirs. In result the damage to the healtth of people, the death of hidriobionts and the other negative sequences may occur [1, 3, 5, 8, 13]. It is important that the field of propagation of the oil and oil products it is not limited only to those areas where it direct use is carried out. Even in areas free from human economic activity (nature reserves, national parks etc.) oil and oil products can be transported with air and water flows and to pollute the territories.
For efficient protection from toxic pollution it is necessary to carry out estimation and control of oily pollutions. It is possible to subdivide the groups of oil products differs by:
- Degree of toxicity in relation to living organisms;
- The rate of decomposition in environment;
- Features of the changes that have occured in the biosphere etc.
This paper is devoted to the description of the approaches to the environmental control of toxicity of the biosphere, especially water reservoirs during pollution by toxic substances, including the oil and oil containing waste.

2. Methods of Environmental Control of Toxicity of Urban Territories

Environmental control of toxicity of urban territories is a complex procedure including estimation of sources of toxicity, determination of the most potentially dangerous zones of toxicity of urban territories, selecting of methods of estimation of toxicity, analysis of results of estimation of toxicity, conclusions about the degree of toxicity, and, finally, development and implementation of methods of reduction of negative impact of toxicants.
It is possible to point out several main stages of complex estimation of toxicological pollutions of the biosphere:
- Collection and analysis of the data about the sources, components and conditions of pollution of water reservoirs;
- Selection of priority toxicological substances for research;
- Modelling of distribution of toxicological substances in environment;
- Determination of characteristic of concentrations of toxicological substances in point of impact;
- Estimation of cancer and non-cancer pollutants with acute and chronic effects of toxicological substances;
- Estimation of ecological risk with multi-mediated, combined and complex effects of factors of various natures etc.
Toxicity can be measured by its effects on the certain target (e.g. organism, organ, tissue or cell). Because individuals typically have different levels of response to the same dose of a toxin, a population-level measure of toxicity is often used which relates the probabilities of an outcome for a given individual in a population [1, 2]. One of generally accepted target of such measure is the LD_{50}. When such data does not exist, estimates are made by comparison to known similar toxic things, or to similar exposures in similar organisms. Then, "safety factors" are added to account for uncertainties in data and evaluation processes. For example, if a dose of toxin is safe for a laboratory rat, one might assume that one tenth that dose would be safe for a human, allowing a safety factor of 10 to allow for interspecies differences between two mammals; if the data are from fish, one might use a factor of 100 to account for the greater difference between two chordate classes (fish and mammals). Similarly, an extra protection factor may be used for individuals believed to be more susceptible to toxic effects such as in pregnancy or with certain diseases. Or, a newly synthesized and previously unstudied chemical that is believed to be very similar in effect to another compound could be assigned an additional protection factor of 10 to account for possible differences in effects that are probably much smaller. Obviously, this approach is very approximate; but such protection factors are deliberately very conservative, and the method has been found to be useful in a deep variety of applications.
Assessing all aspects of the toxicity of cancer-causing agents involves additional issues since it is not certain if there is a minimal effective dose for carcinogens, or whether the risk is just too small to see. In addition, it is possible that a single cell transformed into a cancer cell is all it takes to develop the full effect.
Biological monitoring is the kind of environmental monitoring allowing estimate efficiently the degree of the toxicity of different sources. Presently many scientists have carried out research devoted to using

biological indicators as test-objects. For example, it is well known that for estimation of quality of water it is using Woodiviss index. For estimation of degree of the toxicity of water medium green protococcus algae Chlorella (*Chlorella vulgaris* Beijer) and craw fishes *Daphnia magna* Straus are often used as test-objects.

For the estimation of the negative impact of the toxic substances to the man the following toxicological characteristics it is suggested to take into consideration:

- irritating impact to eyes;
- skin-resorptive impact;
- sensitizing impact;
- toxic particles assignable under exploitation of lubricating cooling liquids (number of singled out toxicants and it class of danger);
- toxicity during inside-stomach injection etc.

Peculiarity of suggested approach to environmental control of toxicity in comparison with existing methods is complex consideration of the main toxicological values of toxicants (e.g. oily waste) on the basis of it point-rating ranging.

Total rating point is determined by summing up of components of points of estimation. Total rating point has 5 gradations, illustrating the degree of negative impact of toxic substances to the man and to environment. Scale of estimation of degree of impact of toxic substances to the man and to environment by total rating points is presented in table 1. Additionally with the purpose of improvement of visualization the scale may be ranged by using of different colors.

Table 1

Scale of estimation of degree of impact of toxic substances to the man and to environment by total rating points

Total rating points	Degree of impact of toxicant	Coding
10-12 points	Hyper impact	HI
7-9 points	Strong impact	SI
4-6 points	Moderate impact	MI
1-3 points	Weak impact	WI
0 points	Do not cause impact	NI

3. Directions for Further Improvement of Methods and Approaches to Estimation and Improvement of Environmental Control of Toxicity of Oil and Oily Wastes

The following methods and approaches to estimation and improvement of environmental control of toxicity of oil and oily waste are suggested.

1. It is necessary to create a regulatory and technical base for estimation of oil and oil-containing waste, including special surveys and investigations, identification of negative factors, estimation and forecast, prevention and elimination of negative processes during the impact of oil and oil containing waste to the man and biosphere.
2. It is necessary to develop more definite list of required parameters and criteria during estimation of the negative impact of oil and oil containing waste to the man and biosphere.
3. It is required to carry out the investigation of the territory of Volga basin of Russian Federation with the purposes of identification of the nature, scale and levels of pollution of Volga basin by oil and oil-containing waste with using of modern methods, including satellite geodetic systems, remote sensing methods, ground-based express-methods of contaminations control, biological indication and biological testing methods etc.
4. For the purposes of research of negative impact of oil and oil-containing waste to the man and biosphere it is necessary to carry out ground-based ecological expeditions for study of ecological parameters in the areas of the oil and gas fields development, ecological monitoring of pollution of water and water reservoirs, study of impacts on hydrobionts near oil and gas fields development.
5. It is necessary to develop and to test the scientific foundations of estimation of the risks of negative impact of oil and oil containing waste to the man and biosphere.
6. During the ecological control of the oil and oil containing waste impact to the man and biosphere it is recommended to carry out the estimation both of separate and of combined ecological pollutions from oil and oil containing waste to the man and biosphere.
7. It is suggested to develop automated system of ecological monitoring and estimation of negative impact of the oil and oil-containing waste to the man and biosphere, including an information database on the state of the lands areas polluted by the oil and oil containing waste, to create multi-level database of results of ecological monitoring and estimation of negative impact of the oil and oil-

containing waste to the man and biosphere, to create the system of forecast, prevention and elimination of the consequences of negative impact of the oil and oil-containing waste to the man and biosphere.
8. Taking to account the results of ecological monitoring and estimation of negative impact of oil and oil-containing waste to the man and biosphere it is necessary to develop ecological ranging of the territory of Russian Federation taking to account the presence and the degree of negative impact of the oil and oil-containing waste to the man and biosphere, to estimate the peculiarities of negative impact of the oil and oil-containing waste in the regions with high degree of propagation of the oil and oil-containing waste.
9. It is necessary to develop and to realize the special programs for the prevention and elimination of the consequences of negative impact of the oil and oil-containing waste to the man and biosphere, including development of the methods and technical solutions.
In total, implementation of the system of complex ecological monitoring and estimation of negative impact of the oil and oil-containing waste to the man and biosphere will allow to reduce their negative impact, to reduce ecological risk for territories and water objects, to improve the state of environment and the health of population.

4. Conclusions

Analysis of existing methods of environmental control of toxicity of water reservoirs during pollution by toxic substances, especially by oil and oily waste is showing that it have a number of disadvantages and cannot provide full and quality estimation of parameters of pollutions.
The paper is devoted to the analysis of peculiarities of monitoring and estimation of negative impact of oil-containing waste to the water reservoirs. The stages of monitoring are considered.
Peculiarity of suggested approach to environmental control of toxicity in comparison with existing methods is complex consideration of the main toxicological values of toxicants (e.g. oily waste) on the basis of it point-rating ranging.
Directions for further improvement of methods and approaches to estimation and improvement of environmental control of toxicity of oil and oily wastes are suggested.
Results of work are allowing to carry out more effective and high quality environmental control of toxicity of water reservoirs during pollution by toxic substances.
In total, implementation of the system of complex ecological monitoring and estimation of negative impact of the oil and oil-containing waste to the man and biosphere will allow to reduce their negative impact, to reduce ecological risk for territories and water objects, to improve the state of environment and the health of population.

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Design and murals for public and private spaces

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Abstract

The main objective of the paper is to support the ever-growing interest in the Campania region, in Southern Italy, for murals realized in public spaces, hospitals, factories and prisons. In particular, the painter's paintings are presented for: the historic center of the city of Bacoli (fig. 1); the hospital belonging to ASL Napoli 2 on the island of Procida, Italian Capital of Culture 2022 (fig. 2); the National Cancer Institute of Naples Pascale Foundation (fig. 3,4,5); the Santa Maria delle Grazie hospital in Pozzuoli (fig. 6); the Genaral Logistic System factory in Frattamaggiore, in the province of Naples (fig. 7); the prisons of Secondigliano, in the province of Naples, and the prisons of Carinola and of Santa Maria Capua Vetere in the province of Caserta (fig. 8,9,10,11). All public works were donated to the referring bodies, including the Ministry of Health for hospitals, the Ministry of Defense for prisons, or representatives delegated to exercise specific functions in the region. For example, Ciambrone has agreed with the Guarantor of prisoners in Campania murals for all regional penitentiaries. At the moment, three have been realized. Therefore, the paper evaluates the impact of the murals created in spaces open to the public such as the murals of Bacoli, Procida and other hospitals; moreover, the relationship between the murals and the workers in the factories is evaluated, as in the case of the General Logistic System in Frattamaggiore, or between the murals and the prisoners in the Campania prisons.

Keywords: design, representation, murales, art, cultural heritage

If one affirms that architecture is a sign vehicle for a certain 'quantity of existence', a work of street art is in the urban context, a sign vehicle of messages of protest, of complacency, of sharing, of re-appropriation. In this sense, an urban space that encloses a work of street art is a contemporary agora whose sign is part of the complex of signs of urban architecture: not forms, but a series of relational facts concerning man [1].
The covid pandemic has somehow contributed to giving new expressions to street art.In Rome, a few days after the end of the lockdown, the embrace created by the artist Harry Grab, inspired by the film directed by Milos Forman, appears on the walls of the National Institute of Infectious Diseases Lazzaro Spallanzani. The mural represents the embrace between the protagonist played by Jack Nicholson and Will Sampson depicted with a mask and gloves. In Bristol, England, Banksy takes inspiration from Vermeer's Girl with a Pearl Earring to reproduce a girl with a protective anti-virus mask on a wall in Hannover Place.
In the pandemic period, a collective of painters, designers and photographers transformed Piazza Vittoria in Livorno into an 'open-air museum', where the spaces dedicated to public billboards are occupied en plein air with paintings, drawings, collages depicting Livorno characters such as Modigliani and Piero Ciampi [2].
In the post-pandemic city of 'increased proximity' and 'social density', the privileged places of public health are also places of art where it is not possible to think about regenerating in the form of small

environmental adaptations and where murals and graffiti are a sign of knowledge and use of a multiple, anti-dogmatic, as well as realistic postmodern 'open-air' museum.
From an aesthetic-semiological point of view, it is clear that a work of street art, a graffiti, a reproduction, a caricature, must be investigated according to very precise iconic codes, altered in terms of material, form and destination. Compared to a painting or a 'pure' work of art, a graffiti or a mural remains, in some way, 'suspended' between two moments: between the creative process and its diffusion, between art and society [3].
But the link between a work of street art and the city, or the architectural space to which it belongs, is not deduced exclusively from an architectural index, much less exclusively denotes a space, a shape or a socio-environmental conformation. A work of street art, a mural or a graffiti, takes possession of the urban space just as a work of art takes possession of its time for the tragedy or the joy, or the 'fascination' it grants to that space with an impact that is as disturbing as it is intrusive and irregular, whose vision is an arational aesthetic experience, since the idea of the regularity of form, harmony and balance come out of the margins of observation, as out-of-the-ordinary details, both production and taste [4]. In 1953 Arnould Hauser published the Social History of Art, written in which, through a historical iconographic investigation of the link between art and society, he also reflected on the risks and needs of the arts with respect to a general planning system and in the ‘middle of a struggle for existence’. In this framework in which art cannot be left to its fate, but the task of those who 'govern' in a certain sense ‘is not to adapt art to the narrow-mindedness of today's masses, but to broaden as far as their horizon is possible. The way that leads to a true understanding of art passes through culture [5].



Fig. 1: Historic center of the city of Bacoli, mural of friendship between Bacoli and Procida

Today it is difficult, or almost impossible, to establish where the field to be attributed to art begins and ends and where its boundaries and goals are, as Gillo Dorfles wrote: ‘it is too convenient and idle to entrench oneself behind pre-established schemes that fix once and for all the number and genre of the arts or that - at most - grudgingly accept an eighth muse. We must instead take note that the human mind feeds on an immense universe of signals and stimulations - both sound and visual - and that such stimulations, both the 'disinterested' ones attributed to art, and the utilitarian ones due to agents not usually considered as artistic, have an effect on the germination of those formative constants that always dominated human activity and from which the various aesthetic manifestations then draw inspiration [6].
It is true that the building, the street, the wall takes on their own particular character with the work that makes it and perhaps returns it as immediately recognizable.
However, 'architecture can be walked' as Le Corbusier stated in his Entretien with the students of the architecture schools (1943), and if frescoes and murals have already become a decoration for public buildings at the beginning of the 20th century, it is also objectively conceivable that ‘putting art at the service of the urban does not absolutely mean refining the urban space with art objects’ [7].
The city underlies and follows without reversible possibilities a continuous fusion of levels and meanings of representation in which street art provides, and inevitably converges, a new theory of representation, according to which it must first "self-represent itself in order to be perceived: it must conceptually be synthesized into an image, technically transforming itself into an image it will be visible, describable, narratable, measurable, thus allowing it to be grasped in its political complexity " [8].
In the eternal conflict between the functional needs of modern life and the semantic load that comes from the history of each city, a work of street art is undoubtedly an iconic sign, to the extent that, on the walls of a public or private building, it carries out its iconicity as a functional expression through a given space.
In the urban fabric a graffiti or a mural cannot be counted in a category or a list of urban functions (such as the decorative one, for example), but is the 'lived sense' of the city, for which the function itself (the function - sign) is penetrates meaning, as well as: "by the mere fact that there is society, every use is converted into a sign of this use" [9].



Fig. 2: Hospital belonging to ASL Napoli 2 on the island of Procida, Italian Capital of Culture 2022

In February 2022 the author painted a 40 square meters mural on the wall of a public building in the historic center of Bacoli, near to the Cento Camerelle and the Piscina Mirabilis, elements of Roman architecture that testify the importance of that locality in the history of the Mediterranean basin.
The 'colored' cisterns of the Cento Camerelle and the Piscina Mirabilis, reflected in the water, evoke their ancient function and the historical contaminations that have characterized them over the centuries. The flames are the volcanic ones, they spread from the cisterns and from the Casina Vanvitelliana and reach Procida, in the background, with its thousand colors. As part of the initiatives related to Procida 2022, the Italian Capital of Culture, an artistic intervention dedicated to the island, created by Ciambrone. On the facade of the Gaetanina Scotto Hospital, a mural was painted characterized by the vivid colors typical of the island and in particular of the 'Corricella'.
The art-work depicts the colorful houses of the Procidan fishermen close to the sea, and its peculiarity is the surrealist geometries that have always characterized the artist's works. This mural has become an attraction for the many tourists who visited Procida in 2022 and helps to enhance the structure that is part of the urban, social and cultural fabric of the island. The architect and artist demonstrate sensitivity to the issue of health and proximity to the Neapolitan health sector, so much so that he has long started a collaboration with the Asl Napoli 2 Nord, and participated in various projects to help bring beauty and warmth to the interior hospital spaces, including the creation of two works in the hall of the Hospital of Santa Maria delle Grazie in Pozzuoli and the organization of an international competition of artists. The competition made it possible to receive 30 art-works by artists for free, which were placed in all hospitals belonging to the ASL Napoli 2 Nord, in particular in the Campi Flegrei in Giugliano in Campania and in the islands of Procida and Ischia.
The awareness that the use of figurative arts in a broad sense in all their forms in hospitals is increasingly widespread - from architectural design to pictorial decoration and the inclusion of works of art, from attention to light to the setting in the green - represents a fundamental factor in improving the health of patients, reducing their suffering and stress and thus accelerating their recovery, as also confirmed by the researches, recently more and more numerous, carried out above all in Anglo-Saxon environments and by the theories behind the designs and constructions of some of the greatest architects of our time [10].

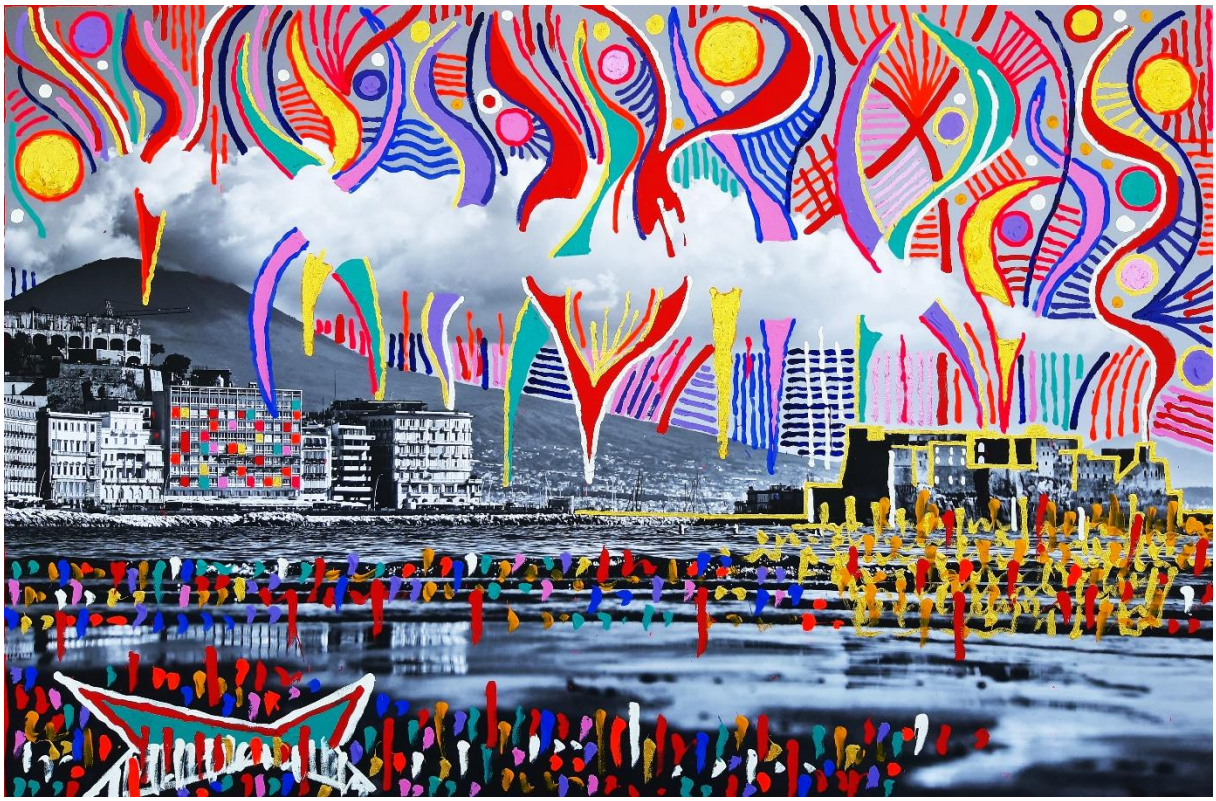


Fig. 3: Hall of the National Cancer Institute of Naples Pascale Foundation, photo by Federica Gioffredi

In this perspective, Ciambrone created, in 2020 and 2021, some paintings for the National Cancer Institute of Naples Pascale Foundation and for the Hospital of Santa Maria delle Grazie in Pozzuoli. In both circumstances, the use of colors was adapted to representations of the city, of Naples and Venice, in the case of Pascale, and of the Campi Flegrei and Procida, in the case of the Pozzuoli Hospital.



Fig. 4: Hall of the National Cancer Institute of Naples Pascale Foundation, photo by Federica Gioffredi

The most recent and innovative theories on the models of hospitals of the future, one consideration seems to emerge with all evidence: the goal of pursuing greater relief of patients also through the aesthetic quality of the hospital environment - in place of traditional artistic production as it normally is understanding (painting, sculpture, etc.) - the architectural design of the hospital and its setting in nature appear today by far the most privileged elements. It is still early to know if this trend will consolidate. What can be said, however, from today is that the beauty and artistic excellence of some of the most recent hospital projects - carried out or under construction on the basis of those theories - may already be sufficient to guarantee them in the future, to it seems to us, the qualification of world heritage of humanity [11].



Fig. 5: National Cancer Institute of Naples Pascale Foundation, General Direction

The characters of the spectacular are reflected in the artworks of Ciambrone. In particular, with regard to works in factories, the desire is to bring art back to the workplace. For example, the factories that scientific historical critics have considered real works of art such as Peter Behrens' AEG turbine factory, the industrial city of Ivrea by Adriano Olivetti, or the Olivetti factory in Pozzuoli, Campania. [12]. In the General Logistic System factory in Frattamaggiore, landscapes of the Campi Flegrei and the Sorrento coast were represented, as well as the GLS logos on the massive rectangular bodies of the elevators. The colors refer to the polychrome windows that characterize the entire establishment. This pictorial intervention, after the mural of the General Logistic System headquarters in Naples in via Ferrante Imparato, contributes to improving the quality of life of workers in an environment that is often devoid of color and hostile [13]. To improve the living conditions of the prisoners, the author signed an agreement with the Guarantor of the detainees of the Campania region and created three murals: in the Secondigliano prison in the province of Naples, he created a mural on the external wall of 30 square meters, representing some iconic places in the city of Naples. Another 15 square meter mural was created inside in the prisoners' passage space. Another mural was created in the Carinola prison, in the province of Caserta. Here, two symbols of the culture of the province were represented in an external space: the Royal Palace of Caserta and the Carolino Aqueduct, with the Belvedere of San Leucio, a UNESCO World Heritage Property. Finally, another mural was created inside the prison of Santa Maria Capua Vetere. As suggested by the prison's director, it was decided to represent the Corricella di Procida, also as a tribute to the Italian Capital of Culture of 2022. According to Gambardella (2021) 'in this particular time characterized by a pandemic due to the expansion of the Covid-19 virus throughout a globalized world, the destinies of everybody have suddenly changed behavior, lifestyles, interpersonal relationships, production methods as well as the governing of the territory; the priority of investing in the healthcare sector has become increasingly urgent and indifferent with reference to a political management of the communities that prevents and does not suffer, as unprepared, the emergencies that increasingly afflict the community' [14]. More generally, the article underlines how the thriving growth of street art is the answer to the ever-growing need for art in public life, in public spaces, in squares, on the facades of public and private buildings, and also in interior places. factories and prisons to improve the living conditions of workers and prisoners. Art educates to beauty, and perhaps to the change of people who have gone through traumatic experiences, from hospitals to prisons.



Fig. 6: Santa Maria delle Grazie Hospital in Pozzuoli, photo by Francesco Paparo



Fig 7: Genaral Logistic System factory in Frattamaggiore, province of Naples



Fig 8: Prison of Secondigliano, province of Naples, internal area

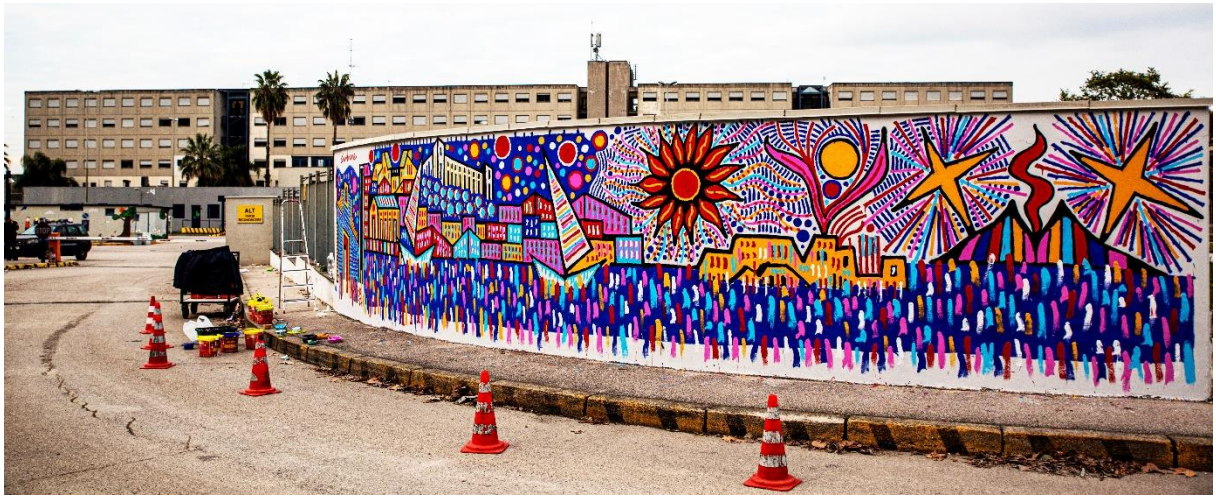


Fig 9: Prison of Secondigliano, province of Naples, perimeter wall



Fig 10: Prison of Carinola, province of Caserta



Fig 11: Prisons of Santa Maria Capua Vetere, province of Caserta

Cultural welfare is an innovative approach to social services that reflects on the benefits that active and passive consumption of culture would be able to generate if integrated into certain management dynamics and policies.
A specific development field of cultural welfare provides for a different conception of hospitals which - in addition to being medical care environments - through the introduction of different artistic practices could contribute to the support and dissemination of the well-being of patients, staff and visitors.
This consideration converges in a broader perspective according to which a positive environment as a whole would be able to induce benefits, not only psychological, in the people who frequent it. Starting a health management through a multidisciplinary approach would mean simultaneously considering different factors such as: light, design, perceived atmosphere, presence of natural environment and, indeed, art.
In this way, the implementation of a careful architectural design (especially in the construction of new buildings but also in the renovation of existing ones) could contribute to an improvement in the quality of care and assistance.
The interaction between arts and health facilities is a reality already investigated by scientific studies and projects. The first systematic experiences date back to the first half of the seventies in the Anglo-Saxon context.
Indeed, in 1973 the pioneering Manchester Hospital's Arts Project [15] began which, under the supervision of artist and lecturer Peter Senior, aimed to explore the potential of integrating arts and health care in order to improve the environment. of the hospital structures.
It immediately became evident how the program would alleviate stress and boredom by meeting the enthusiasm of patients, medical staff and the public and, over the years, contributed to increasing public awareness on the issue of artists' presence [16].

Several studies have progressively supported the thesis that the integration of artistic practices health care is a determining factor for improving the quality of life of patients and operators and, at the same time, an element capable of positively impacting the process of treatment and recovery from the disease. Art also becomes a tool with which to positively change the perception of clinical environments and with which, in certain cases, the consumption of medicines and analgesics in operative and postoperative procedures can be reduced.
It is easy to understand how this approach can also give rise to an economic reflection aimed at optimizing and saving resources, an issue that could be of no small importance in a society where life expectancy and healthcare costs are constantly increasing.
The same can be said for prisons where the care of the spirit and soul plays a role of primary importance [17].
The introduction of arts / humanities in education and professional training courses for doctors and nurses, both in university and post-graduate courses, has had beneficial effects on health professionals, contributing to a better quality of the service offered.
In addition, improvements have been found in the health management of patients with mental disorders thanks to the use of different forms of art which also prove to be a way of self-expression and communication for patients.

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Raw earth & additive manufacturing: two case studies

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Raw earth & additive manufacturing: two case studies
Modern construction is expensive, slow and produces today 35% of solid waste on earth, whereas resources are being reduced and population grows. Due to its advantages and potential, additive manufacturing for architecture is becoming to be largely investigated. It enables the extrusion of completely sustainable mixtures like raw earth.
The research starts with the widespread study of raw earth 3d printed structures, observing that, due to the technological limitations of the common horizontal layers' deposition, the recent examples of large-scale prototypes are characterized by 3d printed walls and, if present, traditional horizontal roofs. In this phase, the authors discuss Najaat village project, a residential complex designed for Sheikh Hilal area (in Syria).
Aim of this study is trying to overcome this limitation, proposing an innovative approach to 3d print roofs without the use of temporary supports during the construction and after.
The research finds inspiration into masonry constructive system and techniques for vaults, in particular the Nubian vault [1]. In consequence, Nubian vault principles are applied to design residential prototypes for Malandra Vecchia, an area in Abruzzo (Italy) already characterized by the presence of manifold raw earth traditional constructions.
The study concludes with reflections about further research needed in AM, specifically in Covid and post-Covid era.

Keywords: raw earth, additive manufacturing, Nubian vault.

1. Potentials and advantages of 3d-printed raw earth

Modern construction methods such as subtractive technologies currently produce 35% of solid waste on earth, while available resources are depleting and population increases more and more [2]. Indeed, 11% of global CO2 emissions are caused by common constructive processes and materials production [3].
Additive manufacturing is becoming relevant in various industries due to its simplified productive approach and its potential in reducing environmental impact of construction. According to ISO/ASTM 529000: AM, additive manufacturing is "the process of joining materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodologies". ASTM also identifies seven major processes: Directed Energy Deposition, Powder Bed Fusion, Sheet Lamination, Binder Jetting, Material Extrusion, Vat. Photopolymerization, and Material Jetting [4].
In architectural field, the material jetting process has been largely investigated due to its advantages [5] and potentials:

i) Reduction of labour force, times and costs.
ii) Increment of process control.
iii) Design freedom and opportunity to rapidly change design attributes with the purpose of meeting functional, aesthetics and structural requirements.
iv) Possibility to 3d print sustainable viscous materials.

For being cheaper than other materials and efficiently meeting structural requirements, cement-based materials have been the most explored in the early stages of additive manufacturing. Recently, innovative systems aimed at raw earth deposition have been developed [6, 7, 8].
Raw earth is a completely sustainable and energy efficient mixture. According with circular economy principles, few emissions are produced by the transport and the processing of the material, being the raw earth available on site. It can also be recycled or reintroduced in the natural environment in case of building demolition [3] [9]. In order not to affect the material circularity, mechanical properties can be improved by introducing natural additives such as mineral, animal or plant-based fibres.
Additive manufacturing with earth-based materials introduces new challenges for researchers, architects and engineers in terms of generation of new design paradigms.

2. From masonry to additive manufacturing: the topic of roofing

Masonry is one of the first constructive system invented, additive manufacturing is the latest. Nevertheless, similarities between the two systems naturally emerged when the first large-scale prototypes were 3d printed. In this regard, AM was defined “a new approach to masonry” by Pegna [10] and the opportunity to 3d print large-scale barrel vaults without supports was discussed for the first time in 2004 by Khoshnevis [11].

Similarities can be noticed in two major fields [1]:

i) *Compositional field*: both systems are characterized by horizontal layers which are constantly high and adhere to each other. Whereas masonry structures are made up of discrete elements held together by mortar, 3d printed structures are made up of continuous layers connected by the extruded viscous material itself.
ii) *Structural field*: both systems work well in compression, poorly in tension.

Columns and vertical walls are the unique elements not involving bending or tension during or after the construction. This aspect explains why 3d printing of roofs is still challenging.
In fact, due to the technological limits in closing structures through conventional horizontal layering, hybrid solutions combining 3d printed walls and traditional flat roofs have been applied the most [12, 13, 7].
Constraints on this subject are proved by small-scale tests on clay domes (Figure 1) and by the study on the village of Najaat.

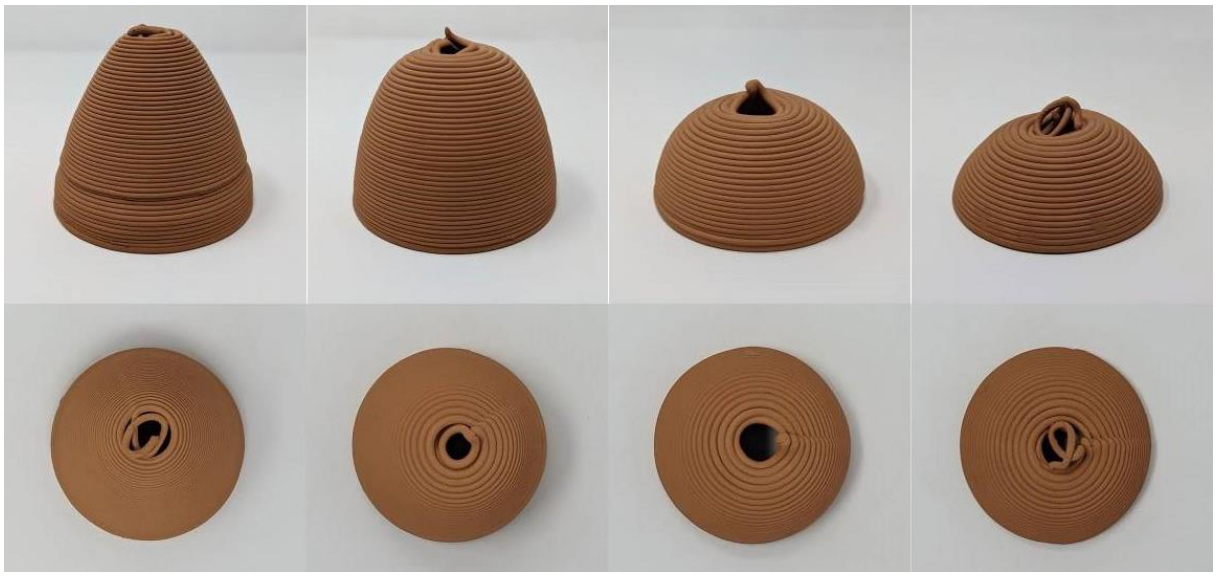


Fig. 1: Prototypes of collapsed clay domes. © Fablab Poliba.

Najaat (Figure 2) is the result of a master’s thesis on architectural composition. The entire complex in plan is characterized by organic shapes, with concave and convex spaces which underline the design freedom enabled by additive manufacturing. The 3d printed structures are portions of vaulted spaces realized with horizontal layering. Even if the walls are tapered and the shapes are designed to support the maximum overhang, the horizontal approach does not permit the fully closure of structures also in this case [14].

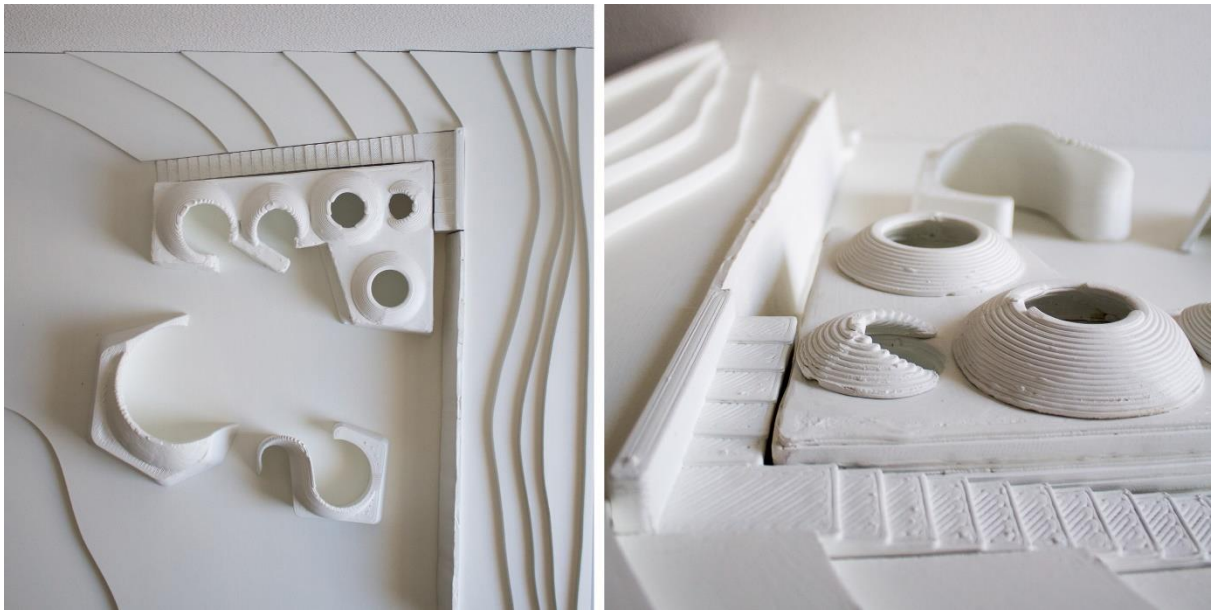


Fig. 2: Scaled model of Najaat in which the raw earth has been simulated by white clay. LDM technology of WASP Delta 40100 has been applied. © Self Made Architecture 04.

To 3d print large-scale roofs avoiding structural collapse, the use of permanent formworks may be required [15]. Nevertheless, design, fabrication and transport costs of supports are high, ranging from 30% to 60% of the total amount of construction costs. In addition, the material needed for formworks could be unavailable and the realization may be too complicated or dangerous for workers [1].
In areas lacking timber, ingenious masonry systems for roofs such as vaults and domes have been developed throughout history. Whereas many techniques require temporary supports during construction, others such as corbels, the Catalan vault, the Persian vault and the Nubian vault do not require supports at all [16].

This research is aimed at resolving the issue of closing structures without the need of temporary or permanent supports by involving a robotic machine. The robot will be able to extrude viscous materials while describing a specific geometry inspired by ancient constructive principles of Nubian vault, as already discussed also by others [1] [17].
This innovative approach will consequently be applied for the design of residential prototypes to be located in Malandra Vecchia, an area in Abruzzo (Italy) already characterized by traditional earthen architecture.

3. The application of Nubian vault principles

The Nubian vault (Figure 3) has its origin in the ancient region of Nubia and the earliest structures built in Luxor still stand after 3300 years from their construction. In modern times, the application of this technique is becoming relevant in emergency contexts due to its potential in constructing roofed architecture without temporary supports.

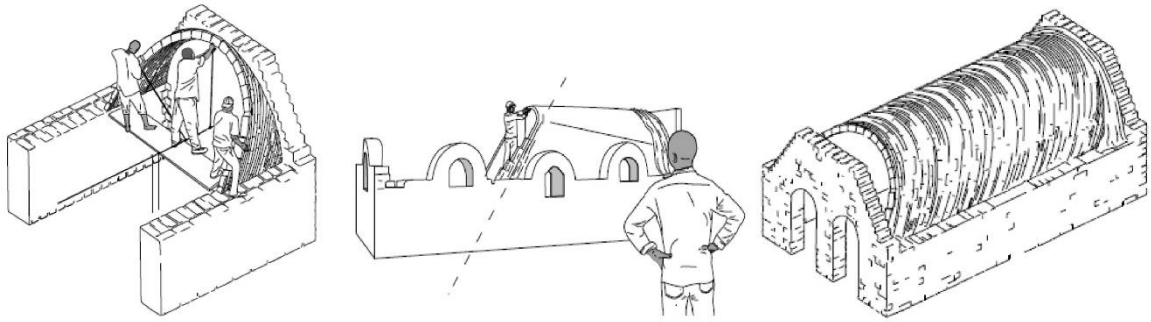


Fig. 3: Construction of a Nubian vault. © AVN.

A Nubian vault is made up of earthen bricks of 24 cm x 12 cm x 24 cm linked together by an earth-based mortar. Layer by layer, the bricks were manually placed inclined at an angle of 45° respect to the ground level. These elements realize a semi-circular vault, except for the final part in which they form a catenary. The process of construction is characterized by three phases [1]:

i) During the inclined deposition of the bricks, the stability of the first arch is temporarily assured by the mortar.
ii) Once all the bricks of the arch have been placed, the thrust line occurring puts the bricks in compression and enable the successive layers to be laid.
iii) Several layers have been positioned and the realized region is stable enough to allow the completion of further arches. At this stage, the principal stress directions are independent from the arches' inclination.

Tests on small-scale models have been conducted in order to identify the proper strategy for Nubian vault 3d printing.
In figure 4, the tests conducted by Paul Carneau et al. are depicted. For the realization of the Nubian vault, an extruder developed by Xtree and mounted on the six-axis robotic arm "ABB" (IRB-6620) has been used. During printing, the extruder is always tangent to the layers of the vault being extruded. For programming the infill regions and the extrusion path, the parametric system "HAL robotics plugin for Grasshopper" has been used in order to better control all the parameters or modify them manually during the printing process. The layers are constantly inclined at 40°, except for the initial part, where the inclination varies from 0° to 40°.

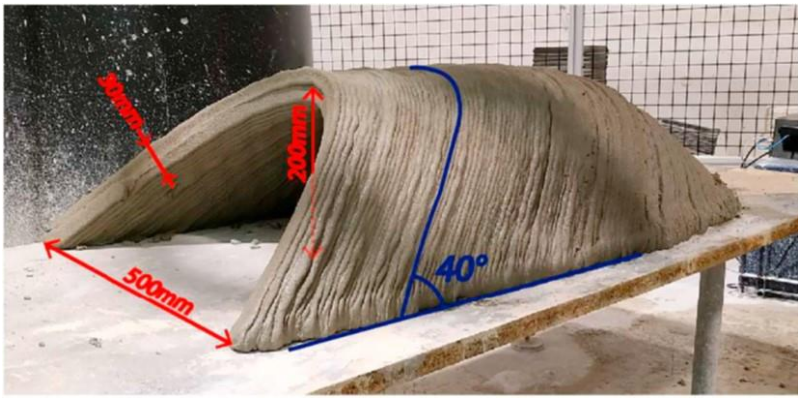


Fig. 4: 3D printed Nubian vault. © Paul Carneau, Romain Mesnil, Nicolas Roussel, Olivier Baverel

The small-scale tests in Figure 5 took place at Digital Fabrication Laboratory "Fablab Poliba" and have been conducted by the authors using the 3D printer "WASP Delta 40100". In this case, the clay prototype is characterized by layers constantly inclined at 45°.

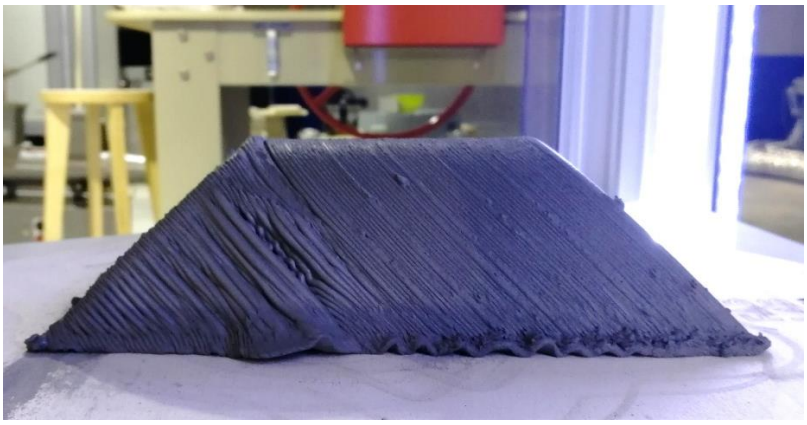


Fig. 5: 3D printed Nubian vault. © Fablab Poliba.

Overall, the tests demonstrate the potential of the inclined layers deposition and the Nubian vault in closing structures without the use of supports even in additive manufacture sector.

The opportunities of this innovative approach are also attested by the tests conducted on the dome in Figure 6.



Fig. 6: Hybrid dome with horizontal and 45° inclined layers. © Fablab Poliba.

The dome is composed by three parts, formed by sectioning the structure through two 45° inclined planes. The portions placing on the ground have been horizontally sliced and work as a support for the third portion. This last part is inspired by the Nubian vault principles and have been sliced inclined at an angle of 45°. The dome is therefore characterized by a hybrid system of slicing and represent a suitable closing solution although several aesthetic defects can be noticed. In fact, further research is needed to reduce the cracks caused by the shrinkage during the process of clay drying. Moreover, in small-scale models the nozzle scratches the layers already printed during the material deposition of successive layers, being not flexible as the robotic arm hypothesized for large-scale applications. The nozzle should always be tangent and perpendicular to the surface of clay layers.

4. Designing emergency: new prototypes for residential areas

The development process of the first prototypes can be observed in Figure 7. The project is the result of a master's thesis on architectural design and the chosen site is a rural area in Abruzzo (Italy) known by locals as "Malandra Vecchia". The design of the buildings takes inspiration by the traditional architecture present in the area. The distinctive traits of the rural residential typology reminding of the "hut archetype" have been preserved and applied for the design of a modern technological "hut". The prototype is thought to be printed with raw earth and the inclined deposition system has been applied. As well as in the Nubian vaults, no temporary or permanent supports are needed since each additional layer is supported by the settled previous one.

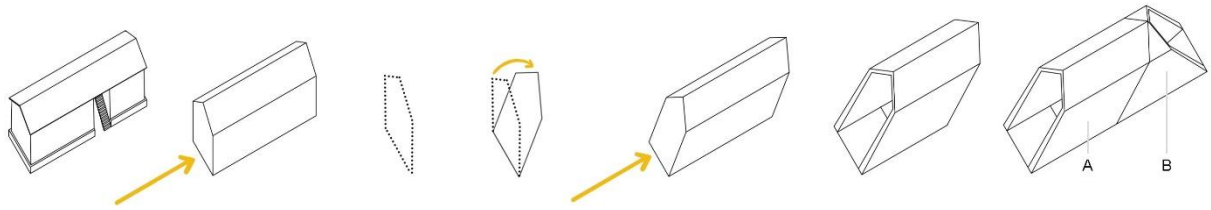


Fig. 7: Prototype design process. © Mariangela Lops, Self Made Architecture 05.

The prototype is composed by two parts sliced differently, A component and B component:

A. Component: it is made by hut-shaped layers constantly inclined at 45°.

B. Component: it is horizontally sliced and work as support for the inclined part. It also serves as principal access to the building, being modelled to form a characteristic portal on the external façade.

By extruding industrial clay, small-scale tests have been conducted. The tests clearly demonstrate that the horizontal deposition does not allow the prototype completion (Figure 8) due to the layers collapsing on the top. In contrast, the model characterized merely by inclined layers does not present structural weaknesses (Figure 9). The authors thus sustain that the inclined deposition of viscous materials could be the suitable system for closing structures without using supports.

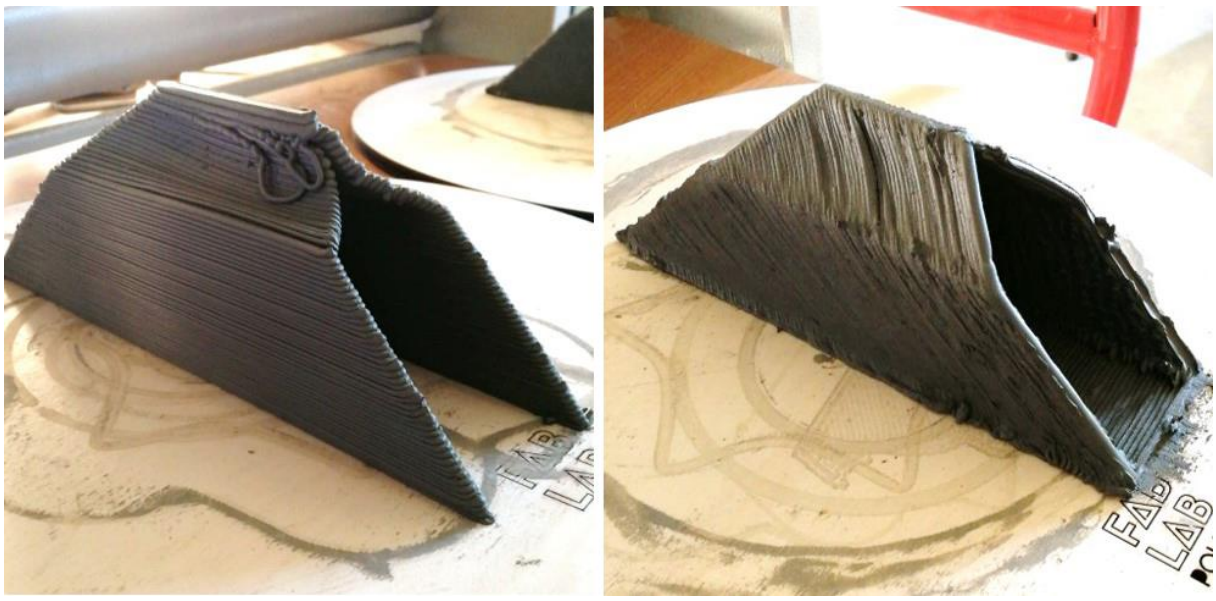


Fig. 8: 3d printing test with horizontal layers. © Self Made Architecture 05.
Fig.9: 3d printing test with 45° inclined layers. © Self Made Architecture 05.

The process of construction is described by Figure 10.
In stage 1, (Figure 10.a) a six-axis robotic arm is mounted on a cart which is allowed to move on two tracks placed on the ground. In stage 2 (Figure 10.b), a disc cutter anchored to the robotic arm is excavating the soil for defining the foundation pit. When this process is completed, the disc cutter is removed and a proper large-scale extruder is attached to the robot.
To provide raw material, a tank full of raw earth placed on a further cart is linked to the extrusion mechanism.
In phase 3,4,5 (Figures 10.c, 10.d, 10.e) the infill 3d printing of the component B can be observed. In stage 6,7, 8 (Figures 10.f, 10.g, 10.h), the component A is realized and the large-scale extruder always tangent to the layer's surface can be noticed [18].

By using prefabricated panels and according to the specific needs, it is also possible to organize the internal space of the prototype (Figure 10.i). The living modules can be aggregated as shown in Figure 11-12, in which the prototypes are located in the area of Malandra Vecchia.

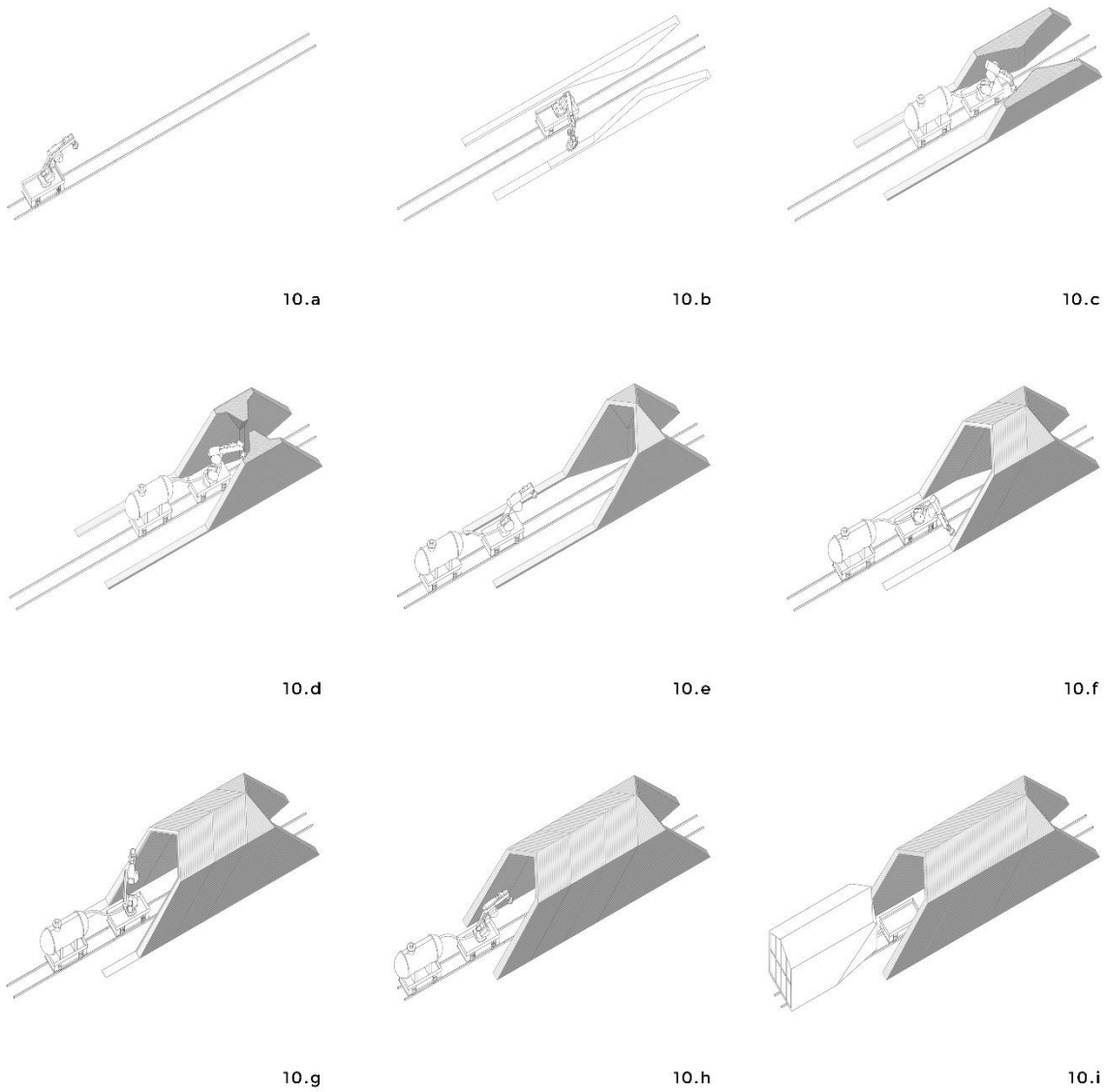


Fig. 10: 3d printing process. © Self Made Architecture 05.

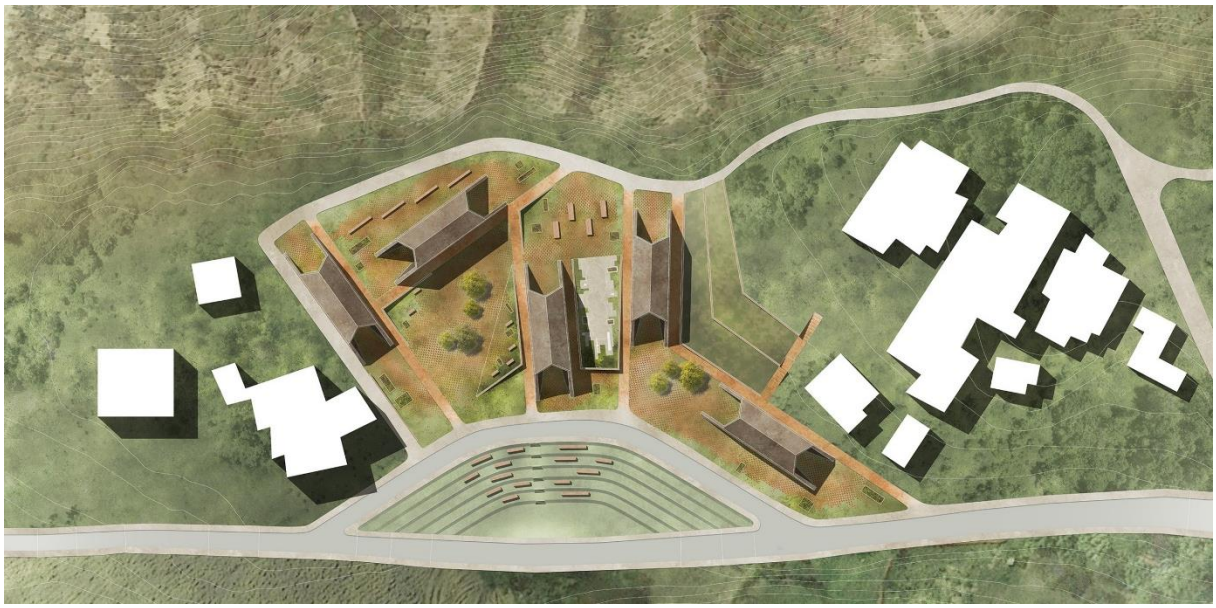


Fig. 11: Site plan of Malandra Vecchia project © Giosmary Tina, Self Made Architecture 05.



Fig. 12: Rendering of Malandra Vecchia project © Federica Alba Delcuratolo, Self Made Architecture 05.

5. Conclusions

Additive manufacturing can transform the approach of architects, engineers and designers to the construction sector and largely influence the development of future societies [18], [19]. This paper takes its origins by actual reflections on digital fabrication and countryside in Covid and post-Covid era. The authors try to figure out how to satisfy emergent social needs by providing a self-sufficient and eco-compatible residential type.

The research is focused on defining the principles for the construction of roofed residential prototypes through additive manufacturing processes. Overall, the structures are inspired by the Nubian vault and are conceived the to be built with viscous materials and without the use of temporary or permanent supports.
The project is imagined to be realized in rural areas and in emergency conditions such as extreme environments where industrial materials for construction are unavailable.

Further research is needed for:

i) Improving mechanical properties of raw earth and defining suitable compositions for natural mixtures.
ii) Optimizing the 3d printing processes for large-scale applications by enabling the deposition of homogeneous material to be continuous.
iii) Enhancing the conceptual design and the slicing phases.

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The drawing of "already done": surveys experiences on the Monumental Complex of Santa Patrizia in Naples

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Abstract
The research carried out at the Monumental building of Santa Patrizia, in the ancient center of Naples, addresses the resilient dimension of the Survey Drawing, or rather the knowledge of the monumental building through, , quoting Carpenzano, "an extractive device that puts a thought in front of the eyes and makes it tangible". in its ongoing conformation, aimed at today, in a synchronic representation of a contemporaneity of what does not have the same date. The knowledge activities of the architectural heritage were an opportunity to think about the role of the "the drawing of the existing space" intended as the possibility of retracing the foundation project, of the diachronic changes on the historical axis of the monument. If the architectural asset maintains its original configuration over time, then the diachronic cut is made on the formal and structural changes. In the case in question, the monument has been subjected to transformations over time, the diachronic cut is made up to the present day and allowed the survey drawing to be resilient with respect to the foundation of the monument. The resilient drawing deepens the grafts, the evolutions of the architectural foundation structure with respect to the formal and typological geometric modifications that include the monument as it has survived to our days. To this end, the significant contribution of the elaborated drawings concerned the reinterpretation of the architectural monumental building: a dense weaving of wefts in the drawing plane and in the geometric matrices that over time have shaped its unity.

Keywords: drawing, resilience, Naples, BIM, survey

1. The role of the drawing for trace the past
The Monumental Complex of Santa Patrizia, in the ancient centre of Naples, located on the hill of *Caponapoli*, isolated and strongly symbolic as the acropolis of the Greek-Roman city, has undergone progressive phases of development and decay, growth and modification.
The Research deals with the resilient dimension of the Survey Drawing, that is the knowledge of the Monumental Factory through "an extractive device that puts a thought in front of the eyes and makes it tangible[1]" in its diachronic conformation, aimed at today; that is a synchronic representation of a contemporaneity of what does not have the same date.
The knowledge and documentation of the spatial and architectural configuration of Santa Patrizia represent the focus of the Research; a critical reading of the survey data acquired in order to retrace the traces constituting the evidential paradigm of the monument's life. "Drawing certainly cannot be considered the equivalent of architecture, nor it can replace it: it aims to make explicit its theoretical structure, it allows careful reflection on the architecture of history and memory, but it also skillfully measures the levels of desire and invention[2]." The Monastery occupies an area with steep slopes, a healthy climate and which is particularly rich in water; it is bounded to the north by Via Santa Patrizia, today called Via Capozzi, to the east by Vico Limoncello, to the west by Via Armanni and to the south by some buildings overlooking Via Anticaglia; the present configuration is the result of the project

published in 1897 by the engineers Guglielmo Milisurgo and Pier Paolo Quaglia. The Monumental Complex has two cloisters: a larger one complete on all four sides, and a smaller one, the current entrance courtyard on Via Capozzi, with only two porticoed sides and into which the ancient church, now used as a lecture hall, is inserted. The main cloister, with its square plan, retains the original four-sided planimetric layout recognisable in Schiavoni's historical maps (1872-80); the flowerbeds are enriched by the graphic representation of a vegetable crop and regular trees. Starting from 1864, the complex has undergone some transformations based also on the relationship between architecture and botany.
In the case study, the detailed graphic clearly showed the different composition of the facades of the two cloisters of *Santa Patrizia* building, due to different eras of construction highlighted by decorative elements belonging to decorative registers evidently not contemporary extensions such as in the case of the last floor level. "The design appears destined to go beyond paper in favor of files generated by the use of pointers that are completely similar to pencils on increasingly advanced touch screens." (M. DOCCI, C. BIANCHINI) The drawing, revealing the past, brings out the traces of the ancient Benedictine building, going up to the archaeological remains of the architecture. Therefore, the aim of the research is to highlight a path that leads to a resilient result with the awareness that the one who detects uses technologies as a prosthesis of thought, claiming the primacy, as Leonardo reminds us, of the senses and of the hand that follows the mind, evidently a hand that uses the scientific evolution of tools up to current digital technologies that can never replace the thought and the ability of the surveyor to understand the projective soul understood as a project. "The spatial experience, as far as architecture is concerned, arises from perceptions in which visual and tactile sensations are intertwined. This is above all a pure observation of a factual situation. By determining the ratios of the most different details, impressions, straight or curved lines, surface structures, masses, proportions, configurations of all kinds of shapes, the purely physical perception is transposed into another sphere. It distances itself from all particular visions and integrates them, instantly, into a spiritual entity. In this mutation from a fact into a spiritual experience he acts ina higher degree than the faculty of abstraction. "

2. The phases of survey: from territorial scale to architectural one

The survey, carried out on Santa Patrizia building, will be used for the subsequent digital BIM modeling to support the planning, design and execution of extraordinary maintenance, structural safety and energy efficiency verification activities envisaged for the University buildings.On april 2021, the acquisition flight with the TABI1800 thermal sensor was carried out on board the plane of the Benecon University Consortium - Tecnam P2006T Special Mission Platform twin-engine 4-seater equipped with hatches to house the BENECON sensors for the Complex Representation of Heritage Cultural, material and immaterial.



Fig. 1: Aircraft Benecon I-CABE P2006T SMP

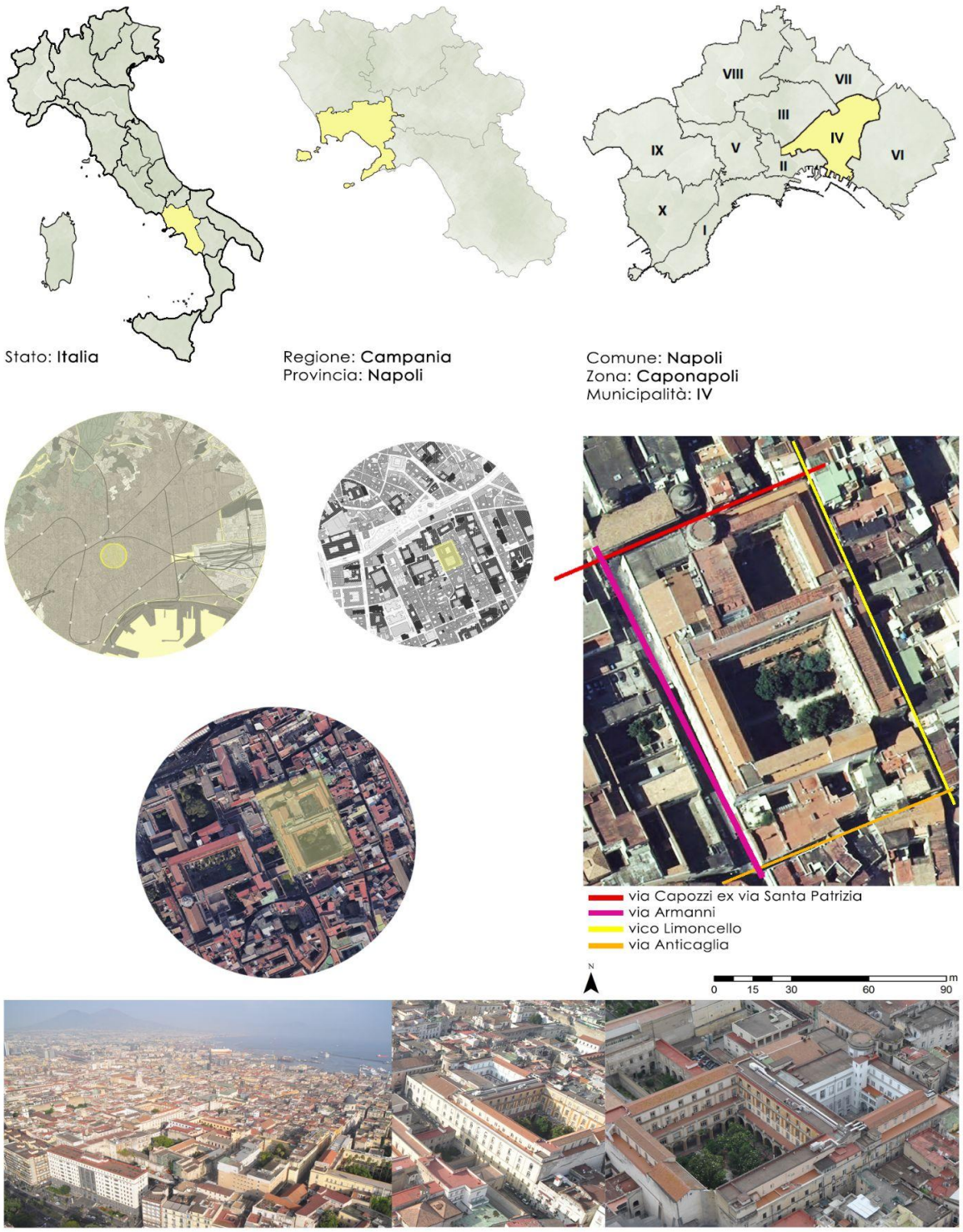


Fig. 2: Naples, The Monumental Complex of Santa Patrizia on the hill of Caponapoli. Territorial localization on cartographic basis, photo from Benecon aerial platform. Graphic elaborations by Rosaria Parente

The planning of the acquisition flight, carried out by the researchers of the Benecon laboratory, was carried out in compliance with all aeronautical safety parameters, taking into account the morphology of the territory and the purpose of the survey, guaranteeing the acquisition of a square pixel on the ground of dimensions 0.20m x 0.20m.
After the acquisition phase, radiometric and geometric correction of the raw thermal data were performed.
Following the application of Benecon algorithms, false color images (gray scale 256; blue-to-red) georeferenced were processed in such a way as to make the data readable and easy to understand.

The critical analysis of the results was performed in a GIS (Geographic Information System) environment using the 2014 regional orthophoto of the Campania Region as a cartographic basis.
The cartographies resulting from the acquisition of the TABI-1800 TSR sensor and from the subsequent post-processing (the TABI-1800 TSR sensor is a unique technology in Europe) made it possible to conduct analyzes on a territorial scale and also to study the characteristics of the individual Complex of Santa Patrizia in Naples.
Below is a detailed focus of the area of the Santa Patrizia Complex where different thermal behaviors are evident between the different roofs with a thermal delta that varies between 5.12 ° C and 34.5 ° C.
It can be seen how the high resolution of the georeferenced images is able to identify the punctual hot-spots present on the roofs corresponding to the systems and glazed elements on the roof.

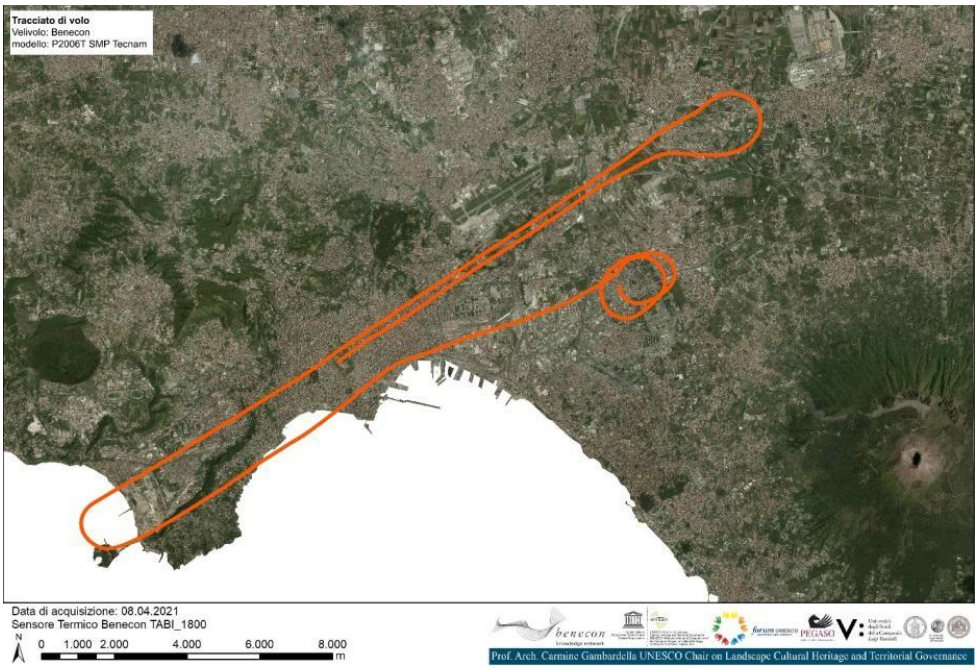


Fig. 3: Naples, The Monumental Complex of Santa Patrizia on the hill of Caponapoli. Flight path, Graphic elaborations by Rosaria Parente

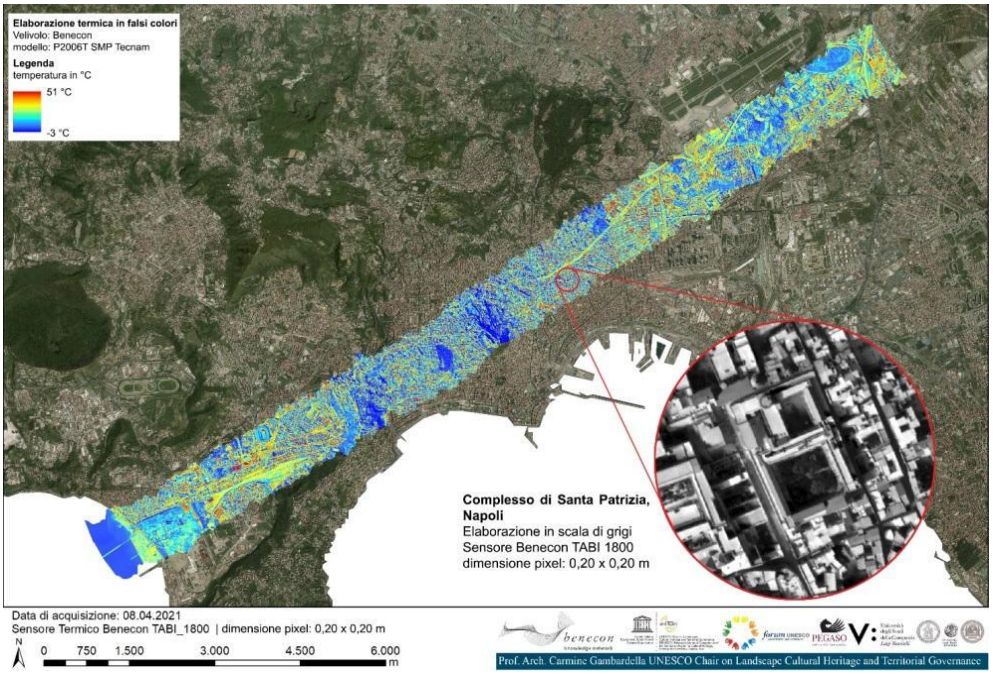


Fig. 4: Naples, The Monumental Complex of Santa Patrizia on the hill of *Caponapoli*. Thermal processing in false colors, Graphic elaborations by Rosaria Parente

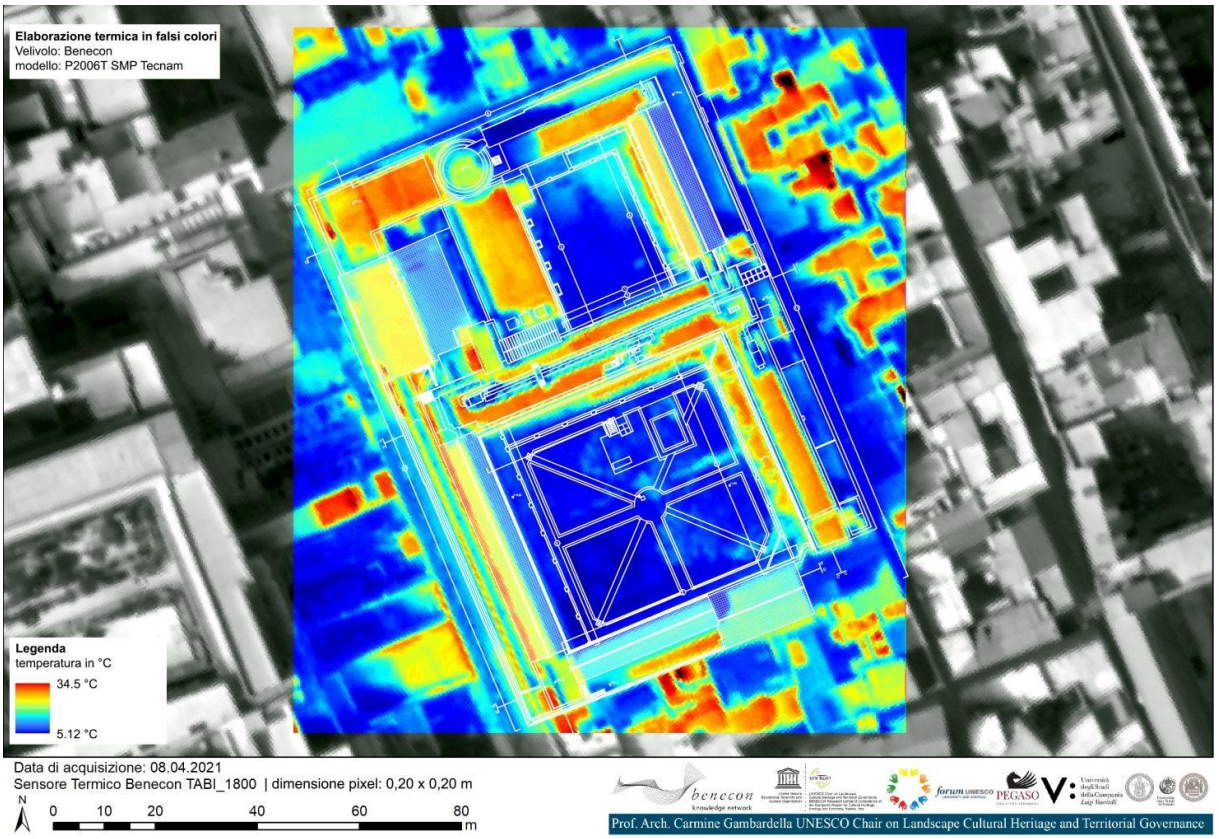


Fig. 5: Naples, The Monumental Complex of Santa Patrizia on the hill of *Caponapoli*. Overlap between the roof plan and thermal processing in false colors, Graphic elaborations by Rosaria Parente

2.1 The representation of building by different type of technologies

The survey of the Santa Patrizia Complex in Naples is intended as a contribution to the knowledge and graphic rendering of the building as rich as possible with information on the shape, place and time of construction and transformations of the Complex.

The survey work and restitution of the Santa Patrizia Complex, due to its size, heterogeneity and preciousness of the environments, could only be accomplished through the use of advanced technologies and equipment that allowed to complete the entire survey campaign without limiting the use of the environments and the normal performance of hospital activities. The site inspection was the first activity that related the representation of the monumental complex georeferenced from above with the representation of the level of the archaeological substrate to be surveyed; this activity influenced every subsequent cognitive and planning action on the monumental complex itself.

The purpose of the inspection was to have the researchers of the Benecon University Consortium acquire elements of knowledge of the geo-spatial characteristics of the complex object of the assignment:

- Information was collected on:
- The location of the complex
- Physico-morphological characteristics
- Orientation, exposure, views to understand the relationship with neighboring buildings and with the urban fabric
- Forms and organization of the floor plan and the elevations and interior spaces
- Relationship between served and served spaces
- Useful details for the syncretic representation of the architecture in question

Furthermore, in order to have a complete knowledge of the levels of the site, exploratory inspections of the underground cavities of the Complex of Santa Patrizia were carried out.

The planning of multiple three-dimensional acquisitions required a series of precautions: each scan, in order to be connected to the neighboring one, required at least three points in common with it. Therefore, the planning phase of the acquisitions was of fundamental importance for the correct execution of the survey. The environments to be surveyed were full of "disturbing" elements, such as furnishings, installations and exposed systems, these elements were used as reference points for the union and alignment of the scans.

Increasing the number of reference points common to scans increased the accuracy of the final recorded scan. The main goal was to position the device in order to have maximum coverage with the least number of scans possible.
The sensor used for the acquisition of the point cloud that has successfully allowed the alignment of all the technologies used is the FARO FARO Focus3D X330, a phase difference 3D laser scanner, with a range between 0.6m - 330m indoors. and outdoor, with vertical incidence on reflective surface (90%) and a linear distance error of about 2mm. The detected points have both precise geometric information and color information, collected by the integrated camera.



Fig. 6: Scan preview obtained with the FARO Focus3D X330 laser scanner during the acquisition phase. Side entrance of the lecture hall.

An MMS (Mobile Mapping System 3D) laser scanner system was used with a range of up to 100m indoors and outdoors equipped with a 360 ° and 240 ° azimuth spherical camera. This is because the Benecon University Consortium has decided to offer a resolution that does not have points of discontinuity in the spatial model.



Fig. 7: FARO Focus3D X330 laser scanner in the acquisition phase. Ground floor, entrance from via Domenico Capozzi.

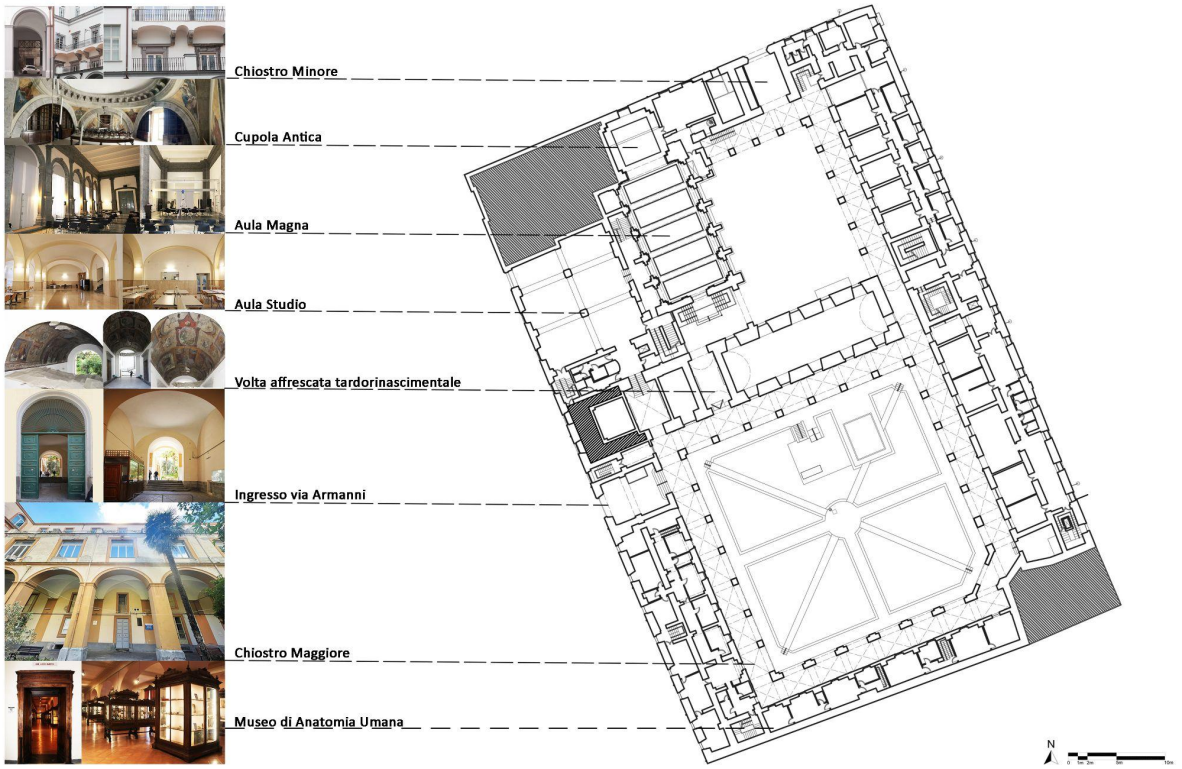


Fig. 8: Naples, The Monumental Complex of Santa Patrizia on the hill of *Caponapoli*, Photographic survey. Graphic elaborations by Rosaria Parente

The historical-critical analysis of bibliographic, archival and iconographic sources, together with the architectural survey, aims at interpreting all the events that, from the initial project to all the eventual phases of transformation, have lead the monument in its current state. This is therefore a multi-temporal and multi-spatial study in which geomatics gives an innovative contribution for its capability of gathering, storing, processing, and delivering different levels of spatially referenced information[1]. The spatial arrangement of the scans, while taking into account the specificities and needs dictated by the spatial configuration of the existing building, has been organised according to a mesh that was as regular as possible, so as to ensure, in the subsequent data processing phase, precise overlapping of the station points and therefore better compensation for errors.
The critical survey of an architectural work which has undergone spatial and architectural modifications over time, sometimes dictated by functional needs or extensions, requires a statute/palimpsest which allows its diachronic legibility in the unitary conformation it has assumed during the various epochs. For example, the study room on the mezzanine floor reveals the configuration of the monument through different ages, since it was built for teaching purposes above the area that was once free and formed part of the remaining Consolation courtyard. Therefore, the precision of the drawing becomes a tool for defining the principles of the project, as a means of retracing the traces, making them material, visible and founding of the changes. (*fig. 5*) *"*The procedure of analysis by means of the traditional tools of drawing represents a way of relocating the architecture created in the historical-theoretical context of reference, a procedure of conceptualisation and synthesis that highlights the scenario of the design themes[2].*"*

[1] Bevilacqua M. et al, 2017

[2] Purini F. (2003)

3. Conclusion

The detailed graphic studies produced have clearly pointed out, for example, the different composition of the facades of the two cloisters of the Complex of Santa Patrizia, due to different eras of construction highlighted by decorative elements belonging to decorative registers, evidently not coeval extensions such as in the case of the top floor level. “Drawing becomes a differential device that is modulated on the ability to start a dialogue that questions the quality of difference as a measure of the mystery to be revealed in it, to which the quality of our action must correspond in tension, if the action is pertinent and participatory in the dialogue it manages to establish.”[3]
By uncovering the past, the drawing brings to light traces of the ancient Benedictine factory, going back to the archaeological remains of the complex. Therefore, the aim of the research is to highlight a path that leads to a useful and necessary result for the transmissibility of the heritage to the future with the awareness that the one who carries out the survey uses technologies as a prosthesis of thought, claiming the primacy of the senses and the hand that follows the mind, obviously a hand that uses the scientific evolution of the instruments up to the current digital technologies that can never replace the thought and the ability of the surveyor to capture the projective soul intended as a project.
Indeed, by echoing Giedon who anticipates interdisciplinarity as a value of knowledge, even with regard to current technologies that allow us to investigate and represent beyond the visible, “the spatial experience, with regard to architecture, stems from perceptions in which visual and tactile sensations are intertwined. This is above all a pure observation of a factual situation. By determining the ratios of the most different details, impressions, straight or curved lines, surface structures, masses, proportions, all kind of configurations of forms, the purely physical perception is transposed into another sphere. It distances itself from all particular visions and instantly integrates them into a spiritual entity. In this mutation from a fact into a spiritual experience, it acts in a higher level of the faculty of abstraction.[4].” The activities carried out in the Complex of Santa Patrizia have led to the representation of the changes which the volumetric layout of the complex has undergone, especially in relation to the nineteenth and twentieth century additional storey built after the suppression of 1864, and with greater intensity in the last decade of the nineteenth century. Other recently built structures have worsened the condition of the complex, also having a serious environmental impact. The issue poses serious problems in terms of restoration, since in some cases it can be said without doubt that these additions can be considered historicised, such as the last two levels of both cloisters, or the hoist tower in the small courtyard. Varagnoli's thought can help in this methodological line, inviting a design practice that makes pre-existing architectures live again according to the shape of time, even if they no longer have a role. "And to achieve this objective, the shapes of the past must not be repeated slavishly, but listened to, taken as a model, like Renaissance architects with regard to the *exempla* of classicism, which they want to revive rather than restore; therefore, no longer a nostalgic and perhaps somewhat rhetorical approach to archaeological remains[5].”

[3] Florio R. (2020)
[4] Giedon S. (1955), *op. cit.*, p. 75
[5] Varagnoli C. (2007)

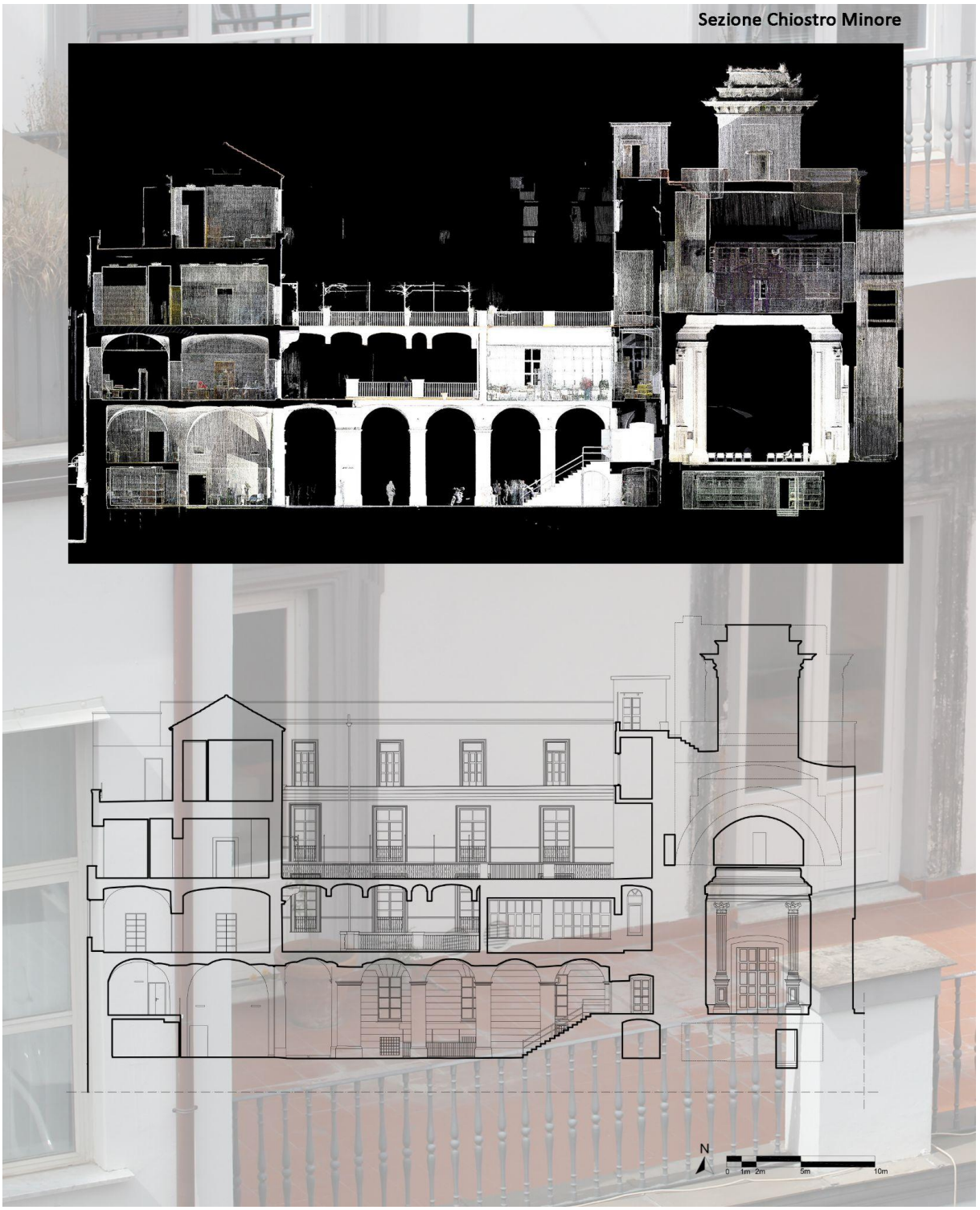


Fig. 9: Comparison between the orthophoto and the redrawing of the section on the Minor Cloister. Graphic elaborations by Rosaria Parente

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INDICE

17 ID 003_Cristiana CARLETTI, Mariella PAGLIUCA
ESG criteria to monitor and assess women's empowerment in development processes: basic framework and proposal for a preliminary theoretical analysis

27 ID 004_Emanuele NAVARRA
The recovery of Miseno and its untold architectures

33 ID 006_Caterina GATTUSO, Domenico GATTUSO
Via Pompilia in Calabria. Potential of a tourist-cultural itinerary

44 ID 008_Piero BARLOZZINI, Rossella NOCERA
Research notes on safeguarding architectural heritage: a proposed mode of operation for defining territorial buffer zones

53 ID 009_Maria Carolina CAMPONE
The oldest ecological Law and the ''Ecological Transition'' in Athens

63 ID 010_Saverio CARILLO
From rural design ideas for the ecological transition. Conservation as a technology transfer

73 ID 012_Maria MARTONE
Architecture and territory. The former convent of the Maddalena in Castel di Sangro

83 ID 015_Piero BARLOZZINI, Fabio LANFRANCHI
Analysis of an ancient fresco expression of mediation and transition between action and contemplation

91 ID 016_Stefania GRUOSSO, Andrea DI CINZIO
Kaleidoscopic ecologies. New scenarios, from ecological utopia to probiotic architecture

97 ID 017_Pedro António JANEIRO, Dulce LOUçÃO, Gisele Melo de CARVALHO
The drawing of the natural landscape in the housing. Jacques-François Blondel's 18th century recommendations

107 ID 018_Nicola ORLACCHIO
Digitalisation and ecological transition through digital twins. An added value for society

114 ID 019_Adriana ESPOSITO
Fengshui theories for a harmonious and sustainable environment

122 ID 020_Takeyuki OKUBO, Riku SUNADA, and Dowon KIM
An effectiveness of Spreading Fire Mitigation by the Traditional Knowledge Using Group of Trees in Japanese Historic Districts

132 ID 021_Angelo TORRICELLI, Giuseppe DI BENEDETTO
“Sub specie æternitatis”: the role of the ruin and the ancient in the process of architectural renewal between metamorphosis and resurgence

141 ID 022_Gigliola AUSIELLO, Luca DI GIROLAMO
The rural architecture enhancement through the sustainability search in the ecological transition era

150 ID 023_Anna Marie FISKER, Daniele SEPE, Jeppe Heden CHRISTENSEN
Towards a Sustainability of Cultural Heritage

158 ID 024_Bernardino CHIAIA, Giulia MARASCO, Salvatore AIELLO
Innovative strategies to preserve the Italian engineering heritage: the historical tunnels

166 ID 026_Diana CARTA
Architecture as a in fieri work. Ecological transition to ensure the resilience of a community

175 ID 027_Violeta BAKALCEV, Sasha TASIC, Minas BAKALCEV
The Seven Maples as Spatial and Social Places in Veles

186 ID 029_Hanan KAFFOURA, Nicola SANTOPUOLI, Ossama KHALIL
The Ecological Transition Role in the Sustainable Development of Historic Urban Ports. The case of the old urban Port of Lattakia in Syria

196 ID 031_Chiara INGROSSO
Renato Avolio De Martino architect of the SME

205 ID 032_Laura RICCI, Carmela MARIANO
Urban regeneration, climate adaptation, and territorial governance. Experimentation and innovation in the Plan for an integrated strategy between urban planning and ecology

214 ID 034_Alessandra BADAMI
Restoration of the Østerå river system as an ecosystem service for the ecological transition of Aalborg

224 ID 035_Andreia GARCIA
Ecological Redevelopment, A territorial (re)generation of the interior region of Portugal

233 ID 036_Tiziana CAMPISI, Simona COLAJANNI, Manfredi SAELI, consultant: Luisa LOMBARDO
Material and immaterial culture of the internal minor centres. Studies and researches for the ecological transition of the Madonie inner mountain area in Sicily

243 ID 039_Fernanda CANTONE, Francesca CASTAGNETO, Rita VALENTI
For ecological transition: analysis and projects in ‘’sciclitato” landscape (RG)

253 ID 040_Valeria MINUCCIANI, Nilufer SAGLAR ONAY
The Valorization of Cultural Heritage to Preserve ‘’Biodiversity” in Lifestyles

262 ID 041_Francesca MUZZILLO, Fosca TORTORELLI
Food Design: Art and Food Culture

266 ID 042_Antonella SALUCCI, Francesca LIBERATORE
Lens on Landscape. Atlas of the coastal villages of Lake Bolsena (Central Italy)

275 ID 043_Massimiliano CERCIELLO, Maria Carmela GAROFALO, Sabina MARTUSCIELLO
Urban Gardens as Drivers of the Ecological Transition in Italy

281 ID 046_Serena VIOLA, Anna Rita VILLANO, Francesca CIAMPA
Towards long-term sustainability: design priorities for outdoor green spaces

291 ID 047_Massimiliano AGOVINO, Antonio GAROFALO, Maria Carmela GAROFALO
Is Transition Design an alternative way to create sustainable futures? Starting from the differences between recycling and overcycling

296 ID 048_Andrea ROLANDO, Alessandro SCANDIFFIO
The Grand Tour UNESCO in the Piedmont region. A slow travel route across ''in between" territories, to improve the accessibility of places in cultural landscapes

303 ID 049_Marco RUSSO
Experiencing places of worship

313 ID050_Ana VASCONCELOS
The interactive condition of the wall: between world heritage and ecological transition. The Storefront Gallery in New York by Steven Holl and Vito Acconci

318 ID 051_Antonio BIXIO, Giuseppe D'ANGIULLI
The transformation of the contemporary city. Exercises of retrofit and improvement of architectural and urban heritage

326 ID 052_Maria Rita PINTO, Maria Giovanna PACIFICO, Francesca CIAMPA
Heritage performance realignment for contemporary community: a maintenance strategy for the historical built environment

335 ID 053_Teresa CILONA
Living in future cities: from overbuilding to ecological transition

345 ID 054_Soheyl SAZEDJ, Jorge CRUZ PINTO, Ljiljana CAVIC
Stone facades and curtain walls

356 ID 055_Valentina SANTORO, Lucia DEL CORE
Digital manufacturing systems and smart materials for a sustainable anastylosis process

366 ID 057_Sara ERICHE, Francesca SALVETTI, Michela SCAGLIONE
The visual identity of wine landscapes through the Piedimont wine posters

376 ID 058_Alexandra AL QUINTAS
The wild garden inside: The universal everlasting dream of capturing nature and bringing in into our lives

384 ID 060_Giovanni MONGIELLO
Metaverse: The architectural speech of digital representation

390 ID 061_Alessandro SCANDIFFIO
Exploring representation tools for mapping landscape evolution. From historical maps to satellite multispectral imagery

398 ID 062_Carla GIORDANO, Davide BARBATO, Barbara MESSINA
Safety begins knowledge: a BIM approach for monitoring built heritage

405 ID 063_Elisabetta BENELLI, Francesca FILIPPI, Jurji FILERI
Sustainability in Eyewear Design

415 ID 064_Hyunguk RYU
Historical Transition of North Korean Commercial Art (1945-2019)

425 ID 065_Cesare VERDOSCIA, Michele BULDO, Riccardo TAVOLARE, Antonella MUSICCO
Integrated 3D survey techniques for historical architecture. The Church of S. Maria Veterana in Triggiano (Italy)

434 ID 066_Giancarlo BILOTTI, Domenico BRUNO, Renato S.OLIVITO
Preservation and enhancement of masonry arch bridges: restoration strategies

444 ID 067_Anna CATANIA
A new sustainable food delivery platform

452 ID 069_Francesca COLOSI, Roberto ORAZI
Chan Chan Archaelogical Park: looming threats and suggested remedies

461 ID 070_Mariacarla PANARIELLO
The experience of the limit

467 ID 071_Daniela PITTALUGA, Giacomo CALVI
A possible sustainability in the conservation of the material heritage: examples in the port of Genoa

477 ID 072_Simona CALVAGNA, Fabio Agatino REALE, Andrea TORNABENE
On the Margins of the Anthropocene. Landscape, architecture and sustainability

487 ID 073_Francesco MAGLIOCCOLA
Best drawing for best conservation of Dawan Chinese Village

497 ID 074_Efisio PITZALIS, Marco RUSSO, Noemi SCAGLIARINI
The talking garden. Distant dialogue with San Lorenzo ad Septimum

507 ID 075_Federico BUCCI, Elena FIORETTO, Nora LOMBARDINI
The role of the UNESCO Chair in the strategies for the enhancement of Cultural Heritage. An overview between Garda Lake and Mincio river

514 ID 082_Massimo MALAGUGINI
From ‘’villa” landscape to industrial landscape. And now?

525 ID 085_Ferdinando VERARDI
New urban communities and the strategic value of knowledge. How networks are changing the urban future by offering an emergency way out

532 ID 087_ António MORAIS, A. BASTO DIOGO, Svetlana IVANOVA MORAIS, J.CARMO FIALHO
A Theoretical Contribution To Improve The Formation In The Historical Lisbon School Of Architecture – The Forgotten Dimension of the Technological Perspective

538 ID 088_Dominik LENGYEL, Catherine TOULOUSE
The amphitheatre of Dyrrachium

543 ID 089_Riccardo RENZI
Mosul UNESCO heritage site. Rebuilding the Al Nouri complex and cultural center

550 ID 090_Salvatore LOSCO, Claudia DE BIASE
Urban heat Island phenomenon and ecological indicators: The case study of the historical town center of Aversa (CE)

559 ID 091_Giuseppe D'ANGELO, Rosaria SAVASTANO
Philosophy physics and math in architecture

566 ID 092_Domenico PASSARELLI
Energy as a paradigm of urban planning. Towards an ecological transition

574 ID 093_Michele D'OSTUNI, Leonard ZAFFI
From horizontal to vertical. Advanced food production in urban areas though vertical farming projects

583 ID 095_Andrey VASILYEV
New Result of Industrial Noise Monitoring and Reduction on the Example of Samara Region of Russia

589 ID 096_Andrey VASILYEV
Environmental Control of Toxicity of Water Reservoirs During Pollution by Toxing Substances

594 ID 111_Alessandro CIAMBRONE
Design and murals for public and private spaces

604 Nicola PARISI, Giosmary TINA, Angelo Vito GRAZIANO
Raw earth & additive manufacturing: two case studies

613 Rosaria PARENTE
The drawing of "already done": surveys experiences on the Monumental Complex of Santa Patrizia in Naples



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