# From Vernacular to World Heritage

*edited by*
LETIZIA DIPASQUALE
SAVERIO MECCA
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FIRENZE UNIVERSITY PRESS

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# Introduction

# VERNACULAR AND EARTHEN ARCHITECTURE AT THE CORE OF LOCAL KNOWLEDGE RESEARCH: A QUALITY PARTNERSHIP WITH SUCCESSFUL OUTCOMES

**Mariana Correia**
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*opposite page*
**Chorá of Pátmos**
*(© L. Dipasquale, 2015)*

Since 2006, Escola Superior Gallaecia (Portugal), University of Florence (Italy), and Universitat Politècnica de València (Spain), with partners as CRAterre-ENSAG (France), the University of Cagliari (Italy), and Ecole d'Avignon (France), have been working together, for the enhancement and protection of vernacular heritage and earthen architecture. As key-institutions in the area, they share high standards and common values, in order to address and achieve fundamental research, capacity building, learning experiences, relevant outcomes, contributing for a broader and deeper knowledge on vernacular heritage and earthen architecture.

Several projects were developed among the partners, throughout the years. This was just possible by running together for European Union funded research, and successfully achieving it, by undertaking relevant contribution to knowledge, as well as comprehensive scientific dissemination. This was the case of the following projects: *Terra Incognita* (2006-2008); *Earthen Domes & Habitat – A building tradition between East and West* (2008-2010); *Terra (in)cognita/Terra Europae* (2009-2011: culture-terra-incognita.org); *VerSus – From Vernacular Heritage to Sustainable Architecture* (2012-2014: esg.pt/versus); *3DPAST – Living and virtual visiting European World Heritage* (2016-2020: esg.pt/3dpast); and *VERSUS+ | Heritage for People* (2019-2023: esg.pt/versus-plus). Other key-projects have been also developed through National Funding Agencies for Science, Research and Technology as it was the case of: *Seismic-V – Local Seismic Culture in Portugal* (esg.pt/seismic-v); *PRIN – Scientific, experimental and tacit knowledge and conservation actions of Earthen Architectural Heritage in Southern Italy*; *ResTAPIA – Restoration of rammed earth in Iberia Peninsula* (www.restapia.es); *SOStierra – Restoration and Rehabilitation of traditional earthen architecture in Iberia Peninsula* (sostierra.blogs.upv.es) and *RISK-Terra* (https://riskterra.blogs.upv.es); among others.

The focus of the distinct researches was to address: a state of the art of earthen architecture in Europe (both *Terra Incognita* projects); to define principles from vernacular heritage that contribute to sustainable architecture (*VerSus* project & *VERSUS+* project); to enhance the quality of vernacular architecture and its World Heritage character (*3DPAST*); to distinguish seismic retrofitting in vernacular architecture, in order to pro-actively strength dwellings facing earthquakes (*Seismic-V*); to

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**Abandoned tower cluster, Murkmeli village, Ushguli, Svaneti, Georgia**
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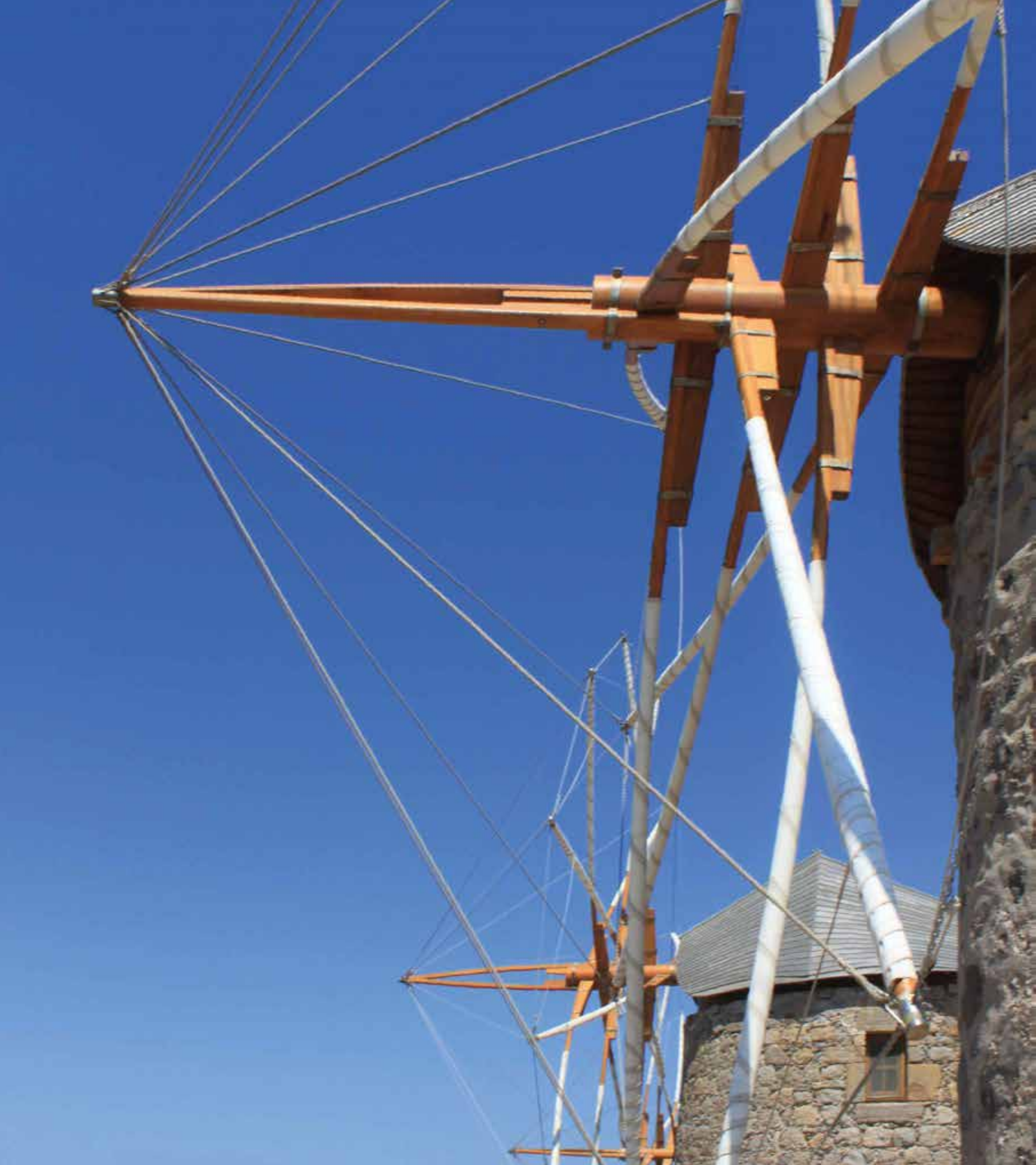
contribute to identify, systematise and enhance tangible and intangible heritage represented by vernacular and earthen architecture - for its conservation, and the conception of new architecture and sustainable settlements (*PRIN, Coupoles & Habitat*, *ResTAPIA*, *SOStierra*, and *RISK-Terra*).

Due to globalisation, urban pressure, and now climate change, vernacular heritage and earthen architecture are under a real threat of disappearing, at a very accelerated rate. Urgent actions need to be undertaken to protect this fragile and undervalued heritage.

This will only be possible by developing strong partnerships and team work, among colleagues and institutions with shared values, which also believe in expanding research in this field of expertise, through coordinated actions, and strategic and critical thinking, in order to value and protect vernacular heritage and earthen architecture across Europe and the World.



**Toshiyuki Kono**
President of ICOMOS International (2018-2020)

*opposite page*
**Historic windmills on the Island of Pátmos, Greece**
*(© L. Dipasquale, 2015)*

Art.1 of the World Heritage Convention stipulates that "monuments", "groups of buildings" and "sites" shall be considered as "cultural heritage" under the Convention. Thus, "groups of buildings" define the scope of application of the Convention. In fact, the World Cultural Heritage properties which were inscribed for the first time in 1978, already included "groups of building", as the City of Quito, and the Historic Center of Krakow. Vernacular architecture, as an essential element of "groups of buildings", started to play a crucial role in the World Heritage system from the beginning.

Vernacular architecture is however fragile in many ways. If a natural disaster occurs or urban development is intensified, private owners of vernacular houses in the affected area may demolish or sell their properties to avoid various burdens. Traditional skills and craftsmanship applied to vernacular buildings would be more easily lost than those applied to monuments, since the job market of carpenters with traditional skills has been shrinking, while the craftsmanship of the highest quality would be subsidised and maintained, in order to keep up monuments. One cannot freeze the lifestyle of local residents. It is therefore difficult, to prevent modern influences, not only on their lifestyle, but also on their traditional houses.

This timely publication contributes to raising awareness of the importance and the challenges of vernacular architecture, not only for policymakers, but also for regular citizens.

Applying advanced digital technology is a resource for heritage communities, to be further explored. Under the current difficult situation of a pandemic, the approach of digital transformation gains more significance than ever. This project is one of the pioneer works where the vernacular architecture and the digital transformation are well integrated.

I congratulate the project team on this impressive outcome!

Yours,
Toshiyuki Kono

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# A HERITAGE OF RECONCILIATION AND OF LINKAGE BETWEEN NATURE AND CULTURE

**Hubert Guillaud**
Université Grenoble Alpes-ENSAG,
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Earthen Architecture, Sustainable development & Building cultures

*opposite page*
**Chazhashi, Ushguli, Svaneti, Georgia**
*(© G. Duarte Carlos, 2019)*

The 'universal value' of vernacular architectural heritage in the prestigious UNESCO World Heritage List, although more or less recognised and considered in the holistic dimension of their integration into exceptional cultural contexts, which are themselves listed, is still very limited as shown by the 1121[1] properties inscribed on this list to date, in 2020. The tangible and intangible values of vernacular heritage, and the exemplary nature they bear, with regard to the eco-responsibility of builders, for example their setting in situation, their anchorage to the 'place' (Norberg Schulz, 1981) constitute a valuable heritage that cannot be neglected, particularly in view of the now undisputed evidence of their relationship to the resources available in the diversity of their environments. It concerns human resources: constructive cultures educated by the collective memory of knowledge and skills, the arts and crafts of construction and architecture, both popular or scholarly. Moreover, it also refers to physical resources: organic and geo-sourced materials, wood, straw and other plant fibres, earth and stone. But also, for their intelligent response to the constraints and potential of the sites, to the benefits and hazards of the climate, to natural risks (floods, fires, earthquakes). And yet these evidences are still too little acquired, although a broader adhesion of the societal thought converges to it.

The vulnerability of vernacular habitat heritage, which has been exposed to massive destruction since the Industrial Revolution at the end of the 19th century, and then with the recent period of economic growth during the thirty 'glorious decades' (end of the 1940s to the beginning of the 1970), is guilty societal blindness. Either this vulnerability is borne by commercial, economic and financial interests, leaving all room for the expansion of the contemporary city, ordering the destruction of historic islets (e.g. the *Lilongs* of Shanghai in China); or either it was induced by economic or climatic crises (e.g. several villages of *Tierra de Campos* in Spain, or elsewhere); or by an ideological nature (e.g. rural housing in Romania under Nicolae Ceausescu); or even in a conflict situation (the ancient historic cities of Syria (Damascus, Bosra, Aleppo) and the domed rural housing of the Aleppo region, and in a post-conflict situation, where the *tabula rasa* policy is enforced. Faced with such situations, despite the international conventions of UNESCO (1954, 1970, 1972, 2003) constituting safeguards, and the recommendations and charters of the ICOMOS International Scientific Committees, it is still very often difficult to intercede and to act for the protection of vernacular heritage, mainly habitat, since the populations are

[1] There are 1121 World Heritage properties, as in August 2019. From those, 213 are Natural properties, 869 are Cultural properties, and 39 are mixed properties. Additionally, 53 World Heritage properties are in Danger (36 are cultural, and 17 are natural), and 39 are Transboundary properties (20 are cultural, 16 are natural and 3 are both).

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driven out or forced to abandon vernacular heritage and their habitat, in spite of themselves, thus exposing them to a slow destruction, for lack of maintenance and to the actions of their climatic environments, or to looting. All the more so, as the value of this heritage is insufficiently recognised or wrongly considered as secondary, or only partially meeting the criteria and codes governing the possibility of a classification. As a result, there are too few vernacular architecture cultures that are listed as World Heritage, or which can even only claim it. The prospect of a multiplied destruction of this heritage is therefore irreparably programmed, and would constitute an immeasurable and irreplaceable loss of culture and history for humanity. An unacceptable denial.

*opposite page*
**Ruined dwelling in Gjirokastra, Albania**
*(© L. Dipasquale, 2018)*

The current times are exposed to many uncertainties and threats widely discussed elsewhere. The broken pact with nature, this "natural contract" referred to by the philosopher Michel Serres (1991), established from generation to generation of popular builders, must be absolutely and urgently restored. To defend this perspective would simply be to protect the heritage of the 'meaning' of life, of its fundamental intrinsic values, which themselves inhabit the vernacular heritage. It would also be recovering from our duty to act for a "reconciled" relationship, more peaceful, with otherness, with humans and nature. Act for a society of the rediscovered 'link'. Thus, paying increased attention to the classification of vernacular housing heritage is an act of resistance, of a sense of measure (against the excess and accumulation of our current societies). It is to stop the destructive madness of nature, and to help found this indispensable culture and ethics of eco-responsibility, more collectively shared, to bring about a society of chosen sobriety and frugality. To preserve this essence, this ineffable meaning to which the vernacular housing testifies, must absolutely be passed on to future generations. A society that would bring humanity to its necessary re-rooting in habitable territories, "a strategic key to sustainable development" (Magnaghi, 2003).

This book is an urgent invitation to move towards other possibilities than those sadly announced by taking a concrete lesson in the values of vernacular architectural heritage, of the 'obligation' to protect and classify them. A lesson providing answers without imitation, without folklorism, without museification, but in mimesis (Alexander, 1977) subversive, imaginative and creative, resolutely contemporary. It is time to follow the path of the "great vernacular building site" (Frey, 2010), in construction, as well as in protection and conservation, by intelligently using the tools of "thinking and doing" that this book proposes at the right height of the major cultural issue that must be addressed.

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# VERNACULAR ARCHITECTURE IN THE WORLD HERITAGE LIST

**Luis Fernando Guerrero Baca**
Universidad Autónoma Metropolitana

*opposite page*
**Tomarapi, Bolivia, Ǫhapaq Ñan, Andean Road System**
(© *L. Guerrero, 2011*)

Even though the definition of the World Heritage concept has been accepted and used for almost half a century, there are categories of cultural assets that pose conflicts for their assessment and protection. Among these, the vernacular constructions stand out, as they are being increasingly damaged and impacted, and are simultaneously excluded from official definitions, leading to an under-recognition of the importance of their conservation.

The 1972 notion of World Heritage emerged as a measure to promote international collaboration to protect the most important landmarks of humanity. In addition, it was intended to incentivise the development of conservation actions that could be adapted to structures with cultural significance at national, regional, or local levels. Thus, the selection of singular sites with universal recognition would serve as an example for the care of the entire heritage.

While these objectives have been achieved in many contexts and an increasingly comprehensive preservation of monumental assets has been reached, the definition of heritage based on the identification of 'Outstanding Universal Value' has generated unforeseen outcomes.

Notwithstanding previously impacts, such as the massive arrival of tourists to some of the World Heritage sites or their abandonment by their original inhabitants due to the increase of land prices in historic downtowns, there is a collateral damage of a conceptual nature whose impact has not been sufficiently addressed. National institutions, and society in general, do not question the priority of safeguarding archaeological sites, cathedrals, sanctuaries, fortifications, or urban centres. Their remarkable singularity due to their antiquity, their dimensions, their style or cultural significance brings out the need for international attention.

Unfortunately, this form of categorisation discriminates against millions of rural and urban structures whose Outstanding Universal Value is not evident. All those anonymous displays of culture, made by hand with natural materials, with 'modest' dimensions and modified at different times in History, are hardly seen as "monuments", despite the fact that their equivalence was declared since the Venice Charter (ICOMOS, 1964).

How to recognise the exceptional universal value of a cultural display characterised by its similarity to many others in the world? How to evaluate the authenticity of assets that are periodically transformed? The indication that "The concept of a historic monument […] applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time" (Venice Charter, Art. 1) conditions the value of heritage to the passing of an undefined period of time.

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**Coro, Bolivarian Republic of Venezuela**
(© *L. Guerrero, 2011*)

**Djenné, Mali**
(© *L. Guerrero, 2008*)

From the first nominations to the World Heritage List, made between 1978 and 1979, cases such as the City of Quito (Ecuador), the Island of Gorée (Senegal), Bryggen (Noruega), Antigua (Guatemala), The Ancient City of Damascus (Syrian Arab Republic), the Historic Cairo (Egypt), bring into evidence the existence not only of great monuments, but of urban settlements clearly characterised by the presence of vernacular expressions. However, in the values that the countries expressed for their inscriptions, vernacular was not even mentioned.

It could be argued that the definition of this concept only begins to appear in international documents towards the end of the 20th century and that the *Charter on the Built Vernacular Heritage* was not signed until 1999. However, this absence has remained evident, even in recent nominations.

Analysing the *Descriptions* of the Properties included in the World Heritage List [see UNESCO-WHC, 2020], it can be observed that there are very few cases with explicit references to popular settlements or traditional productive areas. The word "vernacular" appears only in the *Descriptions* of the cases of Mount Athos (1988); Historical Centre of the City of Arequipa (2000); Alhambra, Generalife and Albayzín, Granada (1994); Viñales Valley (1999); Monasteries of Haghpat and Sanahin (2000); Historic Centre of the Town of Goiás (2001); Franciscan Missions in the Sierra Gorda of Querétaro (2003); Historic Quarter of the Seaport City of Valparaíso (2003); Quebrada de Humahuaca (2003); Bam and its Cultural Landscape (2004); Historic Centres of Berat and Gjirokastra (2008) and the Cultural Landscape of Honghe Hani Rice Terraces (2013).

In some cases these sites are referred to under the term "traditional", as in Old Towns of Djenné (1988); Coro and its Port (1993); Mount Emei Scenic Area, including Leshan Giant Buddha Scenic Area (1996); Historic Monuments Zone of Tlacotalpan (1998); Mount Qingcheng and the Dujiangyan Irrigation System (2000); Harar Jugol, the Fortified Historic Town (2006); Bassari Country: Bassari, Fula and Bedik Cultural Landscapes (2012) and Kaiping Diaolou and Villages (2007). In the case of Timbuktu (1988) it is mentioned that "The mosques are exceptional examples of earthen architecture and of traditional maintenance techniques, which continue to the present time" but paradoxically, no reference is made to the hundreds of earthen vernacular houses that surround the mosques.

This absence had already been questioned since the end of the last century at an *Expert Meeting on the Global Strategy and Thematic Studies for a Representative World Heritage List* that was convened in 1994 at UNESCO Headquarters in Paris. "The expert group noted a number of 'gaps and imbalances' in the existing List, e.g.: Europe was over-represented in relation to the rest of the world; Historical periods were over-represented in relation to prehistory and the 20th century; 'Elitist' architecture was over-represented in relation to vernacular architecture; In more general terms, all living cultures – and especially the 'traditional' ones – with their depth, their wealth, their complexity, and their diverse relationships with their environment, figured very little on the List." (ICOMOS, 2004) Also, the word "vernacular" does not appear in the 2019 *Operational Guidelines for the Implementation of the World Heritage Convention* (UNESCO-WHC, 2019). How to safeguard a built heritage that has not even been named?

**Hongue Hani Terraces, China**
*(© M. Correia, 2017)*

Among the main advances that have been made in the heritage assessment of this millennium, the inclusion of the territorial perspective stands out. The definition of categories such as Mixed Cultural and Natural Heritage, Routes and Cultural Landscapes shows a growing interest in the comprehensive safeguarding of monuments and their natural environment. At the same time, the nomination of intangible heritage has gained great impetus, which includes gastronomic customs, dances, processions, rituals, crafts and means of integration between the members of the communities, as well as between them and nature. However, the vernacular constructive knowledge is also a cultural expression that needs to be protected, and yet is poorly represented within the Intangible Cultural Heritage List. At each site, specific constructive solutions were reached due to the presence or absence of natural resources that allowed evolutionary adaptations to the prevailing climates. Nature is an intrinsic part of the buildings as well as the social organisation, beliefs and traditions that support its use, maintenance, and intergenerational transmission.

Vernacular architecture has not been precisely characterised. It was defined gradually until the end of the 20th century, but for its categorisation the logic of 'opposition' was used, taking historical monuments as a reference (Agudo, 2006). It was mentioned that these are buildings that do not have recognised authors, were not executed by "professionals", do not respond to precise styles, are not dateable, do not have large dimensions, were not made with durable materials, etc.

Therefore, in order to propose the integral conservation of the vernacular heritage, it is essential to start from a definition based on its reality, which does not intend to make it fit into biased, commercial or idealised views. Adequate recognition of their intrinsic material and intangible values is expected (Guerrero, Soria, 2018).

It would not be logical to try to safeguard biodiversity in nature, if only the tallest and most beautiful trees are cared for; thus, integral actions are required. Vernacular assets are remarkable for many reasons, notably, their role as depositories of knowledge, and their existence as evidence of the dynamic connection between the past and future of humankind's adaptation to the environment. Underlying

their constructive details lies the "genetic information" that explains the Outstanding Universal Value of the monuments where they are found.

From this perspective, it will be possible to redesign the visibility of the vernacular displays that are present at properties inscribed at the World Heritage List, in correspondence with the List of Intangible Cultural Heritage, from efforts such as the writing of this book. With objective information, each State Party will have elements to manage their safeguarding, not through usual 'conservation and presentation' strategies, but rather by allowing their development within the limits derived from the own nature of each site.

All these properties share a series of heritage values derived from the following four parameters (Correia et al., 2019): landscape environment, urban layout, architectural characteristics and building culture. There are sites whose Outstanding Universal Value is rooted in the balanced connection between traditional ways of life and the rational use of natural resources for both agricultural and construction purposes. As defined for the case of the Hongue Hani Rice Terraces Cultural Landscape in China, the vernacular nature of these assets is manifested through the "specific interaction with the environment mediated by integrated systems of agriculture and water management, and sustained by socioeconomic factors - religious systems that express the dual relationship between people and gods and between individuals and the community […]" (UNESCO-WHC, 2020).

In vernacular structures, the relationship between nature and culture, between the tangible and the intangible, becomes indissoluble. That is why they have survived to this day. They are the best proof of sustainability and, therefore, constitute an irreplaceable source of learning towards the search for balance that has become an inexorable condition for the survival of the human species.

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# LIVING AND VIRTUAL VISITING EUROPEAN WORLD HERITAGE: AN OVERVIEW

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## Introduction

World Heritage sites have an outstanding and exceptional significance for humankind. *Living and virtual visiting European World Heritage* opens the minds of people to discover the 'spirit of place' and the remarkable vernacular heritage still existing in Europe. This is a unique chance to experience World Heritage special character, through virtual travelling to these sites' intrinsic spatiality and architectural quality, daily experienced by their inhabitants.

The key-idea is to share the exceptional character and the quality of living of vernacular buildings in these unique World Heritage sites. This is possible by: seizing the cultural space of today's architecture and its historical evolution; submerging through new realities brought up to non-traveller audiences that do not have the chance to experience this unique heritage in situ; developing the creative potential associated with these site's intangible culture and the site's vernacular expression; sharing through capacity building publications, building workshops, and digital visualisation, the knowledge associated with the inhabited dwellings of European World Heritage.

*opposite page*
**Chazhashi, Upper Svaneti, Georgia** (© *M. Correia, 2018*)

## Key-questions and aims

To better address the purpose of *Living and virtual visiting European World Heritage* and its unique vernacular architecture, 3DPAST project established some key-aims that became fundamental for the success of the project. The project's main idea was to learn how the dwellings were inhabited and authenticity maintained; to identify and disseminate the ancient building systems, and the local building culture; and to develop new interactive ways to transfer knowledge to new audiences, considering creative and technological approaches.

The key-questions of the project were:

1. How construction of the vernacular dwellings was undertaken in the *past*?
2. How maintenance is addressed at *present* in vernacular architecture?
3. How to contribute for the *future* through awareness and preservation of local knowledge and traditional building?

These questions resulted in core aims that helped define the project:

1. To share vernacular architecture quality and its intangible local know-how, regarding the preservation of authenticity and integrity in World Heritage sites.

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Letizia Dipasquale, Saverio Mecca, Mariana Correia (edited by), *From Vernacular to World Heritage*, © 2020 Author(s), content CC BY-NC-SA 4.0 International, metadata CC0 1.0 Universal, published by Firenze University Press (www.fupress.com), ISBN 978-88-5518-293-5 (PDF), DOI 10.36253/978-88-5518-293-5

**Identifying coordinates for survey, Chazhashi, Ushguli, Svaneti, Georgia**
*(© G. Duarte Carlos, 2019)*

2. To explore the inhabited heritage experience through different dimensions and components.
3. To establish a genuine transdisciplinary approach, by interconnecting architecture, history and intangible culture through creativity and digitisation.
4. To bring to light to new generations, vernacular and traditional know-how through interactive and digital technologies.
5. To enhance and preserve the intangible building culture of World Heritage Sites in Europe.
6. To stimulate and improve vernacular heritage knowledge within the cultural sector, across Europe.

## Focus of the Project

This project focused on the vernacular dwellings located in different sites across Europe. Their outstanding value and knowledge were studied in World Heritage properties from Eastern Europe, as in Georgia and Albania, to Western sites as in Portugal and Spain, to Northern properties as in Finland, Central sites as in Romania, or to Southern sites as in Italy and Greece. The project focused on exploring the architectural dimension regarding the building's maintenance, which would contribute to the awareness and the preservation of the authenticity and integrity of these sites.

Moreover, the project contributed to identify the historical attributes of the dwellings' sites, which were recreated through 3D visualisation and augmented reality. This is a powerful didactic tool for children, young people and interested citisationns, which helps to learn and value the relevance of vernacular buildings. These little-known dwellings should be preserved, and more enhancement should be given to the intangible culture still in-use nowadays, regarding the buildings' architectural techniques, materials and building systems' maintenance: a legacy passed down from generation to generation, essential to survive, as part of the European identity. The project aimed to attract non-travellers, young people and different visitors to these sites through the use of Mobile Apps and a digital platform, which opened the mind of citizens to other ways of inhabiting.

**Material transportation, Chazhashi, Ushguli, Svaneti, Georgia**
*(© G. Duarte Carlos, 2019)*

**Roof tile production, Santa Luzia, Pico, Portugal**
*(© M. Mourão, 2017)*

## Vernacular architecture in World Heritage

The reinforcement of cultural and creative connections between countries of the European Union and countries of the Council of Europe contributes to strengthen cultural ties, regarding intangible knowledge across Europe. Also, some of the World Heritage sites from the Council of Europe countries are isolated and do not receive many tourists. Preparing virtual reality visits to these sites would contribute to the circulation of knowledge and the dissemination of cultural heritage diversity across Europe. Furthermore, as intangible heritage is more alive in isolated sites, this project becomes a unique chance to learn from empirical knowledge in remote European regions.

The selection criteria for the European World Heritage sites addressed within this project comprised:

• Vernacular architecture, reflecting local traditions, the uniqueness of the different building cultures, and the singularity of the empirical knowledge, still exists throughout Europe. As the number of vernacular dwellings is decreasing at an alarming rate, the existing World Heritage sites with vernacular expression becomes crucial as referenced examples to consider for the preservation of this unique heritage.

• Inhabited sites, which embraces the engagement of local communities. The in-use vernacular dwellings could be located in isolated European regions, or in World Heritage historical centres. As monumental heritage is usually under more attention, the focus on inhabited vernacular dwellings, highlights the exceptional character of this living architecture.

• Traditional techniques and materials, that are recognised and specific to each site. Stone, wood, and earth are the traditional materials that constitute the main structural compound of the vernacular buildings, assuring an expressive geographical selection of World Heritage sites. One of the main focuses of the project was the traditional heritage associated with construction know-how, to be valued for the maintenance of the inhabited dwellings.

## Case studies across Europe

The selection of different types of World Heritage properties in different contexts and regions assured that the developed approach could be further implemented in the future, in other sites in Europe, and across the world.


**Localisation of the eight selected case studies in Europe**

Pico island

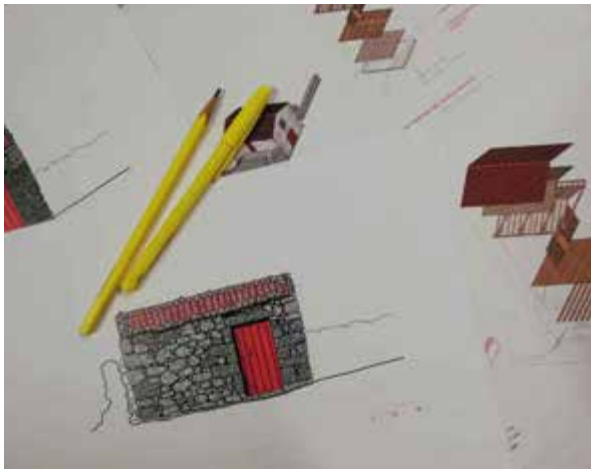
Eight World Heritage properties from different geographical locations in Europe were selected, analysed and their outstanding value was enhanced. Each property is found in a different country, with six case studies located in the European Union, and two others in countries from the geographical area of the Council of Europe (Albania and Georgia). All the selected sites represent, geographically, unique contexts of the European territory, from the north (Finland), centre (Romania), south (Italy and Albania), southeast (Greece), southwest (Spain), and from the east (Georgia) to the west (Portugal) of the continent. Also deprived economically regions were considered, such as Transylvania in Romania; Pico island, in the Portuguese Atlantic Azores archipelago; and Svaneti in Georgia.

Following, the 8 selected case studies were:

1. Landscape of the Pico island vineyard culture, Azores, Portugal (island)
2. Historical walled town of Cuenca, Spain
3. Historical centre of the city of Pienza, Italy
4. Old Rauma, Finland
5. Villages with fortified churches in Transylvania, Romania
6. Historical centres of Berat and Gjirokastra, Albania
7. Historic centre of Chorá on the island of Pátmos, Greece
8. Upper Svaneti, Georgia

## Development of the project

The project was structured to explore the distinctive dimensions of World Heritage properties (their architectural heritage, historical building culture, and intangible construction), correlating them with



**Plan of the World Heritage Historical Wall Town of Cuenca (Spain), produced for 3DPast project**
*(© M. Mourão, 2020)*

**Technical drawings, printing trials, ESG, Portugal**
*(© G. Duarte Carlos, 2020)*

different components (such as digitalisation, creativity and communication), to enhance the exceptional character and outstanding value of vernacular dwellings.

The development of the project began by data collection, followed by several missions organised to the case studies, in order to develop site surveys, and collect records, and documents. In each site mission, observation, analyses, interpretation and co-relation were a key-approach for the content's development in the planned publications, the platform, and the App.

This contributed to enhance the quality of vernacular dwellings and for its maintenance and preservation. It definitely became a unique chance to experience the World Heritage special character, allowing citizens in general, youngsters and elderly, but also minorities and challenged people, to digitally travel as virtual visitors, to these sites.

## Outputs of the project

The project enclosed a programme of interdependent activities, which were carried out over a four-year timeframe. The activities included: an International Conference; several scientific digitalisation workshops developed by professors and university students (closely linked to the plenary meetings developed by the partners); in situ technical workshops for the transfer of local knowledge; survey missions covering geographically the European territory; several seminars developed during the time frame of the project and an international conference for further scientific dissemination; the creation of several dissemination tools as publications (illustrated book, booklet in different languages, international proceedings); and inter-active communication tools, such as a website with a digital platform to support virtual reality, videos, a digital booklet, a digital book, and an App.

The research was carried out with focus on World Heritage Sites selected across Europe. These were particularly relevant as they consisted of Inhabited Architectural Vernacular Sites that had been preserved, recovered and safeguarded by local craftsmen and their knowhow – a legacy passed down from generation to generation.

These European World Heritage dwellings were deeply studied, as were their building cultures, traditional systems and materials. Empirical vernacular knowledge was also fundamental to help understand heritage, and to widely disseminate local know-how, a positive reference for community good-practices.

# Vernacular World Heritage

A discovery
through
3 dimensions

# CROSSING DIMENSIONS AND COMPONENTS IN VERNACULAR ARCHITECTURE RESEARCH

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## Introduction

*Living and virtual visiting European World Heritage* (3DPAST project) is a research focused on the vernacular heritage of World Heritage properties across Europe. These sites are particularly relevant as they consist of inhabited architectural vernacular properties that have been maintained and safeguarded by local craftsmen and their know-how; a legacy that passed down through generations.

The project was based on valuing the significance of vernacular heritage tangible and intangible knowledge. This was possible by the development of innovative technological ways of reaching new audiences, which became a factor of distinctiveness of vernacular architecture in European World Heritage Sites. It also contributed to the identity and diversity of local communities, as ancient and new knowledge continue to be learned through traditional ways, but also through new communication tools.

*opposite page*
**Tower's trap door, Chazhashi, Ushguli, Svaneti, Georgia**
*(© G. Duarte Carlos, 2019)*

## The research problem

The inherent research problem associated to vernacular heritage, based on the pre-industrial activities and specific geographic site conditions leaves this legacy in a very sensitive situation. The challenges, once centred in the building conservation and management, considering previous paradigm of places without inhabited building cultures, have been systematically guided to local communities' issues. The actual socio-economic situation, especially enhanced by the thriving global networks, results in an unprecedent pressure for the inhabitants of such places, who are impelled to leave or to change profession at a remarkable pace.

The institutions responsible for cultural protection and preservation, aware of this fact, have been adjusting the approach, by converging strategies to protect and to support local communities, and enhance their role and responsibility in the process. The 3DPAST project, align with UNESCO conceptual recommendations and the European Commission technical premises for Cultural support, has drawn a strategy focusing on both, tangible and intangible aspects of the site's features, of which the present local community is not only an audience, but a fundamental part of the heritage asset.

A key factor for the research that was carried out was accepting the cultural dynamism of each place, and to contribute to more economical competitive communities with better living conditions – all without compromising the Outstanding Universal Value of the sites. The obvious tourist approach is no longer the only, nor the more adequate answer for the population prosperity. It has been confirmed,

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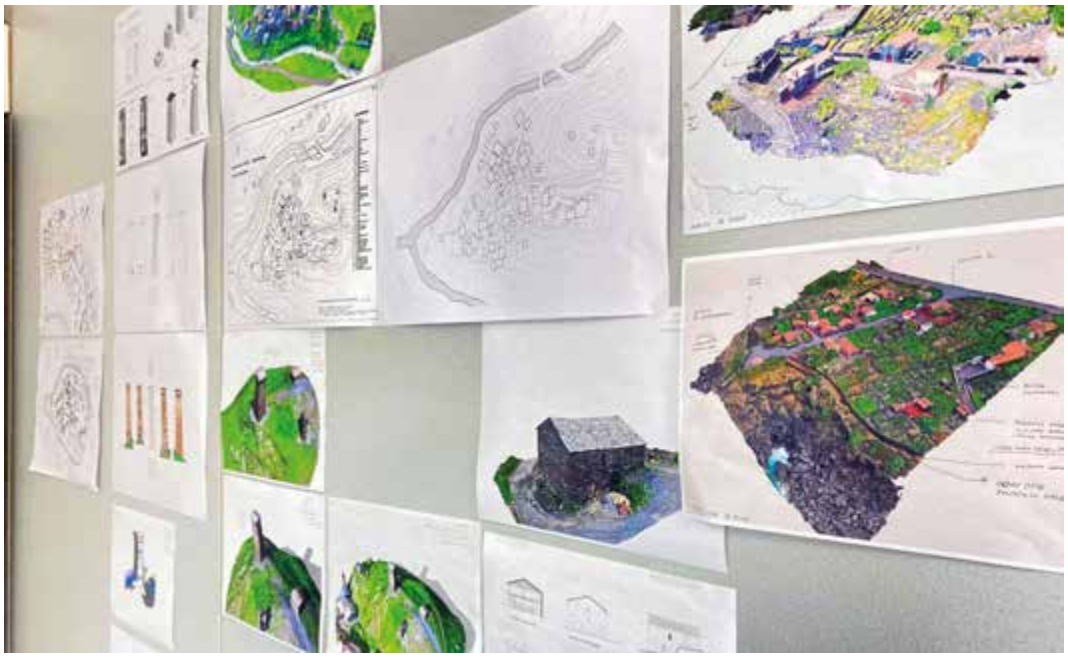

**Overview of some of the drawings and documentation produced for 3DPAST project**
*(© M. Mourão, 2020)*

especially in the long term, that just relying on tourism can have significant limitations and consequences for the heritage asset itself. The impact of COVID-19 confinement revealed the problems resulting from sites, regions and countries only focused on development based on tourism revenue.
The value of a place cannot be interpreted by its profitability rate, but this does not mean that it has to be assumed as a passive resource. Furthermore, it should be considered as its main resource, and it should be crucial for local population to be aware of that fact. Respecting all local communities' socio-economic expectations, suitable conditions and tools should be provided to engage local players; from local administration to private stakeholders.
The 3DPAST strategy attempted to stimulate measures that could be transversal to different economic sectors, promoting the audience spectrum beyond the obvious beneficiaries, and updating related contents and their exhibition, using digital technology as a determinant tool to preserve and promote the uniqueness that prevails on each site's cultural identity.

## Dimensions

The essential approach of the project presented a tripartite holistic interpretation, according to the following phenomenological dimensions of each World Heritage property:

- Architectural Heritage Dimension (D1) that is still persisting nowadays. Inhabited dwellings entailing a unique legacy that requires maintenance;
- Historical Building Dimension (D2), concerning building techniques and materials that can be tackled to the buildings. It also relates to particular socio-cultural episodes that can influence specific technologic changes;
- Intangible Heritage Dimension (D3), regarding craftsmen empirical knowledge to build and maintain the vernacular buildings. This third dimension was addressed all throughout the research, aim-

ing at preserving the immaterial culture of the building techniques in-use, based on the empirical existent knowledge.

The stated dimensions represent the classic homogeneous domains of analytic interpretations. Although isolated for methodical convenience and data collection pragmatism, they represent a connected corpus of information that is indispensable for the overall understanding of the traditional built environment. They also represent different scientific frameworks that range from geographical disciplines to anthropologic fields, specifically interrelated by the Architectural and Urban domain, in which the traditional building technology played a determinant role.

## Components

Aware to the fact that the project represents a unique opportunity to experience the special character of the World Heritage, the main structure of the project was developed through 3 major components that were interconnected with the 3 stated dimensions, which contributed to the enhancement of the significance of the World heritage properties:

- Digital Component (C1). Digital interactive communication tools were developed, considering new digital realities for people who cannot travel and visit the exceptional and unique heritage of the listed sites;
- Creative Component (C2). Creative potential was associated with observation drawing, artistic drawing, photo, video, digital image, etc., aiming at different audiences;
- Communication Component (C3). Communication was considered as a tool of work, in order to better structure and disseminate the project.

The main outputs were essential to enhance the contribution of the distinct components. The digital component was boosted through an app and a digital platform, but also through the collection of data though photogrammetry, and other recording techniques. The project was also enriched by using Virtual and Augmented reality. The creative component was heightened through different data collection such as drawings, photos, videos, art installations, drone record, etc. Data was also collected and transfer of knowledge was achieved during the workshops organised in the different case studies countries. This was possible through the organisation of scientific workshops, digital workshops, technical hands-on workshop, art workshop, etc. The communication component was responded through the organisation of a large online international conference,, the production and dissemination of videos, the organisation of different international seminars, the dissemination of activities among different networks, etc

## Data collection and survey missions

The project was based on the collection of data gathered from several vernacular architecture World Heritage properties, but also from national and international archives, and on the Internet. Data was also gathered before, during and after the site missions. Following, revision of the literature was ad-

**Photogrammetry and Plan of the World Heritage property of Upper Svanetti (Georgia), produced for 3DPAST project** (*© Ci-ESG, Escola Superior Gallaecia, M. Mourão, 2020*)

dressed, in order to identify relevant issues to consider for the content's development. Site missions were undertaken to all the selected sites, by partners and university students, to work on surveying, recording and drawing, in order to properly document the sites. Some dwellings were chosen as case studies and were deeply studied through architectural surveys (intended to respond to Dimension 1), and through historical dwellings analysis (to answer to Dimension 2). Craftsmen that were still active were also contacted to share their knowledge regarding building's maintenance (to address Dimension 3).

## Content's development and scientific review

Efforts were mainly devoted to the development and production of contents concerning the three dimensions of work and their specific outcomes. A general methodological approach for site maintenance, for historical, tangible heritage building cultures, and for intangible heritage knowledge was previously established to address systematic and consistent approaches across the different sites. This activity addressed specific contents for each selected site. Later on, site missions to World Heritage properties were accomplished to validate the produced contents. The crossing of findings from the missions with the results emerging from the data collection and the literature review contributed to a comprehensive scientific analysis of the subject.

## Working plan

3DPAST developed a methodology that was addressed in the three dimensions, which can be applied in the future in other heritage researches.

Its approach consisted in:

Phase 1 | Planning: it relates to the planning of the activities and establishes organisation procedures.

Phase 2 | Data collection: To address data collection for the different dimensions in the sites, in local and national archives, international institutions, and on the Internet.

Phase 3 | Content development: a) To define methodological guidelines for a consistent approach in the different dimensions and sites following data collection; b) to produce content development con-

**Photogrammetry of the World Heritage property of Upper Svanetti (Georgia), produced for 3DPAST project**
(*Ci-ESG, Escola Superior Gallaecia, M. Mourão, 2020*)

**Photogrammetry and Plan of the World Heritage property of Upper Svanetti (Georgia), produced for 3DPAST project**
(*Ci-ESG, Escola Superior Gallaecia, M. Mourão, 2020*)

sidering the aimed outputs in the different dimensions; to address capacity building in all the dimensions, through technical and scientific workshops;

Phase 4 | Implementation of communication tools: To implement the developed content through effective communication tools;

Phase 5 | Outputs and dissemination: a) To develop specific and effective outputs; b) to address a cross-approach regarding the dissemination of results.

The project offered the opportunity for non-traveller citizens, to visit other dimensions, through videos, photos, diagrams and 3D modelling of World Heritage Sites in Europe. The project also intended to attract tourists to these sites, through the use of 3DPAST Mobile App on site, which opened the mind to other ways of inhabit, as well as to new audiences. These digital interactive communication contents are now available on a 3DPAST Digital Platform that was created throughout the project (www.esg.pt/3dpast/platform).

## Conclusion

It is undeniable that vernacular architecture in European World Heritage has been progressively studied. The research problem shifted from the historical and architectural characterisation to the understanding of their building cultures.

Empirical knowledge beyond tangible heritage is still existent in these sites, and must be preserved and widely disseminated. Local know-how becomes then a positive reference for good-practices.

Intervention priorities, previously focused on the traditional materials and building systems technical conditions, are now complemented with the promotion and support of the related empirical knowledge. The 3DPAST initiative was set according to these principles and expects to actively contribute to the development of such conceptual approach.

# DISCOVERING VERNACULAR HERITAGE AND ITS TANGIBLE DIMENSIONS

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*opposite page*
**Pico's Island** (© *D. Matos, 2017*)

Considering the built environment as the most enduring receiver of human behaviour, one can easily assume vernacular heritage as an objective consequence of the essential features of specific local communities.

As a form of cultural expression, vernacular heritage has the advantage of constituting a pragmatic testimony of the main subsisting activities and their geographical relation, balancing the focus within the social relationship of their community groups (Oliver, 2006). This local environment-human appropriation dichotomy is clearly expressed from the territory occupation to the applied technology (Llano Cabado, 1996). This symbiotic relation is often responsible for the reinforcement of the regional cultural identity, developing specific features that influence the consubstantiation of a particular building culture (Rapoport, 1972).

The resulting building environment comprises the natural resources management, the adaptation to the climate and to the environment conditions, and the inhabitant's technological knowledge. Vernacular architecture emerges from the synthesis of these conditions. When recognised as a heritage asset, its morphology becomes the fundamental material statement of the community's values, representing their main traditions and stating its collective memory.

It is within this approach of material statement recognition throughout morphologic interpretation that the 3DPAST research *Living and virtual visiting European World Heritage* was endured. The selection of World Heritage sites, which integrated vernacular built environments, emphasises the identification of their tangible exceptional features, promoting a more objective morphologic interpretation, resulting in a pragmatic characterisation and subsequent analysis of the sites.

The pursuit tangible dimension is therefore contained from the landscape perception of the place until the craftsmen's tools for the community activities.

The vernacular built heritage represents the physical link between these scales and the stated abstraction levels, conforming from the collective perception to the recognition of the place. The approach that was considered for the selected case studies followed a formal depiction method, developed within four general levels of scale classification.

## Landscape and territorial scale

The landscape level regards the territorial occupation, reflecting the human appropriation and management of the natural surrounding elements. It is a direct reflection of the main structures and in-

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**Settlement of Upper Svaneti and the surrounding mountains, Georgia**
(© *M. Correia, 2018*)

frastructures locations, the settlement's distribution according to the natural resource's exploitation and their direct relations with other communities.

The consolidation of the territory features into what we understand today as cultural landscape, is directly related to the applied solutions for the local communities' survival, balance and prosperity activities. The analysis of this level allows understanding the main subsisting activities of the social groups that coexist in a specific region. It comprises the selected strategies to take advantage of the particular physical geography conditions and to attain the best possible outcomes.

It considers also the communication itineraries, the direct access to the local resources and the suitable structure accommodation considering climate, sun exposure and the geologic characteristic of the region.

The territorial occupation reflects the settlements relation towards the geographical context, usually classified as the physical support or 'super-structure' (Correia, Dipasquale, Mecca, 2014). The super-structure is constituted by the relief variations and the water lines and basins, conforming the main spatial delimitation of the vernacular built environment influence area.

Forest, pasture and extensive agriculture can be identified as the most common distribution soil system, conforming the first macro-scale landscape conception. The macro-connection system also plays an important part, as it is deeply related with the local communities' external relations. These relations comprise the foreign cultural ties of these settlements, representing their regional economic and political dynamics and affecting local characters such as trading, defensive and religious aspects.

The landscape preponderance is particular striking in places of rough natural conditions, such as the Upper Svaneti settlements, in Georgia. The Caucasian mountain atmosphere is the essential reason for the occupation of these extreme territories, in order to increase their defensive ability, as a regional enclosed redoubt. In these isolated villages, the management of the winter cycles and their relation to the natural elements is a matter of plain survival. From the communication infrastructure efficiency, to the melting snow water lines, everything contributes to the territorial appropriation strategies.

## Settlement's urban layout

The Settlement's urban interpretation configurates the analytical depiction concerning the build clusters, their overall organisation and spatial structure. It concerns the relation between the collective domain and the private property, being special attention paid to the residential building aggregation.

Due to its nature, vernacular elements usually resort to organic layouts, strongly conditioned by the topographic support. The resulting overall shapes are usually consequences of dynamic aggregation logics, rather than hierarchic intentions, assuming informal and flexible patterns of irregular geometric forms. This is often interpreted as a reinforcement of the terrain configuration, but rather as a consequence than a voluntary act, since some of the urban layout solutions are a direct result of the available building technology, which can lead to very abstract configuration results (Oliver, 2006).

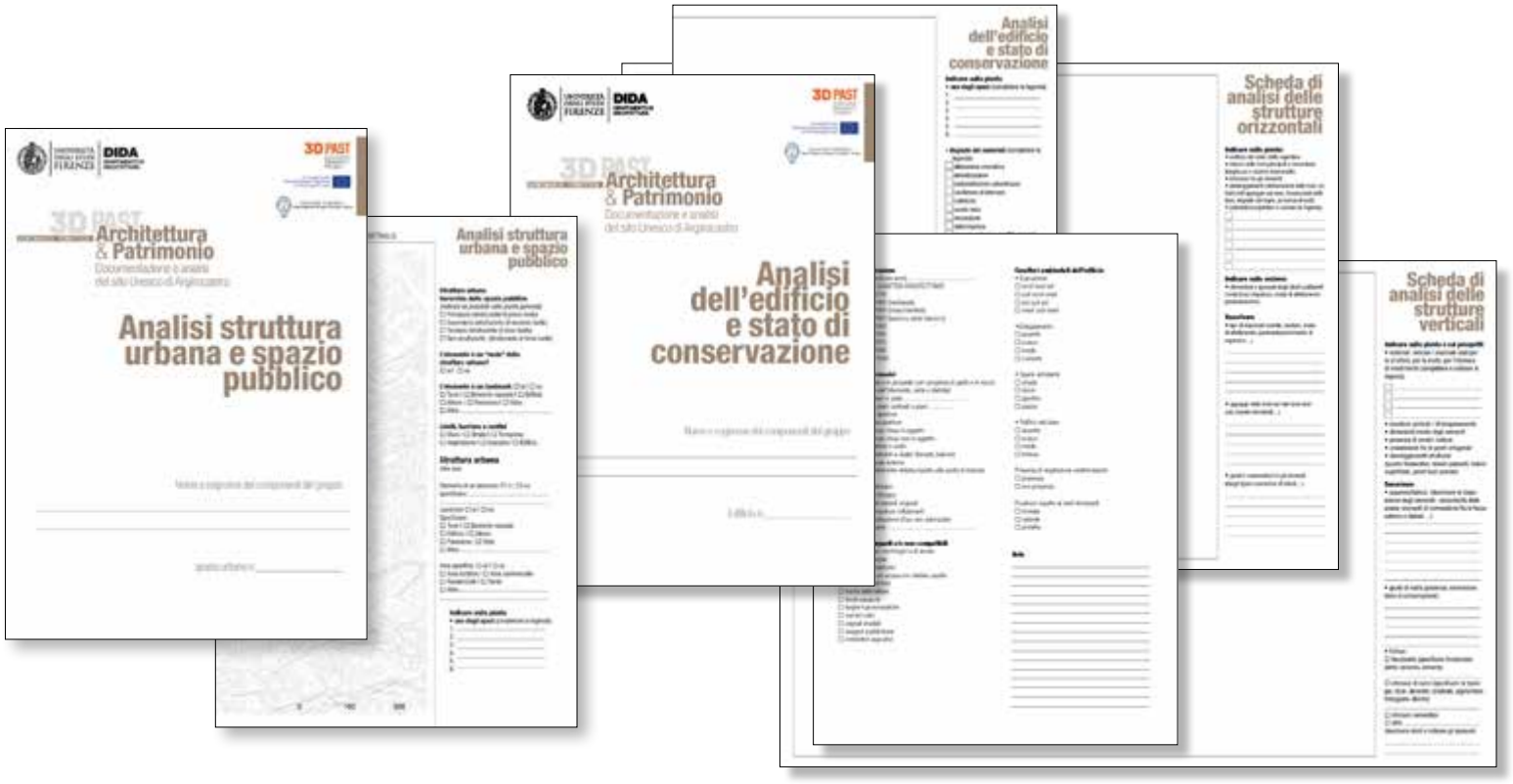
This is the case of Cuenca's location for the original 'skyscrapers' block aggregations, located precisely on the cliff that surrounds the settlement, emphasising its general defensive character, despite their residential use, acting as true urban element of collective purpose. The settlement's urban layout also responds to the social organisation of the inhabitants, enlightening collective rituals and behaviours, assuming their groups, bonds and tendencies into spatial differentiation or even segregation. This reflects the elected cadastre system and the internal access solutions, includes the main infrastructure boundaries and implies a relation with the main collective symbols, usually represented by exceptional built structures for communal support (Correia, Dipasquale, Mecca, 2014).

## Architectural unit description

The study of the architectural element is mostly related to the identification and characterisation of the traditional architectonic typologies. Despite the informal aspect of the vernacular solution, it frequently assumes rigid logics of development, in which one can identify different phases and organisation settings, consolidated in stereotype models. Since they are related with empirical knowledge and regional restriction, these models accentuate the coherence of their variations, without significant ruptures in time, space and form. Therefore, less affected by cultural contamination and external technology, they tend to represent a morphologic continuation, stabilising architectural solutions and configurations into cultural patterns (Rapoport, 1972). This cultural pattern, of abstract perception, is widely associated with specific places and groups.

As it should be expected, concerning the vernacular built environment, the dwelling constitutes the major focus of study, dominating a great percentage of the concerning literature. This situation is related to the opportunity of the community's quotidian perception, throughout the domestic conditions expressed by the residential typologies.

Concerning the architectural unit scale, the study of the dwellings offers very objective premises in terms of family structure, reflecting matters of lineage or clan interactions. The partitions hierarchy and configuration, the segregation between intimate and collective areas, the separation and transition between




**Survey data sheet used in Gjirokastra, Albania**
*(© Dar Med Lab, DIDA, UNIFI, 2019)*

the social and the private domain, are all effects of architectural expression of high ethnographic significance.

There are visible cases where the main communal activities are responsible for the development of specific constructions completely differentiated from the residential use. But, with minor exceptions, they are always a complement to the anthropological shelter necessity (Oliver, 2003).

One excellent example is the case of the wine cellars of Pico's island, a vineyard cultural landscape listed as World Heritage since 2004. The wine cellar constitutes the fundamental cellule from which all the typological variations are generated. Nevertheless, this is a circumstance determined by their seasonable occupancy and their relative proximity to the villages, in which the inhabitant's main residences were located. These complementary buildings contain the understanding key to the inhabitant's labour and surviving strategies: from agriculture exploitation to fishing deeds, from cattle breeding to alimentary processing. These production utilitarian units are strongly connected to the natural resource's consumption and management.

Defensive, commercial, ludic or religious propensity are also traces to attain when studying the architectural traditional typologies, usually determined by historical episodes of intense or consistent impact that reflect a wider regional relation (Asquith, Vellinga, 2006). The Transylvania villages with fortified churches, a World Heritage serial property in Romania, are a good representative of this reality expressing the incursion and settlement of Saxon groups through eastern territories, constantly subjected to local and foreign disputes and migration movements. The circumstances defined the exceptional development of building solutions that expressed their religious identity and their adaptation to military protection.

## Construction technology analysis

Regarding the building technology analysis, the vernacular built heritage can be synthetised as the crossing between available material resources and empiric knowledge. The building material is usually circumscribed within the conventional traditional alternatives, resorting to less transformation as possible, due to tools and energy restriction. This does not mean that the building solutions are not efficient and creative; on the contrary. The lack of technologic resources is usually compensated, according to Frey (2010), by extremely pragmatic and inventive construction solutions, providing the development of very peculiar systems and techniques. The cantilevered verandas of the 'hanging houses' of the World Heritage historical centre of Cuenca in Spain are a well-detailed example of such solutions, demonstrating an interesting articulation of wooden floor structure and stone masonry.

As it should be expected the observed building systems present a stone masonry predominance on the south part of Europe, with more presence of mortar on the regions of the Roman historic influence. Some of the driest climates also apply earthen construction systems, and some of the more populated locations also determine the use of firebrick building methods. The use of wood is transversal to all cases, particularly in the upper floor and roof support structure. However, its preponderance in other architectonic elements increases considerable, as one goes into the north of the European territory. The World Heritage site of Old Rauma's, in Finland, demonstrates the wood usage in its full potential, assuming it from the rough structure to the delicate finishing, and from the internal elements to the external coatings.

Despite the objectivity of the data regarding the traditional building systems, the present interpretation is rather restrictive when there is limited documentation of the traditional building techniques and processes. Once again, Old Rauma constitutes an excellent example in the perpetuation of the building crafts, implementing mechanisms for local training and traditional architectural intervention support.

In conclusion, for preservation and conservation matters, the collected data only makes sense if one can apprehend the local building culture essential characteristics, understanding as well the associated intangible knowledge, in order to perceive the site's authenticity. Accordingly, this is a premise that needs to be extended to all the morphologic analysis, from the territorial display to the construction detail interpretation.

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Historic settlements are like palimpsests that, in many ways, have become stratified over centuries in urban, architectural and constructive terms. The current appearance of a given historic centre or vernacular nucleus is the result of multiple layers and phases of its life, which have been superimposed. These include the direct interventions of construction, transformation or retrofitting, as well as the degradation of materials, structural lesions or incidents suffered. Unwritten and undocumented history is often reflected in the built substance of the buildings that make up these towns and cities (Mileto, Vegas, 2015). Understanding the dimension of the historical evolution of their urbanism, architecture and construction allows us to consciously respect their values, introducing the necessary changes and transformations to suitably adapt them to contemporary life, and to write this palimpsest without having to completely erase or cancel the fragments written in the past.

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**Passage at Biertan, Romania**
The current appearance of an ancient building is the result of multiple superimposed phases of its life, to understand and respect while adapting it to contemporaneous standards
(*© F. Vegas, C. Mileto, 2017*)

## The urban dimension

The layout of urban or rural settlements is born of different factors: defensive, in search of higher up areas; topographical, such as curves in the ground; commercial, with the existence of communications between paths, rivers or canals; or pragmatic, such as individual access of each plot to the respective properties or crops. Some are vital, such as water supply, the existence of hunting or fertile countryside; climatic, searching for optimum ventilation, sunlight or shade, while social factors aim to distinguish between public and private spaces and their use. These locations are never haphazard, but rather the result of centuries of trial and error, which have established the best location and layout for surrounding conditioning factors.

Rural nuclei are often clustered on the southern slopes of a mountain, so as not to occupy arable land in the valley, while ensuring as much sunlight as possible, and avoiding possible floods. They thus find the most sheltered corners from the dominant winds, and thus spared from avalanches or landslides. In seismic or volcanic areas popular experience makes it possible to avoid settlements in the more conflictive cracks and faults, or arranges them in streets or avenues to minimise disruption (Vegas, 1999). There is wisdom in a non-haphazard placement of settlements, often forgotten until natural disasters act as a reminder of the initial reason for these locations.

In other cases, the location of these settlements has created its own physical or even orographic conditions for their survival and quality of life. Thus, for example, the old prehistoric nuclei of the plains

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**The city of Sibiu (Romania) is a good example of a built palimpsest that has managed to adapt to contemporary life without damaging its historical architecture**
*(© F. Vegas, C. Mileto, 2017)*

**The addition of new built volumes or the introduction of modern materials, precast elements or pre-dosed mortars in well-preserved pristine settings, such as this complex of the village of Archita (Romania), would seriously affect its vernacular character**
*(© F. Vegas, C. Mileto, 2018)*

were built successively over the remains and rubble of earlier ruins or torched or looted constructions, successively elevating the ground to create *tells*, which become useful defensive vantage points. It is also common to find that the unhealthiest and most foul-smelling activities were located where the wind could blow the effluvium away from the population rather than towards it. Sometimes, screens were built to protect from the most insidious wind by strategically locating secondary buildings, such as grain stores or warehouses, which receive the initial impact of the wind, protecting the main nucleus of population.

Towns and cities have gradually grown or been transformed on themselves, even unconsciously respecting these tacit rules for a logical urbanism, on which their defence, support or survival depended. Breaking such rules, implicit in the urban layout, entails negative consequences from floods or catastrophes on a never-before-seen scale, to higher energy costs, or worse quality and conditions of life.

## The architectural dimension

Architecture is also the result of the combination of available materials, climatic conditions, and local idiosyncrasy and culture. Like urbanism, it is not completely static but has traditionally been subject to modifications and transformations on itself, rather than to complete demolition and new constructions. Therefore, in a single facade or especially in an interior, it is easy to find structures, walls, elements belonging to past times, to past phases of the building. That is why it does not make sense to only protect facades as urban scenarios of buildings void of content, as the buildings are likely to incorporate elements that are older and possibly even more valuable than the facades themselves.

Over the centuries, buildings have undergone a gradual transformation deriving from the technological advances that improved the quality of life of their residents, who arrived in each individual location at a specific point in time linked to specific circumstances. Not all these evolutions have taken or will take place in the future, as they all depend on local conditions, although many reflect a common trend.

The evolution of roofs and floors often attests to the progressive scarcity of wood in some places and the search for solutions that are less reliant on it, incorporating specific flooring and progressive insulation

from the lower floors. There is a transition from exclusively wooden floors and roofs to those combined with other materials, a shift from floorboards laid directly on joists, to layers of anhydrite or lime and brick dust terrazzo flooring, or from gypsum paving to terracotta, glazed or cement tiles; all types of flooring, often found superimposed.

In the distribution, this evolution saw stables smelling of hay and manure transformed into garages smelling of fuel; attics became part of the dwellings; spaces which were traditionally for servants were used to expand the dwellings; workshops and work spaces on the ground floor became commercial premises. Smaller dwellings were grouped to increase their size or divide mansions and single-family buildings into apartments.

Balconies were added to facades with full length windows, while wooden railings were replaced with wrought or forged iron ones (Privitera, 2015). Small windows, scattered around the facade to provide daylight and ventilation, were transformed into academically ordered facades with large openings. Decorations were added to facades and systems to filter sun and shade evolved.

Glazing was added to window carpentry, replacing the oiled linen screens and other materials, which let light in, while the size of the windows increased, as the manufacturing processes produced larger glass panes. The transition from the original wooden shutters, as the only carpentry, to blinds took place; hinges evolved from hinge hooks and wrought iron hinges to butt hinges; and the invention of the *cremone* and *espagnolette* bolts made it possible to eliminate the central mullion of double windows.

In terms of installations, running water, electricity and gas were added to interiors; candles were replaced with candlesticks, Argand lamps, oil lamps and electric lighting. Traditional heating systems such as *gloria* heaters (Vegas, Mileto, 2014), braziers or ceramic stoves evolved to be replaced with hot water radiators. Plumbing made it possible to add lavatories in dwellings, while there was a transition from the kitchen hearth to the ceramic stove, metal stove, and gas or thermal induction stoves.

The building is also a built palimpsest of the history of the city, often showing how it has lived by transforming and adapting to the needs that have arisen over time. These modifications were often carried out by taking advantage of the existing building, thus leaving the traces of its previous life. In the past, this philosophy was a response to saving on resources. Now, we simply know it as sustainability, since experience has shown us that, with the odd exception, the greenest building is the one already built (Elefante, 2014). It saves on resources and use of existing structures, without generating rubble from a demolition. This sustainability, which is becoming increasingly clear, together with the preservation of the cultural identity reflected in the built palimpsest of the building, should be reason enough for us to intervene and conserve, restore, retrofit or adapt to contemporary habitability standards. It is necessary to proceed with the utmost caution and to respect the previous phases of the building, seeking a middle ground for their conservation.

**The excellent conservation of the village of Viscri (Romania) requires not introducing at all or inserting only those changes that are strictly necessary so as not to affect the harmony of the complex**
*(© F. Vegas, C. Mileto, 2017)*

## The constructive dimension

The material substance and constructive essence reflected in the architecture of a given settlement is the result of centuries of local tradition deposited in it. The availability of different materials, usually sourced nearby, generates logical combinations of these to make up local architecture. Taking into consideration the existing limitations, these are the best solutions in response to climatic conditions, sunlight and ventilation needs, seismic activity, etc., as they distil the wisdom accrued from similar circumstances in the past.

In some cases, the presence of rivers, along which wooden logs could be transported, or seas, where cargo ships sailed, increased availability to hundreds or thousands of kilometres, even in a seemingly non-globalised past. River or maritime transport of wood (Diodato, 2015), the sale of iron bars from enclaves other than those of local foundries (Privitera, 2015), a trade in brick, perhaps used as ballast on return voyages (Mitchell,1997), and glass transported from production centres, are just some examples of the raw materials that used to be supplied for construction, and which were not always gathered from the immediate surroundings of the buildings.

The idea of local materials has long been much broader thanks to water communications, which were extremely cost-efficient in terms of energy as they mostly used wind or currents. From the 19th century on, improved communications by land further increased the potential to acquire materials from elsewhere, even defying logic, economy or traditional aesthetics.

In particular, the addition of industrially manufactured materials, especially predosed or prefabricated ones, burst into well-conserved artisanal surroundings, homogenizing constructive solutions and erasing the cultural wealth and diversity, which is characteristic of vernacular architecture. Although the

**Repair of a roof with a wooden board in old Rauma, Finland**
*(© F. Vegas, C. Mileto, 2017)*

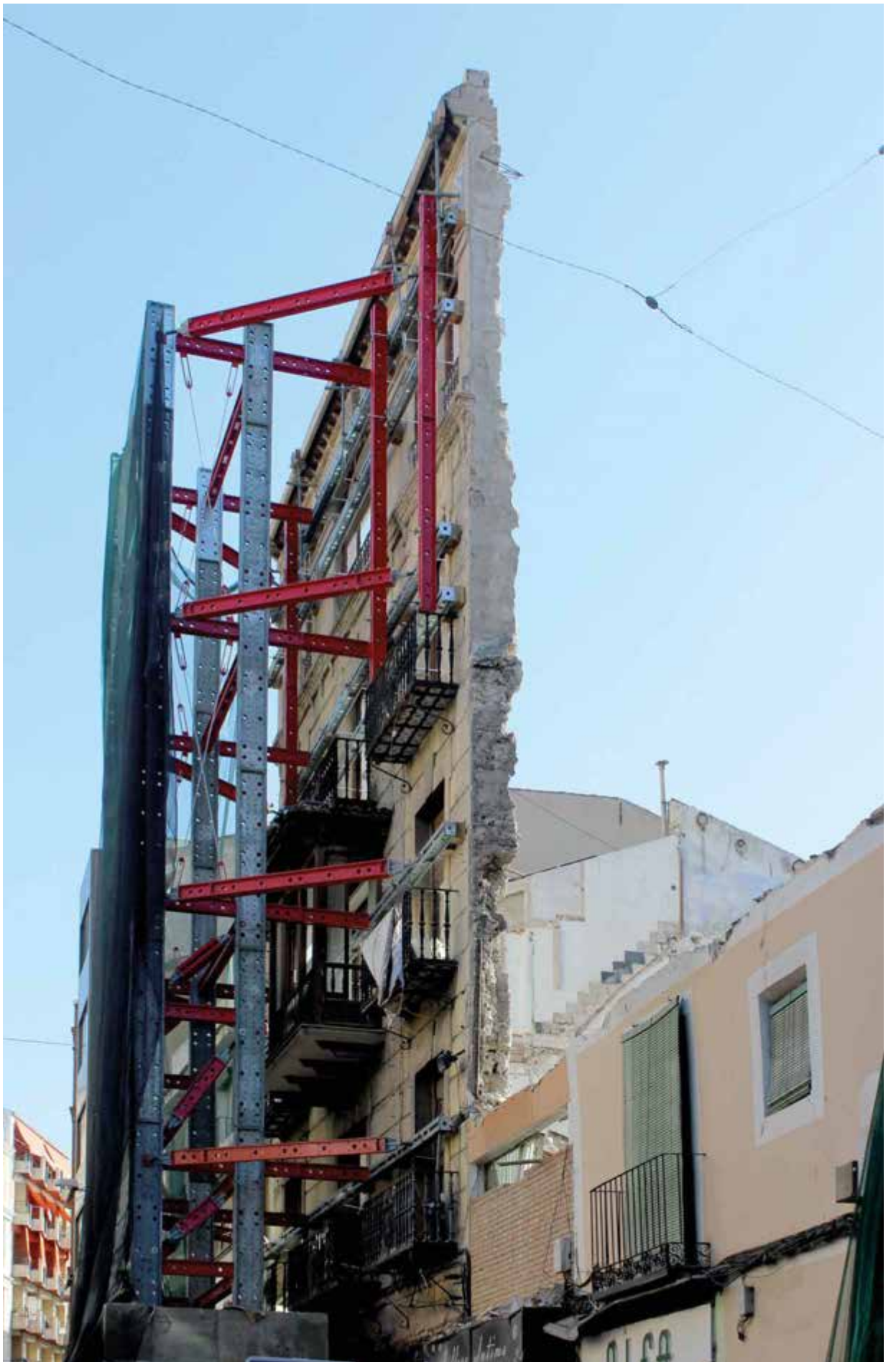
vernacular spirit called for the spontaneous use of all available materials, these did not necessarily integrate in the same way as materials extracted locally, or those traditionally imported.

The consequences are not merely aesthetic but also economic, as architecture that has been manufactured or restored by local craftsmen or artisans goes straight back into the local economy. This contrasts with the acquisition and use of industrial products and solutions, as investments benefit the factory and production centres, far from these settlements.

## A lesson to be learnt

All these factors must be taken into account, in order to understand the dimension of historical evolution of the heritage of a historic centre or vernacular settlement. The main problem faced by our historic and vernacular nuclei is the staggering speed of current globalisation. It does bring materials, forms, elements and solutions that can be imported at greater speed than they can be absorbed, which did not occur in the past. There is a risk of complete loss of this heritage which has been passed down that also represents our identifying traits. All this suggests a series of recommendations derived from knowledge of the stratification philosophy described:

- Softening changes to be introduced in consolidated built surroundings, both in terms of materials, which are preferred if manufactured, and of new uses.
- Preventing building speculation to save full buildings with their interiors from demolition, avoiding both excessive elevations and combining plots for tertiary uses.
- Stopping demolitions as a result of ignorance or lack of knowledge of the constructive materials and their performance and potential to be consolidated and restored.



- Adding our intervention to the built palimpsest, respecting the previous constructive phases and showing sufficient awareness not to disturb the overall balance.
- Respecting the consolidated built scenario as it stands today, given the difficulties in operating or reproducing the traditional vernacular attitude.

All these recommendations, applied to each context as relevant, allow the built heritage of our historic centres and vernacular settlements to be conserved, so that future generations can enjoy and benefit from this reflection of their cultural identity.

*opposite page*
**Complete demolition of a building only keeping the facade, a terrible and misguided example of conservation of the historic palimpsest of a city, in Cuenca, Spain**
*(© F. Vegas, C. Mileto, 2016)*

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*opposite page*
**Intangible heritage is transmitted socially from parents to children, from masters to apprentices, from the elderly to young people, generation after generation**
(*© F. Vegas, C. Mileto, 2017*)

Architectural heritage is not solely the built object. It also involves the transmission of vernacular culture and wisdom and constructive know-how. Physically tangible heritage could be said to be based on a complex, articulated and rich intangible knowledge, which is a sort of intangible heritage in its own right. It is undoubtedly the most social and human aspect of heritage, as it is linked to all kinds of culture, activity, customs and human representations. Intangible heritage is linked to the sustainable way in which individuals understand, settle in and relate to territory and climate. This intangible heritage is often expressed through vernacular architecture on its different scales – urban, architectural, and constructive.

The well-known Chinese *feng shui* and its lesser-known versions from other traditional cultures from other countries safeguarded the correct choice of materials, location, configuration and placement of cities, habitats and objects. *Feng shui* is essentially linked to the environmental conditions of individual places, but has shown itself as a perfect way for codifying and transmitting traditional wisdom from generation to generation.

## Urban dimension

The urban dimension of this intangible heritage is the equivalent of the cosmogonic vision of the culture in question, its social structure, and human relations, combined with climate and the relation to the presence and supply of water and other resources which, together, make up the city. All these factors configure the urban outline of vernacular settlements to varying degrees, depending on each case. An interesting example, which completely reflects all these factors, is that of the Dogon people in Mali, whose traditions have remained mostly intact until now. Behind the apparent disorder of the towns and villages of the Dogon tribes along the Bandiagara fault lies an anthropomorphic urbanistic layout that vertebrates human relationships, and adapts in all cases to local orography. In this configuration the head is usually oriented to the north, and occupied by the forge and *toguna* or shelter, where the elders convene. Most of the dwellings are found along the chest and stomach, while the women's home, where women stay during menstruation, is located in the hands. The sanctuary with common altars is in the feet, while in the centre we find the female oil quern and the male altar of the foundation of the people (Griaule, 1966). Its position in the great Cliff of Bandiagara also provides cool air, timber, water, protection and defence. This cultural response only represents the urban level. The actual fabric of its buildings, whose formation will be examined later in the text, is conditioned by locally available materials. This cultural cosmological-religious component exists or has existed in all cultures. In Western culture,

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Letizia Dipasquale, Saverio Mecca, Mariana Correia (edited by), *From Vernacular to World Heritage*, © 2020 Author(s), content CC BY-NC-SA 4.0 International, metadata CC0 1.0 Universal, published by Firenze University Press (www.fupress.com), ISBN 978-88-5518-293-5 (PDF), DOI 10.36253/978-88-5518-293-5

**Traditional trades interpret the needs of the place and solve them by using the materials available nearby**
(© *F. Vegas, C. Mileto, 2017*)

suffice it to think of the prevalence of the positions on the right-hand, rather than on the ill-omened left, writing from left to right (rather than the opposite or vertically as in other cultures), the frequent cross-shaped layout of Catholic churches or their orientation to the east, to name but a few examples. These components are easier to perceive and identify the further the distance of the observer from foreign cultures, although in some cases these have seemingly disappeared. Occasionally, this cosmogonic vision even outlives the disappearance or complete transformation of the original architecture, as it is the case of the current vernacular habitat and its forms of grouping in Mexico (Torres Zárate, 2000), or the current concept of plaza (Wagner et al., 2013), which have been shown to have inherited the cultural interpretation of the pre-Columbian peoples, as shown recently by these authors.

The outline of the streets is also largely a response to the needs for daylight and ventilation, as well as a desire for protection from excessive solar exposure and the shifting winds. The layout of streets, levels and slopes are often the result of a need to organise the runoffs for collecting water for consumption, or to allow it to run off with the least possible damage to constructions.

The climatic conditions combined with local ancestral culture – also often defined by the climate – result in the existence of filter locations, in-between spaces usually associated with the need for shade in warm locations (Vegas et al., 2014a). These in-between spaces can take on different forms: courtyards, porches, pergolas, gazebos, verandas, awnings, the shade of large trees, etc. This intangible knowledge of the weather conditions also makes up and shapes urban design in its transition to the architectural scale.

Local culture, with its conception and abrupt or progressive delimiting of the private and public spheres, also configures the urban design of cities. In the Islamic city for instance there is a veritable transition between openly public space and completely private space in five or six degrees of in-between space, which can be observed in the decreasing width of branching streets, morphological characteristics of urban space, architectural elements, the treatment of paving and the use of light, water and filters (Mileto, Vegas, 2003). These hybrid semipublic or semiprivate spaces can coincide with the in-between spaces mentioned above (Vegas, Mileto, 2013).

**The use of wood to create walls in vernacular architecture depends mainly on the availability and local abundance of this material and has generated specific construction techniques according to each context**
*(© F. Vegas, C. Mileto, 2018)*

**Openings on the facade have different treatments depending on the culture, as well as its windows and respective maintenance**
*(© F. Vegas, C. Mileto, 2018)*

This intangible heritage, which reflects profound knowledge of the enclave of each individual architecture, also dictates and shapes the existence of city squares and enclaves for temporary or permanent markets. It also defines the creation of large meeting spaces sheltered from inclement weather, like mosques that host many other activities apart from prayer, as opposed to Christian churches. It also determines individual or collective forms of habitation, in the form of single-family dwellings, housing in rows, blocks, etc. and the form of use of open domestic space, either private or communal, depending on local idiosyncrasies, in the shape of house courtyards, inner block courtyards, open Italian *corte*, English yards, open Finnish *piha*, etc. (Dipasquale et al., 2014). However, intangible knowledge is not limited to urban configuration and placement but also extends to housing interiors.

## Architectural dimension

The concept of dwellings depends on the culture of each individual country. When these cultures have been expressed through hieroglyphs, rather than syllabaries or alphabets, each individual concept can be observed through the schematic drawings used. Thus, Sumerian houses seem to represent a floor plan, Chinese houses represent a roof section, and ancient Egyptian dwellings are square complexes designed based on floor plans, where one of the sides forms a spiral, with a clear desire to protect the interior. This concept of a bent entrance lives on in traditional Arab housing, which often has L-shaped entrances designed to preserve privacy in the dwelling.

The dwellings of each culture also depend on the territory and the forms of settlement within it. The vast Chinese plains have resulted in symmetrical dwellings, while the predominantly mountainous Japanese space gave rise to a type of modular dwelling – given its use of timber – that was asymmetrical – as dictated by the orography – and adapted to the nature around it, following the Shinto philosophy in which even stones have a life of their own. The old dwellings and chicken coops on Easter Island were shaped like the upturned hull of a boat, the island's only means of communicating with the outside world. The concept of dwelling is completely different for the inhabitant of a palafitte on water, an igloo in the tundra, an underground habitat or a house in a tree. The conception of the world of the

residents and the materials used also shape it, more squared or organic, and the life within it also, eventually, reciprocally influences the vision of its inhabitants.

Fractal patterns are often used in Africa, this is to say self-similar and self-organised forms progressively repeated on different scales, not only in the design of the dwelling, but also in the decorative patterns of their arts, paintings, hairstyles, etc. (Eglash, 1999). This use of fractals is widespread in Africa as a design guideline, with multiple variants stemming from intuition and observation of the fractals found in nature, rather than a mathematical analysis of reality. In other cultures from other continents there is a predominance of the concept of mandala, grid, spiral, symmetrical circular and cross forms, squares and circles combined, etc. In addition to spatial organisation, the African fractals translated into the shape of villages and dwellings outline the map of the social scale on a geometric scale.

An interesting example is the village of Ba-ila in the south of Zambia, where the urbanistic placement in the form of an open ring is reproduced on a smaller scale inside the domestic enclosure, which is larger in size the more powerful the resident, and is repeated in a smaller format in the shape of the dwelling, and further down again in the house of the spirits. These small symbolic models housing the spirits within the home, also found in many other cultures, are a representation of the collective imagery of habitat.

The Dogon dwelling does not use fractals but is coherent with the anthropomorphic configuration of its settlements on a smaller scale, often taking the form of a sitting man. This follows a rectangular floor plan where the head is a kitchen with a circular floor plan, the body is the living room, the arms are stores for food or tools, and the feet are made up of the main entrance hall (Griaule, 1966; Lauber, 1998; Vidal, 2009). The human figure continues on a smaller scale as a decorative pattern in the reliefs of dwellings, doors, etc. Anthropomorphism is not exclusive to the Dogon people, and it is widespread throughout other locations in Africa (Guidoni, 2000).

The Dogon toguna is a low shelter with openings on all sides, and a roof up to three metres thick made up of branches interwoven on nine wooden pillars and fulfilling several requirements at the same time. Firstly, it responds to the need to allow for ventilation and to create a light shade on the fretwork roof in the warm rigours of local climate, but its half height is due to the belief that heated discussions are not possible in the sitting or lying down position imposed by the form of this shelter.

The concept of family or basic or extended social nucleus, closer or spread out to several generations and branches, is a major determining factor in the dimension of the habitat and its internal articulation, as well as that associated to other dwellings. The proxemics of use made of personal space in every culture, whether smaller or more extended, determines the size of domestic spaces, of the dwelling and of its immediate surroundings, just as it is reciprocally influenced by the morphological characteristics of the territory, access to water supply and other resources and population density. The type of work practised in primary, secondary or tertiary sectors also largely defines the configuration of residential buildings, the existence of workshops, businesses, stores, associated garages, etc.

**Group of young blacksmiths working on the repair and maintenance of a temple at the churchyard**
*(© F. Vegas, C. Mileto, 2018)*

**The traditional red ocher paint typical of Scandinavian countries is still used in some places for the protection and maintenance of wood surfaces**
*(© F. Vegas, C. Mileto, 2017)*

Climate and cultural relationships shape the exterior and interior configuration of buildings. The existence of local characteristic sloping or flat roofs, which are occasionally used for domestic activities, depend on the rainfall patterns, constructive materials available and how dwellings are grouped in relation to each other.

The dwelling can have a rigid enclosure with a strict compartmentalisation of thick interior walls depending on the climate and materials available, or may be permeable to breezes with light enclosures and partitions. The concept of privacy and this possible permeability are not necessarily mutually exclusive. One example of this is the domestic altar or *tokonoma* of traditional Japanese dwellings, usually hidden behind a broken route among filters and paper walls (Nishi, Hozumi, 1996). The interior distribution of dwellings also provides a similar response to the conditioning factors of heating, ventilation, solar exposure and the interpersonal relationships of its residents. The size of kitchens and how they are used depends in great measure on the climatic zone in which the habitat is located, as the hearth is still associated with heat needed to survive, especially in very cold climates, even to the neglect of beautiful living rooms.

The ancestral knowledge of climate can even determine the constructive layout of the chimneys in some colder climates in winter and great summer heat, so that they can benefit from the dominant breeze and generate a more energetic draught, turning into air conditioning systems (Ji, 2014). The combination of flues with water sources or courses in the domestic interior characteristic of systems, such as the wind catchers in Iran or Bahrain, results in magnificent natural ventilation and cooling systems (Achenza et al., 2014).

The openings on the facade also have different treatments depending on the culture, from complete opening to the insertion of solar filters or visual protections such as shutters, louvered windows, blinds, shades, net curtains, moucharabiehs, etc., which make it possible to simultaneously protect the interior privacy of the habitat (Vegas et al., 2014b). Equally, the entrance doors are a faithful reflection of the idiosyncrasy of their own culture: solid gates, fretwork doors, doors with upper fanlights which provide light

to the inside, personal small doors set in a larger door, glazed accesses, etc. The degree of interior light is also closely linked to culture and the context in which it was born. It is sufficient to remember Tanizaki's thoughts on the delicate Japanese twilight in contrast with excessive Western lighting (Tanizaki, 2019).

### Constructive dimension

Intangible heritage is a major part of daily life in general, and particularly of construction, understood as the transmission of trades, crafts and centuries-old know-how. The skilled workers, professions and master builders are the depositories of this knowledge, and to some extent are an asset to be protected and conserved. The preservation of this knowledge occurs through transmission through successive generations of apprentices and artisans. The direct relationship with local resources and raw materials, how these are transformed and eventually executed in the building, in combination with other elements, form a wealth to be preserved, which is of equal or more importance than the resulting building itself or physical object. This relationship is significant as it reveals how the environment is worked and exploited sustainably, living in harmony with it. Construction and especially maintenance were carried out at the times of year when the land was not being worked.

It is essential to perpetuate the traditional trades in construction (www.redmaestros.com/; www.guildmc.com/). Keeping vernacular architecture alive would allow it to be reproduced as much as possible, occasionally incorporating relevant adaptations to contemporary life, and could also preserve the vernacular architecture, which has survived until the present, when conservation requires the periodic replacement of perishable architectural elements, such as thatched roofs, earth renderings, lime wash and deteriorated mortars, etc. The promotion of traditional trades must not be the excuse for unnecessary chipping away or demolition of parts of the building to remake them. In addition, for the purposes of preserving authenticity, it is necessary to resort to specific restoration techniques, which do not necessarily match the traditional trades which generated them.

### Intangible dimension

This is the definition attached to all intangible heritage, which has not taken direct material form as a physical construction or object, of equal importance, whether or not it is linked to architecture. This includes music, poetry, dance, literature, cooking, celebrations, legends, traditions, the arts of agriculture, hunting and fishing in individual locations, etc. For example, the clicks of Xhosa languages in South Africa seem to date back to the early forms of development of human language. Given their immense value, these phenomena deserve special attention and protection. On occasions, intangible heritage survives, but has been transformed over time: the recipe for roast pig buried in embers in the Fiji islands is a faithful reproduction of a procedure used by cannibals on the island to cook their enemies as recently as 150 years ago. All these manifestations of essentially intangible heritage can be recorded on mediums such as writing, recording or video, but like the examples above

they depend essentially on the transmission from parents to children, from masters to apprentices, from generation to generation.

## Conclusion

Architecture comes to be with the concurrence of tangible and intangible materials, which are often intertwined and cannot be separated, as in traditional or construction trades or the procedures for the extraction, transformation and use of materials. Climate, the season of the year, lunar cycles and agriculture also determine the periods for woodcutting and execution, often expressed in the form of legends, myths or religious indications established by a millenary tradition. Understanding these beliefs and the rhythms of life of each culture is essential to understanding the multiple dimensions of traditional architecture, especially the human one.

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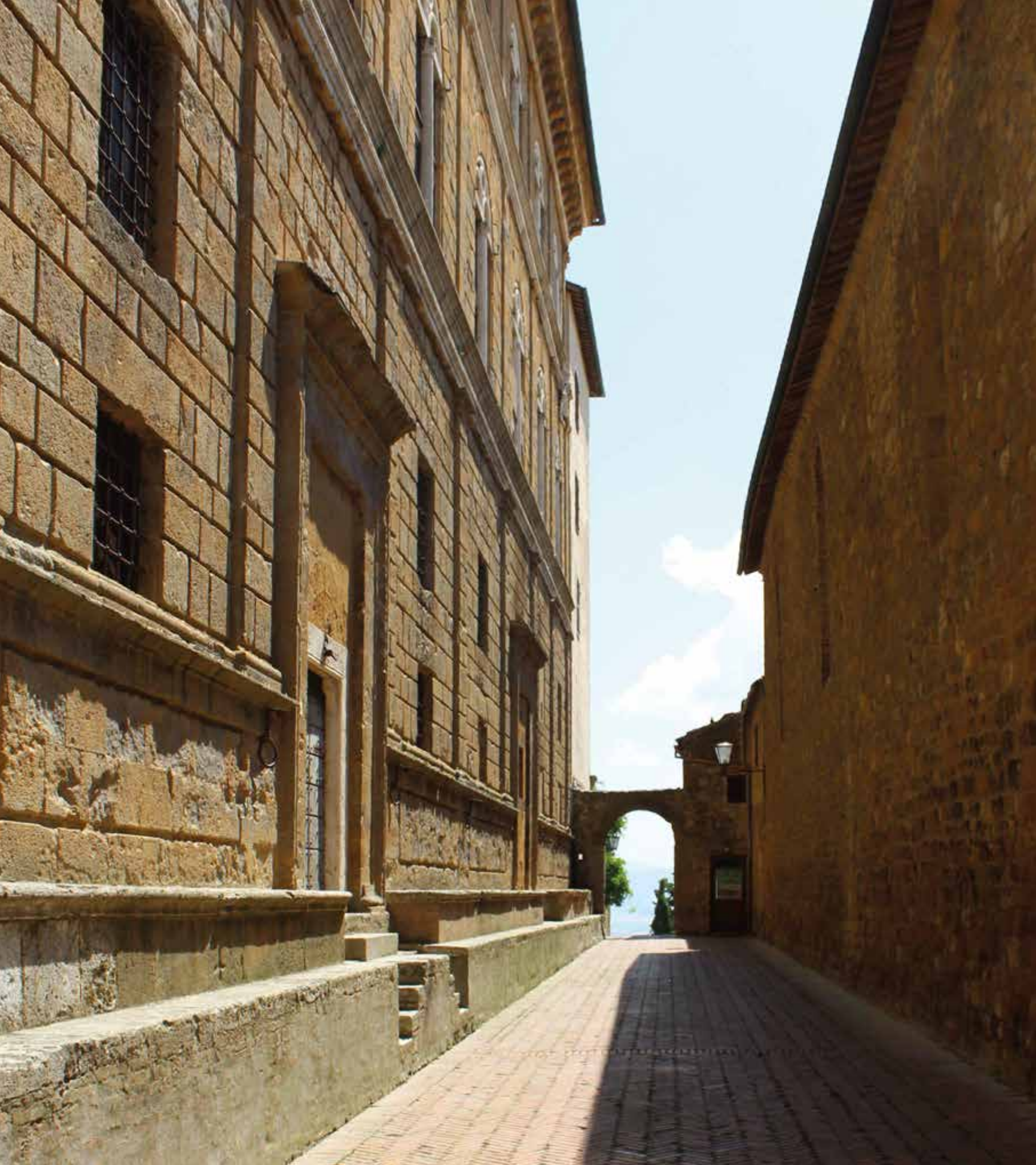

# ENHANCING VERNACULAR WORLD HERITAGE THROUGH DIGITAL TECHNOLOGY AND MULTIMEDIA TOOLS

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*opposite page*
**Pienza, Italy**
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During the past two decades, digital information and communication, accessible through mobile devices such as Laptops, Tablets and Smartphones, have taken on an increasingly central role in everyday life.
The interaction between ICT (*Information and Communications Technology*) and human and social sciences, embodied in the *Digital Humanities*, must also include the *Digital Cultural Heritage*, which has among its aims that of the valorisation and dissemination of the Cultural Heritage.
Disciplines that are distant in terms of focus of interest and research methods have doubtless taken advantage from the specific contribution that derives, in particular, from the use of info-graphics (Merlo, 2019), which has modified and enhanced the traditional approach to knowledge.

> Heritage… is our past history, the foundation of our future choices. To take out from the archives of the Superintendences and of the University those documents that contain the data of the research… – sometimes unpublished, often published in an incomplete form and almost never swiftly – making the information easily accessible to all, and not only to authorised personnel, means expanding the horizons of knowledge and therefore also of safeguarding and planning (Luciano Modica, 2013)

## ICTs

Since the end of the 20th century, well into the digital era, alternative solutions, which make extensive use of ICT, have increasingly developed alongside the usual forms of usage and enjoyment of the Cultural Heritage. The communication/usage of the Cultural Heritage today uses, thanks to ICT, interactive, virtual reality and augmented reality applications, which allow, when used on the web, involving millions of users simultaneously. For this to take place, however, it is first necessary that the Cultural Assets be digitalised, and then made available through ad hoc hardware/software platforms (Merlo, 2019).

## Digitalisation

Digitalisation is the process of conversion that transforms audio, video, images, texts and 3D objects from analogic to digital, thus making, in other words, a virtual copy of a real artefact that is as faithful as possible to the original.
It is thus, a first important distinction regarding the nature of the object to be digitalised and the output that one wishes to obtain. In the case of 3D artefacts, in fact, present day technologies permit the creation of a digital copy in the form of a 3D model using acquired dense point clouds.

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**3D laser scanner**
An instrument used for recording a digital point cloud from the reality
(© *CHM Lab, DIDA, UNIFI, 2019*)

In the field of real estate assets, this process (also known as digital survey) is carried out with the use of active and/or passive sensors (the former trough the use of Lidar tools, and the latter with the use of photogrammetry techniques), which allow the realisation of reality based 3D models, initially point cloud and subsequently polygonal (with or without colour textures), of the actual structures (Russo et al., 2011). Neither of these two methods is invasive, and both take place without direct contact with the object, through the mediation of optical instruments that render the surfaces of the structures as 3D models, placed within a virtual Cartesian space.

The main difference between the two methods consists in the fact that the active sensors permit obtaining range based point cloud 3D models already during the data acquisition phase, whereas the passive sensors, in order to obtain the same results, require mathematical algorithms for transforming homologous pairs of points present in the two-dimensional photographic images into 3D coordinates (SfM technique – *Structure from Motion*).

Furthermore, the point cloud derived from a laser scanner survey is in itself a model at a 1:1 scale, whereas in the photogrammetry survey the point cloud and the subsequent mesh model need to be put to scale by using at least a known measure.

Generally, where a greater detail is necessary, a combination of modelling techniques is used, which preserves the dimensional and geometric features of the structure (reverse engineering); whereas when it is possible to render the forms of the architecture through elementary surfaces, direct modelling techniques (*box modelling*) are preferred.

The copy (or *facsimile*) of the real object, as faithful to it as possible in morphometric and perceptive, replaces the object itself in the digital (virtual) environment, opening, in fact, the possibility not only of interacting with it, but also of analysing, studying and promoting it through forms and tools that were

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**Trasformation of an artefact into a 3D model**
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inconceivable only a few decades ago. Among the many possible applications it is worth mentioning digital conservation, digital restoration, VR/AR applications, archiving, cataloguing and finally, geographic systems (Ruggeri, 2019).

The realisation of a polygonal model of an existing building is not an automatic or mechanical operation, but rather the result of cognitive analyses and critical choices (Merlo, 2019). Independently of the purposes for which it must be produced, preliminary studies aimed at understanding the building from the morphometric, historical and material points of view is essential, recognising the various elements that compose it (semantic analysis), ordering them hierarchically in function of their role, the materials with which they were built, the rules that subtend their form (taxonomical analysis), and ascertaining the spatial relationships that they establish between them (topological analysis), so as to determine the overall volumetric articulation (Gaiani et al., 2010).

The work pipeline is greatly transformed when the polygonal model no longer needs to represent an architecture in its currently visible 'facies', but in one of the moments that have preceded it considering the spatial measurements established by the material and intangible history of the building. In this case the analysis of the morphometric data, *tout court*, of the parts that have been preserved as they were, must be necessarily completed (on occasion substituted) with the interpretation of the historical-documentary data taken from iconographic sources and/or more frequently from literary sources. In these cases, the reconstructions are based on conjecture (Avella, 2018), and will be more or less valuable depending of whether they are based on certain suppositions or credible hypotheses.

In this specific field, although in fact the modelling operations are aimed at obtaining 3D reconstructions of the forms of a building, even if it does not exist anymore, it no longer makes sense to speak of reverse modelling, due to the limited nature of the geometric data available, and to the manner in which

it was acquired. Consequently, the resulting *maquettes* will be produced essentially with the use of direct modelling techniques, capable of ensuring a compromise between the simplification of the forms and verisimilitude (Carlevaris, 2011).

### 3D rendering: static rendering, animations and walkthrough

In function of the level of detail sought and consequently to be viewed through static or dynamic rendering, either photorealistic or lacking in texture, and based upon the modelling techniques used, the *maquette* may be more or less detailed. In any case the realisation of a 3D model assumes that the author has the necessary competencies for de-codifying and re-codifying an architecture, without which it would be unthinkable to achieve a correct representation of the building.

In those cases, where the models are to be used for animated sequences, and specially when they will be utilised for real-time viewing, for example in walkthrough platforms (virtual walks), techniques derived from the entertainment industry are adopted. These allow, through baking procedures and the use of UV maps (such as normal maps and diffuse colour maps), to represent the geometries of the most minute elements of mesh models, made of few polygons with a high degree of realism (Merlo et al., 2013).

*opposite page*
**Image of a high-poly, low-poly and low-poly model + texture**
(© *CHM Lab, DIDA, UNIFI, 2019*)

**Example of a spherical panorama**
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### Spherical panoramas and 360° videos

Panoramic photography is the technique that permits creating an image with a field of view in a range between 180 and 360 degrees through a composition (mosaic) of adjacent photograms. Panoramas can reach 360 degrees horizontally (cylindrical panoramas) and 180 vertically (spherical panoramas). In this case, therefore, no 3D models are used to simulate an environment, but only two-dimensional images.

Panoramas can be immersive and interactive; the user can move within a scene and interact with the objects that are a part of it. However, unlike the previous techniques, it is not possible to obtain metric data from them.

A 360 degree video consists instead, of a sequence of spherical images. Although the movement of the camera has been previously determined, the user has the possibility to choose where to direct his gaze, while the scene evolves around him.

### Virtual Reality – Augmented Reality – Immersive Reality

Virtual Reality (VR) can be defined as a digital copy of the world that surrounds us, carried out through digital tools and techniques.

Immersive Virtual Reality (Immersive VR) is the possibility to explore and interact with virtual reality using devices (headset, gloves, earphones) that project the user into a digital environment.

Augmented Reality (AR) can be defined as an altered representation of reality, in which additional information is added to the normal perception acquired through the five senses.


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A single term, Extended Reality (XR) (Chuah, 2019) is increasingly used to define these environments as a whole. In the specific field of Heritage, XR is often used for the 'typological' or 'philological' reconstruction of an asset. This difference, which is linked to the quantity and quality of the written and iconographic documentation available, although generating similar products aimed at the reconstruction of the image lost with the passage of time, is considered by scholars as a discriminating element, which should be highlighted during the model conception phase (Cochetti et al., 2018).

Today, it is the entertainment industry that finances this sector, mostly directed to the young and very young, who are those more interested in alternative systems for using and enjoying heritage. Video-games, a mass tool for experimenting with man-machine interaction techniques, when used for educational purposes (serious games), can be profitably utilised in the field of *edutainment*, which is aimed at acquiring content through play. Also the sector of Cultural Assets has experimented, often successfully, with this technique. An example of this are the many products developed by national and international universities and research centres (Gabellone, 2020).

## The London Charter (2009) and the Seville Principles (2011)

The main references in the field of the valorisation of the Cultural Heritage through digital tools and methods are the *London Charter* (http://www.londoncharter.org) and the *Seville Principles* (http://smartheritage.com). The former concerns the convenience, or not, of using 3D viewing in function of the objectives to be achieved, also touching upon the methods and tools to be used (Gabellone, 2012). The latter proposes specific guidelines for the various fields in which it operates, with special reference to that of Virtual Archaeology (Brusaporci, Trizio, 2013).

The digitalisation of heritage is at the centre of the cultural policies of European countries as shown, for example, by the MiBAC initiatives in Italy (Direzione Generale Educazione e Ricerca, 2018; Direzione generale Musei 2019).

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# THE IMPORTANCE OF CREATIVITY IN VERNACULAR HERITAGE

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## Introduction

It is rather common to establish orthodox criteria when addressing built heritage subjects, especially regarding operative procedures that range from valorisation to conservation measures.

The scientific accuracy, on behalf of unarguable validation, is often mistaken with broad standard methods that consider little or nothing, the distinctiveness that compels a certain asset to be documented as heritage. The built environment, and in particular vernacular heritage, on which technical issues play a significant role, constitutes an example of such approach. In vernacular heritage, the concept of creativity is often intentionally supressed from the object interpretation and the preservation process.

This paper intends to be a critical essay on the implications of the creativity approach in the vernacular architecture research, contesting formal prejudices linked to etymologic distortion and formal assumptions. The paper also intends to consider the potential impact of creative-based strategies and approaches regarding the preservation and awareness of World Heritage Sites.

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**Communities technologic inventiveness, Cuenca 'rascacielos'**
(© *G. Duarte Carlos, 2017*)

## Creativity meaning and defnition

The most general association of the meaning of creativity relates to the production of *original* and *unusual ideas*, which, in turn, does not encompass a negative connotation. However, the confluence of perception in scholar spheres that *unusual*, as 'out of the typical', implies an inevitable subversion of methodical procedures, where transversal analytic indicators cannot be directly applied, has contribute to a very sceptical approach to this phenomenon. And, obviously, within the framework of quantitative-comparative studies, this approach is particularly reasonable (Chalmers, 1988).

Therefore, this specific 'categorisation' is easily admitted within abstract thinking sectors, where cognitive and perception mechanisms are commonly incorporated in the veil of the intuitive/sensitive phenomena creation. The artistic sector used and abused of such definition, in particular after the decay of figurative representation and upraise of the conceptual artistic movements (Harris, 2006). This relatively recent paradigm placed creativity, as the 'out of the box' thinking, on the fundamental premises of the aesthetical domain with such an intensity that almost exhausted the term for other areas.

Presently, little attention is driven to the first part of the word definition, on which the explanation is set upon the action instead of the content. In most of the English language dictionaries *creativity* is described as an ability or skill. The focus on creativity as a capacity, instead of a result of abstract nature, is particular interesting when addressing the scope of vernacular built heritage. Moreover, it can be ap-

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**Collective and individual artistic expression, Pico's strong color painting, wineyard gate** (© *G. Duarte Carlos, 2017*)

**Collective and individual artistic expression, Svaneti's wood carving, Temple door** (© *G. Duarte Carlos, 2019*)

plied to both its tangible and intangible aspects, which reinforce the cultural relevance of the architectural asset, also emphasising the associated empirical knowledge and its forms of transmission.

## Creativity and innovation

As stated previously, the tendency is to consider 'creativity', almost exclusively, within the scope of the artistic production, forgetting its immense significance at technical and scientific levels. For most of the authors, this narrow perspective can easily compromise the potential progress of determined communities (Davis, 2006), especially in cases of cultural network limitation.

When addressed in technologic terms, 'creativity' is directly associated with 'innovation'. In this case, the semantic connotation of the concept takes a twist on its scientific perspective. It is understood as a paradigmatic jump, that a technical solution development can be extended from the available resources to the operative application (Addis, 2015). Nevertheless, this proclaimed evolution does not oblige a compulsive rupture on the current technologic process. In empirical based activities, as vernacular building techniques, the paradigmatic shifts are usually characterised as a progressive technical adjustment or appropriation (Frey, 2010).

## Creativity in vernacular architecture

Another essential aspect regarding vernacular architecture is the rigidity associated with enduring building stereotypes. In fact, this has been transversal to all architectonic categories since the development of the typo-morphological theories, so well disseminated during the last quarter of the 20th century. The building type representativeness should not be confused with an inflexible model.

As Rapoport argues (2006), in most cases, vernacular heritage reflects the consolidation of site-specific logics and principles, rather than imposed elements or solutions. Therefore, when analysing vernacular buildings, enhanced by its informal nature, one can observe a wide range of practical variations based on the same logic, i.e. placing the individual expression within a systemic dynamic. This formal liberty enables that inventive results within a collective coherent framework always consider the available resources.

On the previous VerSus Research Project, this issue had already been approached within the vernacular built heritage inherent characteristics (Correia et al., 2014). VerSus researchers argued that one of the fundamental principles of vernacular heritage was *to enhance innovative and creative solutions*. Integrated in the

socio-cultural scope of the phenomenon, this attribute is associated with the development of native forms of cultural expression, corroborating, as recalled by Guillaud (2014), the consolidation of the overall regional identity, in which the establishment of originality features constitutes a fundamental premise

The creative capacity of the vernacular architecture is predominantly expressed by the following socio-cultural principles (Guillaud, 2014):

- The development of collective intelligence;
- The encouragement of diversity in building system solutions;
- The consideration for other building cultures influence;
- The opportunity for experimenting building techniques and processes;
- The improvement of using building techniques from previous know-how, through selective trials.

The implementation of these principles is key for the consolidation of active building cultures with sustainable aspirations, capable of creating stimulating habitats, in order to preserve and transfer their inherited values. Nevertheless, this interpretation has always to consider the socio-economic context and their main activities evolution, avoiding patronising approaches, regarding the maintenance of socio-cultural value (Asquith, Vellinga, 2006).

## Creativity in World Heritage

The creativity component presents an essential contribution for the definition of Outstanding Universal Value (OUV). This becomes a core-value of the World Heritage justification of vernacular sites, especially when focusing on the analysis of the Integrity and Authenticity foundation principles. But it is upon the community's stimulation of inventiveness that one can achieve outcomes prone to be consider as site-specific attributes, with evident significance to contain and manifest the OUV designation (ICOMOS, 2008). All the cultural properties represent a valid contribution to the creativity concept, recalling the OUV attributes in World Heritage. Nevertheless, properties located on challenging geographic environments, less susceptible to human occupation and with scarce natural resources, represent wider cultural challenges. The 3DPAST case study of Pico's Island cultural landscape seems to reflect this condition, as stated by Pico's World Heritage justification: "The Landscape of the Pico Island Vineyard Culture is an outstanding example of the adaptation of farming practices to a remote and challenging environment" (UNESCO-WHC, 2004). This reveals that the Outstanding Universal Value of Pico's site is composed by a man-made landscape based on the "inventiveness" of local communities (back in the 15th century) of surpassing the sterile volcanic soil found.

## Creativity in 3DPAST research

The 3DPAST project approach considers creativity on different, yet complementary, scopes within the developed research: (i) A dimension of the Heritage asset, as a specific component of the selected object itself; (ii) A resource for the World Heritage's attributes identification; (iii) An instrument for the

**3DPAST digital technology, Photography overlapping, panoramic view, Svaneti, Georgia**
*(© G. Duarte Carlos, 2019)*

World Heritage Site's interpretation; and (iv) A tool for the World Heritage Site's promotion. As it may be inferred, the connection between creativity and the first two scopes is conceptual. However, the operative relation with the term is obviously addressed in the last two scopes. This strategy was set according to the priorities of the European Commission 2016 program: to assure the society adaptation to digital technologies and to contribute to the development of the local creative industries.

The impetus to address World Heritage research assuming digital technology as the outcome touchstone constitutes already a conceptual challenge by itself. The urgent need for adaptation to this resource is far from being implemented on technical and artistic levels. A good example of the potential associated with creativity is the development of a *serious game* for Pienza World Heritage site, in Italy, under the 3DPAST project framework. In this case, the scenario of the game action is a digital simulation of the city during the XIV century period. The narrative of the game also allows the display of historical and technical information regarding architectural and urban features of the site.

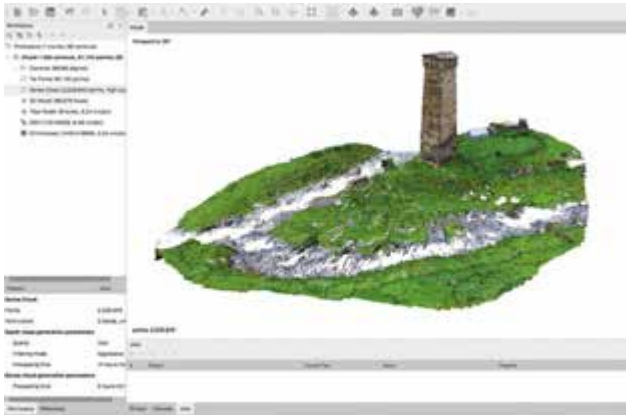
## Technology improvement

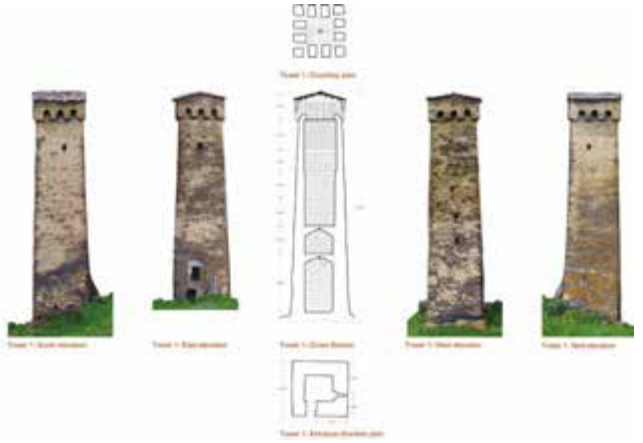
The change between the analogical record and the digital database is also a significant step for the data collection sector. The benefits brought to World Heritage documentation are overwhelming between the advantage of condensing physical archives and speed of information exchange, which was made possible by digital networks. The technology regarding the physical survey and the resulting information assessment presented an exponential increase, in terms of approach and accuracy.

In recent years, the development of areas such as aerophotogrametry and laser scanning increased greatly, more than the previous recording instruments that become almost obsolete. The compatibility between the generated data and the available computer programmes is creating a wide new range of possibilities that are often reduced to ludic purposes without scientific validation. The construction industry, particularly the one dealing with the rehabilitation of law-protected heritage, has already assumed the paradigm shift, understanding its technological improvement.

## Conclusions

The application of these innovative tools in heritage domain requires creative approaches and creative techniques, in order to enhance their value. However, despite some preliminary efforts of the education





**3DPAST digital technology, 3D model after drone photogrametric survey, Svaneti** (© Ci-ESG, Escola Superior Gallaecia, *G. Duarte Carlos, 2020*)

**3DPAST technology, technical drawing after photogrametric survey, Svaneti** (© *G. Duarte Carlos, 2020*)

sector to create more appellative didactic tools regarding historical themes for new generations, there has not been much systematisation on the congregation of interests in terms of built heritage exploitation.

Recently, the institutions that manage touristic assets have increased their investment in the expansion of the visitor's experiences throughout digital resources. The trivialisation of mobile devices and the impact of immersive events have set the heritage related industry into a receptive mode, understanding the potential of such an instrument.

The relentless access to Virtual and Augmented Reality displays and to their sensorial quality interaction is changing broad audiences' expectations, increasing their interest and comfort, while accessing it. From a more ethical stand, these tools also create an alternative to the display of certain contents, protecting sensible matters from unnecessary disclosure or degradation risks. It is therefore believed that heritage assets that encompass this type of displays are more competitive, attracting new audiences.

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## Enhancing vernacular heritage to ensure its outstanding significance and safeguard

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**Chorá of Pátmos, Greece**
(© A. Manzi, *L. Montoni, 2018*)

Vernacular architecture is one of the most significant cultural expressions of a socio-economic structure: it represents the way in which local materials and traditional building techniques, learned from endogenous evolutionary processes and from cultural advances, were used to respond to the physical and socio-economic needs of a group, thus generating remarkable architectural models adapted to the historical-cultural experience and the specific environmental restriction of each territory. They are, therefore, unique models strongly linked both to the environmental and to the socio-economic and cultural context, which nevertheless have universal elements in common: they use local resources; they adapt strongly to the morphology and to the bioclimatic characteristics of the place; they are the result of the transmission of experience and knowledge; they are the expression of a living model and the identity of a group; they are extremely vulnerable, as they face sudden changes (natural or cultural); and the deterioration process can be easily triggered.

Thanks to the universal nature of vernacular architecture, in recent decades, various organisations have asked for the protection and recognition of this heritage as a cultural asset, and as a shared value. It should be mentioned, in particular, the Charter on the Built Vernacular Heritage, ratified by the General Assembly of ICOMOS, in Mexico in 1999, on which the character of vernacular architecture is claimed as essential for the identity of people: "The built vernacular heritage is important; it is the fundamental expression of the culture of a community, of its relationship with its territory and, at the same time, the expression of the world's cultural diversity" (Introduction, ICOMOS, 1999).

However, the knowledge to maintain and preserve vernacular heritage is disappearing at an ever-increasing pace, when not properly recognised as part of the people's identity. Especially considering the few numbers of vernacular sites listed as World Heritage, precisely due to their character, a long way still needs to be undertaken. Raising awareness and sharing the significance and the quality of this still little-known vernacular World Heritage, existing in Europe, increases its Outstanding Universal Value, and contributes to its safeguard and enhancement, but also to raise awareness to future vernacular World Heritage nominations.

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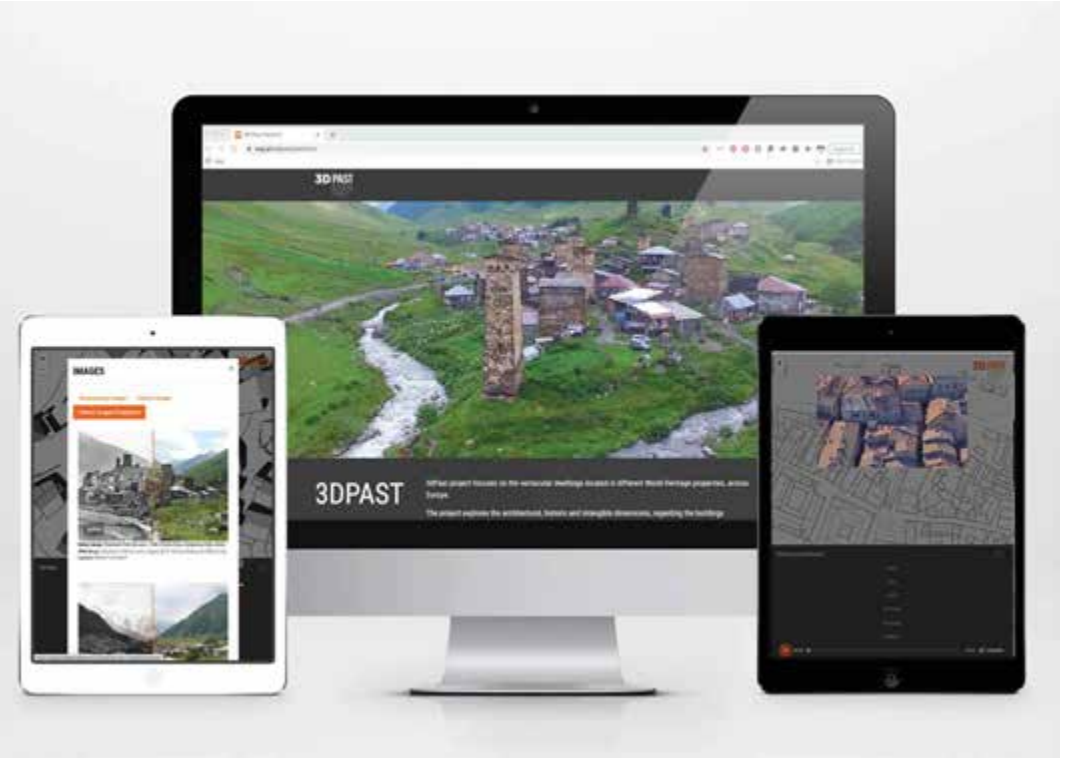


**3DPAST Platform**
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**3DPAST App**
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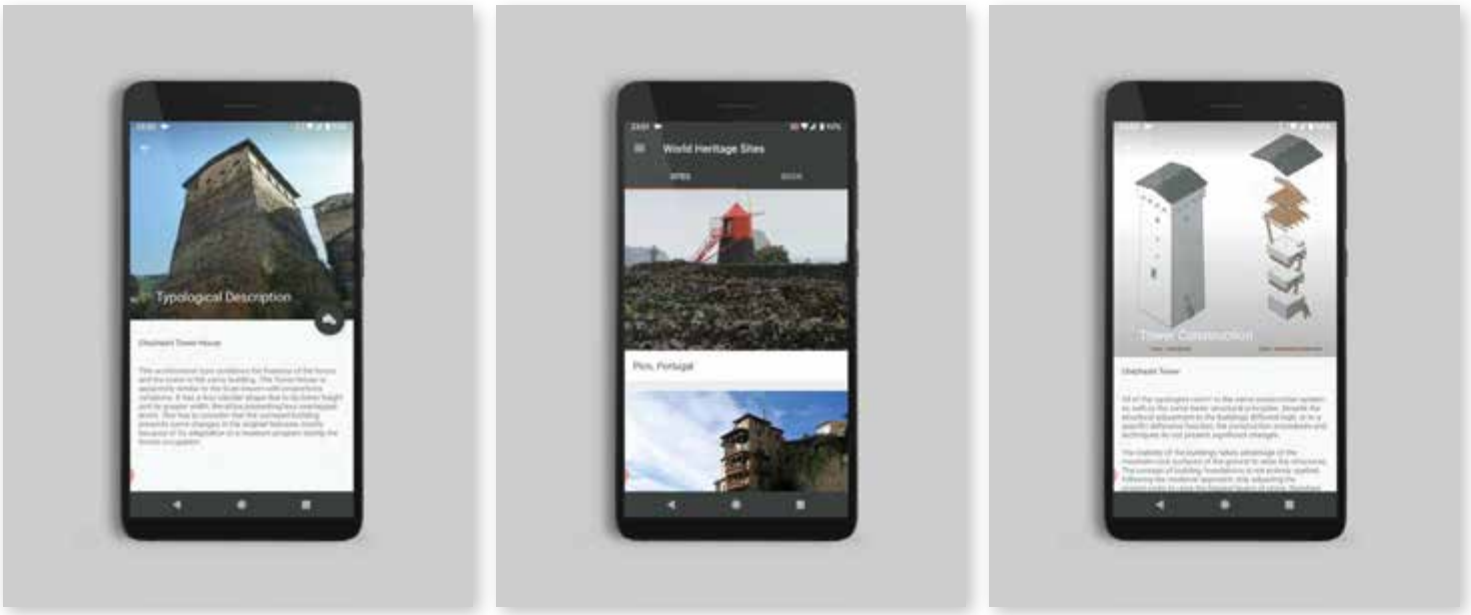
## Communication and Dissemination strategies

*Living and virtual visiting European World Heritage* project, known as 3DPAST, was developed to enhance vernacular heritage, the character of its architecture, historical building traditions, and building cultures knowledge, which is still alive in several of these sites, through the use of new technologies. The project contributed to the increase of cultural interest for vernacular dwellings by different audiences. This is the case of World Heritage sites travellers that *in situ* are able to use 3DPAST App and experience technology and augmented reality. It will also give a chance to non-traveller audiences, which by visiting 3DPAST website (www.esg.pt/3dpast) and platform, will be able to experience (e.g. through virtual reality) the exceptional significance of the World Heritage properties. Communication and dissemination activities can promote and enhance this unique and valuable vernacular heritage. 3DPAST project contributes to its worldwide diffusion, through different tools and outputs.

## Communication tools and outputs

### Development of 3DPAST Website and interactive platform

The development of the project's website and platform was an activity transversal to the entire timeline of the project, focusing on the project's aims, activities and outcomes. It provided an opportunity to document the missions; disseminate workshops, conferences and seminars; mirroring findings and the results of the project. Moreover, the website included a digital platform addressing the different project dimensions, displaying the reconstitution of some of the dwellings. The vernacular buildings deconstruction was also available through virtual reality at the project's platform, shared with other websites




and local platforms (e.g. local tourism interactive points). Both are relevant outputs for didactic purposes to different audiences. The website and the platform were created, maintained and updated by the project leader. Following the conclusion of the project, both outputs will continue active. The access to the platform is free, and can be reached at: esg.pt/3dpast/platform

**Development of 3DPAST App**

To enable enhanced *in situ* visits with added information regarding the tangible and intangible heritage of each site, the project team developed the 3DPAST App, which is available for IOS and Android Platforms. This App provides photos, in-depth texts, detailed drawings and 3D models of selected heritage. Using augmented reality (AR) technology. It allows the visitor to experience a richer visit, with exploded 3D deconstructions of selected buildings, using georeferenced location and target image markers. Through the juxtaposition of historic images and current visualisation, it is possible to understand the site heritage evolution. The 3DPAST App also connects with the project book, enabling AR content from the publication images.

**Multimedia communication tools**

Several multimedia communication tools were produced throughout the project, namely an interactive digital e-book; an interactive digital e-booklet; an interaction design and underlying code for Apps; interaction design and code for virtual reality included in the multimedia platform of the project website; Videos of the selected World Heritage sites gathering the 3 dimensions of the project; but also videos of the different outputs, as well as the 'making of the project'.


**Images from the booklet**
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### Edition and publication of 3DPAST *From Vernacular to World Heritage* book

Following the analysis, revision of the literature and content development, the systematisation of knowledge regarding the 3 dimensions of the project was produced. It was presented in a scientific book that gathered the main results developed by 3DPAST research teams. The findings emerged from the elaboration of fundamental data collected at each site: through drawings, laser scanner data, digital images, interviews, tangible and intangible knowledge documentation, etc. The scientific book was sent to key-institutions working on vernacular architecture and World Heritage, which also play a key-role for the project's dissemination in Europe, and around the World. The book has also been designed to interact directly with digital contents. The 3DPAST App uses the camera of a smartphone or tablet, to recognise selected printed images of the book. Then, it overlays media on the top of the images, in the form of videos, 3D models, galleries of pictures and web pages. The digital book was produced for dissemination and it was made available for free download, contributing to open access and free transfer of knowledge.

### Edition and publication of a booklet, digitally and in paper

Technical strategies for conservation of vernacular architecture, looking for to enhance best practices, were gathered and presented in a booklet, approaching, particularly, study and knowledge, material conservation, policy and management, and dissemination. This publication was produced through a printed booklet and a digital e-booklet, in five European languages: English, Spanish, Portuguese, Italian, and French. The booklet is also available for download, at the website of the project (www.esg.pt/3dpast/), contributing to the free transfer of knowledge, regarding the preservation of World Heritage, and, in particular, of vernacular dwellings.

### Digital and Technical workshops for broader local and regional impact

This activity encompassed the identification of intangible knowledge regarding traditional techniques and materials, as well as its maintenance, still in use by local craftsmen. It also become an opportunity for international networking and transfer of knowledge regarding multimedia, virtual and augmented reality. This was just possible by the development of local digital and technical workshops, an indicator of capacity-building and knowledge transference as aforementioned.

Hands-on workshops on stone, wood and earth construction, aiming at the transfer of knowledge among high-school and university students, and involving craftsmen, architects and professors, were developed among the university institutions involved. This activity was also relevant, as it created a network of entities working on tangible and intangible heritage, but also on digital tools. As a result, technical and digital workshops in some of the World Heritage sites were developed, enhancing the knowledge transference, the capacity building of students, and interested people.

## Dissemination of results

The results and outcomes of the project are intended to be disseminated in Europe and world-wide, as they were digitally developed and produced, thus breaking barriers and crossing frontiers in nowadays digital era. These outcomes are also devoted to the development of audiences, as they are intended for major interested people, such as: inhabitants of World Heritage Sites; architects and heritage professionals; traditional building and vernacular architecture experts; interaction designers; local developers; craftsmen and technical representatives from the municipalities. The project results are also intended to reach the general public, and to disseminate results across adults, elders, people with disabilities, students and children. It is also meant for tourists, or people interested in travelling or discovering new sites, who can personally find and rediscover this unique heritage through the digital produced contents on virtual and/or augmented reality.

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# From Vernacular Heritage to World Heritage

8 case studies

# THE TRADITIONAL CULTURAL LANDSCAPE OF PICO ISLAND AND ITS VERNACULAR ARCHITECTURE, PORTUGAL

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Pico Natural Park

## Introduction and landscape context

In the middle of the Atlantic Ocean is located the Azores archipelago, composed by nine volcanic islands. Pico island was the seventh to be discovered by Portuguese sailors, during the 15th century. Its name is due to the pyramidal form of its mountain, a geological volcano reaching 2.351 meters, the highest mountain in Portuguese territory (Costa, 1997). Pico island has an amazing vineyard culture, especially in its western coastline. The exceptional landscape character granted to Pico a World Heritage status in 2004.

The hardness of the volcanic stone, the resources shortage and the archipelago unstable weather, relies on a communal perseverance to achieve tangible outcomes. The resulting landscape configures "an outstanding example of the adaptation of farming practices to a remote and challenging environment" (UNESCO-WHC, 2004), articulating the desolate nature of the lava coast with a man-made system created throughout five centuries of hard labour in very difficult climatic and environment conditions. The success of this unlikely agrarian development produced an exclusive type of wine, known as *verdelho* wine. This is one of the most traditional casts that was, for a long time, the main economic activity of the island, and one of the most emblematic products of the Azores archipelago (Maciel, 2018).

## The vineyard cultural landscape

In the island, vineyards were planted in compact portions with protected walls presenting remarkable patterns. Even though these walls have a recognisable matrix, vineyards present an irregular character. Their singularity is related to the systematic aggregation of small and contiguous walled spaces that were built to better protect the vines against salt and maritime wind. Vines were planted for centuries and continue to be planted in very challenging conditions.

The volcanic stone masonry that surrounds these small plots (known as *currais* in Portuguese) was composed by walls with rock extracted from the clean lava land that superficially covered the soil. These were the areas that inhabitants classified as 'biscuit ground' (*chão de biscoito) and 'lajido ground'* (*chão de lajido*). In this way, raw material extraction and ground preparation consisted of the same task. Afterwards, the surplus of the material that was not used for the construction of the *currais* was piled in huge volumes (known as *maroiços*), resembling to rough pyramids, which constituted a unique landscape reference, along the wine production region (Ordem dos Arquitectos, 2000).

*opposite page*
**Vineyards hinterland access (*Canada*), Pico island, Portugal** (*© M. Correia, 2017*)


**Localisation of Pico island, Azores archipelago, Portugal**

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**Wine barrel inside ruins, Pontinha, Pico island, Azores, Portugal** (© *M. Mourão, 2017*)

In some locations of the World Heritage property, it is the case of the *Santa Luzia* place, the fig liquor production was as significant as the wine making. This activity resulted on a variation of the *currais* configuration. The partition wall facing the sea always presented a semi-circular configuration, in order to better adjust to the shape of the treetop. Traditionally, the fig harvest was accomplished in two phases: first, the fruit was anointed (*untado)* and then, 8 days after, it was harvested (Amorim, 2016). This task defined the beginning of the coastal area seasonal occupation.

Most of the vernacular architecture of the World Heritage property directly supported the vineyard activity. The architecture configuration was related to the production, transformation and distribution of the wine and of the fruit liquor. The vernacular built elements complemented the logic of the farming areas (Ordem dos Arquitectos, 2000). The stone walls built to protect the wine and the figs plantation constituted the stone plots that were the main responsible for the overall visual impact, forming the traditional structural element of the territory organisation.

## Historical context

By the time of its discovery, Pico island was covered with rich forests and had proper land for agriculture practice. Both resources were crucial in the 15th century, at the beginning of the population of the archipelago, when the Azorean economy was built on commercial trading with the mainland, and the main products exchanged were cereals, pastel, cattle and leather. With the growing occupation of Pico, and the island inherent deforestation, these conditions gradually disappeared (Costa, 1997). The production of wine, probably dating from the beginning of the island's occupation, increased in economic importance at the same rate that the conditions for agriculture practice disappeared.

**Lava soil (*lajido*), Pico island, Azores, Portugal**
*(© D. Matos, 2017)*

Pico has a slightly warmer and drier climate than the other Azorean islands, so it was an appropriate island for vine cultivation (Costa, 1997). Those plots were the only source of economic income, on the West part of the island; a landscape of small man-made open plots that were built with volcanic stones. Monterey (1978) mentions that the first priest on the island, Frei Pedro Gigante, was responsible for importing the Verdelho strain from Madeira island, and for cultivating it in Pico island. Other authors argue that it did not come from Madeira, but from Cyprus or perhaps Rome (Duarte, 2001).

Along the 16th century, wine production was already an important source of income, but was intended entirely for local use (Costa, 1997). Over the following centuries, its production intensified with great strength and the economic importance of its production grew with its exportation to several countries, such as England, the North American English colonies, Brazil, but also Russia, where, after the 1917 revolution, some bottles were found in the Czar's cellars (Açores, 1977). Its importance was such that, as highlighted by Duarte (1995), the territory was organised according to the convenience of the wine production, transportation and storage.

But this important development came to a sudden ending in the 19th century, when a phylloxera plague destroyed most of the vineyards. This disaster induced the grafting of a new variety of grape, resistant to phylloxera. The solution did not solve the problem and probably was the cause of other plagues that attacked the vineyards over that century, such as fungus (Açores, 1977). This massive de-

struction ruined the wine economy of the island and led to the abandonment of the Verdelho production, and the introduction of the *Isabella*, a variety of grape imported from America. But the new wine did not have the same quality, so the economic importance of the wine production was never fully recovered (Açores, 1977).

The island lack of resources and the wine-centre approach was decisive in the formation of the handmade landscape and culture of the place (Alcindor et al., 2020). Settlers forced to survive where there were no resources, were responsible for the construction of Pico's traditional architecture, always associated with the culture of wine. In the 19th century, the vineyard plague forced islanders to search for another way of survival. Whaling, a tradition that was inherited from New England, become, for a certain period, one of the most relevant activities in the island.

## The occupation of the territory

The interaction between natural challenging conditions and a built environment created with great difficulty produced a distinctive cultural landscape, with a unique legacy of Outstanding Universal Value. These characteristics favoured the implementation of technical building solutions that reveal great ingenuity and long-term commitment, to ensure lasting results.

The buildings are assembled in small clusters and settlements presenting a fragmented configuration, dispersed along the peripheral road that follows the coastline. These small settlements are connected with each other. However, some of the settlements present an extensive area without any traditional structure between them. In other cases, their limits are overlapped, resulting in a continuous occupancy without ruptures.

The configuration of this ensembles does not present any specific shape or clear delimitation. The only observed tendency is the increase of density in the intersection between the coastal road and the perpendicular roads (*canadas*) that penetrate into the island centre. These perpendicular roads cross the vineyard slopes connecting the coast and the highest settlements, outside the wine area. In some cases, the *canada* adopts the settlement name, which reveals their structural importance in the territory organisation.

The wine settlements need to be interpreted as a seasonal expression of the community's production activity. These communities live in villages located above the island lowlands, where the agriculture production is more intensive and diverse due to a better soil condition. With the increase of the wine and liquor production, these seasonal settlements gained a progressive importance. Despite their singularity, it is not possible to look at the World Heritage area without considering it a complement of the entire regional livelihood. The vineyards should be considered like a satellite entity of the small villages, connected between them through the *canadas* roads. According to Jorge and Valdemar (1998), this communication assumes a significant importance in the territory organisation, often influencing the building alignments, specifically in the densest occupation areas.

**3D model of a cluster with wine cellars, Pontinha, Pico island, Portugal**
*(© Ci-ESG, Escola Superior Gallaecia, Atlantic scale, 2020)*

The distinction of the World Heritage property in two areas, according to the UNESCO classification, follows the spatial organisation related to vineyard management – distribution channels of the western part of the island and the neighbour islands. The southeast area corresponds to the maritime connection between *Madalena* village and the *Faial* island, namely to Horta city, the closest biggest settlement, where most of the Pico's wealthiest landlords lived (UNESCO-WHC, 2004). The Northeast zone relates with the *São Roque* harbour and its connection to the *São Jorge* island. The *Cabrito* place, selected as a representative cluster, is considered a satellite entity of the *Santa Luzia* village, located in the Northwest coast of the island.

The Cabrito settlement is one of the less altered building cores, preserving a significant number of buildings with original elements. It is located in the oriental extreme of the North Coast of the World Heritage property. This settlement is at the end of the vineyard culture, at the topographical transition that precedes the region of *São Roque do Pico*. From this settlement, there is no paved road and the old coastal access is suggested by sections that simultaneously resist maritime erosion, but also cadastral alteration, with increasingly larger and more irregularly shaped plots. Cabrito settlement

**Traditional coastal settlement, Pico island, Azores, Portugal** (© *M. Correia, 2017*)

expresses well the actual planning pressures between the introduction of current residential programmes, focused on summer occupancy, and the preservation of the traditional systems, with hard to find man labour work.

## Settlement aggregation and collective dynamics

Most of the buildings are located near one of the communication roads of Pico's World Heritage property, which is linked to an isolated plot of land. The road is on one of the sides of the plot, and the vineyards are on the other side (Jorge, Valdemar, 1998). Usually, buildings are isolated, and their main facade faces the sea, not always corresponding with the main access to the plot. Within each core, a greater affinity can be observed between small sized sets, never exceeding 3 or 4 building units. *Cabrito* settlement clearly presents some sets of this kind. However, it reveals a disturbing evolution, as many of the sets are in an advanced state of degradation or in a process of adulteration due to the addition of elements without typological reference. Currently, new construction does not have a community preconception, or collective dynamics. It is more about isolated and individual interventions, breaking the logic relation gathered between groups of different units.

On the North coast, the ensembles rarely presented a closed configuration, as in general they were not limited. However, they were often segregated by flagstone areas, which irregularly delimitated the territory, separating the 'stone walled plots', also known as 'walled vineyards' *(currais)* from the sea.

The social centre of these cores was considered a typical public space, structuring the dynamic of the main community activities. These centres had, at least, one of the following traditional built components: a tide-well (*Poço de maré*); a small port *(Portinho)*; and a Hermitage *(Ermida)*. In most of the cases it forms a reasonable defined enclosure. There are transversal spams of about 30 meters, as there are places of passage during most of the year, with greater concentration of people during the harvest period, and the religious festivities, such as the Patron Saint and the Holy Spirit devotion.

These traditionally built components revealed the difficulties of people's lives on the island. The tide-well featured the implementation of the old method to obtain fresh water, through the intersection of the underground water table in saltwater environments of the Atlantic Coast.

The wine barrel-roll (*rola-pipas)* reveals the marks of the wheels that were left on the rock, expressing well how difficult it was to transport wine barrels on volcanic ground. This rock marks helped slide the wine barrels and the fig liquor production to the boats. The production distribution was possible through canals sculpted on the coastal rocks, at the extension of the mentioned community spaces.

The worship components, specifically in Hermitage places, also constituted characteristic features of this type of settlement. Due to their symbolic importance, sometimes there were more exceptional features standing above the remaining buildings (Ordem dos Arquitectos, 2000).

## Architectural typologies

The little wine cellar, the wine cellar-house (*adega-casinha*), and the summerhouse with cellar are the dominant typologies of the vineyard landscape. These are evolutionary variants that reinforce the increase of the summer occupation beyond the harvest season (Ordem dos Arquitectos, 2000).

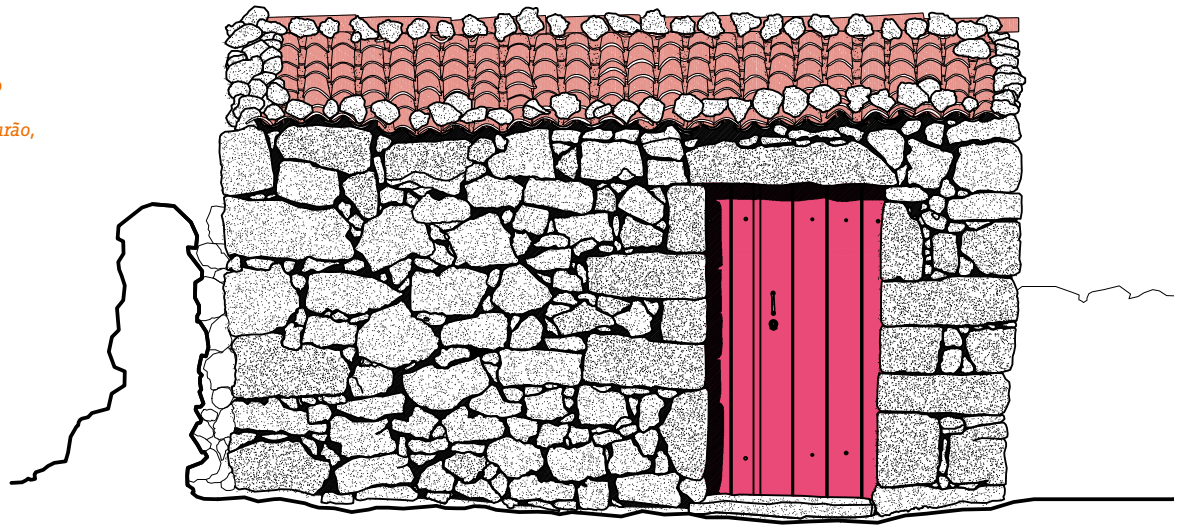
### Little wine cellar

This typology constitutes the basic unit devoted to the storage of small quantities of barrels and bottles. These extremely small buildings are located in small properties of individual production, usually close to the main village. They present a rectangular regular shape, with a simple pitched roof, only one door and no windows.

They do not have any interior partition, and their functional complements are reduced to a single wooden shelf or bench. More than a production unit, these elements are related to family and friends' gatherings, used as a place for outside meals in the summer.

### Wine cellar-house

It represents the horizontal extension of the cellar by the addition of the kitchen and the subdivision of the sleeping area. In all the observed cases, the kitchen and the rooms corresponded to transversal separated compartments. These spaces were created by detachable wooden partitions, segregating the new functions from the areas of wine and liquor processing. This development represents a significant im-



**Little wine cellar, South elevation, Pontinha, Pico island, Azores, Portugal** (*© G. Duarte Carlos, M. Mourão, 2020*)

**360° courtyard view** (*© G. Duarte Carlos, M. Mourão, 2020*)

portance of the wine production for the family income, and therefore a bigger investment in the size and quality of the construction. In most of the cases the building also accommodates the tank and press mechanism, which implies bigger dimensions.

### Summerhouse with cellar

It represents the vertical development of the original cellar, adding an upper floor to the original structure. In this case the residential function is completely segregated form the wine production, with no internal communication, allowing a more flexible use of the building from the harvest activity. It also represents a more elaborated construction technique, namely on the first floor, exclusively used as a house. The kitchen is the main space, serving also as the social gathering room; the bedrooms are segregated from the main internal volume through the placement of the previously stated wooden partitions.

## Typological components

### Water tanks and cisterns

Despite the fact that tanks and cisterns constitute one of the most abundant and differentiating elements of Pico's architecture, it seems they were added at the end of the XIX century (Betencourt, 2017). Their execution obviously dependeds on the efficient lime mortar application, a material whose origin of production was extremely difficult to identify during this research. The cistern is a catchment element and as well as a water tank to collect rain water. In most of the cases it constitutes an addition to the main building (the dwelling or the wine cellar-dwelling), responding to domestic needs. Their progressive use came to substitute the role of the tide-well (*poço de maré*), replacing the little reliable collective system of subterranean catchment with an individual system of superficial retention.

**Wine cellar house, Cabrito, Pico island, Azores, Portugal** (© *M. Mourão, 2017*)

**Abandoned wine cellar house, Cabrito, Pico island, Azores, Portugal** (© *M. Mourão, 2017*)

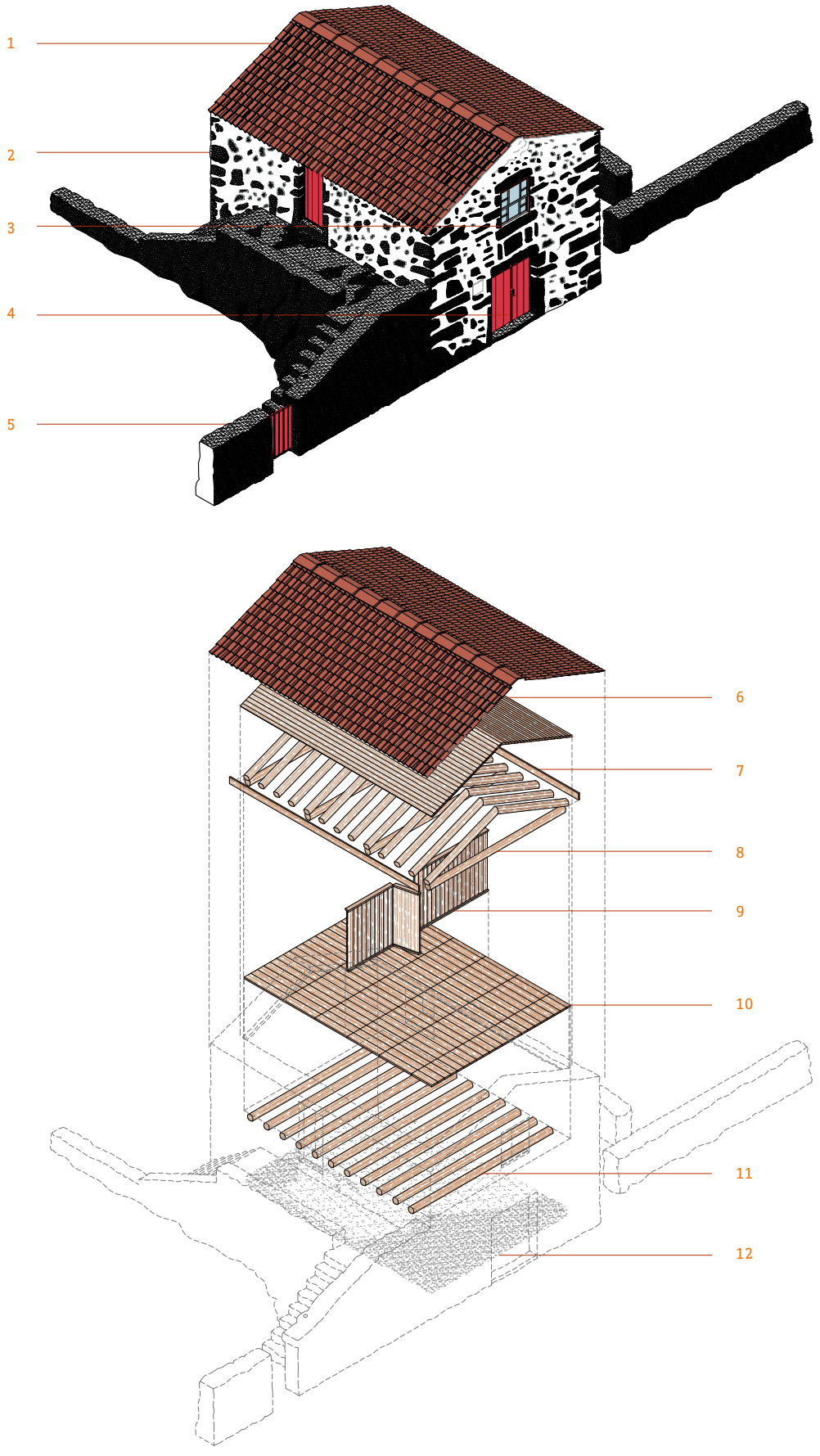
Most of the tanks and cisterns present an external solid volumetry of a rectangular configuration. In general, these were built on the side of the main building, in one of its longest elevations. Usually, it corresponded to the opposite side of the principal entrance. Their construction presented a continuation of the external walls constructive system, with less height than the ground floor and a characteristic steep, covered with a concave configuration with a smooth finish (Ordem dos Arquitectos, 2000). This allowed to catch and to drain the rain water from a central hole until its internal chamber.

### Kitchen and oven

The kitchen and its oven constitute an ensemble typological element. They determine a programmatic addition, resulting in an evolution of the original building. It consisted in a direct increase of the pre-existent volume, or in its addition to one of the building sides, or even, in the overlap of another floor. This rectangular compartment has the same geometrical building pattern, with the usual addition of a traditional oven. The oven presents a circular configuration and it is generally located in the opposite side of the main façade. The oven has a dummy vault integrated in the stone masonry, in a kind of bag, thus considerably lengthens the thickness of the external wall. Inside, the oven is featured by a rectangular entrance preceded by a stone stand (known as *lar*, in Portuguese).

### Wine press

The wine press (*prensa)* constitutes the essential instrument to produce wine. The wine tank (*lagar*) and its press define the geometry and the configuration of the space designed to this activity. Its relation with the building is fundamental to the perception of the architectural typologies developed in the region. Not all the wine cellars have wine presses and wine tanks, mostly used for wine storage only (AAP-CDN, 1988).




**Summerhouse with cellar, exploded 3D model, Cabrito, Pico island, Azores, Portugal**
Axonometry:
1.Clay tiles; 2.Volcanic stone masonry; 3.Single hung window (*janela de guilhotina*); 4.Painted cellar gate; 5.Wineyard walls (*currais*)

Building components:
6.Wooden planking; (*tabuado*) 7.Ring-beam (*frechal*); 8.Wooden truss ensemble; 9.Detachable wooden partitions (*frontais*); 10.Wooden floor platform (*sobrado*); 11.Recessed floor beams; 12.Volcanic gravel layer (*bagacina*);

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## Construction systems and elements

### Pavement

The building's foundations are usually inexistent, as buildings directly arise on volcanic ground. This is usually done through the direct levelling of the pavements. In most of the old wine cellars, especially in the most modest cases, the ground is simply covered by a volcanic gravel layer with fine granulometry, the characteristic lapilli (*bagacina)*. This solution allows a pragmatic drainage of the spilled liquids (derived from the production), without any scoring system.

### External walls

The external walls were built by multiple volcanic stone layers with a varied geological composition. They present considerable thickness, which reached a section around 50-60 cm. Openings are occasionally integrated with more bearing and regular lineal elements, provided with lintels supported by keystones – pillars. The support pieces present an indented alternation with the execution of a transversal locking, which covered all the internal surface of the opening.

### Internal non-structural walls

The internal walls were constituted by simple wooden partitions (*frontais)*. These non-structural elements were executed with vertical alternated planking (with a width of 20cm), generally in cryptomeria or Japanese cedar wood *(Cryptomeria japonica)*. The wood was cut directly and had a superficial sanding, without any additional treatment. This kind of wood was particularly appreciated the Azores due to its durability and resistance, even without any protective treatment.

### Wooden Structure

The wooden structure that supported the roof was extremely simple, generally composed of a truss ensemble, with a reduced spacing between each truss. These wooden elements presented a small circular section, joined by a simple fitting at the extremes of the beams, which had a wedge shape. The solutions generally present a ring-beam *(frechal)* to solve the contact with the external walls, and it usually did not include any ridge-beam (*tábua da burra)*. Sometimes, the type of wood could change, and in the case of Cabrito settlement, it is possible to identify the use of incense wood and beech wood.

### Roofs

Traditional roofs were covered by one canal tiles, with the following features: a noticeable length, an upper flatten arch. Over time, ceramic tiles were gradually replaced with cement tiles with the same type of configuration. Besides the lack of clay as a raw material in Pico island, clay tiles had the advantage of a better resistance against erosion, caused by the sea salt. These tile elements were a handcrafted production, with little production in the island market. Nowadays, there are still some stored sets of clay

tiles, which are insufficient to the current demand. This causes that many inhabitants replaced their roof tiles with an industrial tiles production of different configuration. Tiles are directly placed above a wooden planking, disposed over the wooden trusses. Wooden planking was overlaid on the top of the conventional board, minimising the effects of the occasional filtrations.

**Openings**

There were three types of openings: doors, cellar gates and windows. One very characteristic detail was the red colour paint applied in the wood of the openings. Usually, the applied colours were green, red and apricot. These exceptional elements stand out due to the contrast with the predominant basaltic black colour presented in the building walls, as well as in the island landscape (Ordem dos Arquitectos, 2000).
Windows were generally built as chest windows and had small dimensions. In most simple cases, they had board doors provided of quadrangular openings in each sheet. In the studied region, there was still the solution based on the single hung window system (*janela de guilhotina*). Glass in the windows had a quadrangular configuration with different compositions, but the most common was 4 or 6 identical fragments per sheet.
Doors were high or low with one open sheet, and were generally aligned with the chest-window (*janela de peito*). The doors were generally distinguished by the domestic entrance and the work entrance. Their particularities gave a chance to verify the evolution from the unit-base to the work space. Doors were made of vertical boards, directly attached to two or three horizontal beams, which were fixed to the rotation mechanism.
Gates always had two open sheets, with a central prominent frame, in contrast to the domestic door, in order to facilitate the transition of more weight elements. The gate was also executed towards a vertical board that was fixed against two horizontal beams, in the interior face.

**Finishes and coatings**

Although the integration of lime mortar was not common to all the local building culture, its use was intense in the Azorean archipelago. It is possible to identify how frequent was its use, not only as a superficial covering of external or internal lime plaster; but also as a binder of some of the stone masonry system layout (Correia, Carlos, 2015). Several Azorean houses have lime plaster and are limed washed regularly, even nowadays.

**Strategies for protection**

In order to manage the World Heritage property, the Azores Regional Government approved in 2006, the *Land Management Plan of the Protected Landscape of Pico Vineyard Culture*. The monitoring of this Plan is being addressed by the Regional Directorate for the Environment (Rocha, 2013), with the collaboration of the technical office established in Lajido, in 2011.

**Vineyards walls (currais) reconstruction, Pico island, Azores, Portugal**
(© *D. Matos, 2017*)

The purpose of this special Plan is to promote the maintenance and the recovery of the vineyard landscape, turning it as the driver for Pico island further social and economic development (Florentino et al., 2020). This plan allowed the financial support of the Regional Government to adopt some measures and strategies, such as: to impose planning constraints on new buildings; to use appropriate local building materials; to reconstruct ruins; to revitalise abandoned vineyards; to remove invasive plants; and to guarantee the revitalisation of the landscape through the increase of cultivated vines under traditional methods.

A few years later, in 2014, the Plan was revised, reflecting the updated regulations for architectural projects. Regarding the traditional cultural landscape, it was possible to address its conservation, but only by forbidding the vineyard to be removed or destroyed. In the preservation of the existing buildings and on their adaptation to new uses, the planning rules also imposed that the design should respect the traditional elements, as typologies, dimensions, materials and colours, following several specific urban parameters. The restrictions were particularly mentioned for all the small settlements at the high and medium levels of protection. For the agricultural spaces there was also different levels of preservation. The World Heritage Technical Office is responsible for all the processes, the management and the implementation of the Plan.

In the long-term, sustaining Pico island Vineyard Culture Landscape will require continuous ongoing coordination between Municipal and Regional levels of government, in partnership with the local communities and land owners. To face these challenges, some tools and new technologies are already

**Wind mill, Cabrito, Pico island, Azores, Portugal**
(© *M. Correia, 2017*)

being implemented, for instance, the Geographic Information System. The main aim and focus is to maintain the traditional environment and cultural landscape, through territorial regulations that can be considered as good practices for the management of World Heritage sites.

## Acknowledgments

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## Introduction

### The historic walled city of Cuenca

*opposite page*
**General view of the Huécar gorge, Spain**
*(© F. Vegas, C. Mileto, 2017)*

Cuenca is a city in the region of Castilla La Mancha in central Spain, nestling between the Júcar and Huécar rivers. Although there is information on the existence of population nuclei around the city since the Upper Palaeolithic (Cuevas, 2000), the urban nucleus, which led to the creation of the current city, first appeared after the Moorish conquest in the late 9th - early 10th centuries (Herráiz Gascueña, 2008). The conquest of the city in 1177 by Alfonso VIII marks the start of the city's Christianisation.

At that time, the city's economy focused mostly on the textile industry, which experienced a major increase in production and economic activity in the 15th-16th centuries. This also led to an increase in the city population, progressively overtaking the earlier Moorish city (Troitiño Vinuesa, 1995). However, in the 17th century, this industry gradually slowed down, causing a population loss from which the city was not to recover until the following century. In 1833, the city became the capital of the province of Cuenca (Prieto Prieto, 2005). At present, the principal industry in the city is tourism, especially since its declaration as a UNESCO World Heritage City in 1996.

The architecture of Cuenca, which blends into its surroundings, has earned it the title of World Heritage City and gives it its unique character. Its privileged location allows Cuenca to still maintain its medieval urban layout almost intact, and has led to its inclusion as a Fortified Historic City the UNESCO World Heritage List. The current city is divided into two very distinct areas, the historic (or upper) city and the new city.

The new city is located southwest of the historic city, and both are divided by the river Huécar. However, UNESCO specifically recognises the upper city of Cuenca (the historic city), which is now a historic city centre where past and present intertwine, and nature and culture coexist in harmony (Muñoz Calero, 2017). The historic centre of a city can provide a wealth of information on its history and the ways of life of its people, a sort of collective memory of the past (Troitiño Vinuesa, 1995). The historic city of Cuenca, with an urban landscape shaped by the Júcar and Huécar rivers, makes Cuenca unique among Spanish cities, spectacularly combining natural and cultural landscapes, where what is valuable is not the individual monument, but the overall combination (Troitiño Vinuesa, 1994). The city's traditional architecture, streets, passageways between houses, and especially its historic centre, transmit the way of life of past centuries, the need to adapt to the high craggy terrain, and the overhanging architecture, which remedies the limited space within the city walls.

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**View of the skyscraper facades on calle Santa Catalina, Cuenca**
(© *F. Vegas, C. Mileto, 2017*)



**Localisation and map from the declaration of Cuenca as a World Heritage city by UNESCO**
In orange the area of the World Heritage property, in grey the buffer zone perimeter
(© *map: L. Garcia, documents-UNESCO*)

There are 15 Spanish cities listed as UNESCO World Heritage Cities. The group of World Heritage Cities of Spain was set up in 1993 with the common objective of acting jointly to protect this heritage and to maintain these historic nuclei, creating common projects and proposals, setting up channels to exchange experiences and issues. This international recognition as World Heritage means that these cities now hold the great responsibility of guaranteeing the protection and conservation of this heritage for future generations (www.ciudadespatrimonio.org/). These cities, which have been working together for over 25 years to defend common interests, to study solutions to similar problems, and to promote high-quality cultural and historic tourism, are organised into three different working commissions: City and Heritage; Education and Culture; Representation, Promotion and Tourism.

### Real Patronato of the City of Cuenca

After the city of Cuenca was declared World Heritage, the Spanish Ministry of Education, Culture and Sport and the Council of Ministers agreed, in 2004, on the creation of the *Real Patronato* [Royal Board] of the City of Cuenca. This body is in charge of promoting and coordinating any action to be carried out in Cuenca, by the administrations and organisations, for the conservation and revitalisation of the city's cultural heritage, and the development and promotion of any related cultural and tourist activities. The *Real Patronato*, which falls under the aegis of the Ministry or Education, Culture and Sport, led to the creation, in 2005, of a consortium of administrations made up of the Spanish Govern-

**General view of the upper city of Cuenca, Spain**
*(© F. Vegas, C. Mileto, 2017)*

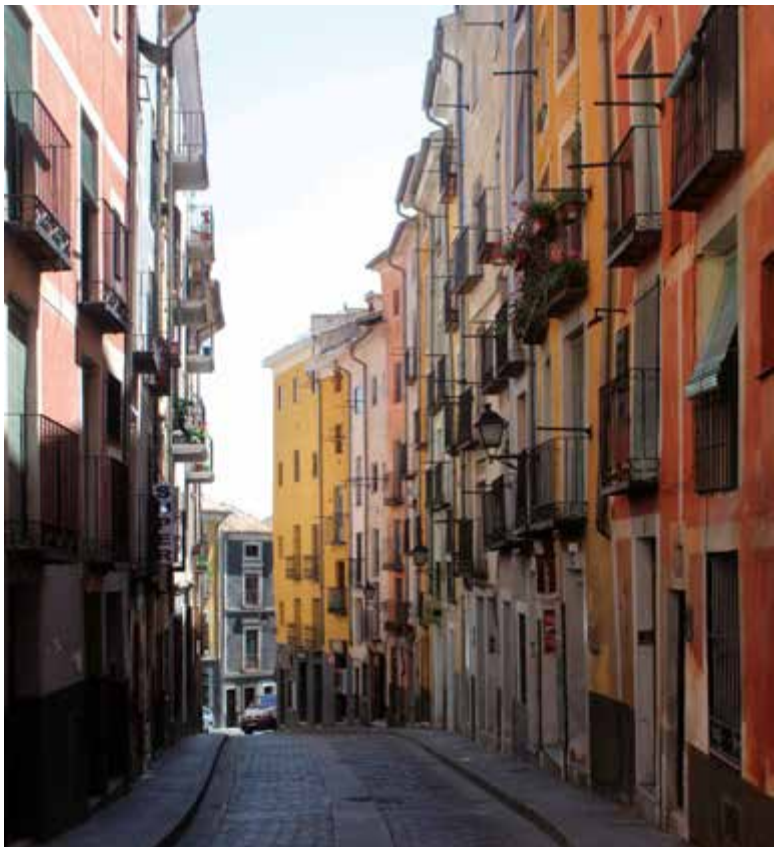
ment, the region of Castilla La Mancha, the City Council of Cuenca, and the Provincial Government of Cuenca.

The Consorcio de la Ciudad de Cuenca was created "for the institutional coordination derived from the competences of the Real Patronato, and for the better application and development of its agreements", in July 2005, with no end date. Its main purposes include the promotion of the execution of works, services, and installations in general; the promotion of coordination of investments planned by the Administrations; increased initiatives and cultural projects geared towards the conservation of Historic Heritage; and support to tourist development in the city (García Marchante, 2011). This consortium has a website showing the different actions and strategies developed or under development in the city of Cuenca (http://www.consorciodecuenca.es/).

## Methodologies / dimensions of analysis / Field of work

The objectives and methodology of this research are in line with the general objectives and methodology of the project *3DPAST-Living & virtual visiting European World Heritage*. The main objectives of this research are therefore:

- The study of inhabited vernacular architecture in the city of Cuenca, declared a World Heritage City;
- The study, definition, and dissemination of management strategies for the city and its built heritage, constructive culture, historical evolution;



**Facades still conserving constructive features of traditional architecture from Cuenca**
*(© F. Vegas, C. Mileto, 2017)*

**Facades on calle Alfonso VIII**
*(© F. Vegas, C. Mileto, 2017)*

- Sharing the different experiences on how this heritage is being managed and inhabited, and the maintenance actions and strategies applied in the different case studies;
- Bridging the gaps between architecture and the younger generations using interactive and digital technologies.

In order to attain these objectives, especially that of the study of vernacular architecture of the city of Cuenca, the study followed a three-pronged approach, as proposed in the 3DPAST project: 1. The existing inhabited vernacular architectural heritage; 2. Historic tangible heritage, as related to historic constructive materials and techniques; 3. Intangible heritage, as related to the craftsmen keeping alive the knowledge of traditional constructive techniques.

Therefore, the work carried out has been structured following a methodology organised into three different levels or approaches:

- General and urban study of the city;
- Study of vernacular constructive typologies;
- Study of specific constructive techniques.

Different research strategies and activities were used for the individual analyses. The first phase of the study consisted in the inspection and analysis of the city through several field visits. One of these visits took place in 2017 in Valencia, as part of the seminar on the 3DPAST project, with initial work by the participants consisting in an urban analysis on the city's current situation. The main aim of the visit was to allow students to carry out direct analysis of the case study of the city of Cuenca. On the same day, a

meeting was held with the Consorcio of Cuenca City Council to ensure a first-hand account of the coordination work of all the public administrations with competences in heritage, culture, and tourism in the city. The work consisted of a brief in situ data collection, using material and plans provided by teachers, to develop a short description of the current condition of the historic city centre, as well as urban analysis on a territorial and detailed scale. Work templates were prepared, so that individual groups of students could carry out independent data collection, along with fellow participants in the groups. An initial analysis was carried out on the environmental context (views, geography, borders and limits, facade colours…). Urban, architectural and tourist landmarks were also studied. A study was carried out on streets, types of flow, traffic intensity, and areas of conflict between rolling traffic and pedestrians. More detailed analyses were also carried out for these flows of movement and the points of convergence of vehicles and pedestrians. Street furniture, design, materials, integration within the surroundings were also studied, as were street sections or building height. Finally, a study began on the interventions carried out in the buildings, focusing on interventions in roofs, cornices, and elements affecting the volume of the building, as well as on interventions due to changes in use of the buildings.

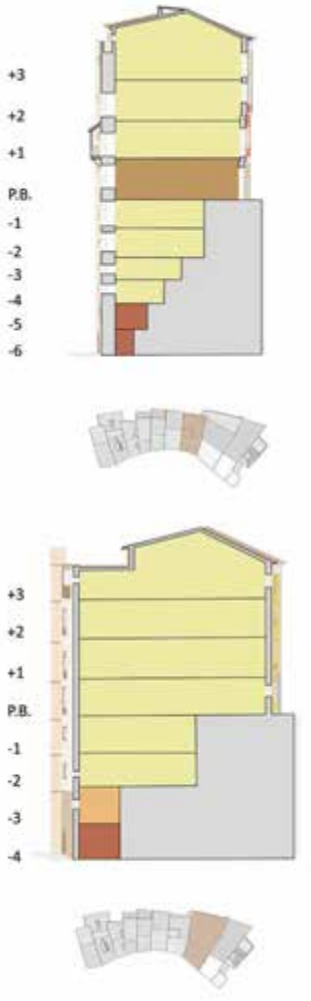
The second phase of the study consisted in the analysis and processing of all the information collected in the visits for a more detailed study of the traditional architecture of Cuenca, and the management strategies implemented for its conservation. This phase also included a completed End of Degree Project (by the student Inmaculada Muñoz Calero), and different 3D studies and surveys of this architecture.

## Traditional architecture of the city of Cuenca

### Architectural features/main typologies/building technique features

The historic city centre of Cuenca is made up of the upper city or old city, the gorges of the Júcar and Huécar rivers, and the area outside the walls, which marks the transition from the upper to the lower city. In this historic city centre it is worth highlighting the neighbourhood of San Martín, which extends along the limey crags formed by the Huécar river. The construction of traditional dwellings in this area adapts to the complex topography and is restructured into narrow elongated plots on solid rock foundations. This makes it possible to erect buildings of considerable height between party walls, veritable skyscrapers, which give this hill its name (Muñoz Calero, 2017). The city's vernacular architecture is characterised by the facades that lean on each other with intertwining layouts to ensure stability. The facade in the Huécar gorge is the best known, as it is the most accessible. In contrast, the urban occupation of the Júcar gorge is somewhat different, leaving exposed the slope by the river. The architecture hanging from the cliffs formed by these gorges is one of the city's signs of identity.

In the area of the Júcar gorge, several actions were carried out to free up space and create gaps in the urban fabric for the purposes of renovation. However, it must be borne in mind that the current lookouts were once modest dwellings, which filled these spaces, while dense vegetation from the river now covers the large stones found in the Júcar gorge (García Marchante, 2003). Although only four facades,




**Analysis of typologies and functions**
In yellow the residential, in red the warehouse, in orange the residential/warehouse, and in brown the residential/commercial
(© *L. Chisari, B. Rossi, 2018*)

**Facades on calle Alfonso VIII, in Cuenca, Spain**
*(© L. Chisari, B. Rossi, 2018)*

now known as the Hanging Houses, survive in the Huécar gorge, there were many more buildings built on the edge of the gorge, and they formed one of the most incredible examples of the city's vernacular architecture typology (Ibáñez Martínez, 2016).

The Upper City of Cuenca includes three areas with the most representative typologies of vernacular architecture in the city: the Hanging Houses in the Huécar gorge, the houses on calle de San Juan, overlooking the Júcar river, and the skyscrapers of la Correría, currently known as calle Alfonso VIII.

Two main dwelling typologies can be found in these areas. The first is built on rectangular plots with maximum facades measurements of 3.5 m, with several bays behind them, and facades with only one or two openings per floor. In this type of dwelling, the ground floor was devoted to artisanal and manufacturing purposes, while the upper floors were residential. The most characteristic features of this typology include: "A single stretch of stair perpendicular to the facade, with no natural light, the sitting room window in the facade, the kitchen at the back and internal bedrooms with no ventilation or a small bedroom connecting to the sitting room"[1] (Ibáñez Martínez, 2016). The second typology is that of the double module, sometimes original or the result of joining two single lots. The facade width in this typology is 4-7 m, which allows the inclusion of two to three openings per storey (Ibáñez Martínez, 2016).

Therefore, traditional architecture in Cuenca is characterised by deep dwellings built between party walls, with narrow facades. In these, the ground floor is often built with masonry, and the upper storeys use mixed framework systems with lightweight fillings, progressive overhanging floors, and openings following the mixed wooden structure (Ibáñez Martínez, 2016). In some exceptional cases the ground

[1] Original text: "la escalera de un tramo, perpendicular a la fachada y sin iluminación exterior, la habitación de estar en la fachada, la cocina en la parte trasera y los dormitorios en el interior sin ventilación o como alcoba que da a la sala de estar".

**Facades on calle Sta. Catalina, Cuenca, Spain**
*(© I. Chisari, B. Rossi, 2018)*

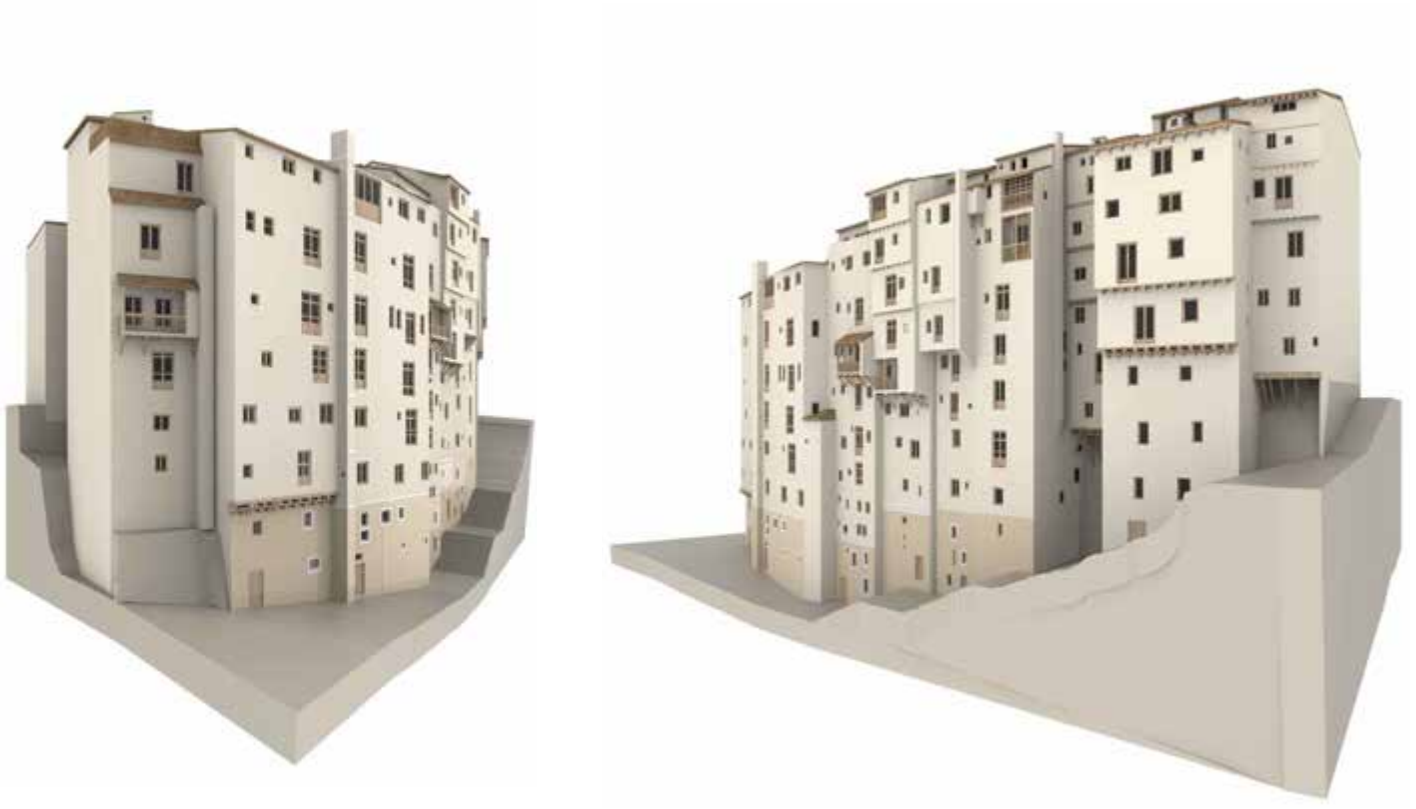
floor is also built using mixed systems of wooden framework. The skeleton structure makes it easy to include openings and allows space for open balconies and galleries. The ends of floor beams are often left exposed in these buildings, at times resting on a wall or course of the ground floor, while each floor overhangs (usually no more than 20 cm) over the previous one. The roof of this type of building is almost always a tiled gable roof, although a small number have hipped roofs, and occasionally chamfers. The interior partitions in these dwellings are usually executed with framework elements, and in some areas wattle daubed with clay or gypsum is used (Flores López, 1973).

## Functional organisation of the buildings

### Skyscrapers

The large block of la Correría, now calle Alfonso VIII, still maintains many medieval architectural features. As a fortified city with little room for growth there was a need to build tall narrow buildings, known as skyscrapers. The foundations of some of the buildings on this street are at the foot of the cliffs, hidden behind the facade, while, in an attempt to gain space inside the dwellings, others are finished with balconies creating small overhangs on the cliff.

The organisation of the facades of these two buildings differs greatly. The accessible facades of calle Alfonso VIII present a distribution characteristic of the 19th-century transformations, which replaced medieval irregular layouts: the new facades are organised with regular openings, symmetrically distributed, decorated with mouldings or ironwork on the balconies, and careful renderings in characteristic shades of grey, yellow and purple (Muñoz Calero, 2017). In contrast, the back facades on calle Santa Catalina still maintain the irregular positioning of different-sized openings, the lack of decoration, and the frequent staggering of floors through overhangs (characteristic of medieval Cuenca), thus contrasting with the retrofitted facade on calle Alfonso VIII (Alau Massa et al., 1983).



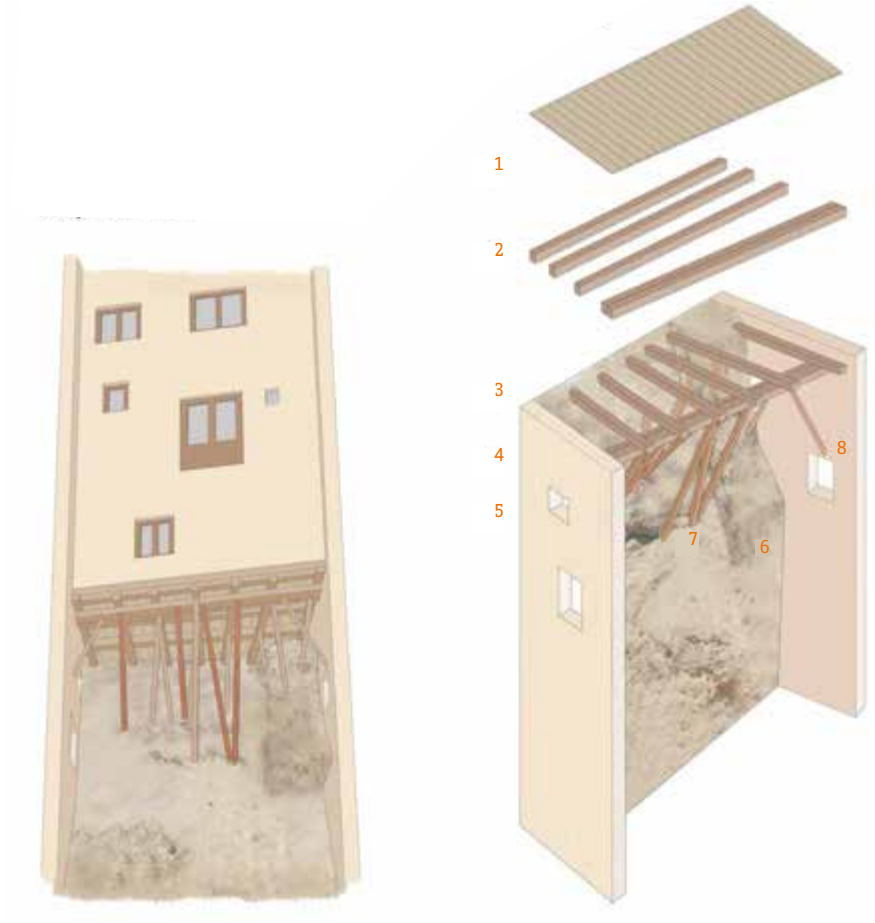
**General 3D images of the group of 'skyscrapers'**
*(© L. Chisari, B. Rossi, 2018)*

**3D interactive model of the skyscrapers (Rascacielos)**
*(© L. Chisari, B. Rossi, 2018)*

The skyscrapers generally have long narrow floor plans, and are several storeys high above the level of the access street (generally three or four storeys), descending at the back (sometimes up to eight floors) to find support at the foot of the cliff or braced by the system of overhanging balconies.

The constructive systems of these buildings are generally based on grid systems and lightweight assembled wood systems, with fillings of adobe, rubble, brick and even stone, forming 'mixed' continuous structures (Muñoz Calero, 2017). Originally, the interior distribution was articulated as a single unit, based on the prototype diagram of bourgeois medieval city: the ground floor was devoted to artisanal and commercial uses and the upper floors to the family residence, although the individual layout of these buildings determined a much more complex superimposition of functions, using the following levels as auxiliary spaces or quarters for rural use. However, after the remodelling in the second half of the 19th c., the subdivision of buildings was generally transformed, creating a dwelling per storey, even on floors below ground.

The dwellings on calle San Juan are not as well-known as the facades overlooking the Júcar gorge, and are more concealed from view. However, it should be stressed that they generally follow the same constructive guidelines as the buildings on the hills of the Huécar river, with the need to adapt to the natural steep terrain, although in this case the large rocks of the Júcar are still visible.



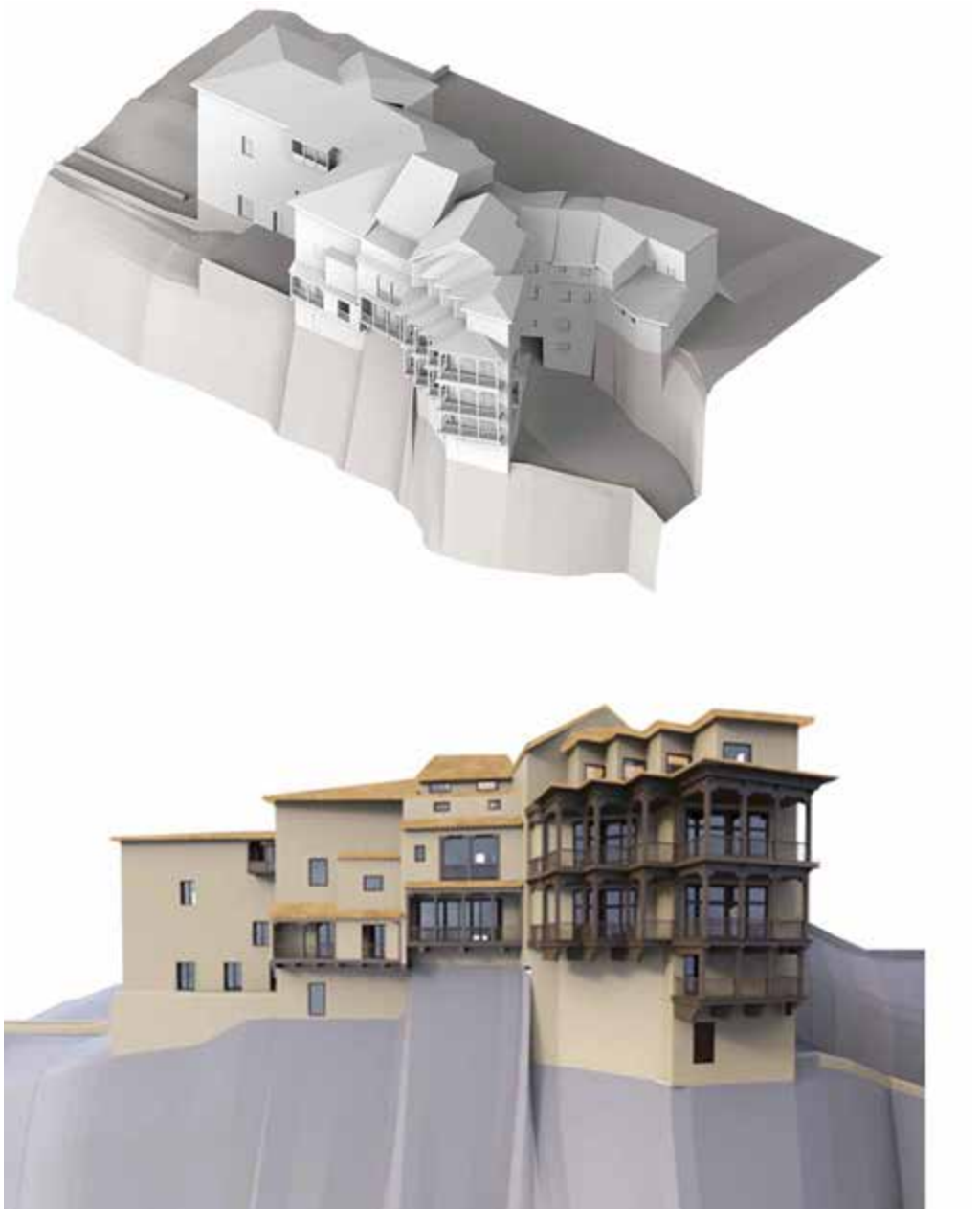

**Detail of the constructive system of overhangs. Example of one of the overhanging structures on calle Santa Catalina - perspective view and exploded axonometric**
Overhanging structures types: 1. Wooden boards; 2. Support beam; 3. Wooden shelves; 4. Main beam; 5. Masonry wall; 6. Mountain cliff; 7. Wooden struts embedded in the cliffs; 8. Wooden struts embedded in the walls
(© *L. Chisari, B. Rossi, 2018*)

## Hanging houses

The hanging houses can be considered the most famous and representative civil buildings of Cuenca's vernacular architecture. They are the most unique and special typology of traditional architecture in Cuenca. They have now been completely transformed, showing the passing of time, human intervention, and the idea of what this extraordinary group of buildings once was in the gorge of the Huécar river. These buildings date from the first half of the 15th c., being Ferrando de Madrid reported as the first known owner, followed by Gil Ramírez de Villaescusa, canon of Cuenca Cathedral. The outline of the block acquired a shape similar to the current one in 1469 (Ibáñez Martínez, 2016).

The four facades currently seen from the Huécar are not four independent dwellings, as Pedro Miguel Ibáñez Martínez states in his book *Las Casas Colgadas y el Museo de Arte Abstracto Español*, but three dwellings. The two facades on the right, looking from the river, are a single dwelling identified as the *Casa de la Bajada a San Pablo* (House on the slope to San Pablo). The third of these facades, right next to the first two, is known as the *Casa del Centro* (House in the centre), and the one on the left is the *Casa de los escudos de Cañamares* (House with the Cañamares coats of arms), therefore referring by extension to the previous group of two, which has been a single dwelling since the late 18th century (Ibáñez Martínez, 2016).

In the first third of the 20th century, the local residents and institutions tried to suggest new uses and a conservation and maintenance strategy for these homes, although occasional conflicts arose during



**General 3D views of the Hanging Houses and 3D diagrams of different typologies of balconies and overhanging structures**
(© *L. Chisari, B. Rossi, 2018*)

this process. Up until this point, the clifftop buildings on the Huécar gorge had been gradually disappearing, with a series of demolitions that began in the late 19th c., until only the 4 facades now visible were left. The *Urbanisation plan for the city of Cuenca between the Júcar and Huécar rivers* presented in 1893 by Antonio Carlevaris proposed the almost entire destruction of the neighbourhoods of Santa María and San Martín, to be replaced by gardens, erasing the medieval spirit of this part of the city and its values as popular architecture (Muñoz Calero, 2017).

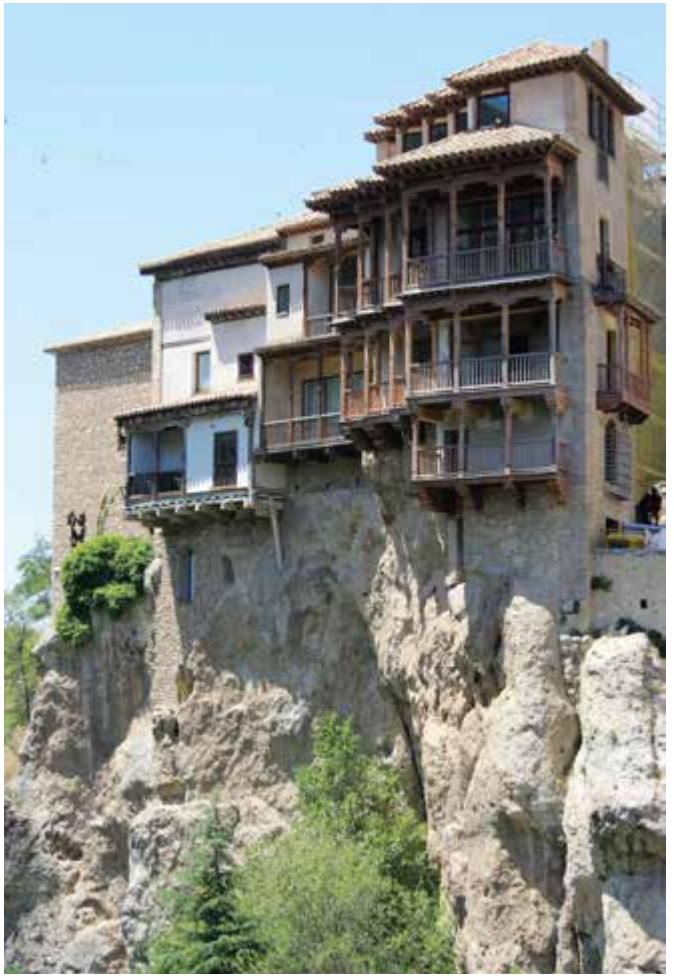
The present appearance and layout of these houses is the result of successive works of restoration and retrofitting. There is interesting graphic documentation of some of these interventions, such as that compiled by E. Torrallas in 1958, and published in the book by Ibáñez Martínez in 2016, edited by the


CASE_2


CASE_3


CASE_4


CASE_5



**Cornice of the dwellings on calle San Juan overlooking the Júcar gorge, Cuenca, Spain**
*(© F. Vegas, C. Mileto, 2017)*

**Facades of the Hanging Houses overlooking the Huécar gorge, Cuenca, Spain**
*(© F. Vegas, C. Mileto, 2017)*

University of Castilla-La Mancha and the Consorcio de la Ciudad de Cuenca. This publication also includes graphic information from 1962 compiled by Francisco León, municipal architect of Cuenca, who documented the original condition of the *casa de la bajada* and *casa del centro*, prior to current transformations. The *casa de los escudos* and *casa del centro* became a single dwelling when the City Council acquired them, but it is unclear when this happened or how it can be verified. There isn't also any documented information on the interior before the *casa del centro* was completely emptied in 1963. However, there are some approximate plans on the interior layout prior to the project to adapt it to its new use as a Museum of Abstract Art in 1966, as the city council had ceded the building for use as a museum managed by the Fundación Juan March.

The most characteristic constructive elements of these facades in the Huécar gorge are the overhanging wood balconies. However, many of these elements are not original but rather are characteristic of the interventions mentioned above. The only constructive elements still conserved in their original condition are the small overhangs of the lower floor of the *casa de los escudos*.

## Values and risks at the site

The cultural heritage of Cuenca can be understood by walking its streets, investigating in museums and archives, experiencing it in churches, squares, concert halls, centres of learning and of course, in its vernacular architecture (Osuna Ruiz, 1997). In recent decades the city has experienced a staggering increase in tourists, attracted by this heritage. It is clear that the historic city centre is the main attraction for cultural tourism to the city, one of the basic pillars of the urban economy of Cuenca. This potential appeal for tourists increased after the city was listed as World Heritage. However, it should be recognised that the tourist potential and appeal of these cities recognised by UNESCO could become a clear risk to heritage conservation, if no proper tourist management strategies were established.

## Strategies for conservation and sustainable development

After this work was completed, a series of conservation strategies characteristic of the management being carried out have been identified in the city of Cuenca. In order to care for and protect this valuable city heritage it is crucial to study and analyse it from numerous perspectives, not just an architectural one. To do so, the regulations in place in the city of Cuenca include a Special Protection Plan, the *Special Plan for the Upper City of Cuenca and its Gorges*, which states that: "We understand the city of the present as a projection in space of the legacies of history, which when investigated make it possible to understand the logic that must guide any urban transformation, as well as the meaning of the relationships between the architectural elements and the social and functional realities" (Alonso Velasco, 2002). This plan includes a map showing the architectural complexes catalogued, the assets of cultural interest and their protected surroundings, and the buildings inventoried, catalogued elements of interest, and critical points of the landscape.

A key strategy in the management of the city's architectural heritage has been the creation of the city consortium. The Consorcio de la Ciudad de Cuenca and the Real Patronato annually carry out actions geared towards the conservation and revitalisation of the city's cultural heritage, as well as the development and promotion of related cultural and tourist activities. Every year, the consortium publishes different subsidies to carry out this objective of conservation and revitalisation of the city's cultural heritage. The year 2020 for instance, has seen the publication of different grants, including subsidies for the development and promotion of cultural and tourist activities at the historic city centre of Cuenca; subsidies for the organisation of congresses, conferences, seminars, and other activities for the promotion of the city in the year 2020; direct subsidies from Fundación de Cultura Ciudad de Cuenca in 2020; subsidies for the retrofitting of premises for 2019; subsidies for the retrofitting of residential units for 2019. These grants incentivise both the maintenance of the historic centre's architecture and the dissemination and study of the city's heritage.

As a management strategy, it is also of great interest to be able to carry out joint actions throughout the network of the 15 Spanish cities classified as World Heritage. The work carried out by the three



**Publications by the network of Spanish World Heritage Cities**
Left: Book which is part of a series of publications on the urban evolution of individual cities. Right: Didactic guide to the city of Cuenca, part of a series of didactic guides published by the network (© *http://www.ciudadespatrimonio.org*)

commissions in this network (City and Heritage; Education and Culture; Representation, Promotion and Tourism) includes studies, gatherings, conferences, activities, and specific publications to raise awareness and promote the heritage of these cities. Specifically, the commission of Education and Culture has had a "Heritage Classroom" programme since 2014. The aim of this programme is to help students, living and studying in these 15 cities, to learn and value not only their city but also the rest of the Spanish UNESCO World Heritage Cities, thanks to local educational activities carried out by their teachers, and the organisation of cultural trips of groups of students to other Heritage Cities. This network's website has made freely available publications geared towards different audiences. Publications for children include a series of short and appealing visual publications dedicating some space to defining key points for conserving heritage, including protecting, looking after, discovering and sharing with others. These publications also feature games and activities, which in turn make the city visits entertaining and attractive for children.

In addition, the commission for Promotion and Tourism is in charge of the vital task of managing and promoting quality tourism. For this, this group of cities has set up a Tourism Observatory, in collaboration with specialist consultancy firm Braintrust. Its 2019 report offers some information such as the increased duration of the average tourist stay. However, the appearance of unregulated holiday accommodation in historic centres is increasing, and it should be addressed immediately. Furthermore, this strategy of tourist information through the Observatory also facilitates both the common and individual work in each city. From this report it is concluded that the cooperation between Public Administration and Private Companies is essential for optimising management, guaranteeing and improving the tourism management model of our heritage in the future (Observatorio Turístico GCPHE 2019).

## Acknowledgements

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# HISTORIC CENTRE OF THE CITY OF PIENZA, ITALY

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*opposite page*
**Panoramic view of Pienza and the Val d'Orcia valley**
(© *CHM Lab, DIDA, UNIFI, 2018*)

Pienza, which has a tourist presence of over one million visitors per year, is a *unicum* due to the exceptional nature of its architecture and of the landscape of the Val d'Orcia in which it is located; the former has been listed as UNESCO heritage since 1996, and the latter since 2004. Before Enea Silvio Bartolomeo Piccolomini (Corsignano, 1405 – Ancona, 1464), elected to the papal throne in 1458 as Pius II, decided to transform Corsignano, his hometown, into the summer residence of his court, the town was one of many early Medieval settlements in central Tuscany. The Pope's ambitious project was carried out very quickly between 1459 and 1462, under the guidance of the Florentine sculptor and architect Bernardo Gambarelli (called Rossellino, Settignano, 1409 – Florence, 1464), who applied the Renaissance town-planning concepts learnt from his mentor, Leon Battista Alberti (Genoa, 1404 – Roma, 1472), a humanist thinker and architect.

Extensive research has been carried out as part of the 3DPAST Project, both on published sources and through measurement campaigns, aimed at describing the evolution of urban morphology, types and construction techniques. The material produced was used to create a virtual tour of an urban section of the city, and a promo version of video game design for younger people.

## World Heritage site characterisation

### Territorial context

From 2004, the Val d'Orcia landscape, including the councils of Pienza, Castiglione d'Orcia, Montalcino, Radicofani and San Quirico d'Orcia, was listed as a UNESCO World Heritage Site. It is a unique and architecturally invaluable instance of different landscape forms, in particular the two opposite slopes of the Orcia: the southern slope, characterised by the cone of Mount Amiata, and the northern slope by the skyline of hill ridges, on which Pienza stands. It presents traits of complexity and variety due to its particular geological structure, in which predominate igneous rocks from the region's volcanos, Amiata and Radicofani, as well as clayey and sandy sediments. This combination underlies two phenomena: on the one hand, the abundance of water sources and hot water springs, around which the habitat has developed since pre-Roman times; on the other hand, the constant transformations of the landscape, due to the fragility of the clay hills and their tendency to open into ravines and gulches in times of drought. This last feature has determined the anthropic construction of the current landscape through water canalisation works and excavations on the slopes, whose functional efficiency is

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**Drawings of small settlements in the Val d'Orcia valley, Italy**
(© G. Cataldi, F. Formichi, 2004, pp. 48-50. Grafic reworking: *L. Montoni, 2020*)

still evident today. The Val d'Orcia territory exemplifies the beauty of well-managed Renaissance agricultural landscapes. The exceptional cultural landscape includes agrarian and pastoral management systems, towns and villages, farmhouses, the Roman Frankish Route (Via Francigena), and its associated abbeys, inns, shrines and bridges.

**Localisation of the city of Pienza, Tuscany, Italy**



Geographically, Pienza is located in a strategic territorial node, at the intersection of two important route axes: the Via Cassia (North / South), roughly halfway between Rome and Florence and the road perpendicular to it, which leading from the ports of the Maremma up the Ombrone river to Val d'Orcia passes south of Pienza, before crossing the pre-Apennine ridge at the source, to reach Chiusi and Val di Chiana.

**Rural system**

Val d'Orcia is a perfect example of an area with a rural vocation. Prior to Pienza there had never been a city inside its territory, which means it had to pay tribute to two adjacent towns: Chiusi to the east, during the Etruscan era, and Siena to the north-west, during the Middle Ages.

Hence, the widespread share-cropping in Val d'Orcia: peasants were not landowners, but halved products (consequently the word the word 'share-cropper') with the landowner or with the town authorities (in Val d'Orcia the Abbey of San Salvatore sull'Amiata or the Hospital of Santa Maria della Scala di Siena), who owned most estates.

The derivation of estates from the Roman country-house is exemplified by the characteristic closed-courtyard form of its dwellings and farmhouses, whose typical forming process can easily be hypothesised: their residential wings were originally placed in front of the entrance doors facing the sun; at a later stage, adjoining rooms progressively formed around the 'threshing floor' (pertinent area) protected by its boundary wall, which is still the estate's main building constituent (Cataldi et al., 2003).

View of the Val d'Orcia valley from Pienza
(© *L. Dipasquale, 2019*)

Historical settlements in the Val d'Orcia, although rare and small in size, are greatly important for the configuration of the territory, and occupy the main hubs or strategic locations, adhering sensibly to the natural morphology.

**Historical evolution**

The territory of the Val d'Orcia has always been populated, and in particular the ridges and the watersheds determined a network of roads and small settlements of huts inhabited since Neolithic times. A settlement, consisting of round huts, occupied the promontory on which Pienza sits.

The Etruscans, who settled in the area starting from the 7th century BC, transformed the landscape through reclamation and canalisation works for the excess water of the valleys and slopes of the hills. They introduced the cultivation of grapes and created a network of settlements throughout the Val d'Orcia.

The primitive inhabited nucleus of Pienza dates back to this period, yet it is only during the Roman era that the settlement, known as *Corsinianum*, possibly derived from the name of the settler to whom the lands of this small promontory were assigned, was configured following the characteristic iso-oriented orthogonal mesh (*centuriatio* or *castramentatio*), in accordance with the agricultural division of the territory (Cataldi, 1998; Catladi et al., 2003; Cataldi, Formichi, 2004).

The Roman occupation of the territory marks the first traces on the Pienza hill that have remained visible so far. The east-west orientation of the current main street (today known as *corso* Rossellino) would in fact correspond to the ancient *decumanus*, while the via Marconi follows the original line of the *cardo*.

In the Roman period, the main building typology was the *domus*, an open enclosure space, with the house, generally one floor, usually located at the bottom of the courtyard. Following the fall of the Roman empire, cities were repeatedly attacked by barbarians and many inhabitants took refuge in the countryside. The fall of the Roman Empire led to the further population of the urban area. The courtyards of the *domus*, in order to accommodate new inhabitants in single-family dwellings, underwent a process known as *insulizzazione* (Cataldi, 1978; Cataldi et al., 2003; Cataldi, Formichi, 2004).

**Conceptual representation of the Etruscan settlement**
(*© Design by CHM Lab, DIDA, UNIFI,2018. Based on the material produced by Inklink studio, Florence, for the Museum of the City and the Territory of Pienza, 1998-2000*)

**Conceptual representation of the Roman town**
(*© Design by CHM Lab, DIDA, UNIFI, 2018. Based on the material produced by Inklink studio, Florence, for the Museum of the City and the Territory of Pienza, 1998-2000*)

**Conceptual representation of the Medieval town**
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**Conceptual representation of the Renaissance town**
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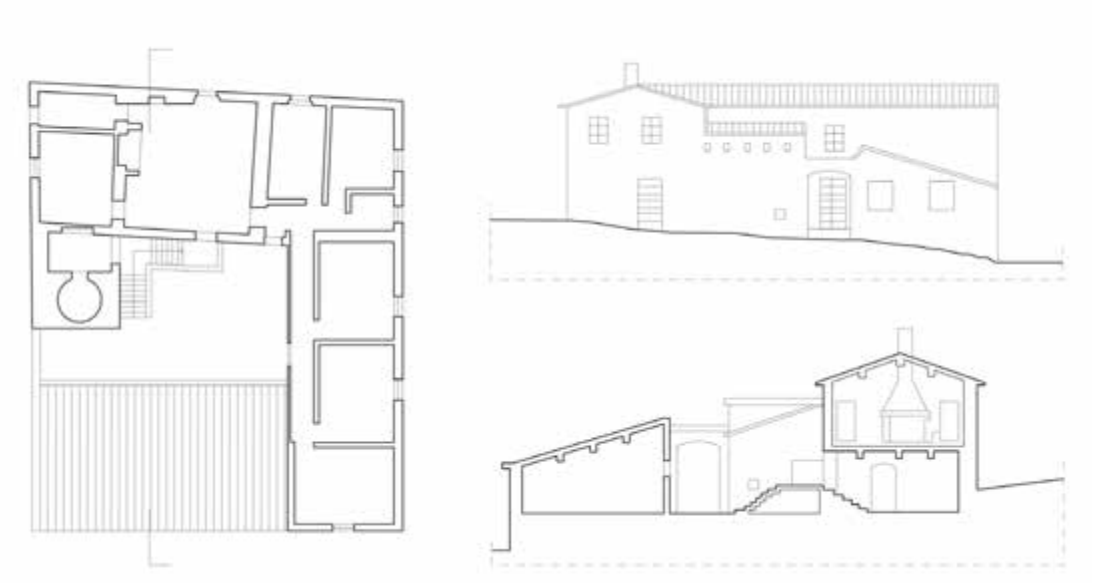
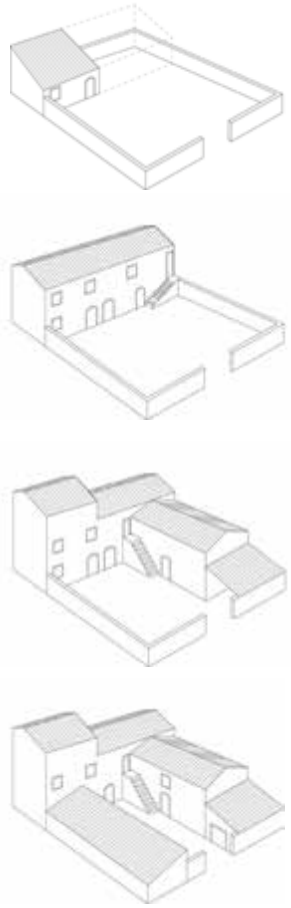


**Layout of a typical Val d'Orcia farm**

**Development hypothesis of a typical farmhouse**

(© G. Cataldi, F. Formichi, 2003, p. 42. Grafic reworking: *L. Montoni, 2020*)

In the Medieval period, the fabric of the first Roman town was flanked to the west by a second building fabric facing in a different direction, doubling the built area. The original city wall had to roughly follow its current circuit as far as the square, including its stronghold. At the beginning of the 14th century, Corsignano had 350 houses and 1750 people; most of the inhabitants were farmers, some were craftsmen.
Between the 12th and 15th centuries, Corsignano became a municipality and took on a precise configuration: the new constructions connected the most ancient nucleus to the fortress to the east, the church of Santa Maria and Palazzo Priori were built. Toward the mid-13th century, the Friars Minor of St. Francis built a monastery with a cloister (Merlo et al., 2003).
In the mid-15th century, the Medieval settlement was almost completely restructured following Renaissance ideals. The architectural ideas of Leon Battista Alberti were widely applied through the masterful work of his closest collaborator, Bernardo Gambarelli.
Following the expropriation of the dwellings for the construction of the square, the Pope had twelve new houses (*Case Nuove*) built for the poorer inhabitants. This set of row houses were once again built according to Pienza's traditional typology, with a masonry structure in exposed bricks, two cells in depth on two storeys for each building unit, a transversal staircase with some steps on the exterior, as typological remain from the stairs placed on the side of the building, known as *profferli* (Formichi, 1978).
In the new layout of the territory of Siena after the fall of the Republic (1555), Pienza lost its leading role as an administrative and commercial centre for the vast agricultural territory that surrounds it, falling back to its secondary role as a rural and agricultural town. This function undoubtedly permitted the work of Pope Pius II to maintain its authenticity throughout the centuries.



### Urban scale characterisation

When arriving from the countryside and looking upwards, it was possible to perceive their shape, rhythmed by towers and gates. This still partially applies to Pienza, whose defensive structures were strengthened around the year 1550 with the consolidation of the walls, and the construction of a fort in

**Functional organisation**
- hospitality
- shops
- restaurants
- other commercial activities
- utilities (fountain, public toilet, garbage collection)
- municipality
- religious / cultural

**Land use**
- green areas
- paved areas
- parkings
- main street

(© *Olin et al., 2017*, redrawn by *L. Montoni, 2020*,)

front of Porta al Prato. Its characteristic southern hill-skyline stands out among the rolling hills of Val d'Orcia, attracting the attention of travellers along the Cassian way en-route from Rome.

However, where the slope is slighter, its walls were demolished or lowered to allow for urban sprawl beyond its ring road, which began in the 1950s.

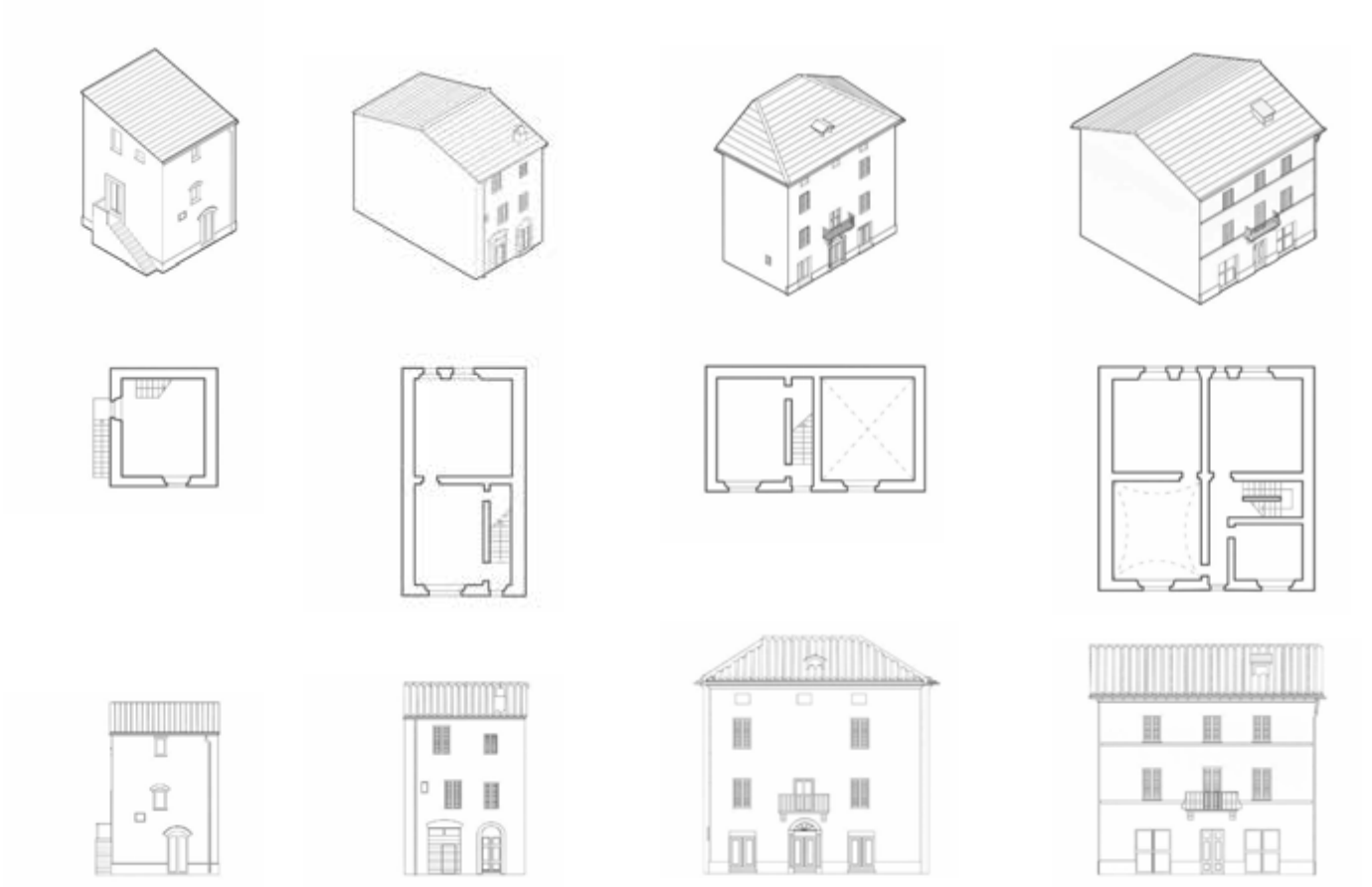
The urban structure of Pienza is typical of the late Medieval village erected on the head of a ridge, and therefore, easily defensible, in order to control the valley below: its two main gates (al Murello and al Ciglio) are connected by its main street, which roughly follows its promontory ridge and is crossed by its alleys, the 'ribs' of its building-fabric. At one end, the main street asymmetrically divides the settlement, which, on its shorter southern slope, stops short at the cliff's 'brow'. Centrally placed, a side street connected two secondary gates (one of which no longer exists), intersecting the main street, where it markedly changed direction. Two squares span this junction: its market square and its civic/religious forum with its town hall and its cathedral. Pienza was thus subdivided into four quarters or districts, whose formation in time is one of the trickiest, most interesting aspects of its history[1].

## Main architectural typologies

Residential construction is the fundamental 'basic' component of the urban scene. The elementary cells have an average net span of 6x6m, but there are also some 7-8x4-5m rectangular shape cells.

The basic typology was the house with one or two overlapping cells; the upper space was accessed through an external staircase extended on the front, called the *profferlo*. The semi-basement level was

[1] During the past fifty years, Pienza has been the object of numerous investigations by well-known history of architecture scholars, among which it is worth mentioning the important contribution by Jan Pieper (Pieper, 2000), who focused his attention particularly on the interventions carried out by Rossellino for the construction of piazza Pio II and the adjacent buildings. The evolution of the original settlement of Corsignano into present-day Pienza was addressed instead, both from the historical-urban and compositional points of views, by the work group headed by Giancarlo Cataldi, at the beginning of the Seventies (Cataldi, Formichi, 1978). The results of their studies – which were meant to be included as a part of the Museum of the City and the Territory of Pienza (expected to open in 2000), and later collected in a number of the magazine Aiòn devoted to Pienza (Cataldi, Formichi, 2004) – constitute an extraordinary depository of material, both iconographic and bibliographical, on which the work aimed at the 3D reconstruction of the settlement in its various historical configurations is based.



used as a cellar and for storing firewood. Today, most of the *profferli* have been demolished or enclosed in the interior of the dwelling unit, through the partial or total demolition of the facade of the building, and the construction of a new external wall.

The various methods of expansion of the covered dwelling area, according to the progressive 'doubling', both in height and in depth, have determined the so-called 'typological process': from the 'matrix' type of elementary cells to the single-family row house or terrace-house type, up to the recent multi-family in-line house type (present sporadically in Pienza and only for the 'recast' of terraced houses).

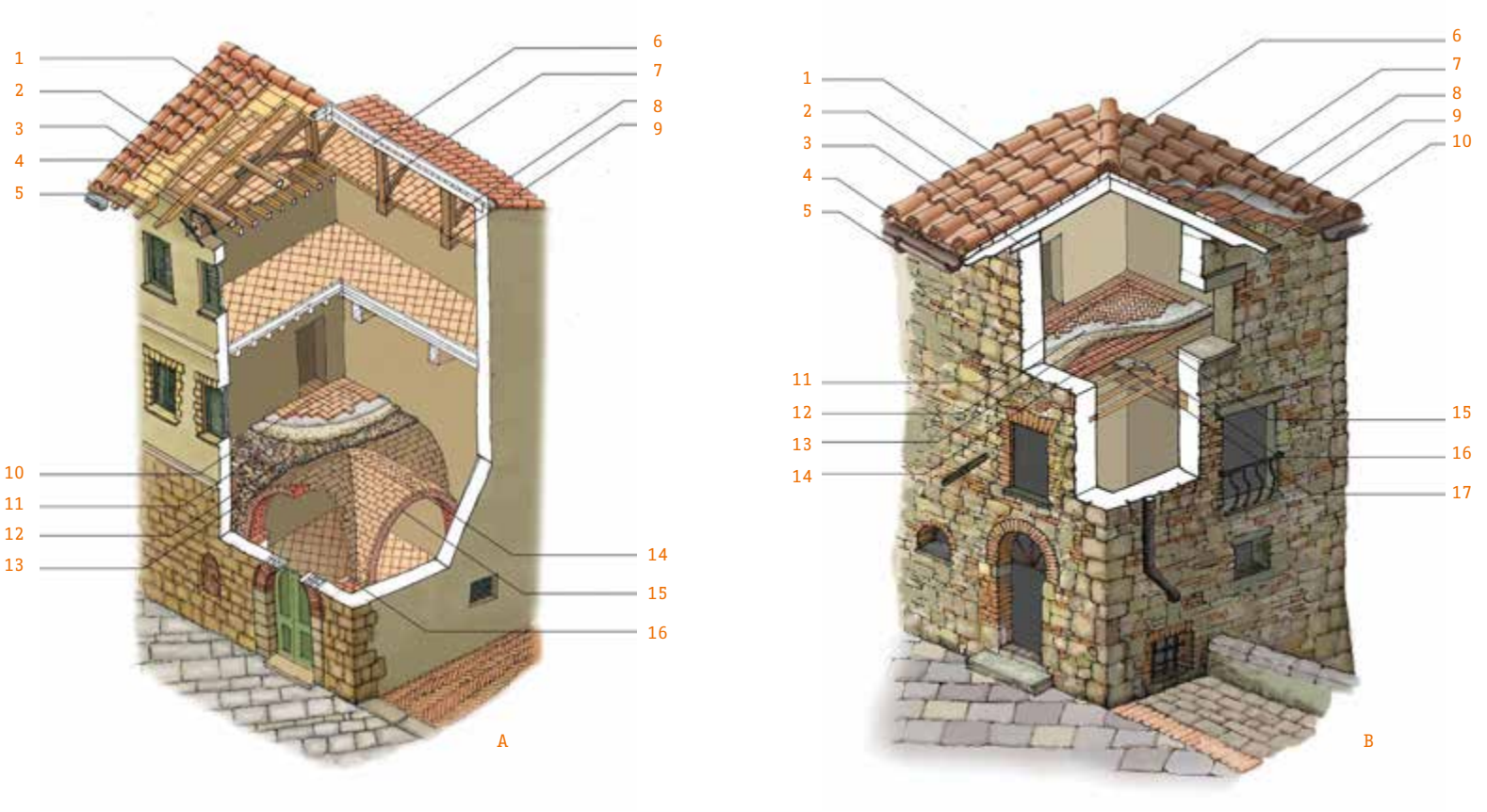
Single-cell homes, especially during the 19th century, expanded in height with the addition of a third floor, or merged together giving rise to online associations, to one or two apartments per floor. The stairs that connect the floors together are generally located in a central position.

Although today the survey of the number of floors shows that most of the buildings consists of three floors above ground, probably the same houses originally did not exceed two floors.

The buildings that face the *corso*, which belonged to prominent families in the city, arriving at Pienza following the Papal court, are attributable to the 'palace' typology, characterised by layouts that are generally symmetrical and compact, and a central courtyard that illuminates the interior compartments, often preceded by loggias and porches.

Given the limited extension of the settlement, the special buildings are in fact a *unicum*. These include the cathedral of Santa Maria Assunta, the municipal building and the Piccolomini palace, designed by Rossellino during the renewal process of the city.

**Diachronic development of the building type**
house with single cell
house with double cells
house with twin cells
house with double twin cells
(*© L. Giannone, CHM Lab, DIDA, UNIFI, 2019*)




**Section of two traditional buildings with highlighted materials and construction techniques**
Axonometric cross section A
Reverse tile; 2. Tile; 3. Common rafter; 4. Stirrup; 5. Hip Jacks; 6. Ridge board; 7. King post; 8. Truss web; 9. Tie beam; 10. Brick paving; 11. Two-layer screed; 12. Debris filling; 13. Abutment; 14. Keystone; 15. Brick arch; 16. Vault impost

Axonometric cross section B
1. Flat tile; 2. Tile; 3. Wedge; 4. Gutter; 5. Bracket; 6. Ridge; 7. Hip jacks; 8. Half bricks; 9. Concrete casting; 10. Plank; 11. Brick paving; 12. Cement screed; 13. Debris coverage; 14. Thin brick; 15. Joist; 16. Beam; 17. Filling of rubble and mortar

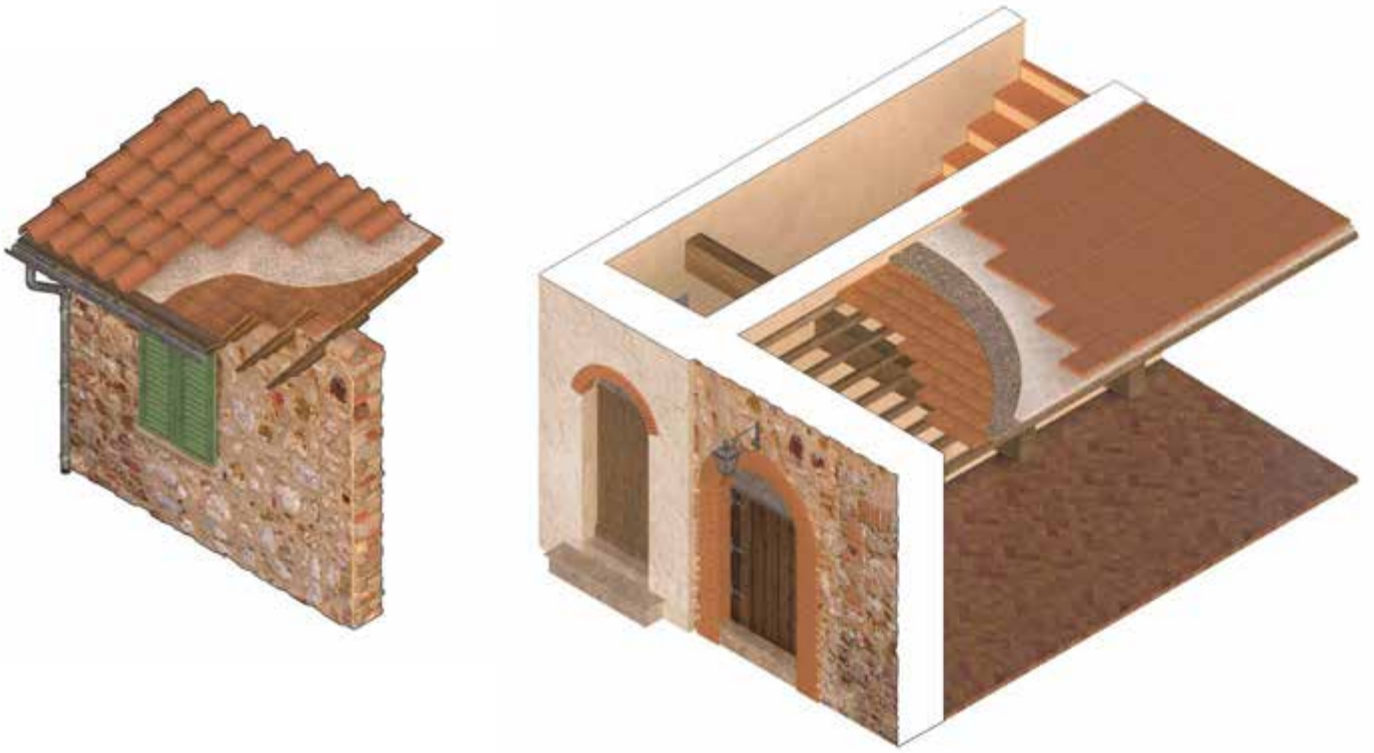
*(© L.Giannone, CHM Lab, DIDA, UNIFI, 2019)*

The square includes the three main elements that characterise the ideal city: the geometrical centre (visible in the pavement), the module (represented in the Classical order of the structure of the well; Cataldi, Formichi, 2004), and the indication of the cardinal points (the facade of the rectory indicates the north-south direction; Pieper, 2000). The shadow of the vertex of the tympanum of the church, moreover, serves as a sundial, marking the time in the various quadrants of the square (Incerti, 2002).

## Main building techniques

The materials used in historical masonry structures are bricks and local stone, mainly of two types: a siliceous sandstone, rather compact and yellow-redish in colour, and a very compact whitish, pale-yellow or grayish-yellow calcareous stone, known as 'tuff '(or 'tuff rock').

These materials are either used on their own or in combination with the other in variable percentages. Mixed masonry is predominant; heterogeneous materials coexist in it in terms of both type and size (rough stone elements, whole or chipped bricks, pebbles, and re-used materials). These various elements are placed in recurring rows or without a predetermined rule. The thickness varies between 60 and 90 cm, progressively diminishing in the direction of the upper stories. On the ground floor the section of the walls is almost trapezoidal. Masonry with a more heterogeneous and composite nature is covered with plaster so as to provide it with a certain apparent uniformity. Masonry with hewn stone, made with larger blocks, was used in more representative buildings, especially in the most vulnerable parts of the building, such as corners, doors and windows.



**Axonometric view of the wall structure, the slab and the roof structure**
(*© L. Giannone, CHM Lab, DIDA, UNIFI, 2019*)

Brick masonry was infrequently used, and is present mostly in the case of upper storeys, in the cladding around doors and windows, and in substitution of damaged elements.

The most commonly used binding element is a lime and sand mortar, which offers both resistance and durability. Both the lime and the bricks were produced in kilns located near the city.

Floors have a load-bearing structure in timber beams (known as *travi maestre*, 18-23 cm x 20-26 cm, with a length corrisponding to the cell they cover, generally 6-8m, and a 160-190 cm centre to centre distance), on which a system of joists (6-10cm x 8-10cm with a 35-37cm centre to centre distance) is orthogonally placed. The beams enter the wall into approximately half of its thickness. The joists support hollow brick tiles (35x70cm). Floors, on the ground level, are usually structured perpendicularly to the street front. This structure is, in some cases, maintained on the upper storey, while in others it is rotated 90 degrees, thus ensuring a better connection to the surrounding walls.

Also the structure of the roofs, either single or double-pitched, and with an average inclination of 30%, has a double frame, with beams, joists and brick tiles (35x70 cm).

The rooms in the basement are covered by barrel or groin vaults. The use of brick arches is limited to the doors and windows: windows use diminished arches, whereas those of doors can be either round or diminished; bricks are laid ledge on (with the greater side perpendicular to the generatrix, and the middle side placed to form the thickness).

The sizes of openings are generally homogeneous: windows are 80-90 cm x 150 cm, whereas doors are 100-105-90 cm x 210 cm.



**Traditional building tecniques for mansory, roofs, and doors** (© *L. Dipasquale, 2019*)

## Digital systems for the dissemination of the heritage of Pienza

During research, two different experiences were carried out: the first aimed at the production of 3D models of an urban section of Pienza, accessible in real-time through walkthrough platforms; and the second aimed at simulating the operation of a serious game, wich allows the player acquiring through play (Paglieri, 2002; Anolli, Mantovani, 2011; Mori, 2012), useful information concerning the architectural and urban development of the city. In both cases, it was necessary to produce mesh models with different levels of approximation to the actual data. The interactive exploration of a portion of the current built fabric of Pienza was carried out through reverse engineering procedures and reality based models, which ensured the greatest possible verisimilitude with reality, as it is perceived by the human eye. The 3D animations necessary for simulating the mechanism of the videogame, instead, were generated through *maquettes* created through direct modelling procedures using Boolean operations, to which *ad hoc* textures were subsequently applied from two-dimensional drawings.

### Pienza walkthrough

In order to produce 3D polygonal models with a great degree of realism to be used in walkthrough (virtual strolls) platforms, it was necessary to undertake a survey campaign that used both active sensors (laser scanners) and passive sensor (digital reflex cameras). The former permitted obtaining a precise and verifiable morphometric documentation of the registered scene (range based models), whereas the latter allowed the production of polygonal models that included chromatic data (image based models).

The area analysed is located on via Gozzante, in proximity of Porta al Murello, one of the main gateways to the city.

The necessary workflow for obtaining photogrammetry models (Structure From Motion) is well-known and consolidated (Russo et al., 2011). 1207 photographs were taken for the case study, which covered the full area of the survey (approximately 60 linear metres). The photographic sets were produced with a Sony Alpha 7rII camera, with a 42.4 megapixel full-frame backlighted sensor, and a Sony 16-35 mm F4.0 lens (Zeiss series), and saved in native ARW format (Sony Alpha Raw).

As in most 3D models developed through digital photogrammetry process, they were re-worked and treated, so as to correct any errors concerning the topology of the surfaces or the excessive density of the

**Image of the *walkthroug***
*(© CHM Lab, DIDA, UNIFI, 2019)*

polygons. In the case of the latter, in fact, the high number of sides generated by the photogrammetry software does not adequately suit the real-time management and visualisation needs of the models in question, thus making it necessary to control their decimation to ensure the correct balance between the realism of the shapes and the density of the mesh.

The photogram in the image shows the result of the operation: the virtual visitor can move freely along a street in Pienza, admiring the quality and details of the architecture.

The sky, the background and the ambient lighting were automatically obtained from a HDRI (High Dynamic Range Imaging) map, created for that purpose on the day of the survey campaign.

Unlike spherical panoramas, which are developed with the use of static images taken from a single position and then projected onto a spherical or cubic surface, 3D models permit browsing the model in all of its parts, without being committed to any predetermined point of view.

### Serious Game and digital video

Through an animated video entirely in 3D, the research group attempted to simulate the operation of a videogame based upon the town of Pienza, which illustrated the various evolutionary phases of the settlement (from Corsignano to Pienza), as well as the features of its historical built heritage. As in all virtual heritage projects, the aim was that of increasing, both at the cognitive and perceptive levels, the knowledge of a specific historical-cultural asset.

While, on the one hand, it was necessary to design the structure of a serious game capable of stimulating the interest of the player in the history, architecture and urban development of Pienza, on the other, attention had to be paid to the specific requirements, both in terms of narrative (storyboard) and of the technique related to a full frame HD video. Two radically opposed needs in the field of entertainment had thus to be satisfied by a single product: one related to active interaction (serious game), and


**Screenshot of the serious game "Pienza under construction"** (© *CHM Lab, DIDA, UNIFI, 2019*)

**Video serious game "Pienza under construction"** (© *CHM Lab, DIDA, UNIFI, 2019*)

the other to passive interaction (animated video), in which the end-user doubles as player in the first case, and as spectator in the second.

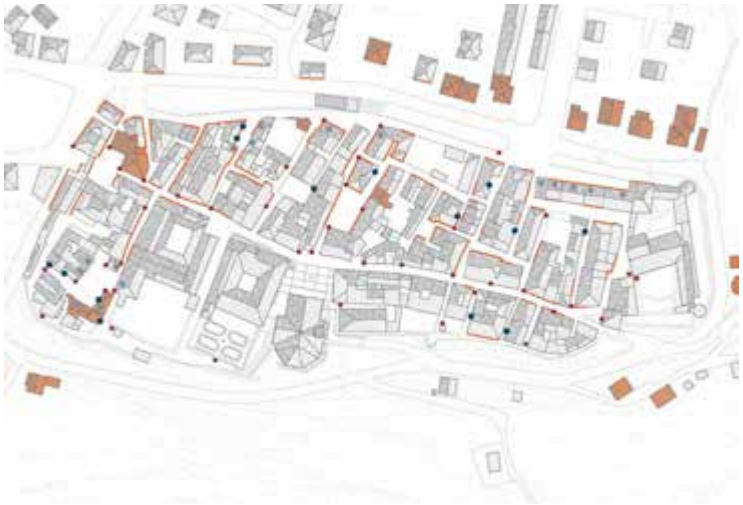
The serious game, as devised, belongs to the category of "management" videogames (Alinovi, 2011, pp. 122-137) set in various historical eras, and whose objective is that of actively involving the player in the processes of formation and development of an urban context (the sub-genre is that of the *city builder*, in other words the creation and administration of cities or villages).

The task of the player, as he moves within the 3D virtual space, is that of making the primitive *pagus* of *Corsinianus* evolve into the city of Pius II through the two intermediate levels of the Roman *vicus* and the Medieval city, utilising with awareness (a series of sheets provide the player with the necessary information for carrying out his endeavour), and in an adequate manner, a series of exhaustible resources, such as labour and building materials, and applying the construction techniques and building typologies that characterise each of the historical periods.

The key figure of the UI (User Interface) is represented by Bernardo, the digital tutor, whose task is to accompany the user throughout all levels, and to provide the useful information regarding the city and the procedures to carry out in order to advance in the game, thus ensuring the correct interaction between player and software.

For the simulation of the correct performance of the game it was necessary to design and produce the graphic interface (GUI) and the widgets (such as icons, dialogue boxes, etc.), as well as to develop the animations, texts and audio contents, which were created specially for satisfying the specific needs of the game.

The image shows a frame from the video: Bernardo appears to the right, as well as the panel regarding the construction materials and techniques necessary for building a *domus*. To the lower left an interactive map of the village is visible allowing the player to verify the results of his actions, also with a view



**Building types**
- tourist use
- residential use
- mixed use

**Interventions map**
- balconies
- garage
- street fornitures
- facade with modified openings
- new buildings

(© *Olin et al., 2017*, redrawn by *I. Montoni, 2020,*)

from above. Finally, on the upper section, are located the icons that represent the resources available to the player (from the amount of food to the number of inhabitants), which he or she will need to advance to the next level.

## Criticalities and strategies for management and conservation

The historic centre of Pienza has maintained its authenticity in terms of urban layout and of building techniques and materials. It is still possible to identify the Medieval urban structure, as well as the interventions from the Renaissance era. The whole town presents today a technological homogeneity, since the building techniques have remained almost unchanged throughout the centuries, also thanks to the absence of destructive events (such as earthquakes), and the care of the inhabitants in maintaining their houses.

Most of the buildings are in good condition. There are only few structures with relevant signs of deterioration (collapsed sections, fissures with infiltrations, obvious bulging, etc.). The decay involves mostly wall materials, especially bricks, mortars and plasters. Bricks are often eroded or chipped, mortars pulverised and plasters partially or entirely detached. To the damages caused by the passage of time, those resulting from inadequate maintenance and restoration interventions can be added. Wall surfaces often present modifications or plugging of holes, substitution of original materials, the adding of flues and technological installations, which can be identified on the exterior by the traces of cement on the walls. Added storeys are also frequent, especially dating from the 19th century.

The surrounding agricultural landscape has not undergone any industrial or infrastructural developments altering its architectural or urban features.

The historic centre of Pienza and its surrounding territory are protected, which means that any intervention carried out in the town must be approved by the entities in charge of its safeguarding. The territory of Pienza, furthermore, has been, since 1989, a part of the Artistic, Natural and Cultural Park of the Val d'Orcia. The Management Plan for the Park of the Val d'Orcia aims at the safeguarding and valorisation of the territory in all its cultural, historical and natural aspects. Its priority objectives are the



**Images of the deterioration in building facades**

**Tourists in Corso Rossellino**

**A street in the historic center maintained by the inhabitants**

(© *L. Dipasquale, 2019*)

preservation of the cultural landscape and of local traditions, within the framework of a sustainable development strategy.

The current management systems have proven to be sufficiently effective for the safeguarding of the site, yet an action in collaboration with the local socio-economic entities and stakeholders is necessary for the sustainable management and valorisation of the resources of the territory.

The most alarming threat today is related to mass tourism, which has brought about an increase in real estate value, and a tourism-related commercial specialisation of the historic centre. The constant presence of tourists has progressively changed the identity of the stable population, as well as the decrease in the sense of belonging of the inhabitants of the historic centre. Artisan activities have almost entirely disappeared to make place for tourist-oriented commerce, concentrated along the main street. This presents the risk of authenticity loss, vulgarisation of the local products, and a reduction of the offer of ordinary goods available to residents.

This is extremely risky in terms of the safeguarding of the values of the historic centre, since it is transforming Pienza into a 'museum-city', with a consequent decrease in the number of original residents, and a social gentrification of the centre itself.

The preservation and maintenance of the existing historical heritage should be agreed upon by the various stakeholders, thus strengthening the dialogue with the inhabitants and the associations that organise the activities and the management of the structures, through the creation of a network of relationships between institutions and community, from the perspective of an active participation in the reconstruction of a 'lifestyle', which has made this territory unique.

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**Matilde Caruso**
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## Introduction: environmental context

*opposite page*
**Kuninkaankatu, view from the Market Square toward east, Old Rauma, Finland**
*(© C. Mileto, F. Vegas, 2018)*

Rauma, located in the region of Satakunta, on the west coast of Finland, is a city with a population of 40,000. Spread across 863 km$^2$, it consists of nuclei built in various sectors. Some of these nuclei are groups of row housing or apartment blocks, while others are mixed groups of housing units, shops, bars, restaurants and public services or industrial areas, ports and elements connected with marine activity, shopping centres, and schools.

The original nucleus of the city is its historic centre, 2 km east of the commercial port, and is still the heart and main centre of cultural and social activities. New Rauma has grown and developed, especially to the north, where most of the residential neighbourhoods are, whereas the south is mainly home to industrial facilities and shopping centres. The main economic activities, especially since the Second World War, are manufacturing industries including shipbuilding, steel, paper, and cellulose pulp. Furthermore, the port of Rauma is the fifth biggest commercial port in Finland in terms of volume of goods.

The historic centre of the city, which occupies around 0.3 km$^2$, is known as Vanha Rauma, Old Rauma in Finnish. There are approximately 800 residents in the historic centre, spread out through 600 buildings, mostly dwellings and small stores, the oldest dating back to the 18th century. The city was built around the church of the Holy Trinity, near the sea, throughout the 15th century, taking advantage of the navigable canal which linked it directly to the sea (Jämsä, 2012).

Throughout its history, Rauma has witnessed numerous major events of different types, from fires to evolutions in culture, economy, and style, and has undergone many modifications which have formed its current appearance. Despite all these changes, the city continues to be an incredible example of Nordic medieval traditional architecture, which was appointed a World Heritage Site by UNESCO in 1991 for its size and state of conservation (UNESCO-WHC, 2020).

## Dimensions of analysis

A multimethodology based on the analysis of written, tangible, and intangible sources was used for the case study, compiling the bibliography and existing documentation, combining interviews, fieldwork during the data collection missions and stays in the city, etc. In August 2018 a task was carried out at three different points in the month, making it possible to establish contact with the specialists from the Conservation Centre of the city of Rauma and of the Town Hall, combining urbanism and planning

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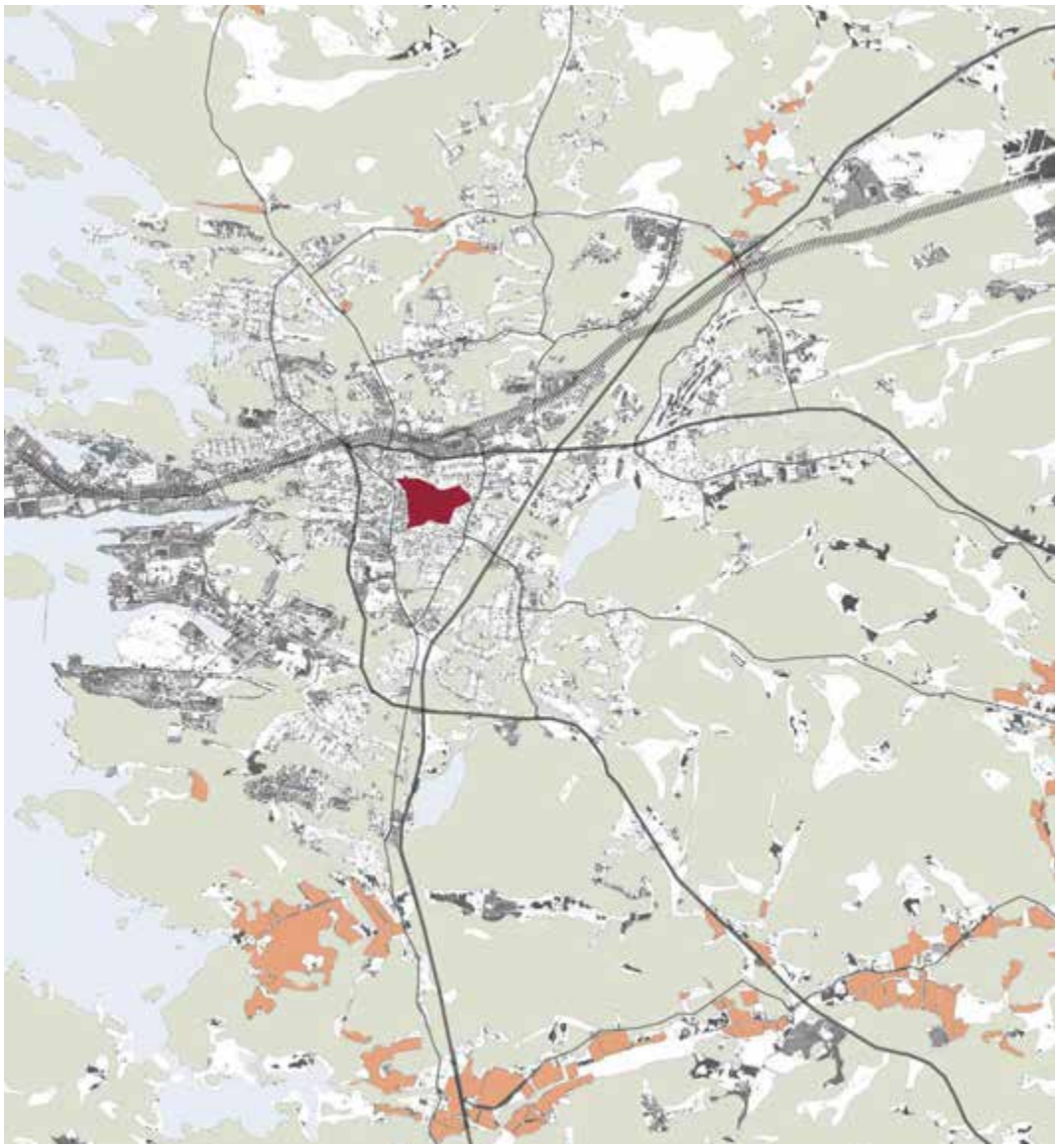
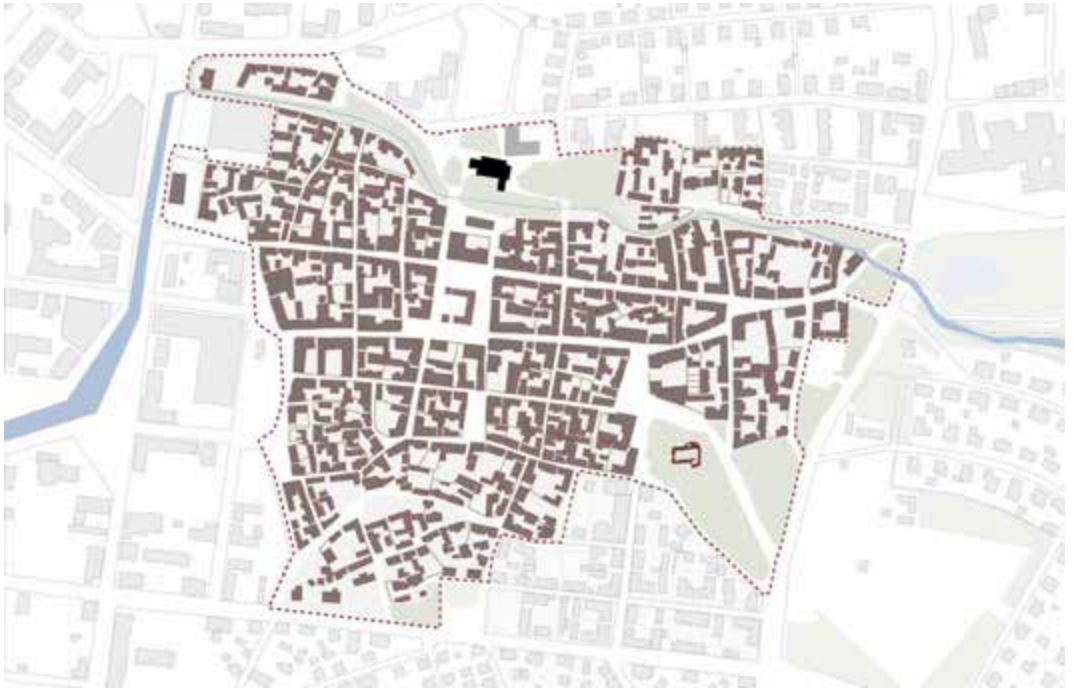


**Localisation of Old Rauma, Finland**

**Localisation of Old Rauma within its urban territory**
In red the protected historical perimeter, in yellow the plantations, in green woods and trees grounds, in blue the sea and lakes
(© *M. Caruso, based on Google Earth picture from 08/2019*)

information, fieldwork for data collection on constructive techniques, materials, dwelling use and conservation, and also taking part in open days for the Conservation Centre. This was followed by a two-month stay (in August and September 2019) at the Conservation Centre that made it possible to widen knowledge on the tangible and intangible aspects of the historic city of Rauma.

This second phase has been vital for both contrasting and expanding the documentation compiled to date. During a research stay at RaumArs artists' residence, there were daily inspections of the historic city centre, including the exterior and interior of some of the dwellings. The collaboration of *RaumArs* and Tammela allowed the authors to participate in some cultural events organised by the centre, which turned out to be of great importance for the better understanding of conservation and valorisation actions and practices. Additional visits were carried out to monumental buildings, as well as to other nearby towns whose architecture and urban planning bears similarities to those of Old Rauma. A visit was even made to the Renovation Centre Toivo, in Pori, which is very similar to Tammela in terms of its



**Late XVII century schematic representation of Old Rauma urban area and structure**
The ancient town hall and the Trinity church ruins appear in the lower part of the drawing, while the Holy Cross church and the canal can be recognised in the upper part
(© *Custom map from the XII century, image included in Koivula et al., 1992, p. 6*)

**Actual configuration of the historical nucleus**
In green forested areas, in blue the canal while the red dashed line identifies the protected area perimeter. The urban and blocks structure from the XVII century has been maintained, despite the growth of the town and the increase of some blocks density
(© *M. Caruso, 2019*)

structure, operation, and actions. This phase, taking part in the daily life of Old Rauma and organising activities along with the residents, has been crucial to understanding the dynamics of life there.
This second phase also incorporated the analysis of the conservation state of the World Heritage Site, detecting the most widespread issues and lesions, and their mechanisms and causes. Based on this knowledge, a study of the interventions carried out in the historic city centre was proposed, thanks to which strengths and weaknesses were detected, and a framework was established for the evolution of dwelling types over time.
Conversations with residents and professionals have provided additional information on norms and laws. These have been further explored, by studying documentary sources, and accessing Town Hall websites in English.
Analyses were carried out through direct observation, visual tests, interviews with professionals, visits, and the production of diagrams and drawings. The final phase of the study, graphic representation, initiated in August 2019, consisted in creating several drawings (diagrams, floor plans, virtual models, etc.), which can be used for the dissemination of the final results among the general public, as well as serving as a tool for analysis, redrafting, and comprehension during the study carried out.

## Historic development

The original settlement around which the city of Rauma expanded was built on the slopes of Raumanmeri[1] before the 15th century (Jämsä, 2012). In the years that followed, the town grew taking advantage of navigable waters and canals, between the church of the Holy Trinity, the sea and the river-canal, and on 17 April 1442 it was awarded the full privileges of city (Salo, Sundelin, 2015). At that point, Old

[1] Area located directly opposite the sea, north of the current historic city centre.

Rauma was already developing around the Fishmarket Square (Kalatori), Market Street (Kauppakatu), and three of the streets which cross it.

The town continued to grow towards the sea throughout the 17th century. Following a fire in the church of the Holy Trinity in 1640, the centre of the city was moved east, around Market Square (Kauppatori). At the same time, a second longitudinal axis, King's Street (Kunninkaankatu) was also built, and fences began to be used to define the limits of the settlement, and to organise tax collection. This was also to limit growth: the delimited area is more or less an exact match to the current perimeter of the protected historic city centre, which at that point was full of blocks (Salo, Sundelin, 2015).

The city was not greatly modified in the centuries that followed, despite being subjected to cycles of abandonment, repopulation, and growth. Different urban planning proposals were drawn up, especially aimed at regularising the urban fabric and preventing fires, although, in the end, none of these were carried out completely. In the second half of the 19th century the city grew towards the sea, following its economic development and population growth (Koivula et al., 1992). Various urban planning proposals were made throughout the 20th century. Among these it is worth highlighting those from the 1960s-70s, which would have drastically changed the appearance of the city, adding modern blocks and destroying almost all the historic dwellings, leaving only part of the historic and traditional constructions, those considered to be the most characteristic and important. A stop was put to this plan, thanks to the determined opposition of residents and changes in attitude towards traditional architecture, which were emerging in northern Europe at that point (Koivula et al., 1992). Thus, a new plan was drawn up in 1981, conserving the historic city centre, and finally, in 1991, Old Rauma was declared World Heritage Site by Unesco (Raitio, Tammi, 2018).

## Main urban features

Old Rauma is located in the centre of the current city's territory, between the two north and south residential and commercial areas, the port and the east sector of the city. The structure of the urban fabric continues to reflect the original medieval settlement, and it is composed of an irregular network of pseudo-rectangular blocks set out in orthogonal streets, with the long sides going from east to west, and the short sides north to south. Therefore, the historic city centre of Rauma follows a grid of orthogonal streets in which more or less rectangular blocks are inserted. There is no specific hierarchy for these spaces, although the two longitudinal streets across the city – King's Street (Kuninkaankatu) and Market Street (Kauppakatu) – are identified as main streets. The city is made up of blocks with interior courtyards with dwellings on the perimeter, while secondary constructions, such as warehouses, workshops, and stores are found inside (Raitio, Tammi, 2018).

At present, the courtyards, well-cared for and organised, are also used as ornamental gardens or leisure spaces, and serve as back spaces or terraces for bars, restaurants, and shops. As these places were originally used for rearing animals, such as hens and pigs, they would have looked very different in the

*opposite page*
**Old Rauma streets and buildings: Isoraastuvankatu**
(*© M. Caruso, 2019*)

**Street view of Old Rauma**
(*© Caruso, García Soriano, Mileto, Vegas, 2019*)

**Internal yard form the north-eastern part of the historical area**
The building on the right is a block of storages
(© *M. Caruso, 2019*)

**Streets and buildings of Old Rauma: Isopoikkikatu**
(© *M. Caruso, 2019*)

**The different elements which make up a block seen in the south area of the city**
Natural elements such as rocks, which form part of the structure of the fabric, can also be seen in this area
(© *M. Caruso, 2019*)


**Axonometric view of Marela historical house' block**
1. Fences; 2. Gates; 3. Internal yard; 4. Storages and secondary buildings; 5. Dwellings
(© *M. Caruso, 2019*)

past: there were no ornamental objects and instead of grass, they often incorporated earth or cobbles (a paving technique still used in many parts of Old Rauma). The secondary buildings found in the courtyards were warehouses and stables. The fences between plots and in the blocks were to prevent animals from escaping. Nowadays, the subdivision between plots is unclear and is often merely theoretical.
No closed typology can be established for blocks, as there is rigorous and systematic repetition of geometries or modules, although some elements are always found forming the various blocks differently every time. These elements are closely linked to the city's evolutions and changes over time. As these appeared 'spontaneously', there are many characteristics irregularities specific to the historic city centre itself, including iron gates and entrances, fences, courtyards, secondary buildings, and dwellings (Raitio, Tammi, 2018).

## Architectural features

Traditional dwellings in Old Rauma came to be the result of the addition of small nuclei grouped within the same building, usually linear volumes or simple L – or T – shapes, the highest built on two levels with a basement below, under a single roof. Entrances can be found in different spots: along the outer edge directly giving onto the street, inside the courtyard, or in the chamfered corners of the block (Raitio, Tammi, 2018). Usually, the middle floor is the only inhabited space, while the other two (basement and attic) remain empty, and are used to ventilate the entire building or for secondary domestic activities[2]. Building height varies substantially and depends especially on the typology of foundation and plinths. In some cases, the buildings have no basement and the foundations are simple individual stone elements, which means that the dwelling rests almost directly on the ground.

[2] The ropes used for these activities can still be found in attics in Tammela. See CARUSO 2019.

However, in other cases, especially in areas where the ground is uneven, the dwellings make full use of very high plinths.

The architectural composition of these houses is usually made up of three horizontal volumes: the stone plinth or base of the building, which corresponds to the basement; the main body of the house or external timber-clad walls, with windows, doors, and the entire system of cornices and decorations of the buildings; and the roof or attic (Mattila, 2014), sometimes complemented with storm windows for lighting, with gable or hip roofs usually waterproofed with painted corrugated iron.

Secondary buildings follow the same composition criteria, albeit simpler and undecorated.

The traditional lifestyle was quite modest: the nucleus of the dwelling was usually made up of one or two large rooms, where all activities were carried out, both during the day and night. Each room tended to have its own stove, a key element in dwellings, where they were not only the main source of heat but were also used for cooking (Nurmi-Nielsen, Lybeck, 1984).

Each housing unit was usually accessed through an entrance area, which connected the different dwellings. The buildings had no running water or sanitary facilities indoors, so water was usually obtained from wells, which were generally public.

A final characteristic element is that of names: almost every building displays its own name, written in Gothic script, on an oval plate, on one of the outer walls. The names go back centuries to when the houses were named after the owners.

## Features of building techniques

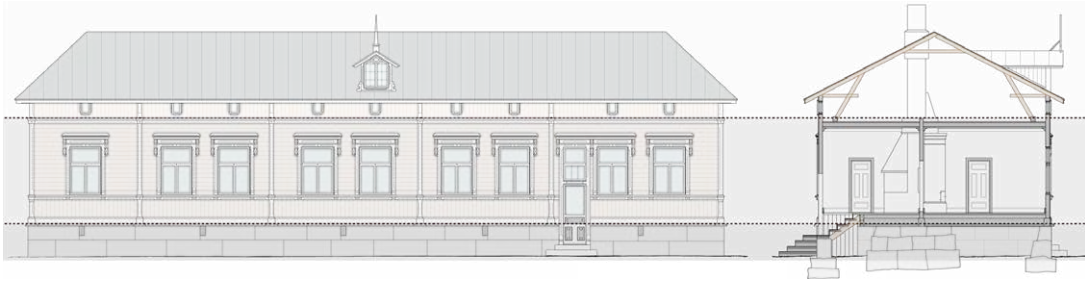
Traditional buildings, the most widespread building typology in Old Rauma, are almost always simple pine buildings. However, it should be noted that some masonry buildings date back to the 19th century, some new concrete buildings to the 20th century, and that the church of the Holy Cross and the original Town Hall were built in masonry and brick.

The foundations of the dwellings are usually large stone ashlar walls 1-1.5 m down in the ground. Furthermore, these walls also support the wooden beam under the upper logs that make up the outer building walls (Salo, Sundelin, 2015).

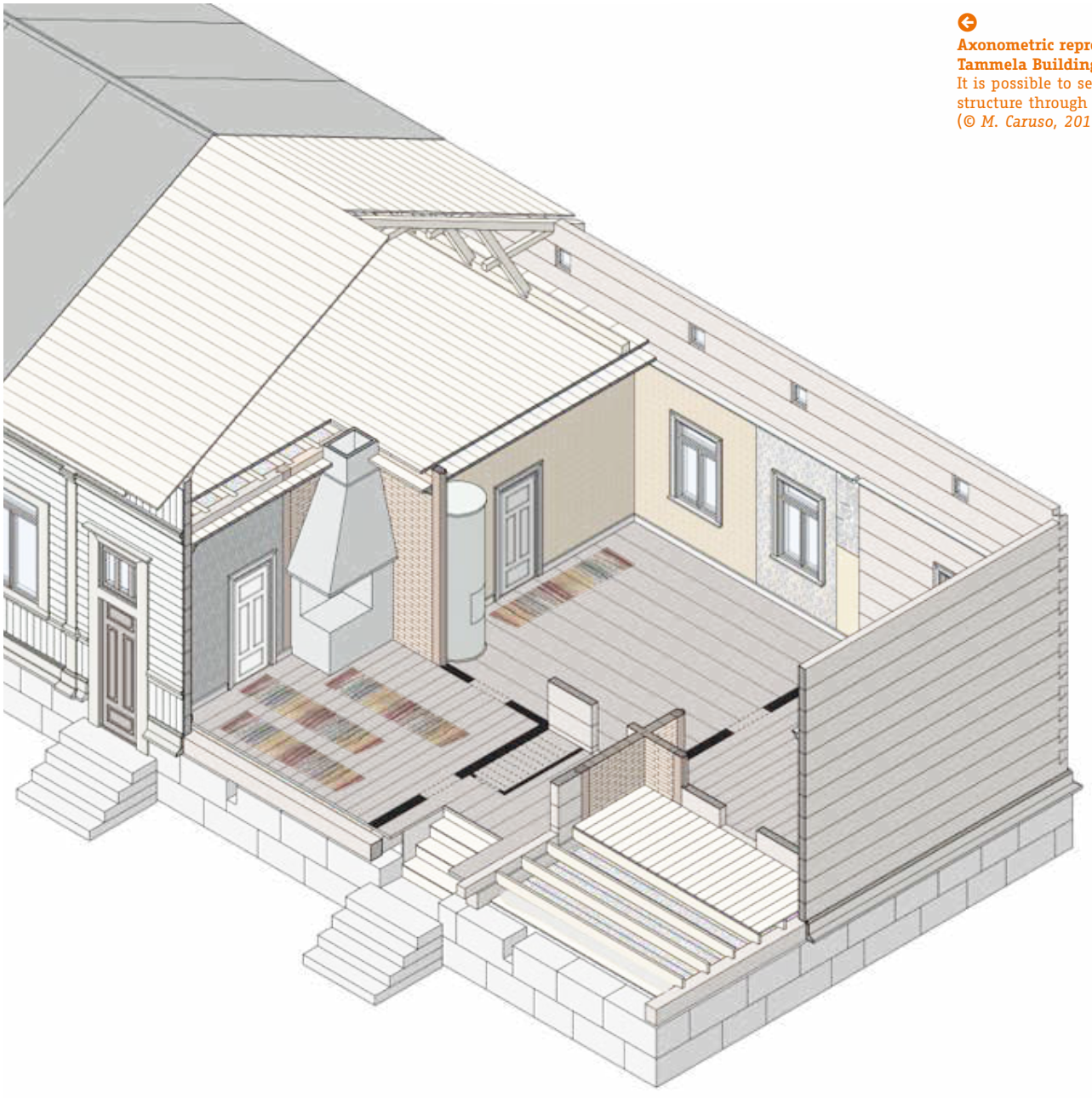
The traditional floor and roofs are wooden, usually consisting of a grid of main beams around the perimeter, and half-log beams or crisscross boards, on which insulation (moss or other natural fibres and gravel) rests. The bare wooden floorboards are sometimes covered in linoleum, a material frequently used in the 20th century (Caruso, 2019).

The walls are built by piling wooden logs assembled at the corner. The exterior walls are separated from the ground by the main beam running along the stone walls of the basement. Strata of fibres are placed between the different rows of logs in order to level and aid insulation.

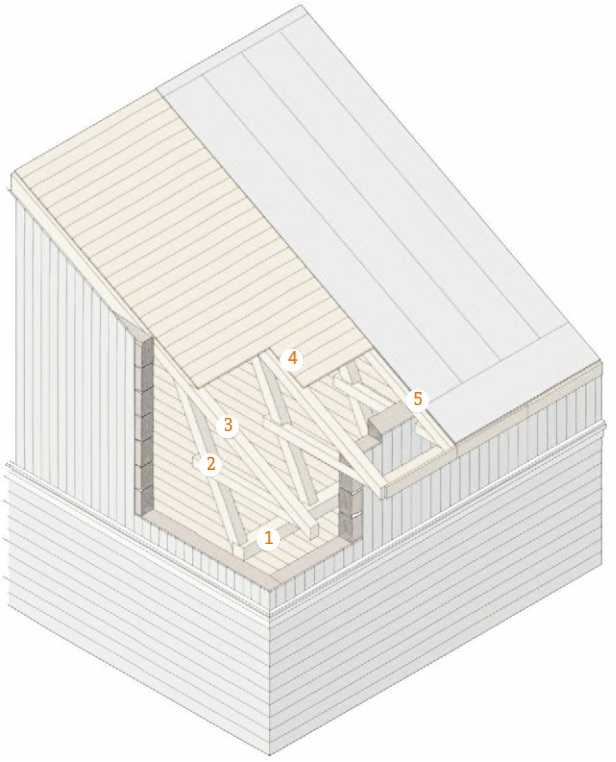
The interior walls are built in the same way, although they rest on a main beam supported at the ends by brick cubes or piled bricks. It is also worth noting the existence of brick walls built around the stoves.



**Horizontal tripartite division of Tammela building**
The exterior structure of the facade corresponds with the dwelling internal structure
(© *M. Caruso, 2019*)



**Axonometric representation of Tammela Building**
It is possible to see its structure through the section
(© *M. Caruso, 2019*)




**Attic of Tammela**
The sawdust on the floor is used for insulation
(© *M. Caruso, 2019*)

**Axonometric view of the roof**
1. Pavement beam; 2. Sloped and horizontal bearing elements; 3. Main beam; 4. Wooden boards; 5. Metallic covering foil
(© *M. Caruso, 2019*)

Walls are usually clad on the outside with timber boards and decorative mouldings, while the interiors are covered with ornamental wallpaper (Raitio, Tammi, 2018).

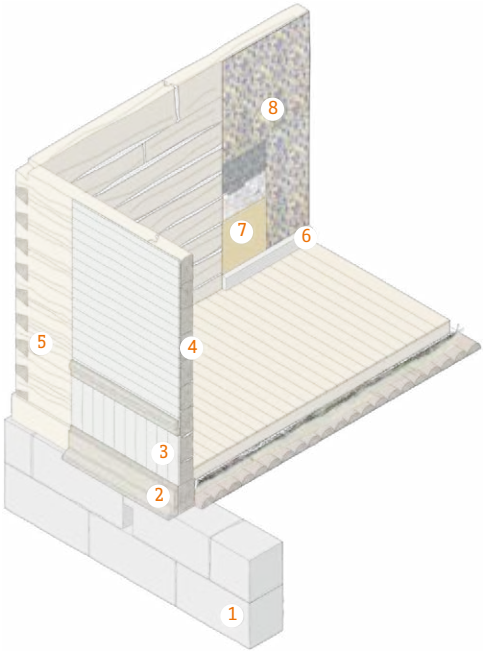
Traditional roofs are truss roofs, made up of wooden boards, often covered with corrugated iron, already used at the end of the 19th century.

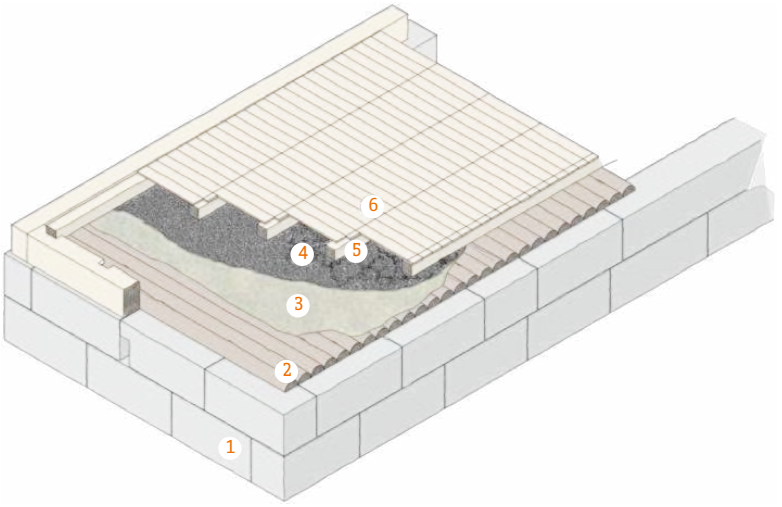
Doors and windows are traditionally made of wood, with shapes and styles which have changed over time and fashion. Windows are generally double glazed to prevent heat loss while letting in daylight.

## Intangible heritage

In Rauma, traditional techniques are well disseminated. Although the younger residents are not as well-versed in traditional trades, and therefore lack the knowledge needed for interventions using traditional techniques in old houses, there are numerous initiatives for transmitting this type of information, as well as professionals interested in the field. In addition, many activities organised in Rauma help to keep traditional products and crafts alive, such as lacemaking, a widespread traditional domestic activity with its own festival in July. Local residents still continue their traditions of the past, such as decorating windows with elements that can be seen from the street, describing the residents and showing whether they are in or out.

The Municipal Renovation Centre of Tammela offers continuous support to citizens, builders, and tradespeople in the process of conservation of traditional dwellings, from information on the processing of grants available for restoration, to contacts with companies and tradespeople who can carry out the work, as well as initiatives like the creation of a workshop open to the public. This workshop offers




**Axonometric view of the wall structure**
1. Stone basement; 2. Exterior wooden frames; 3. Exterior facing wooden boards; 4. Wall logs structure; 5. Corner logs joint; 6. Wooden baseboard; 7. Cardboard; 8. Several types of wallpaper (© *M. Caruso, 2019*)

**Axonometric view of the slab**
1. Basement stones; 2.Inferior half-logs surface; 3. Moss; 4. Gravel; 5. Secundary beams; 6. Wooden boards pavement (© *M. Caruso, 2019*)

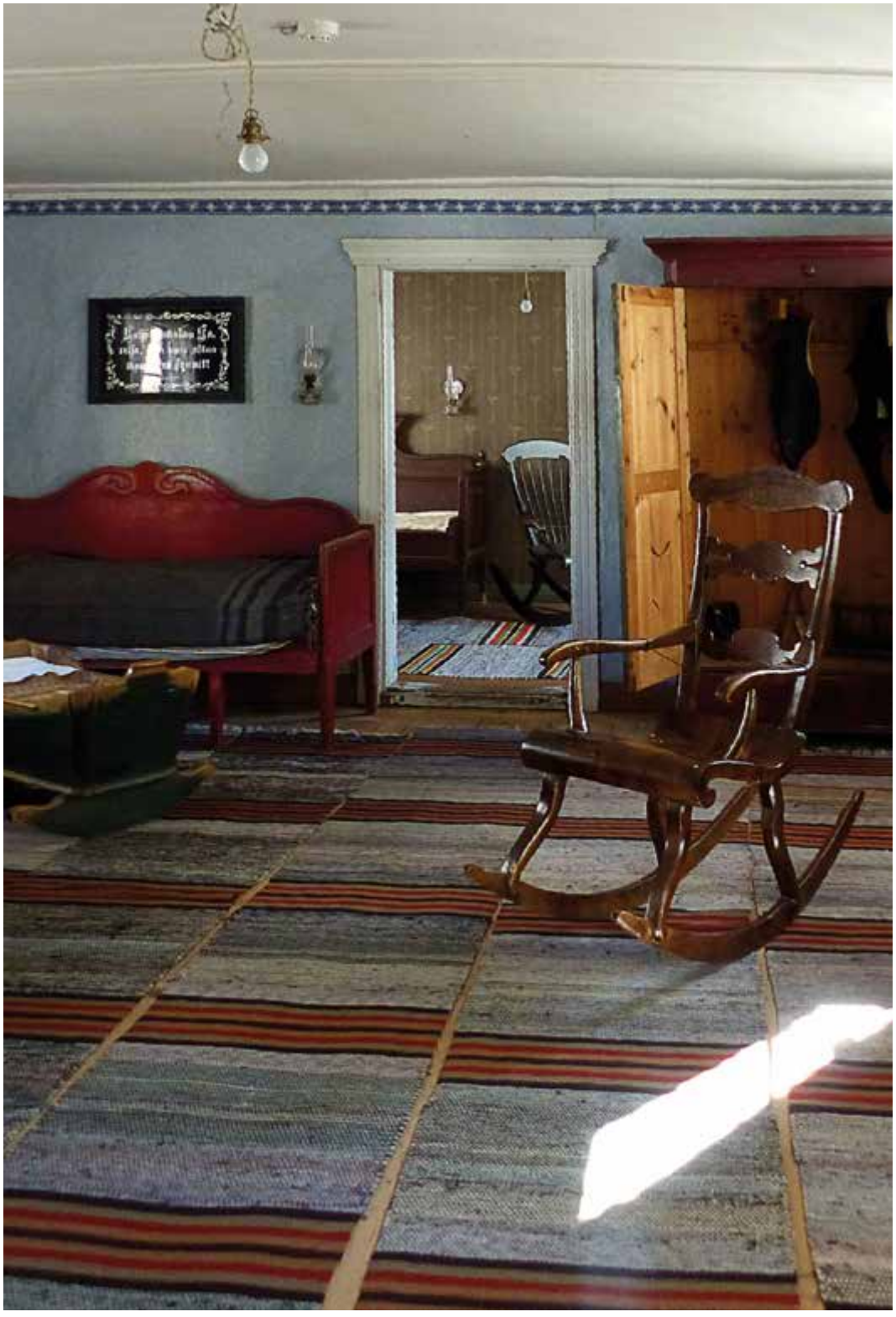
citizens all the tools, spaces, and conditions they need for maintenance and repair work in the form of do-it-yourself. This centre has also created a warehouse of materials and antique elements, which can be acquired for installation in traditional buildings (beams, boards, doors, windows, handles, switches, tiles, fireplaces, etc.).

The centre manufactures traditional red paint (for periodic application to dwellings) following the traditional formula, which it sells at an affordable price. Finally, the centre organises periodic meetings with the different craftsmen in the region. During this time, the courtyard of the centre in Tammela is open to citizens, offering live demonstrations by the tradespeople and construction craftsmen wishing to take part: carpenters using axes to carve beams; carpentry restorers demonstrating how to replace stucco around glass; blacksmiths; and manufacturers of traditional wallpaper and traditional or compatible paint. Thanks to this initiative, citizens of all ages, including children and young people, come into direct contact with the traditional trades, either to carry out their work at home, or to learn techniques to take care of their homes.

## Values and risks at the site

Old Rauma should be considered a valuable example of an inhabited traditional historic site: some users have reported on their knowledge of traditional trades, which they continue to use, partly due to the initiatives mentioned. In general, the state of conservation of the historic city centre can be considered rather good, generally tending to maintain buildings. Citizens usually have a high awareness of their surroundings and many of them try to respect them to the best of their knowledge and possibilities.

**Interior view of the landlord' residency in Kirsti House**
In this case, the residential nucleus was the building biggest area, composed of 2 rooms. The place is fitted with tailored furniture which is adaptable and suitable for all kinds of activities. In the left corner, rests a foldable bed
(© *C. Mileto, F. Vegas, 2018*)



**Some of the traditional windows of Old Rauma**
From left to right: old simple traditional window, Neo-Renaissance styled and Jugendstil fashioned window (© *M. Caruso, 2019*)

In addition, local professionals display good knowledge of the characteristics of local architecture and carry out sensitive intervention. Some of the current constructive techniques are based on traditional ones, while a few newly built dwellings have continued to use traditional materials and an architectural composition, which is very similar to the traditional one.

The general architectural, technical, and material state of conservation is good: many buildings have been preserved to the present day, and the original urban configuration can be clearly seen. In addition, systematic maintenance helps to combat the chronic degradation phenomena affecting materials, especially wood, which is vulnerable to water and deformation (Dumitrescu, 2016).

It is interesting to note how far dwellings have evolved in accordance with changes in lifestyle and needs. Originally, each building contained one or two bedrooms. Over time, dwellings have been merged to create modern dwellings with more rooms, which take up the whole building, but do not excessively change or denaturalise it. It should also be noted that some of the dwellings have undergone radical modifications, especially in private areas such as interiors and courtyards, resulting in irreversible and often harmful change due to the use of incompatible materials and/or techniques (Raitio, Tammi, 2018) by non-professionals with limited knowledge of traditional architecture. In addition to potentially causing irreversible damage to urban architecture and the urban complex, this trend could also lead to traditional trades being completely lost.

Another worrying phenomenon, perhaps the most important, is the transformation of the urban environment, where major commercial and industrial areas are built, adding to the detachment and isolation of the historic city centre from its surrounding territory and landscape. The type of architecture in these areas can also be completely unsuitable in terms of the size and materials, threatening to increase the isolation and denaturalisation of the whole (Dumitrescu, 2016).

**View from the old town eastern edge towards the buffer zone**
the presence of very tall and large buildings completely interrupts the territory continuity between Old Rauma and its surroundings
(© *M. Caruso, 2019*)

## Strategies for conservation and sustainable development

Rauma provides an excellent example of strategies: above all it shows the importance of a centre for education and coordination, contributing not only to the dissemination of knowledge of trades among non-professionals, but also to their training in heritage, making them more familiar with old buildings, learning about them, while accepting their limitations, and appreciating their value and strengths. This is why it is important to incentivise and promote the activity of Tammela, as well as considering setting up a network of similar centres in various cities, to coordinate on a wider scale. Another lesson to be learnt from this last observation regarding Rauma is the unquestionable importance of citizens' involvement in activities which promote and take care of the city.

Old Rauma is to some extent a system of sustainable development, where buildings continued to be used as dwellings, with compatible transformations (Dumitrescu, 2016; Raitio, Tammi, 2018) (although at times it becomes necessary to compromise and sacrifice some elements), living in them and allowing the whole to continue to be a living community rather than a museum. Their survival depends on the promotion and application of urban regulations to protect the historic city centre. It is vital to strengthen this urban planning protection. The design of more compatible planning, tied to the territory, historic landscape and the historic city itself is needed. This planning should take into account the resources as a whole, providing guidance, and proposing architectural structures and urban spaces that guarantee a connection with surroundings, strengthening these based on its positive aspects. It is also important to consider an urban planning that implements compatible economic measures that respect and do not threaten the type of economy found in the historic city centre, an essential resource for the survival of Old Rauma.

Some sort of sustainable and 'active' development could be recommended for Rauma, not unlike that in place. That is to say, one with people still living in old dwellings, attempting to respect them as much

**Internal yard of commercial activities buildings**
It is possible to observe many of non-compatible interventions, such as: the original pavement substitution, the insertion of other elements different from the traditional ones and the construction of new buildings, whose size is not adequate in comparison with the old town features (© *M. Caruso, 2019*)

as possible, with interventions, modernisation, and retrofits suited to a 'normal' life following modern standards. However, these should also take into account the conservation of constructive techniques, materials, architecture, and the most important characteristics (Raitio, Tammi, 2018).

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## Introduction and historic development

### Transylvania: the heritage legacy of Saxon minority

The name Transylvania is a reference to the perspective as seen from Hungary: *Terra Ultra Silvam* (The land beyond the forest), looking east from the Pannonian plain. However, its history began long before the Hungarian takeover. In fact, its culture can only really be understood taking into consideration a rich melting pot of religions, settlers, and ethnic groups that have intermingled over the centuries.

In this pluralism, Romania's major German (Saxon) heritage is basically present in southern Transylvania, where many Saxon towns and villages can still be found. The result of these nine centuries of existence of the Saxon (German) community in southern Transylvania is a cultural and architectural heritage unique in Europe. The Saxon colonisation of Transylvania is generally believed to have started with King Geza II of Hungary (1141-1162), with settlers coming from the nearby regions of the Rhine and Moselle rivers. Although most of the colonists came from the Holy Roman Empire and generally spoke Franconian dialects (German), they became known as Saxons in the Hungarian chancellery. For many decades the main task of German settlers was to defend the southeast border of the kingdom of Hungary. This colonisation continued until the late 13th century. Respected for their skill, they gained administrative autonomy, a fact almost unrivalled throughout feudal Europe with its absolute monarchies. At present, hundreds of towns and fortified churches built by Saxons between the 13th and 15th centuries can be found in Transylvania, highlighting a heritage that is still part of Romanian cultural DNA (Philippi, 2016).

The Saxon population numbers in Transylvania are much diminished, having fallen sharply since the Second World War, partly due to emigrations in large numbers, mostly to Germany. However, they still account for a considerable minority in the country, coexisting with a second small gypsy minority.

*opposite page*
**Viscri fortified church, Transylvania, Romania**
*(© F. Vegas, C. Mileto, 2017)*

### A portrait of Transylvanian fortified villages

The Saxons populated the edges of what is currently Transylvania, hoping to resist invasions from the Mongols, and later from the Ottomans. The strategy of the fortifying village churches provided protection to the entire community when at risk of imminent attack (Tiplic, 2006).

To this day, some of these churches appear isolated, with no protection, while others barely have an outer wall to protect them or are veritable medieval fortresses with impressive outer walls and defen-

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**Localisation of UNESCO listed villages with Fortified Churches**
*(© A. Maiulini, M. Mastronardi, V. Cristini, 2020)*

sive towers (Duguleana, Postelnicu, 2018). In the outskirts of Sibiu, the centre of the Saxon Community, seven of the over two hundred fortified churches found in Transylvania were declared World Heritage sites by UNESCO in 1993: Biertan, Calnic, Darjiu, Prejmer, Saschiz, Valea, and Viilor Viscri. As expected, these religious building complexes are of great constructive, architectural, and documentary value. However, these are not their only merits. They also provide a global overview of the villages, prompting reflections on domestic and residential architecture, in relation to the many centuries, resulting in a unique blend of culture and ethnicity.

Three main categories can be established when categorising Transylvanian fortified churches by type of fortification (Popescu, 2016): fortified churches, churches with fortified enclosure walls, and churches with mixed defensive features ('church-fortress'). The first category, that of fortified churches, can be identified by the belfry towers, which were converted into donjons (keeps), or by the thick walls, which had wide paths with holes in the floor for guards, and mortars below the cornice. The second category sees the church buildings with no defensive elements, but surrounded by walls, relatively small in some cases, without crenels, and few defensive towers, or on the contrary, tall and thick with guard paths, several towers, and crenels. Other types have multiple enclosure walls. Finally, the last category presents the fortifications that combine the first two types. This can be seen as a double protection system. In addition to the use of the church building as a defensive structure, surrounding walls with multiple defensive elements are also found.

## Characteristics of the villages of Transylvania

### Seven enclaves for understanding the intercultural past of Transylvania

Among the 250 Saxon villages still existing in Transylvania, in order to understand the objectives of the 3D Past project, it is worth including a brief mention of the seven UNESCO monumental enclaves. Based on this, the domestic and residential architecture of the constructions of the villages are assessed in depth. The medieval fortress-towns of Sibiu, Sighisoara, and Brasov serve – amongst other things – to define the Saxon lands of southern Transylvania, one of Europe's least known, but most authentic examples of cultural survival of a medieval landscape. Fortified churches, unspoilt villages, and non-intensive mixed farming in ecological balance with nature and wildlife are found amongst mature woodland and hay-meadows full of wildflowers (Akeroy, 2006).

In the 16th century the ancient medieval city of Biertan got the status of 'town'. Competing with nearby Mosna and Medias for control over the See, locals decided to build a huge church on the location of an existing one, right in the village centre. This practice was not uncommon. In fact, the villagers from Saschiz chose the same strategy to build an enormous church, when competing with nearby Sighisoara. Sometime in the 13th century, the aristocrat Chyl de Kelling built a small castle for himself, a monument now known as Calnic church. The site was owned by the family until 1430, when villagers purchased the monument to transform it into a proper fortification to defend them from the numerous raids from armies. Darjiu fortified church, built in the Romanesque style and later rebuilt in the Gothic style,

**Calnic Fortified Church, Transylvania, Romania**
*(© F. Vegas, C. Mileto, 2017)*

was fortified in the 16th century, when locals drew inspiration from the fortified churches of neighbouring Saxon villages. Furthermore, Prejmer, built by Teutonic knights in 1212-1213, is currently considered the largest fortified church in southeast Europe, and it was well-known as a great defensive system. Saschiz, a major hub of carpentry and wood-painting, is also renowned as home to one of Transylvania's finest fortified churches and the birthplace of Saschiz blue pottery in 1702. In addition, the Evangelical Church of Saschiz, built by Saxon colonists between 1493 and 1496, continues to impress for its sheer size and its fortification elements adapted to the shape of a church building.
The fortified church of the Valea Viilor complex in the Vineyards Valley was built in the Gothic style in 1263, but expanded and fortified in the 15th and 16th centuries, with the addition of several walls of 26 feet tall and 5 feet wide. It also houses a most unique element, a well in the centre of the church choir, which provided water for the locals during sieges.
Finally, Viscri church, built circa 1100 by the Szekler population, was taken over by Saxon colonists in 1185. This explains why this unique Gothic church displays a plain straight ceiling, rather than a traditional vaulted one. The eastern section was rebuilt in the 14th century, and the first fortification walls with towers were added around 1525 (Corsale, Ionio, 2014).

**Architectural features: a balance between monumental and residential architecture**

During the study and analysis of the fortified churches the researchers were taken aback by certain discoveries. As well as displaying an excellent state of preservation, the seven villages listed by UNESCO stand out for their exceptional residential and domestic fabric, which covers the urban and territorial scale, as well as architecture and detail. A series of urban nuclei with a strong cultural identity and



**Detailed view of Prejmer fortified church**
**Valea Viilor fortified church**
**Darjiu fortified Church**
*(© F. Vegas, C. Mileto, 2017)*

rich constructive features have gradually formed around the seven major fortified churches, and the 3DPAST project aims to publicise this as a whole.

The villages developed by the Saxons tend to consist of a central nucleus (fortified church) and its defence systems. Despite their central hubs, urban nuclei grow linearly, not radially, and are composed of main streets, whose point of reference is the church and/or other nearby public buildings, such as the Council Hall or school (Szaktilla, 2008). Streams and rivers can also condition the orientation of streets, which follow straight plots to varying degrees. This is the case of villages like Viscri and Biertan, structured on either side of the water line.

Perhaps one of the most distinctive characteristics of these inhabited nuclei is their fully regular and rhythmic residential plots, with adjoining housing of similar typology and spatial interpretation, and barely distinguishable by rendering and finish in historic terms.

### 'Typical' housing and its use

There are however some differences between the morphology of these villages. The residential buildings of the Saxon villages of Transylvania are decidedly rural, and the distribution of domestic space is closely tied to the relationship with agricultural production and crop cycles (Fabini, [2010] 2015). Typically, dwellings were situated at the end of each plot, overlooking the street with an entrance delimiting and closing off the property. The elongated internal courtyards, separated by the main door, show a clear 'introverted' sequence of spaces, usually divided into five major areas. The first strip of the plot is occupied by the family home or the residential nucleus strictly speaking.

The next space encountered was a threshing floor with an oven, summer kitchen, and other service areas. Yards, incorporating a small stable and/or chicken coop, and a lavatory were usually found beyond these spaces. The fourth space housed storage buildings and stores for the family's seasonal crops (grain, hay…), while the fifth and final section, with an orchard and garden, was located at the back.

**Biertan fortified Church**
**Saschiz fortified church**
*(© F. Vegas, C. Mileto, 2017)*

The residential building located in the first part of the plot is accessed from the courtyard and is the only part of the volume 'open' to or in direct contact with the village (on its decorated facade). The building incorporates a partly underground vaulted cellar, with strong brick or masonry load-bearing walls. The living room, kitchen, and bedrooms are found on the upper level, slightly raised from the ground, and protected by an oak roof (Wilkie, 2001).

## Queries about intangible and tangible heritage: the village management plan

UNESCO first recognised these villages with fortified churches in 1993. However, a gradual transition took place before they were officially awarded protected status through a Management Plan drawn up by the Ministry of Culture of Romania in 2013, and revised in 2014 (https://whc.unesco.org/en/list/596/documents/).

This period saw major alterations to the constructive and typological features of the villages, and especially to privately owned residential buildings. While floors, roofs, beams or joinery were replaced in many of these buildings, many other unsuitable interventions were also carried out, with alterations to the historic sector, the demolition of agricultural annexes or the addition of new volumes to courtyards.

### The management plan: some details about values and risks at the sites

The 2013 management plan incorporated some graphic, historical and legislative sections, as well as maps to a scale of 1:5000 of the relevant locations. Following a painstaking inventory of the buildings, a 'protected' area and buffer zone were outlined to prevent tourism and real estate speculation from causing an uncontrolled expansion or urbanistic changes. This protection measure is also useful for ex-

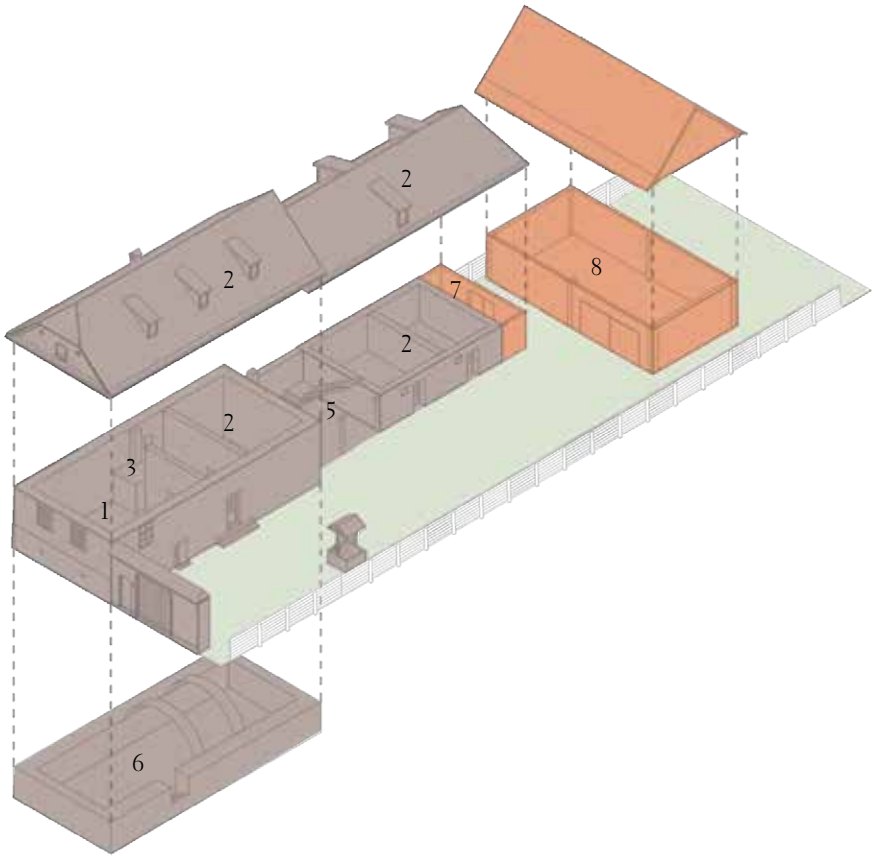
**Sequence of residential buildings in the village of Viscri, Transylvania, Romania**
(© *G. Figuera, 2018*)

tended monitoring of how these villages have developed and grown, and of the conservation policies followed.

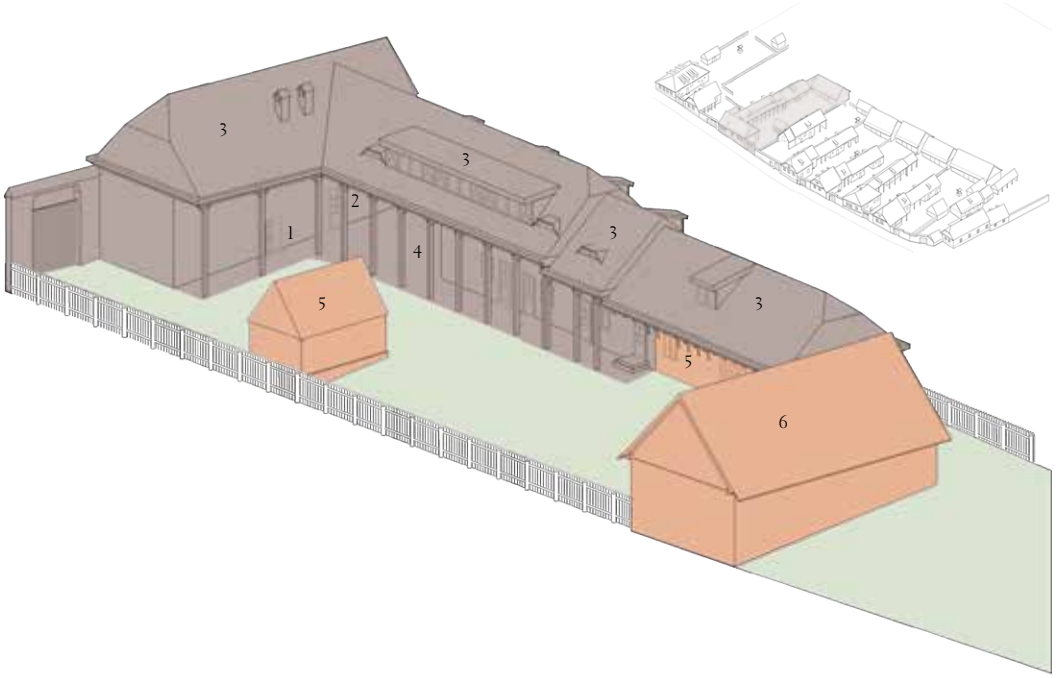
The plan follows four basic lines of action. Some are more spread out in time, and as seen in the 3DPAST data collection processes, which are still in place; while others, more occasional ones, have a shorter duration.

The first of these actions is the programme for "Buildings in need of urgent intervention", supported by periodic reports from specialist inspectors in charge of updating and revising the inventory of the classified buildings, examining different factors when considering potential subsidies (Nypan, 2006).

This programme analyses buildings based on several items, including building type (dwelling or agricultural annex), degree of occupation, damage observed, uses, information on the owners, historic report of interventions… There are very few Saxons still living in Transylvania today. Their sudden emigration in the late 20th century led to a large number of houses being left empty, falling into disrepair and causing major problems. Today, these are basically the object of 'nostalgic tourism' by German-Hungarian people.




**Dwellings study**
In grey the residential area, in orange the agricultural area and in green the yards;
1. Dining room; 2. Bedroom with bathroom; 3. Kiln; 4. Water well; 5. Summer kitchen; 6. Basement; 7. Storage; 8. Stable
(© *G. Figuera, 2018*)




**Graphic reconstitution of a typical dwelling in the village of Viscri**
In grey the residential area, in orange the agricultural area and in green the yards;
1. Basement; 2. Dining room; 3. Bedroom; 4. Summer kitchen; 5. Barn; 6. Stable
(© *G. Figuera, 2018*)

**3D reconstitution of the traditional constructive system of a dwelling**
*(© A. Maiulini, 2017)*

**3D interactive model of the dwelling**
*(© A. Maiulini, 2017)*

*opposite page*
**Top: Dwellings of Biertan; Bottom: Details about urban nuclei in Calnic, Transylvania**
*(© F. Vegas, C. Mileto, 2017)*

Furthermore, Saxon heritage also suffered the trauma of a totalitarian and oppressive state, which has strengthened people's increased pride in their roots in the countryside, and traditional rural knowledge (Gherman, 2019).

Attempts have been made to limit the gradual obsolescence of these villages through the "Buildings for reuse" programme, which draws up periodic reports, as well as carrying out inspections in collaboration with local authorities, and under the supervision of the Transylvania Trust (www.transylvania-trust.ro/#).

The aim of this action was to identify solutions to bring these buildings up to contemporary housing standards, without decontextualising or drastically altering their structure (volumes, accesses, openings…), their historical planimetry and/or constructive features (roofs, floors, joinery…).

Another programme worth noting is "Protect know how from oblivion", carried out in collaboration with Romania Nostra and several local and supraterritorial institutions.

This programme aims to promote and formalise resources relating to the place of origin of local materials, traditional processing forms, and specific autochthonous construction processes.

In fact, a major point within the programme is to set up and train teams of craftsmen to guarantee the long-term transmission of specific types of constructive and artisanal know-how connected to the architecture of these villages.

The final action is the "Education for understanding and protection" programme, which covers different collectives (specialists, local administration, citizens, students, owners…). The aim of this programme is to inform and raise short-mid-long term awareness among the different agents involved in the amazing vitality of the historic villages and their fortified churches, covering important social and ethnic issues, as well as 'technical' ones.

**UNESCO protected area and buffer zone - Viscri case study**
In orange the Saxon Church UNESCO World Heritage, in red the main road to the Church and in black the analysed residential complex
(© *G. Figuera, V. Cristini, 2020*)

All the above contribute to the promotion of resources, clearly identifying respectful or inappropriate actions, and in turn generating potential driving forces for local development that take into consideration possible ethnic or social differences (Iosif, 2011; Gabor et al., 2013).

## Strategies and perspectives

For centuries, the fortified churches have been the religious and cultural centre of rural communities – built, used, and maintained largely by Transylvanian Saxons and Transylvanian settlers. From their construction in the late Middle Age until the end of the 16th century, most churches have undergone numerous alterations and additions. For over five centuries, their role was both religious and military. However, over the last three centuries, especially the 19th and 20th centuries, the defensive elements of the enclosures (towers, walls) were partially or totally demolished as they no longer fulfilled their role. The departure, in recent decades, of most of the Transylvanian Saxon population in the region has brought about uncertainty to the future of these fortified churches, universal heritage part of the UNESCO World Cultural Heritage. The number of these buildings – now much lower – makes up one of the densest and best-maintained medieval fortification systems on the European continent. Many have been conserved until today, and play an important part within a unique landscape. This importance is heightened by the density and variety of monuments, which have become the hallmark of many villages, as well as of the region as a whole.

In this framework, it is worth noting the role of The Fortified Churches Foundation (founded by the Evangelic Church of Augustan Confession in Romania) in creating an expert institution focusing



mostly on preserving religious heritage. The existence of a legally constituted foundation enables the necessary long-term perspective, and improves the possibilities of fundraising for this endeavour.

The Foundation is active in some interesting fields of work, such as construction and preservation measures for the fortified churches and movable religious assets, education programmes for strategy development, public relations, the organisation of cultural and professional events, fundraising, and tourism management. It should be stressed that the Foundation is working with UNESCO listed sites, as well as with other lesser-known and more fragile and vulnerable fortified churches throughout the region.

One of the most important Foundation missions is the implementation, upkeep, and sharing of knowledge in the traditional methods and techniques that were used to build the fortified churches in the past. Knowledge of these methods and the preservation of monuments in general are transmitted to craftsmen, castle guardians, curators, caretakers, and other interested groups. With these resources the foundation is supporting the people who work on the churches and fortifications on a daily basis, thus contributing substantially to their preservation. Architects, restorers, archaeologists, and other experts are systematically involved in this endeavour.

In this context the Foundation is promoting, among others activities, interesting *hands-on conservation* workshops at endangered fortified church complexes, geared towards young heritage professionals from Romania and from other countries. This recent partnership, possible between NGOs such as European Heritage Volunteers and the Foundation, makes conservation work possible on the fortification walls/main church bodies but also, and just as importantly, on general architectural elements of the ensembles (gates, dividing walls, staircases, accesses, paths, annex buildings, residential units), raising awareness of the rich tangible and intangible heritage.

**App - example of promoting resource, Alma Vii village**
(© *F. Vegas, C. Mileto, 2017*)

**Examples of inappropriate actions stressed by the management plan**
(© *F. Vegas, C. Mileto, 2017*)


**Examples of publications which are driving forces for local development**
*(© F. Vegas, C. Mileto, 2017)*

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**Examples of hands-on activities undertaken by The Fortified Churches Foundation**
(© *Raul Pop-Kirchenburgen Org.*)

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## Location, landforms and territorial structure

The historic centres of Berat and Gjirokastra, located in central and southern Albania, were added to the UNESCO World Heritage List in 2005, thanks to the valuable presence of several remarkable examples of Ottoman-styled houses, and to the integrity of their vernacular urban landscape.

Gjirokastra was founded on the slopes of the Drino valley, in a strategic position that satisfied the strong need for defence, but imposed some important limitations to the builders (Mezini, Pojani, 2015). The main structure of Gjirokastra consists of two ridges standing out from the massif: the Rruga Pazari i Vjeter Pllake runs on the first ridge (in the South), dominated by the Castle, and the Rruga Alqi Kondi runs on the second ridge further north. Towards the mountain, at the junction point of the two ridges, just where the valley that separates them is not so wide, we find the Bazaar district, the true nodal point of old Gjirokastra, with its characteristic crossroads. From the bazaar, the Rruga Ismail Kadare follows the slope of the ground and becomes part of a sort of chessboard located on the wide slope overlooking the valley and lying to the limit of the old centre, a ravine at which the extension towards the valley of the Bulevardi 18 Shtatori arrives: an important road, perpendicular to the river, marked the expansion of the modern city on the valley.

Berat is located approximately 120 km south of Tirana and has stood for more than 2,400 years. The city is situated in an overview location between the mountains Tomorri and Shpiragu. It arises on sloping and rocky ground and its urban layout is structured on two hills facing each other, and separated by the river Osum. The citadel is located on the northern hill on the Osum River. In front of the citadel there is a smaller fortification (Gorica Castle), which is now in ruins. This urban morphology, consisting of two fortified sites on two hills facing each other, has been effective for the defence of the valley around the river, and it was the base for all the following developments of the city (Pashako, 2015).

## Methodologies of analysis

The activities carried out in Gjirokastra and Berat were aimed to analyse the local building through the use of the instruments of the survey and digital representation, with the collaboration of students and local experts. Two scientific seminars, aimed to share knowledge on the vernacular architecture of Gjirokastra, were held in Florence, with the participation of Albanian scholars and students. Two work-

*opposite page*
**Gjirokastra view from Zekate House** (© *E. Lamacchia, 2018*)

**Localisation of the cities of Berat and Gjirokastra, Albania**



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**Ottoman detached tower-houses and terraced gardens in Gjirokastra**
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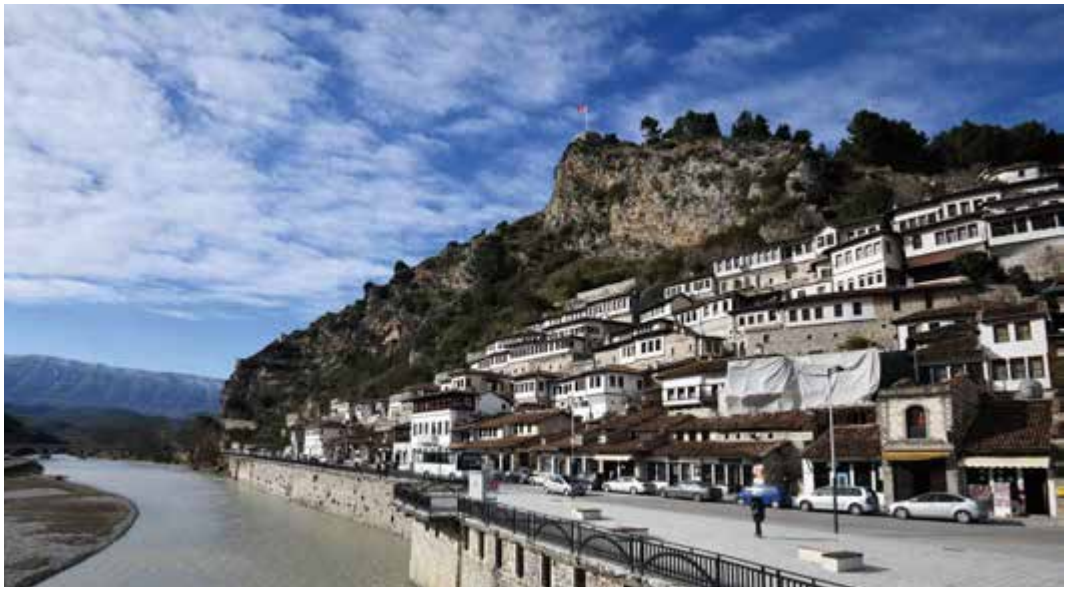
shops were held in the framework of 3DPAST project: in Gjirokastra from the 17th to the 21st December 2018, in which 28 Albanian students from the University of the Our Lady of Good Counsel based in Tirana, 12 students and researchers from the University of Florence, and local experts in architecture and traditional construction attended. In Berat, the workshop took place from the 2nd to the 8th February 2020, with the participation of 3 tutors and 15 students from the Architecture Course at the UNIZKM, Tirana, with the local support of Eugen Kallfani, Director of the Regional Directorate of Cultural Heritage in the Berat region. This workshop took the digital survey of various architectures from *Berati*: a part of the castle walls, three churches from the upper citadel, some well-preserved houses maintaining the original organisational structure, two extended fronts along with the town and the waterfront on the river.

In Gjirokastra the investigation adopted an interdisciplinary approach, using both traditional and advanced data gathering techniques. The first level of investigation has the bases on range-based and image-based survey tools and instruments, used for the documentation of the three buildings chosen as case studies. The data, acquired through 3D laser scanners, topographic total stations, photographic and photogrammetric instruments, allowed to obtain 2D representations and 3D models. The second level of analysis, concerning the building elements and their structural behaviour, required the use of survey data, direct observation, interviews and the compilation of analysis sheets. The third level of investigation concerned the urban scale and meant to reconstruct the evolution of the urban settlement. The field research was based on direct observation, photography and analysis sheet that allowed the drafting of interpretative maps at different scales.

In Gjirokastra, three buildings have been identified as case studies. They are located in the Palorto district and they differ in their period of construction, state of conservation and current usage.

The first case study is the Zeko family's house, a building included in the national list of first-class monuments, actually used as a museum house. It started to be built in 1811, it underwent the first restoration from 1968 to 1975 (Riza, 2015), and a second one in 2004. The conservative restorations did not



**View of Berat, Albania**
*(© G. Verdiani, 2020)*

alter the planimetry and the construction systems. The house is located in a dominant position towards the south-western part of Gjirokastra. The two-wing planimetric scheme is composed of two rectangular blocks and a central connection element, with two large arches (*kemer*) on the facade, which support the top floor terrace with a pergola (*çardak*), a privileged point of view towards the city and valley of the Drino.

The Fico House, built in 1902, represents a late development to the two-wing planimetric scheme and allows to understand the changes of the Gjirokastra dwelling, when they lost their defensive character. In the 20th century, the new buildings, while maintaining traditional planimetric and structural aspects, showed a stylistic evolution towards more western models. The house, which is easily identified because of its golden yellow facade, is included in the national list of first-class monuments.

The third building, the Dalipi House, whose construction dates back to the beginning of the 20th century, is currently in a state of abandonment with a process of increasing degradation, and continuous loss of wall portions. The reading of the morphological components and construction features allows to trace the history of the building, which has undergone numerous functional and technical transformations, and to understand some recurrent problems in the buildings of Gjirokastra.

In Berat, the students were brought to learn lasergrammetry with *hands-on* activities coordinated by the tutors. The scanner unit used for all the surveys was a Zoller+Fröhlich Imager 5016, a phase-shift 3D laser scanner (Verdiani, 2012) capable of taking accurate measurements up to a distance of 180 metres and colourise the point clouds with a good quality camera, capable of autonomous lighting and high dynamic range imaging (HDR) processing. These features turned out to be very useful for documenting all the various aspects of the interiors of the historical houses. The high speed and the long-range of the scanner allowed the adaptation of the survey campaign for mostly interior and urban situations, allowing an easy connection of the interior architecture with the urban (and landscape) scenario. At the same time, the photogrammetry session was aimed at pushing the students to use their cameras as the base tool for creating 3D digital models based on pictures. In case of need a couple

**Digital survey in Gjirokastra: lasergrammetry of two interiors**
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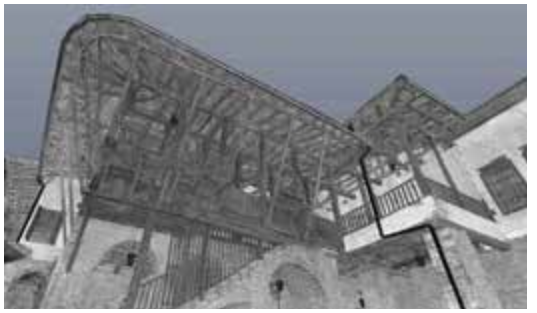

**Berat, 3D Laser Scanner digital survey of Berat, lasergrammetry of the Holy Trinity Church and the Ethnographic Museum**
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of professional, high-resolution cameras were available for their operations[1]. After a proper briefing, all of them were able to operate on their subjects with autonomy. In some cases, a UAV/Drone unit owned by the students, a DJI Phantom 4[2], was used in close range, short flights, for integrating the documentation of the roofs and the most inaccessible areas (Rodriguez-Navarro, 2012). Later on, the groups of students started working on the treatment of the data, extracting shareable contents out of the point clouds and the textured polygonal models produced by the digital survey. Almost all the data processing was done using Autodesk Recap Pro (lasergrammetry data alignment and treatment) and Agisoft Photoscan/Metashape (photogrammetry processing), the final drawings were all developed using Autodesk Autocad. The students were guided in the production of both technical and accurate drawing but also in the creation of multimedia and versatile contents, quickly usable in presentations and social media environments.

In Berat, the main subjects of the interventions were planned to have various samples from the local architectures. In this way, a part of the walls around the main access gate; the Churches of St. Mary

[1] The cameras thet have been used are a Nikon D800e and a Nikon D850 (both with an FX sensor and a resolution of 36.3 and 47.3 Megapixels), equipped with a 24-120mm F4 and a 16-35mm F4 Nikkor Zooms, two very versatile lenses for any urban environment

[2] The UAV/Drone was equipped with a 13Mp standard camera

Blachernae and St. Nicholas, the Church of the Holy Trinity (all from the inside area of the castle); two well preserved traditional houses and a full urban front from the Gorica neighbourhood and the Ethnographic Museum (which venue has recovered a large traditional house in the downtown area), have focused the efforts of the whole workshop creating the first complete digital documentation of these outstanding buildings.

## Historical background

Gjirokastra was a meeting place for Greek, Roman, Byzantine and Ottoman cultures, stretching South-East/North-West and enhancing its defensive potential thanks to the position of control between the Ionian Sea and the Balkans. Until the end of the 19th century, the perimeter of the city centre was drawn by the lines leading to the Castle, corresponding to the ridges perpendicular to the Mali i Gjerë massif (around 1800 metres above sea level). From the 1900, and especially after the end of the Second World War, a progressive expansion of the town could be identified in the valley (Torresi, 2006).
Also Berat features a castle (locally known as the Kala) mainly built in the 13th century, which origins date back to the 4th century BC. The city was taken under Roman control in the IInd century B.C. During the middle ages, Berat was able to stay relatively unscathed due to the natural and human-built defences. The city walls, which formed a triangular shape, were also built during this medieval period (Pashako, 2015). In the XVth century, under Ottoman domination, Berat lived a period of urban and demographic development, through the migration of the rural population and the creation of new districts (Pashako, 2015).
During the 18th century, Gjirokastra and Berat lived a prosperous period as demonstrated by the buildings with larger and better quality dwellings (which were required by the feudal class), and by the consolidation of the urban and mobility structures (Pashako, 2015).

## Main Urban features

The fortress-houses were organised in 'neighbourhood units', based on parental or 'clan' principles.
Gjirokastra has a low urban density, with irregular blocks, an articulated road hierarchy, and a large amount of green open spaces inside the blocks, among the buildings and in the spaces between the properties, with extensions of various shapes and densities. The ancient presence of small parks, orchards, gardens is still legible where now there are some uncultivated areas that cover the slope below the Castle.
The urban configuration is comparable to an open hand, where the palm is the city core and the fingers are the city extensions. Between the 'fingers', gaps where watercourses run, some impassable on foot: vegetation areas free of construction, through which in the past paths crept up to the city core.
The urban structure mirrors a relatively horizontal society, with strong individualities competing with each other. The town, in fact, is not divided into zones according to hierarchical principles, and the main building organisms (the tower-houses) with their reference area are organised in blocks or neigh-

**Gjirokastra, 3D Laser Scanner - digital survey and localisation of Zekate and Fico House**
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**3D view of Zekate house**
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bourhoods. The buildings were connected indirectly to the street through a gradual system of filters, made up of courtyards, gardens and private and semi-public spaces.

This horizontality of the social and urban structure in Gjirokastra returns a city that did not have urban squares as meeting grounds for the population, nor did it have a city hall for their representation. The only building embodying rule and administration was the castle, and the only social spaces were the religious complexes. The only public space of certain importance and structure is the crossroad of the bazaar, from where the residential areas were strictly separated (Mezini, Pojani, 2015).

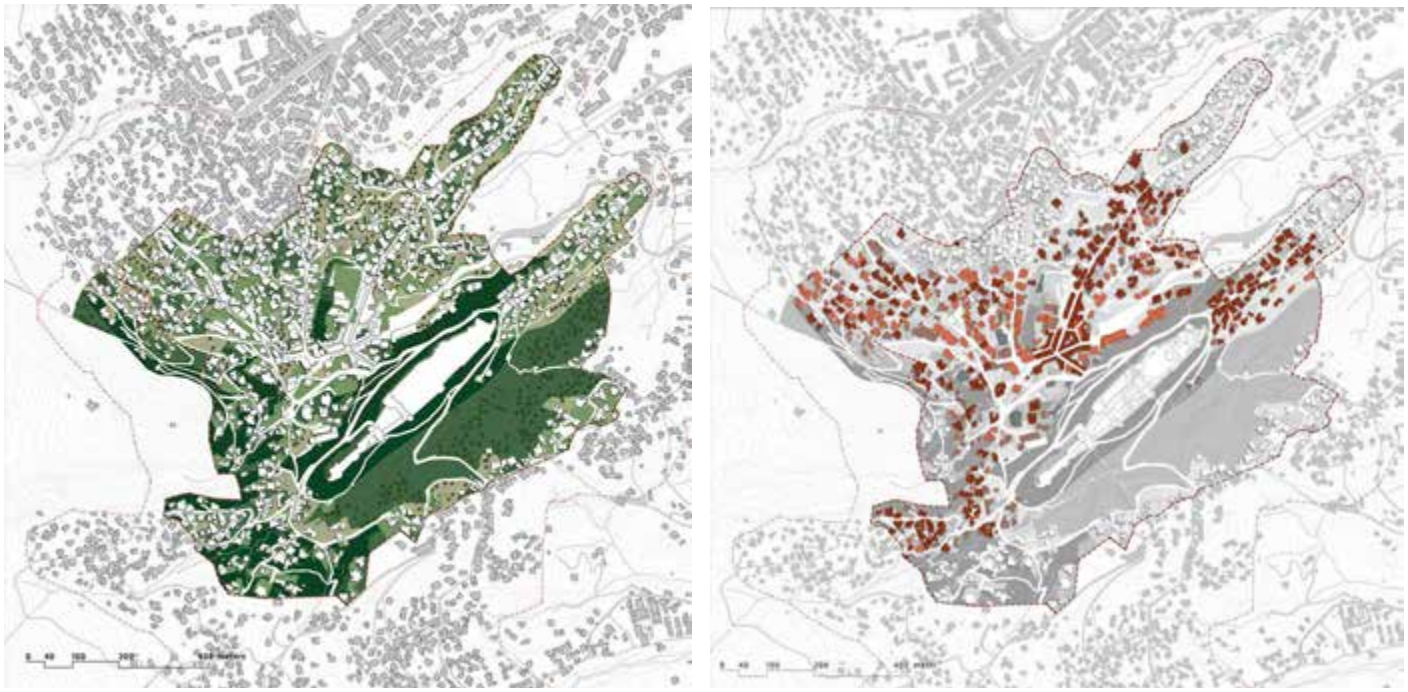
Traditional cobblestone streets in Gjirokastra are paved with a mix of black shale and pink and white limestone. The problem of different slopes sometimes made stairways necessary.

Berat houses have a more horizontal development and most of the time have a better connection to the outdoor spaces. Many houses are built in rows along the main streets, with predominantly horizontal layouts. These differences are partly explained by natural features: Berat has a smaller amount of rocky terrain, which builders sought to use as efficiently as possible by bunching houses together. Unlike Gjirokastra, which was ruled by major landowners often involved in reciprocus conflicts, the main occupations in Berat were trade and handicrafts, which are necessarily linked to a more open life- and building style (Mezini, Pojani, 2015).

## Functional organisation of the buildings and main architectural typologies

The urban vernacular landscape of Gjirokastra is marked by the Ottoman detached tower-houses (*kullë*). The building served a living and defensive purpose, being at the same time a symbol of power and wealth. The interiors reflect the hospitable character of Gjirokastra people, as well as their propensity to display their status through opulent furnishings. The basic unit of the house is the residential room (*oda*), which maintains the same dimensions but presents different decorative elements in accordance with the people, family members or guests who used it.

Three variations of the *kullë* can be identified considering the planimetric and volume composition as the basic criterion for its classification: the perpendicular type, the one-wing type, and the two-wing type. The perpendicular variation, dating back to the late eighteenth century, is the simplest one: it



**Gjirokastra: urban evolution and open spaces**

**mainly permeable**
**mainly impermeable**
**uncultivated**
**building's relevance**

**ante 1900**
**1900-1945**
**1945-1972**

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consists of a prismatic block with a rectangular basis, with two or three storeys, linked by outer stairs. The one-wing variation, consisting of two blocks perpendicular to each other, is the most common kind of the Gjirokastra house. The two-wing variation, dating from the nineteenth century, has two parallelepiped blocks connected together by a central distribution volume.

The functional organisation follows a vertical hierarchy. The ground floor, always built in stone, housed the service spaces: livestock (*katoi*), a space to store food reserves (*qilari*), big water cisterns to collect rainwater from the roof for the dry months of summer (*stera*), sometimes a mill and cereals (*kube*). The upper floors, more protected and safe, accommodated the living areas: the living room, called 'fire room' (*oda e zjarrit*), and the 'guest room', named 'good room' (*oda e miqve* or *oda e mirë*). The main rooms (*oda*) have low couches (*sofa*) and small ornate niches around three sides, while the fourth side is occupied by the *musandra*, a large cupboard, which stored mattresses and other bedding during the day. A short staircase concealed inside the *musandra* led to a small gallery (*dhipato*), where women and children used to retire during the meetings reserved to the men of the house and to the guests (Doempke et al., 2012). Generally, the guest room is richly decorated, with floral paintings on the walls, ceilings, and on the fireplace, wardrobes with mouldings and notches.

The two residential floors usually have different uses depending on the seasons. The second floor, with small windows and thick stone walls, was used in winter (it is called *dimerore*, which means the wintry floor). The third and last floor (generally higher than the first), was used in summer (it is called *beharore*, which means Summer floor). It presents larger windows on the façades and thin walls with timber structure. The presence of the porch under the roof (*cardak*) provides climate benefits in winter, making the most sunny interior rooms; and also in summer, creating a more airy space, used for leisure, contemplation or for family festivities (Çuedari, 2014).

**Gjirokastra: *musandra* and *dhipato* in Zekate house**
(© *L. Dipasquale, 2018*)

**Berat: interior of a well preserved traditional house in the Gorica neighbourhood**
(© *G. Verdiani, F. Tioli, UNIZKM, DIDA, 2020*)

In Berat there are two main types of dwellings, which can be divided into some subcategories or variants (Çuedari, 2014; Pashako, 2015): the isolated unit (or house with *çardak*), and the aggregate one. The common compositional characters of both types consist of two levels building. The ground floor (basement) is in masonry. The upper floors may be in load-bearing masonry with the addition of light structures using timber walls. The large wooden roof is one of the most characteristic elements of the house, distinguished by the numerous folds and the large overhang of the eaves.

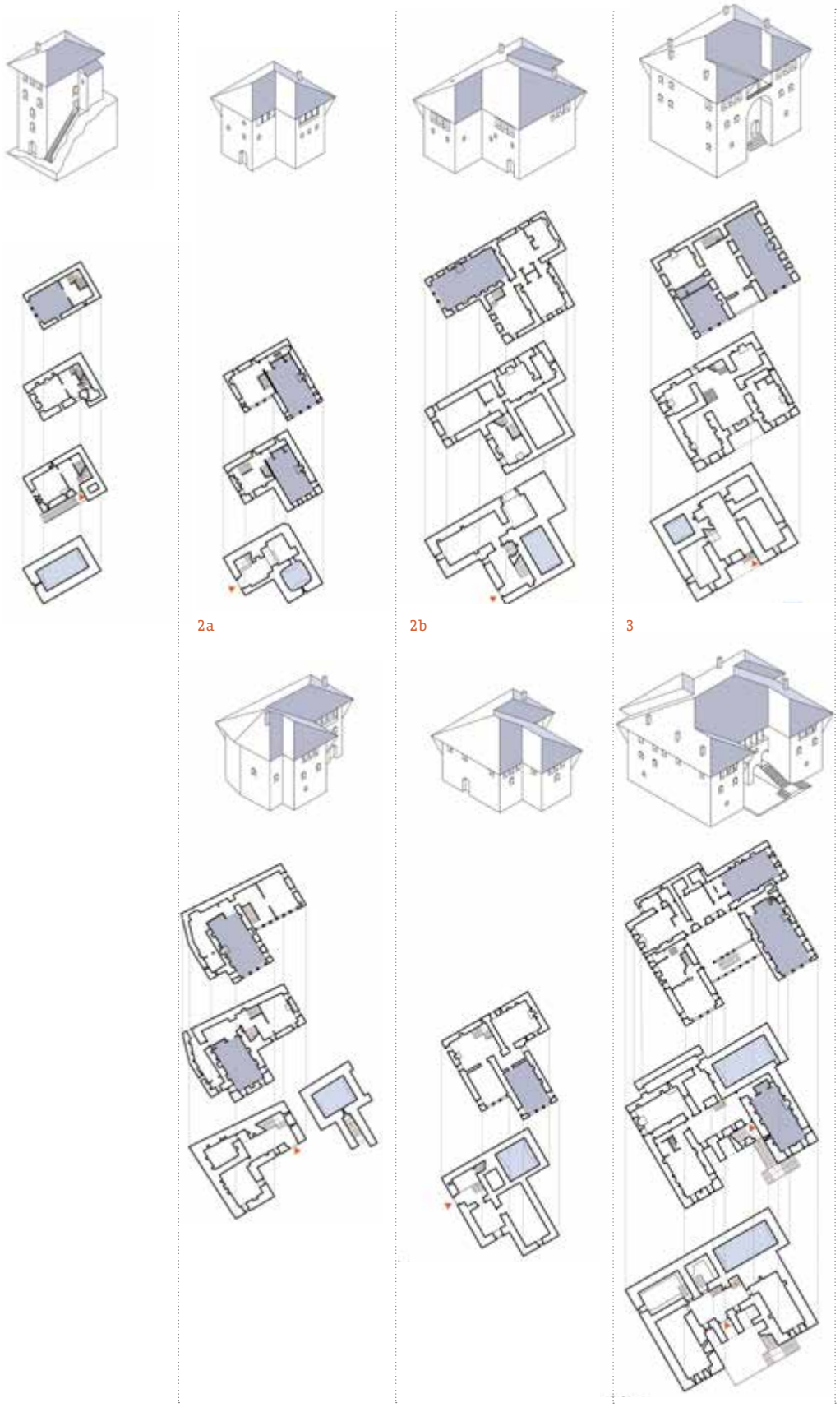
The isolated house gets its name from the central porch on the first floor called *çardak*, which held several functions, being at the same time a corridor, a living room during the hot months, or even the place for the treatment of agricultural products.

A variant of the isolated house, influenced by the land features, is the house with 'half floor'. In fact, the definition 'half floor' means a section jagged, with a greater extension of the surface of the first floor than the ground floor. The first floor has a greater surface area, both in the back of the house, thanks to the excavation of the soil, and in the front, with projecting wooden facades and typical bow windows, spread throughout the Ottoman cultural area, here called *erkeri*.

The aggregated type of dwelling has a lower extension than the one with the *çardak*. Its users are middle class people, employed in agriculture and handicrafts, without resources to own a house with *çardak*. This type has an aggregation scheme called 'string'. It has undergone transformations of the 19th century with the addition of *erkeri*. The houses have a functional scheme very similar to the house with *çardak*: the ground floor was used for storage (*katoi*), while the first floor was for family life. Here the rooms are fewer and smaller than the house with *çardak* (Pashako, 2012; 2015).

## Traditional building techniques

Building techniques used in Berat and Gjirokastra have been influenced both by the Albanian and the Ottoman tradition. The heavy stone construction of the lower floors has its roots in the rural Albanian tower house (*kullë*). The uppermost floors, with a timber structure (*çatma*), a wooden lath and plaster, a row of windows and terraces follow urban Ottoman building tradition.




**Typology of the tower-house (kulla) in Argirocastro and their variants**

water cistern
*'oda'*

1. Perpendicular type
2a. One-wing type - variant a
2b. One-wing type - variant b
3. Two-wing type
4. Irregular Plan

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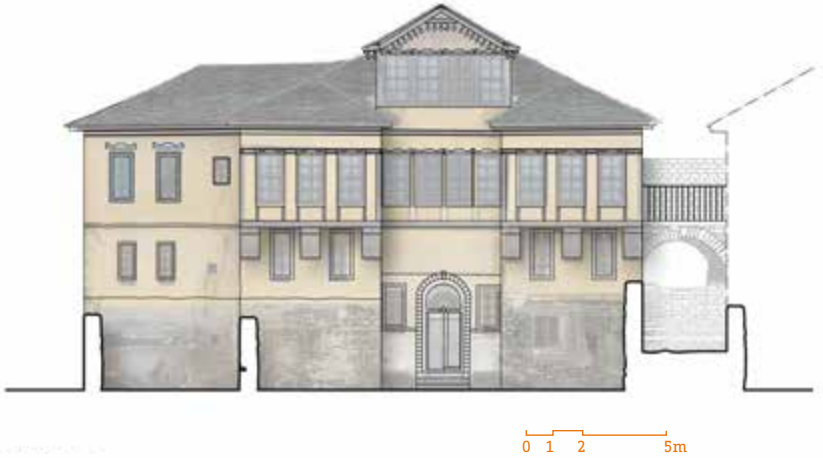


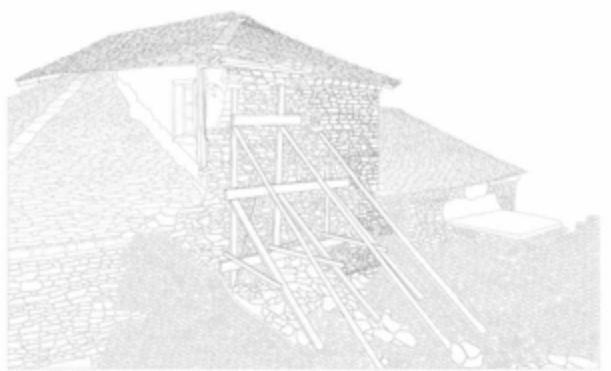

**Fico house survey**
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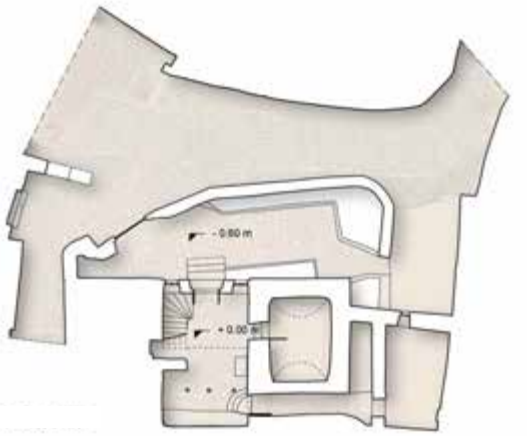
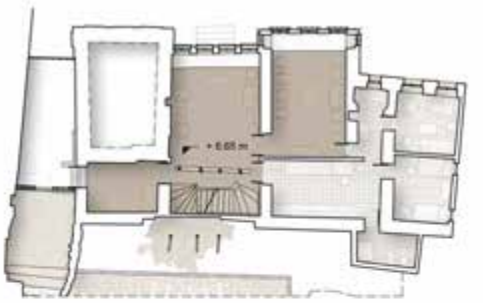
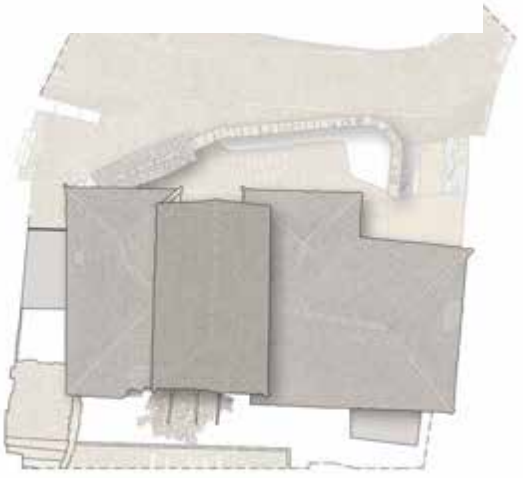



Ground floor

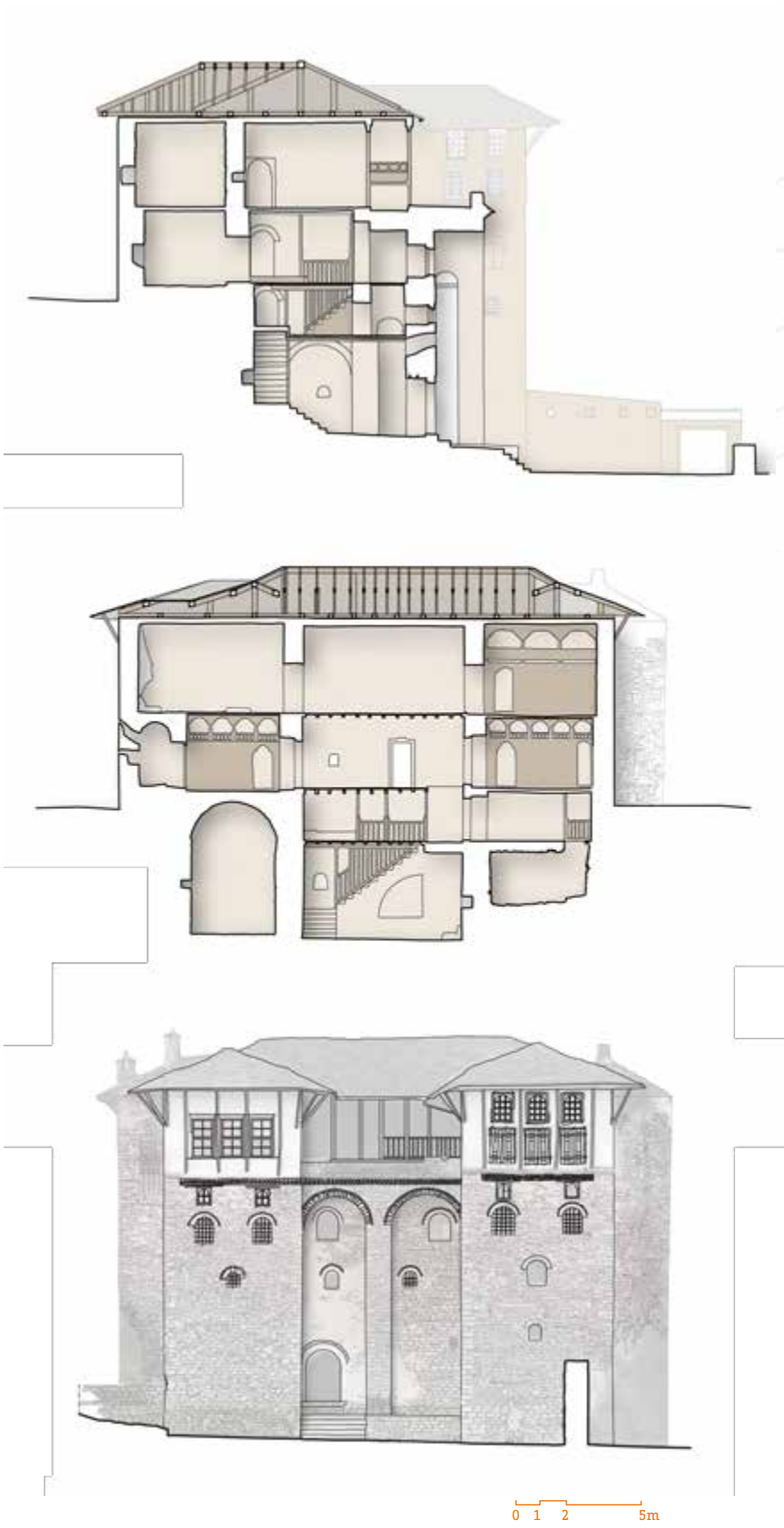



First floor


Second floor



Rooftop plan




**Zekate house survey**
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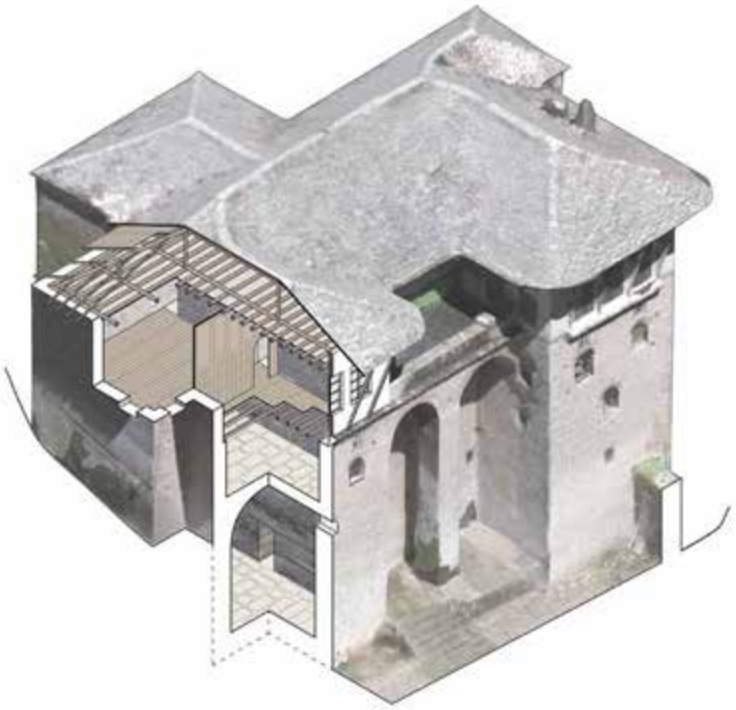


**Axonometric view of Zekate house** (© *E. Lamacchia, Dar Med Lab - UNIFI, 2020*)

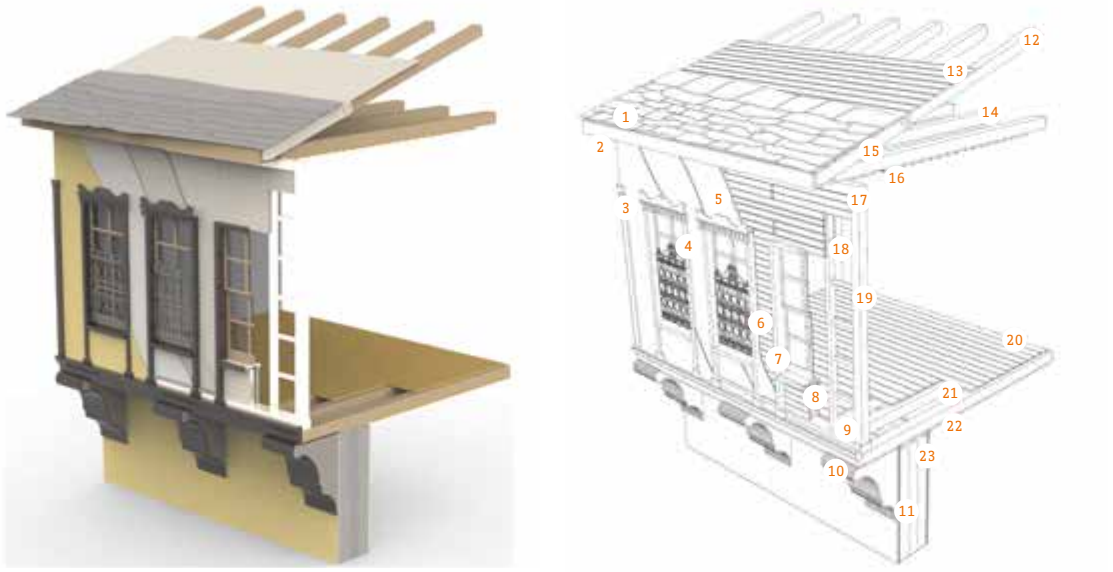
Local stone is the main building material of the town: the walls, the roofs, the paving of the streets and the courtyards are made of blocks or slabs of local limestone and slate. Wood is used for the masonry reinforcement elements, the structures of the floors, the roofs and the uppermost walls.

Bearing walls, up to one meter thick at their base, are built with local limestone hewn blocks and bound with a mortar composed of lime and river sand. In general, the foundations, up to 130 cm thick, are dry-walled, in order to allow the drainage of groundwater and prevent capillary rise.

Horizontal timber ties, made of oak or chestnut wood, are embedded along load bearing masonry. These wooden elements, two or three according to the thickness of the wall, are placed every 80-120 cm on both sides of the wall, connected by transverse wooden pieces; at the corner, they are ensured by a diagonal tie element. The horizontal timber ties, generally squared, are often visible on the interior side of the wall, while in the external side of the wall they are protected by a stone course, in order to protect them from the rain. This system allows to connect the external faces of the masonry and create horizontal planes to lay the successive layers of stone blocks, ensuring the longitudinal and transversal stability, and improving the anti-seismic building performance.

The thickness of the walls decreases by 10-20 cm for each floor. In the oldest walls, dating back to the XVII and XIX centuries, there are not always wood elements of reinforcement, but the connection of the two faces of the wall was ensured by large stone blocks, which occupy all or almost all the thickness of the wall. Sometimes, masonries are covered with a first layer of earthen mortar, then a layer of lime and sand covering plaster.

The walls of the upper floors and the internal partitions are built using the technique called *çatma*. This traditional technique consists of a frame made by vertical posts and horizontal battens, on which wooden boards are nailed. The frame is filled with waste material and stones. The plaster is composed of a first layer, 2 cm thick, of straw and earth, and a second 5 cm straightening coat of lime, sand and wool. The



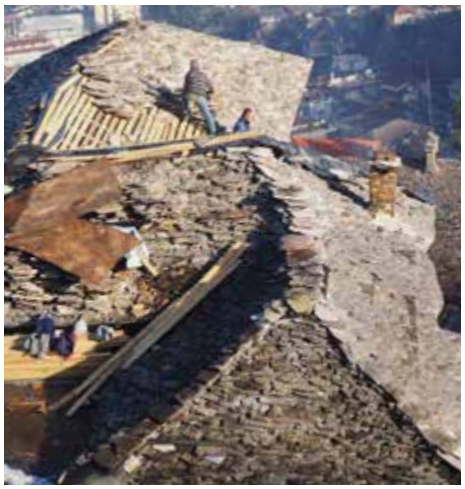

**Axonometric view of the *çatma* component in Fico House**
1.Schist overlapped tiles; 2.Gutter; 3.Finishing plaster layer; 4.Plaster layer made with lime and wool; 5.Plaster layer made with straw and clay; 6.External wood boards; 7.Structural beams; 8.Interior wood boards; 9.Beam; 10.Decorated corbels; 11.Stone masonry; 12.Common rafter (*mahi*); 13.Wooden plank; 14.Support beams; 15.Extension of common rafter; 16.Wooden ceiling; 17.Ceiling longitudinal beam; 18.Joists; 19.Vertical beam; 20.Wooden floor; 21.Beams; 22.Internal plaster (*© G. Koli, University of Our Lady of Good Counsel of Tirana, 2019*)

wood and lime plaster is laid on the first layer with a trowel, and then it is floated for three or four days. A coat of lime milk paint is applied on it. The facades of the most notable houses (Zekate is an example) present tall arches (*kemer*), which often support an open roofed space or terrace (*kameriye*).

Barrel vaults are used to cover mainly entrances and tanks, which are located at the ground floor. They consist of blocks of accurately dressed stone, walled with lime mortar. The vault is generally 35 cm thick, above construction debris and small stones are laid and levelled.

The floors consist of wooden joists – with a cross section of 8 ÷12 x 8 ÷12 cm – placed each 35÷50 cm and nailed at either end on the horizontal timber beams embedded in the walls. Planking consists of pine wooden boards – with a cross section of 2 x 20 cm – which are directly nailed to the joist. Pine wood is also used for the windows; chestnut or beech wood are used to make shutters and doors; stairs are generally made of beech, oak or walnut wood (Mamani, Merxhani, 2012).

The grey limestone slab roofs are an essential characteristic of the Gjjirokastra's urban landscape. The number of chimneys on the roof was a symbol of the wealth of the homeowner. The internal wooden false ceilings hide the structure of the roof, so it has been possible to observe only a portion of the roof of the Zekate house, partially rebuilt following the last restoration. The supporting structure of the roof is made of oak beams nailed together, which take on a rather complex hyper-static three-dimensional configuration, where all elements cooperate to support the heavy stone covering of the roof (Merxhani, Pompejano, 2015). A system of ceiling joists, with a cross section of 14÷18x15÷20 cm, the principal rafters who support the ridge beam, are connected to the edge beams (*taban*) through riveted joints. Ridge beam and principal rafters are also supported by vertical posts (called *baballëk*), which rest on horizontal beams (Merxhani, Pompejano, 2015). The principal rafters can also be supported by radial timber elements working as struts, which converge in the horizontal edge beams resting on a central wall or placed at 90 degrees on the ceiling joists. The common rafters, placed at a narrow distance, have a cross section of 5÷12 x 5÷12 cm. Wooden boards are fixed on them, at a distance of 5-8 cm from each other. The grey slate stone slabs of the roof are approximately 1.5 cm thick and are placed on the



**Rehabilitation of a roof, Gjirokastra;**

**Abandoned building in the historical centre, Gjirokastra**
(© *L. Dipasquale, 2018*)

**Back of Fico house, Gjirokastra**
(© *M. Carta, 2018*)

boards, without mortar or connections through metal hooks. The larger slabs are placed in the lower part of the roof, which is to be the most stable, while the smaller ones are arranged in the upper part so as not to overload the structure and to reduce the thrust towards the lower layers. The eaves of the roof protrude 50-60 cm; the rafters that bear them (called *testek*) are supported by timber elements connected to the wall, at the height of the lower floor. The slope of the roofs is between 25-30 %. Constant maintenance, especially before and after the storms and torrential rains of the winter, is needed to avoid the movement of the slabs and the infiltration of water.

## Values and risks of the site

During the last decades, both Gjirokastra and Berat are benefiting from a growing number of tourists, which are contributing to boosting the economy and raising awareness to an endangered Albanian heritage.

The historic town of Gjirokastra is legally protected by the Decree on the Museum City (1961, 2007) and its status as a World Heritage Site (2005). The Law on Cultural Heritage (2003) places, in addition, more than 600 individual buildings under protection as cultural monuments of 1st or 2nd categories. Since 1959, Berat has been declared a "museum city", and 444 buildings have been classified as protected, and divided into two categories: "first class" (64), with particular historical and artistic values, and "second class" (380), distinguished by the environmental value. Furthermore, the protection includes all houses and green spaces that are free, following the indications of the general plan of the city. Despite the strict legal protection, a great part of the built heritage is at great risk of neglect, abandonment, or subject to interventions disregarding the integrity of the building (Lamprakos, 2010). The risk analysis report of the historic center of Gjirokastra (Scalet et al., 2014) highlighted serious risks, caused by natural (seismic threat, wildland fires, erosion, landslides, rock falls) and human factors, which can compromise the integrity of the site.

Among the human factors, the abandonment of the site from the inhabitants, certainly contributed to the general degradation of the building and the potential fire risk. The process of degradation and abandonment began with the fall of the regime and the economy in 1992, when the municipal offices and merchants moved to the 'new towns' in the valley, and many skilled builders and craftsmen

emigrated to Greece and elsewhere. Anti-government violence and fires in 1997 destroyed part of the bazaar, houses, and much documentation on historic buildings. During 1997-1998, due to the unstable political and economic situation in the country, most of the intellectual elite of Gjirokastra and homeowners had emigrated. Since then, many buildings have been abandoned and are now owned by many heirs, who do not reside in town. The current inhabitants are often unable to pay the costs of restoration. In addition, sometimes the house owners do not recognise the value of the authenticity and integrity of the building, and do not understand that incompatible changes can be a problem. For example, replacing an entire slate roof represents a great financial burden, much more expensive than installing one of clay tile, and is not considered a priority by most of the inhabitants. Roofs maintenance and restoration are hampered by the costs, but also by a shortage of skilled craftsmen (Lamprakos, 2010).

## Strategies for conservation and development

The most relevant initiatives addressed to a sustainable conservation and development of the sites are those carried out by two local NGOs: Gjirokastra Conservation and Development Organisation (GCDO) and Cultural Heritage without Borders (CHwB). For more than ten years, both NGOs have been carrying out activities aiming to save the ruined heritage of the towns, and to rebuild interest and capacities, through actions of dissemination, training, restoration and active involvement of the inhabitants (Doempke et al., 2012). Regarding the dissemination of knowledge on cultural heritage, they produced books and brochures, aimed at promoting educational activities, which often involve kids.

Since 2004, Gjirokastra Foundation has undertaken numerous restoration projects, with an approach focused on reuse and sustainability, integrating training, business development, and community outreach. These include the rehabilitation of: Zekate house (2004-2005), the bazaar (2007), the fountains and the square of a 17th century bathhouse (2004), and Babameto House (2010-2013).

The Gjirokastra Experiential Tours project is another interesting action aimed at the involvement of the local communities in the management of cultural heritage. The goal of this project is promoting the local and natural resources of the area, through their inclusion in tourist experiences based on local traditions such as cooking, dancing or singing.

In terms of training, since 2007, CHwB has implemented 38 Regional Restoration Camps, during which young people and students collaborate with local workers to restore parts of protected buildings. The value of the Restoration camps as a powerful educational and vocational training-ground has been internationally endorsed by the recognition in 2014 of the European Union Prize *Europa Nostra Award* in the category of "Education, Training and Awareness-Raising" (Briganti, 2016).

From 2015, CHBwB has launched the *Window to Albania* marketing campaign, promoting cultural and sustainable tourism – in contrast with the global mass coastal tourism – and the discovery of local traditional craft in the building construction field (Briganti, 2016).

CHwB also conducted a Disaster Risk Management plan in Gjirokastra and Berat, determining a building's level of risk based on structural integrity and occupancy, level of historical content, and priority category. In addition to CHwB's work, UNESCO held a workshop in 2011, focused on natural disasters that Berat faces, such as flooding, fire, and earthquakes, and considering what risks they pose to both people and the historical sites. It went on to lay out guidelines on what can be done to respond to these risks, as well as how to best prevent them.

## Digital Survey as a strategic tool for protecting built heritage

The intervention on built heritage should be based on knowledge, correct comprehension of the building techniques, of the place, and of the mix of specific characteristics. The respect of historical values and the definition of sustainable interventions are fundamental. All of these elements need to be coordinated around a clear documentation of each building and its surroundings. The digital survey operations in Gjirokastra and Berat were aimed to create such a base, with the creation of a first digital twin of various architectures, chosen on the base of their relevance and their specific values. It considered the history of the city and to the building traditions, thus creating the original building aspects of the place. The survey strategies were the base of the two specific workshop sessions, bringing the groups of students from the UNIZKM Architecture courses to take part in lasergrammetry and photogrammetry activities and following data processing. The set of selected buildings became the subject of an accurate documentation, aimed to represent correctly the features and pathology of these built heritage elements. The base data were shared with the local cultural heritage institutions, giving them a valuable tool for applying their future interventions. Most of all, the learning experience from the students produced a positive influence on their professional development, now a little more in line with the value of the historical building, and driving them a step further to the full understanding of the value of cultural heritage in any context of development and urban evolution.

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# HISTORIC CENTRE CHORÁ ON THE ISLAND OF PÁTMOS, GREECE

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## Introduction: environmental context

The Chorá of Pátmos, one of the best preserved and oldest of the Aegean Chorá, is settled in one of the highest point of the island of Pátmos, about 200 m above the sea. It is characterised by compact, white-washed volumes, terraces that fit together and adapt to the morphology of the ground. Pátmos is one of the smallest inhabited islands of the Dodecanese, a group of Greek islands in the Southeastern Aegean Sea, off the coast of Asia Minor. The island has an area of 34.05 km$^2$, and 3047 residents that are distributed between the settlements of Chorá and Skala, the commercial port. The island is dominated by the Monastery of St. John the Divine (190m above sea level), located at the highest point of Chorá, from which it is possible to observe the morphology of the whole island, the neighbouring islands, and the coast of Asia Minor. The island is long and narrow, with further narrowing in the middle; its morphology consists of a harmonious succession of rocky hills with scattered Mediterranean vegetation that end in an impressive variety of beaches and gulfs.

The high landscape value of the Chorá of Pátmos is already recognised in the 1970-71 legislation as "historical and landscape monument" first, and subsequently as "historical monument and place of special beauty". Although new buildings have been identified in the limits of the site, we can consider the boundaries of the settlement almost completely unchanged.

Since 1999, the Historic Centre (Chorá), with the Monastery of Saint John the Theologian and the Cave of the Apocalypse on the Island of Pátmos, have been added to UNESCO's World Heritage List. The city represents one of the few settlements in Greece that has developed continuously since the 12th century (World Heritage Committee, 1999a).

*opposite page*
**Chorá in Pátmos island, Greece**
The extension of Chorá, on the ridge of the mountain, is particularly appreciable from the surrounding hills. The houses are arranged along the slope and the fortified monastery, dedicated to St. John the Theologian, represents the core of the settlement and the elevated volume of the city
(*© A. Verrina, 2018*)

**Aerial video of Chorá**
(*© A. Manzi, L. Montoni, A. Verrina, 2019*)

## Historic development

According to the Greek mythology, Pátmos was a sunken island that came into existence thanks to the divine intervention of the goddess and huntress of deer, Artemis, daughter of Leto. During the Hellenistic period (3rd century BC), the settlement of Pátmos acquired the form of an acropolis, surrounded by a fortification wall and towers. Traces and remains of wall foundations from the 4th century B.C. were found in the area of present-day Skala (Iakovides, Philippides, 1990). Since 95-96 AD, the island entered the history of the Christian world, when the apostle St. John, the Divine, spent his exile on the island and composed the Gospel and the Apocalypse (Philippides, 1999). Nowadays, it is one of the

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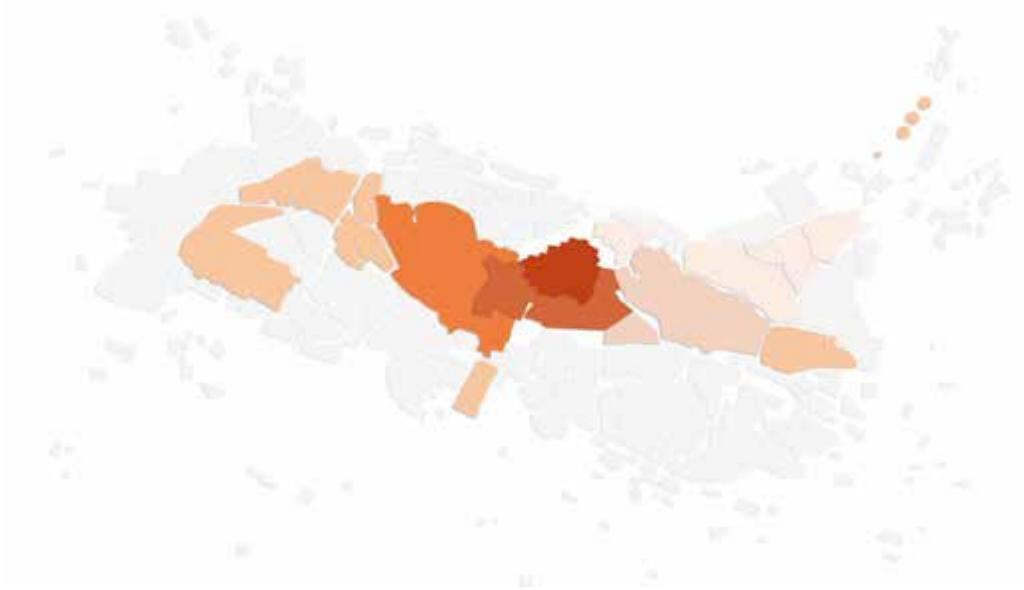


**Historical evolution of Chorá**
The historic districts are underlined in different shades of orange. From the central monastery, built in 1088, to the 18th century neighbourhood
(© *A. Manzi, L. Montoni, 2019*)


**Localisation of Pátmos, Dodecanise, Greece**


seven most important Christian world pilgrimage sites. In 1088, the Bizantine Alexius Comnenus and the monk Christodoulos of Latros began to erect the Monastery dedicated to St. John, a task which took five years. It benefited from the help of 150 monks for the construction work, some experts from Constantinople for the planning of the Monastery, artisans from Trabzon for the fortification, and unskilled labourers from the surrounding island. From 1132, an agrarian settlement began to develop around the base of the Monastery's high walls. The local inhabitants were increased by immigrants that came from the surrounding islands and from the coast of Asia Minor across from Pátmos to escape the persecution of the Turks. In 1453, after the dissolution of the Byzantine state, a new wave of refugees from Constantinople settled in the Chorá, building a new neighbourhood, called *Alloteina*. The new settlers, with a higher cultural level, introduced in Pátmos new urban customs and ways of life, but they did not upset the existing economic and social structures controlled by the Monastery. The old and the new settlement were enclosed by a five-gated wall: this area was called Eso Kastro (Iakovides, 1990).

The conquest of the Venetian Rhodes by the Turks in 1522 led to a wide-scale reshuffling of the populations in the Dodecanese, including Pátmos. In this period (1522-1636), several rural complexes arose outside the fortified zone (Eso Kastro), respecting the geomorphology of the site. Part of the settlements located near the monastery walls were demolished to make way for the crops needed for the subsistence of the monks.

The Venetian invasion of the island in 1659 did not cause structural changes of the settlement, but influenced the economic and social life that moved from the monastery to the community of Pátmos. After the fall of Candax in 1669, many Cretan families sought refuge on the east part of the Chorá. They founded the Kritika district, and the first square of the settlement (the present square of Ayialevia) was created. In the following decades, the population density increased, the urban tissue grew denser, the fortified walls were expanded, and the rural complexes were integrated into the urban structure and fragmented into several housing units (Iakovides, Philippides, 1990). On the steepest part of the hill, overlooking Skala, the district of Aporthiana developed. In the early decades of the 1800s, Chorá reached the economic and urban highest point. The period between 1832 and 1947, during the Italian occupation, was character-

ised by degrowth and migration. From 1947 to today, the development of the city is characterised by the appearance of mass tourism, the economic growth and the increase in construction activity.

**Public spaces and streets**
In grey the secondary driveway, in light grey the main driveway, in orange the pedestrian path, in red the squares and in blue the covered passages
(© *A. Manzi, L. Montoni, 2019*)

**Current use of buildings in Chorá**
In orange the commercial, in light orange the residential buildings, in red the religious buildings, in blue the public services, in light blue the museums, in yellow the windmills and in grey unused spaces
(© *A. Manzi, L. Montoni, 2019*)

## Methodology of investigation

In the framework of 3DPAST project, the research on Patmos was developed in two main phases. The first part of the research concerned the analysis of the tangible components of the architectural heritage of the Chorá of Pátmos: the urban structure, the evolution of the main architectural typologies and the feature of the main building systems. The analysis was conducted by crossing what little information was available in the literature with the results of the fieldwork, which was based on direct observations and surveys of the buildings, interviews with inhabitants, professionals, local experts and administrators. The second part was focused on the risk analysis on heritage and the assessment of the impacts on the heritage, adopting the HIA (Heritage Impact Assessment) method. To date, the built heritage of Chorá appears to be rather well preserved, both as regards the state of the historic buildings and the containment of the urban sprawl outside the boundaries of the ancient settlement, which would otherwise have altered its authenticity. But the built heritage of the Chorá is nowadays at risk, as it is affected by a phenomenon of abandonment by the inhabitants, along with new pressures for transformation with the purpose of encouraging mass tourism. Threats and dangers for the preservation and conservation of the site were identified by processing the information from the interviews with the municipal authorities, direct observation of the site, recommendations and evaluations in the 2014 Periodic Report. This approach has been applied to identify possible strategies for the conservation and sustainable development of the Chorá (Nijkamp, Riganti, 2008).

## Urban features

The transition from the urbanised area of the Chorá to the surrounding rural area are well defined. Chorá can be reached via the only driveway that runs along the entire island, and a nineteenth-century pedestrian street that connects it with Skala. The fortified monastery dedicated to St. John the Theolo-

**Buildings and streets in the settlement of Chorá**
(© *L. Dipasquale, 2015*)

gian represents the volume that dominates the city. It is placed on the top of a promontory and has the appearance of a castle. The settlement features numerous small churches inserted in the urban fabric, some private chapels and others open to the community, which contain valuable pictorial elements (Olympitis, 1997). To the south-west of the town is the Zoodochos Pege female monastery, another large religious complex, founded in 1605.

The urban structure is compact and the streets are narrow and winding, with an irregular pattern without main axes, almost labyrinthine. The uneven alleys sometimes end in a dead end street leading to the houses. The houses are arranged along the slope and, in general, are built on one or two floors, except for the 19th Neoclassical buildings, which can reach three-storey. These mansions stand out within the settlement for their dimensions. Most of them are located in Aporthiana, replacing the defensive wall towards the port of Skala.

The small courtyards and terraces, which occupy the part of the house facing the street, create a particular play of full and empty spaces. The presence of many covered passages, which were built after the expansion of the second floor of the houses, further characterises the urban morphology. The green urban areas are usually included in private properties, and the few productive and commercial activities are distributed in the north-east side of the settlement. In ancient times there were two important internal axes; the commercial one, which is the one still present today, and the road with small artisan shops to the west. Windmills have been built since 1588 for grinding cereals and other agricultural products. Located in an area on the edge of the city, these are architectural elements that strongly mark its profile.



## Architectural features

### Functional organisation of the house

The simplest and oldest form of dwelling consists of a single room on one floor, called *monospito (mono+spiti)* or *ospition*. The simplest nucleous has a rectangular volume 2,8 to 3,5 m x 7-8 m and 3,5m high. The distance of the longitudinal walls depends on the length of the wooden beams; the ratio between the dimensions of a room is generally 1:2:1. Following the traditional way of measuring (*xylometrima*[1]) used by experienced craftmesn before the metric unit, the length of a room corresponds to 10 pieces of cane, the width and the height are 5 pieces. The buildings developed according to the morphology of the slope, parallel to the contour lines, with the entrance mainly located on the short side. Internally, the cell is divided in two areas. The first, next to the entrance, called *spiti*, is dedicated to the daily activities of the home, such as cooking and handicrafts. The second, on the back of the building, called *camari*, was used for sleeping. The division between the two areas is obtained through a partition in stone, wood or cloth. The ratio between the sleeping and the living areas is 1:2.

The first development of the basic cell saw the insertion of a new space between the street and the building: a little courtyard, called *avlidaki*, with an oven and underground cistern. In the case of larger courtyards, it is possible to find a sink, a grinder, a fireplace or a rudimentary bathroom. The presence of the courtyard surrounded by high walls, in almost all the houses of Chorá, shows the need of separation between the public and private spaces (Arikan, 2015). For the lighting of the room, there is a door and a window facing the *avlidaki* and, no openings on the two longitudinal sides of *monospito*. Sometimes, it is possible to find interior windows to light the rear.

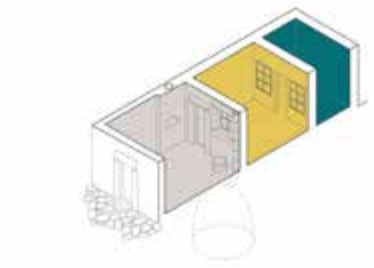
[1] Xylometrima corresponds to a cane of 74 cm in length with rudimentary subdivisions (Iakovides, Philippides, 1990)

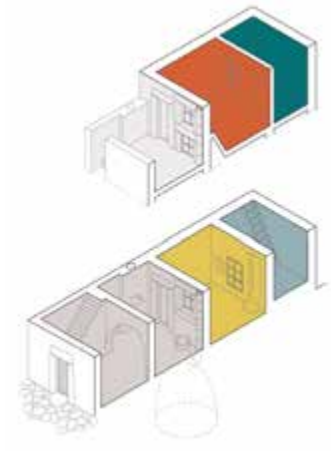
**Internal courtyard**
(© *A. Manzi, I. Montoni, 2019*)

**Traditional house with one or two storey**

- storage
- living room
- courtyard
- terrace
- sala
- bedroom

(© *A. Manzi, I. Montoni, 2019*)

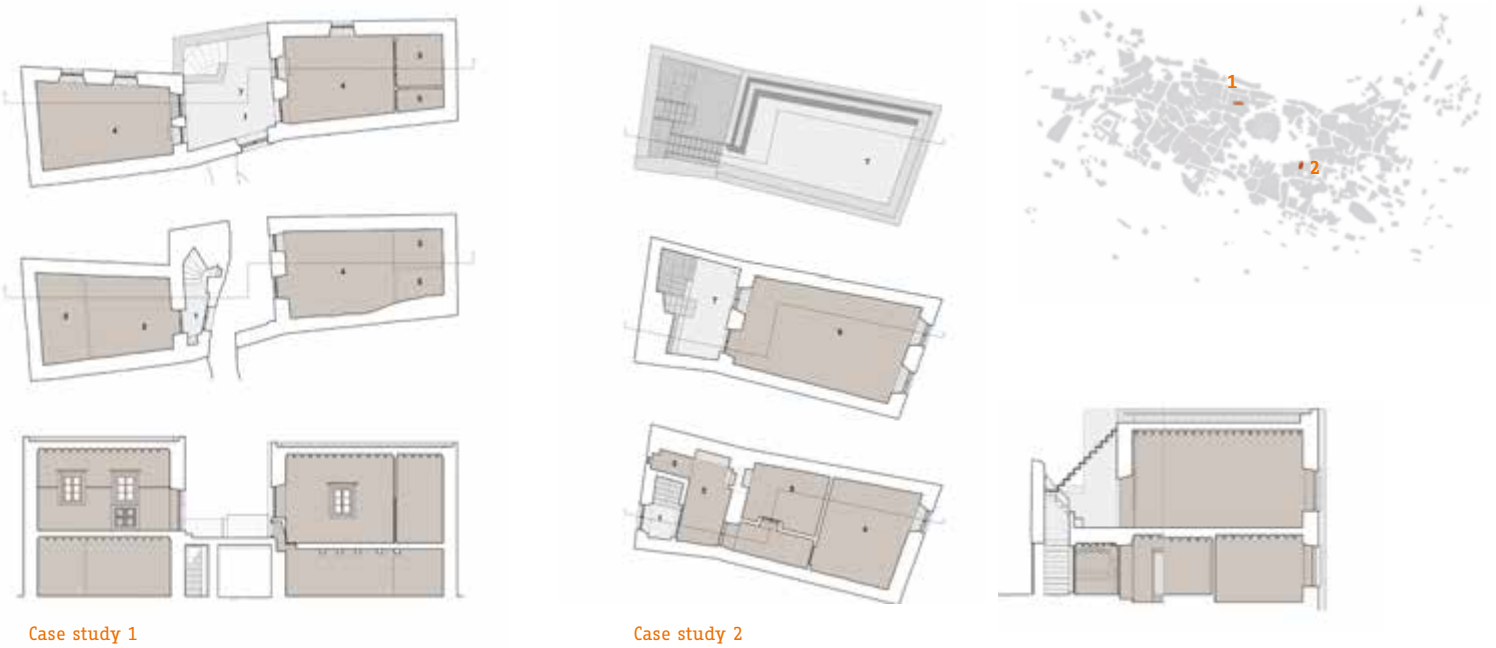




The following extension of the house consists of the addition of a second floor or, where possible, in the horizontal repetition of the basic cells, which is arranged parallel or perpendicularly to form an 'L' with the existing building. Single-storey buildings are not very common today. In fact, most of the cases studied are relatively more articulated buildings and very often on two floors, the result of integration and transformation processes to meet space requirements. The two-storey house is called *anogokatogo* and consists of overlay of cells *(anoi + katoi)*. The two-storey houses of Pátmos differ from similar cases in mainland Greece, where the ground floor was generally used as a barn, warehouse or stable, since the ground floor here was part of the house.

The courtyard is divided into an entrance and an external area, covered by the upper terrace, and houses the oven and the cistern. The terrace, called *pano avli*, is reached by a main external staircase located near the entrance to the courtyard, and by an internal one, called *katarrachias*, which is located at the rear. The added terrace is supported by an arch, called *kamariko*, on the ground floor, which creates a communication between the yard and the remaining outdoor part. With the construction of the *pano avli*, the room on the ground floor became darker, so most of the daily tasks were generally conducted on the covered section of the *avlidaki*.

On the first floor there is a formal space for special events, called *sala* or *kalospito*, usually 4,5 m wide and 7,5 m long, considered the most important place in the house and therefore, much more refined in the furnishings. It was in fact the showcase of the house for visitors, with paintings and photographs hanging on the walls, handicrafts of the occupants and pictures from travels to foreign lands. At the back of this room, adjoining the *sala*, there is the sleeping space: a wooden structure that was set up on the existing wooden floor. In the wealthiest residences this wooden structure is very articulated and heavily decorated with carved and painted decorations. This complex alcove takes the Greek name of *ambataros*. The best preserved example can be found in the Nikolaidis house-museum.




**Localisation and drawings of two old houses of Chorá that have been adapted for contemporary living**

1 entrance/courtyard
2 kitchen
3 storage
4 bedroom
5 bathroom
6 sala
7 terrace
interior
exterior

(© *A. Manzi, L. Montoni, 2019*)

0 1 5m

Subsequently, another room was added to the upper floor, called *ondas* or *nondas* which had a dual role. It was used like an observation spot to control the street beneath and as a secret passageway connecting with the adjacent property, which was on the other side of the street. In case of attack, the inhabitants had the opportunity to get into a protected area and defend themselves thanks to this system.

From 1832 on, three-storey buildings arose in the northern area of Chorá, replacing the defensive wall towards the port of Skala. Maritime and commercial exchange with the outside favoured the spread on the island of new architectural styles, in particular of the Neoclassical tradition. The different way of life and attitude of the inhabitants, in addition to this new socio-economic developments, change the architecture of the dwellings from the middle of the 19th century (Filindra, 1975). The new buildings no longer followed the usual path in their composition and construction. Compared to the traditional typology, the volumes are compact, and there is a lower flexibility of the internal spaces.

The date of the Italian occupation of the Dodecanese (1912) must be considered as the end of the vernacular architecture development in Pátmos.

### Main architectural typologies

Based on the observation of case studies, two main types of buildings have been identified. The first starts from the basic module (simple cell) and develops in a multitude of variants that arise from the horizontal or vertical combination of one or more cells. It is the most widespread, and characterises the vernacular urban structure of Chorá. The second type is more recent and incorporates neoclassical elements.

The first typology emerged between the 13th and 19th centuries. The variants depend on the way of aggregation of the simple cell and its position in the block, which are influenced by the morphology of the site. The main variations can be classified as:

**Building tipologies**
From left: drawings of the four variants of the first typology (1a, 1b, 1c, 1d) and the Neoclassical buildings (2). In grey the interior space

0 1 5m

**Building types scheme**
Typology: 1a. Simple cell, in Greek *monospito*; 1b. Twin cells; 1c. Cell with additions; 1d. Single cell with the front parallel to the street;
2. Neoclassical building

- module
- submodule
- courtyard

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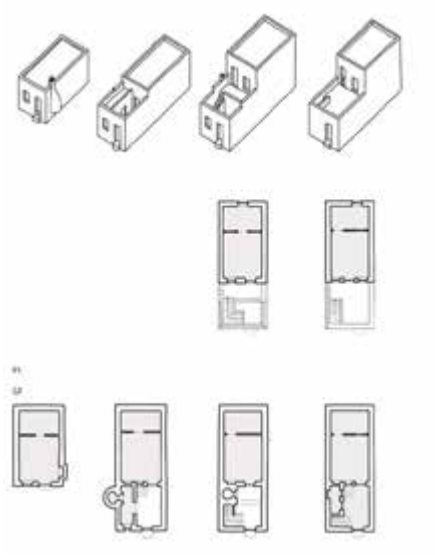
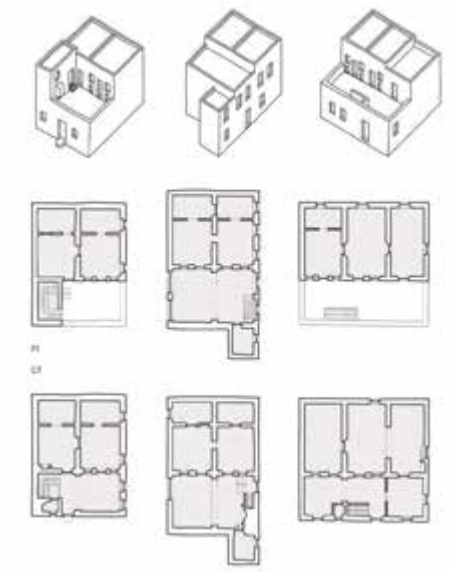


1a



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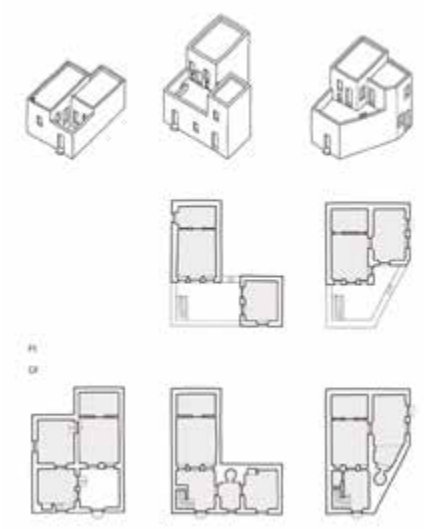

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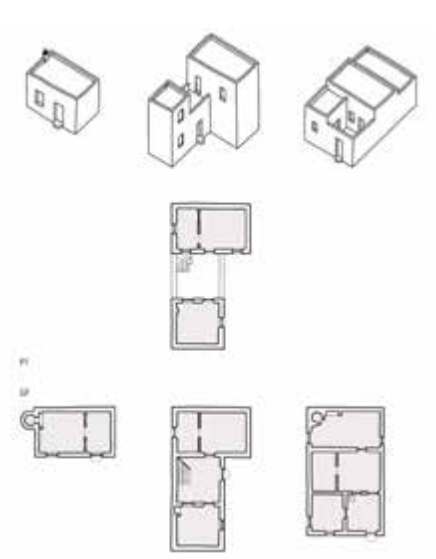

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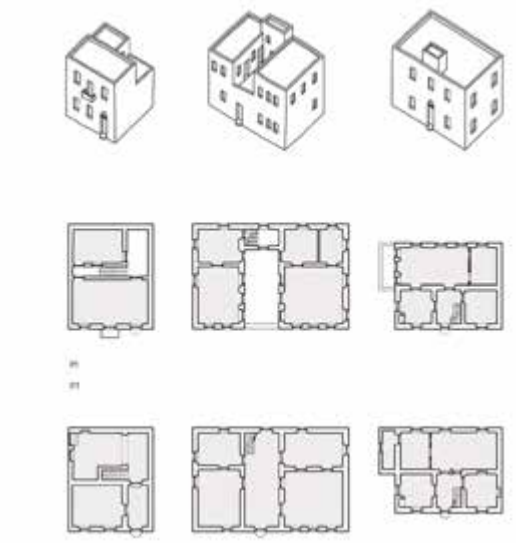
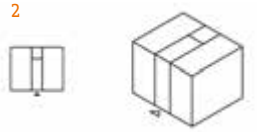


2





**Features of a typical dwelling**
The *sala*, the most fine space, in Simandiri Mansion
The *ambataros* in Nikolaidis house-museum
The cistern, placed in the patio, still exists in the houses although not always used
(© *A. Manzi, L. Montoni, 2019*)

1a. Buildings consisting of simple cells with one or two floors and the entrance on the short side;
1b. Buildings, with one or two floors, resulting from the overlay of one or more cells, with the entrance on the short side;
1c. Buildings with one or two floors, with entrance on the short side and added modules in an irregular way, so as to create variations to the scheme and dimensions of the base cell;
1d. Buildings with the entrance in the long side of the cell, with one or two floors, simple or complex.
The second typology was born at the end of the 19th century and corresponds to buildings with Neoclassical influence. Despite the break with the previous architectural typology, there are some elements of morphological continuity, such as the rounded corners and the frames of the exposed stone openings. The new construction trends were also accompanied by the use of a different stone, with a prevalence of limestone, and imported materials, such as marble and gypsum (Filindra, 1975).

## Building techniques features

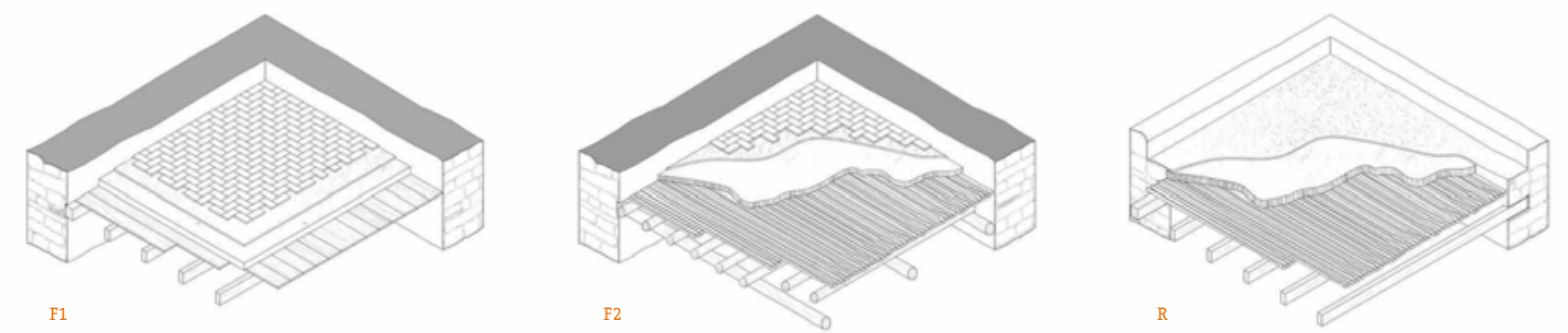
Stone is the predominant material on the rocky island and the main building material. The walls are made with two lithotypes: the granitic grey rock from the quarry of Manolakas, a tough, unwieldy and hard stone, and limestone rock (of a beige-ochre color), from the Megalos quarry, which had less durability and hardness. In most cases, the external walls have a limewash covering. The thickness of the masonry varies between 55 and 65 cm and, in general, decreases as the height of the building increases. Stones are squared and brought to hammer-dressed or straight cut finish before being laid. Stone elements can be more or less dressed, depending on the importance of the building. They have the approximate dimension of 20 x 20 x 40 cm and they are laid in horizontal courses of equal layers, with uniform and staggered joints (Iakovides, Philippides, 1990).
Smaller stones, stone flakes or bricks are used to fill the uneven gaps remaining among the stones and to improve the uniformity of the wall texture. Larger blocks, which occupy the entire thickness of the wall, are used to connect the two external faces. The corner of the walls is made with particular atten-


**Openings**
D1. Traditional door frame;
D2. Neoclassical door frame;
D3. Door with segmental arch;
W1. Traditional window frame;
W2. Neoclassical window frame;
W3. Window with segmental arch
(© *A. Manzi, L. Montoni, 2019*)

*opposite page*
**Main constructive elements**
(© *A. Manzi, L. Montoni, 2019*)

tion, using ashlar blocks and very tight mortar joints. At the ground floor, corners are sliced off to facilitate the passage of loaded animal through the winding alleys of the Chorá. Corners and frames of the openings are not the plastered, unlike the rest of the building. The mortar used for the walls is always based on earth and lime, while the finishing plasters are composed of sand and lime, with the possible addition of straw. Terraces and fences are made with dry walls without the use of mortar.

The openings are generally few, located on the main front of the house. The height of the windows corresponds to two canes of *xylometrima*, the sill of the windows is one cane. The structure is made using the technique of the architrave system, called *mantomata*. The stone lintel, with the dimensions of 30 x 30 x 150 cm, presents caved decoration, the date of construction, the name of the builder or symbols, which protected the house against curses. Also the jambs could have glyphs and mouldings running around the contour of the frame. The elements of the *mantomata* (lintel and jambs) have been reused in case of




**Axonometry of the floors**
F1. Simple floor;
F2. Double warp floor;
R. Roof
(© *A. Manzi, L. Montoni, 2019*)

demolition of buildings, creating some confusion in the dating of buildings, due to erroneous carved inscription. Few other openings present a round arch, always made with granite or limestone.

To span larger openings (from 3 to 3,5 m wide), for example for the support of the terrace or for the covering of public passage ways, arches or masonry vaults (locally called *voltos* or *kamariko*) were used.

The facades sometimes have discontinuities owed to projections of the upper floor. These serve to give greater regularity to the first floor, as the ground floor often followed the uneven boundary lines.

The maximum span of the rooms of the buildings in Pátmos is 3,5 m, which is why the most recurrent floor has simple warping. The wooden joists rest on the load bearing longitudinal walls. The warping of the joists is parallel to the shorter side of the cell that usually faces the street. Joists have regular-size, usually 7-12 x 8-15 cm, but sometimes rough trunks of 4-8 cm in diameter are used.

In case of bigger spans, for example in the covered passages, a main transversal structure, generally consisting of cypress wooden beams, is arranged every 50 to 120 cm. Above the joists, wooden boards or reed branches were juxtaposed, constituting the support layer for the filling screed, composed of *astivi* (thick, tough, prickly bushes), and then a layer of ordinary sea-weed. Above, a layer of earthen mortar is placed, and then the last finishing in ceramic tiles (*keramìdia)* or wooden boards. The entire floor structure reaches a thickness of maximum of 35 cm.

The traditionally most widespread roof of Pátmos is flat, except for the churches, which usually have barrel-vaulted roofs. The structure of the roofs is quite similar to the floors, but has a finishing layer that traditionally consists of earth, lime and crushed tiles *(kourasani)*, which was well-tamped, allowing the necessary outflow, so the rain water would flow into the cistern (Iakovides, Philippides, 1990).

The stone paving is used in the entrance courtyard, wooden boards are arranged on the first floor and the typical Pátmos ceramic tile is used to cover outdoor terraces and ground floor surfaces. Different compositions and decorations of the tiles enrich the interior floors.

## Risks and impacts on the heritage of Pátmos

The island maintains a significant architectural, natural and spiritual value, and hosts a high number of visitors per year, both for tourism and as a pilgrimage destination.

The impact of tourism is one of the potential threats to Pátmos' values. There are no clear strategies to manage the development of touristic phenomenon. Flows of visitors do not affect its authenticity yet, and it is far from the experiences of the nearby islands that have undergone an overtourism phenomenon. The fascination of Chorá has attracted many foreign tourists, who have purchased residences and settled in the island (Theocharopoulou, 2009). Their presence is often seasonal, but they ensure high continuing standards of care and maintenance. On the one hand, it has launched good practices such as the restoration of some houses in Chorá, on the other, it has incentivised the abandonment of the settlement, as the original owners prefer to sell or rent houses to visitors.

The main movements within the island are towards the city of Scala, which has seen uncontrolled growth over recent decades. This affected the quality and integrity of the Pátmos experience and, if not handle, it is a danger for the values of the nominated site. Skala is the port of Pátmos and holds all the utilities and attractions. Many activities in Chorá are only open in the summer season and there is no community capable of keeping the site active throughout the whole year. The tendency of residents to leave Chorá could compromise the identity of its social texture, as it is the merge of cities and citizens that constitutes the identity of a place.

The material fabric and design features of the significant elements and their organisational patterns have been well maintained, and provide an authentic and credible expression of the site's stylistic and typological models. All major monuments receive regular conservation attention but, despite the good general condition, there are numerous buildings within Chorá in a state of decay or abandonment, mainly in the south-west area, the one most isolated from commercial activities. The bad condition of this area could be a consequence of the high costs to restoration and the depopulation (Filindra, 1975), since when a space is inhabited, spontaneous maintenance mechanisms take place.

Some state organisations have shown interest in rehabilitation projects on buildings, such as the Nikolaidis house, which, after the damage suffered during the 1956 earthquake, has now been transformed into a museum and houses some cultural events and a permanent exhibition on the history of the island. Pátmos is located in an area with a high seismic risk and, despite the traditional techniques that reveal the presence of some anti-seismic construction measures, another element of weakness could be the lack of recent consolidation and strengthening of the structures.

The craftsmanship have been compromised with the modernisation of the construction industry, the progressive detachment from local traditions on the new generations and a dynamic market that requires innovation and internalisation of the artisan product. Some efforts to revive these crafts (such as the typical ceramic tile) are part of a conservation project that supports the use of traditional material for the restoration works.

The risk management techniques applied to the handling of this heritage can help identify priorities in the definition of interventions aimed at recovering or safeguarding architecture (Mecca, Masera, 2002).

**The architectural value of the settlement and the Monastery of St John attract many tourists per year. Despite this, Chorá has maintained its authenticity** (© *L. Dipasquale, A. Manzi, L. Montoni*, 2019)

## Strategies for conservation

No management plan has been applied in Pátmos, but the site conservation is achieved through a complementary set of coordination mechanisms and local initiatives. The preservation and safekeeping of the spiritual, cultural and popular tradition of the island is promoted by the Municipality, which organises cultural events and traditional feasts and by associations as the Cultural Centre of Pátmos that was established in 2001 in Skala, and works for the spiritual and cultural development of the inhabitants of Pátmos. Furthermore, inside the settlement there are some house-museums – Nikolaides Mansion (1705-1796), Simandiri Mansion (1625) and Stavrakas Mansion (around 1870-1880) – which are valuable for the enhancement of the architecture and history of the site.

Legal protection is afforded to the nominated site by a number of complementary legal instruments at national level, and no changes to structures or spaces within the area are permitted without the approval of the Ministry of Culture's 4th Ephorate of Byzantine Antiquities, under legislation established in 1960. Monastery and municipality work together for the future perspective, but there are also public institutions, whose objectives are closely aligned with the preservation of the island's cultural heritage (World Heritage Commitee, 2014). The combination of responsible ownership, protective legislation, continuous monitoring of construction activity, and evolving traditional coordination mechanisms and relationships is working to assure the survival of the special qualities of the nominated site. In 2007, ministerial decisions have strengthened protective measures for the environment of the island, in particular to better control the buffer zone surrounding the site, where new unauthorised constructions have been built.

To improve the identification, forecast and assessment of the impact of new interventions on Pátmos, it could be useful to apply the Heritage Impact Assessment (HIA). This assessment tool was introduced by ICOMOS within the *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS, 2011) and allows to respond to the transformation needs of the sites in a systematic and coherent way. The aim of this tool is to safeguard the values which allowed to include the site in the World Heritage list. The results and conclusions of the HIA can be integrated into the planning and decision-making process to mitigate the negative effects and improve the positive aspects of a project on the Outstanding Universal Value (OUV) of a property (Pereira Roders, Van Oers, 2012; Francini,

2019). An example of application of the HIA was therefore used to evaluate a rehabilitation project hypothesised for a ruined area of Chorá as part of a design proposal developed for an architectural degree thesis (Manzi, Montoni, 2018).

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# VERNACULAR ARCHITECTURE IN CHAZHASHI SETTLEMENT, UPPER SVANETI, GEORGIA

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## Introduction and context

*opposite page*
**Chvibiani settlement, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

The Ushguli territory is located in the *Upper Svaneti* region, in Georgia. Its occupation is particularly influenced by the *Enguri* River course. The river *Enguri* is born in the Caucasian mountain chain, formed by the glaciers of the *Shkhara* peak, the Georgian highest point (5068m). From a geographical perspective, the high valley conformed by the *Engury* stream constitutes the fundamental axis for the implantation of the four historical settlements that are part of *Usghuli* area, listed as World Heritage, since 1996 (UNESCO-WHC, 1996).

The settlements appear alongside the river, following the valley slope, occupying the in-between natural platforms that are less vulnerable to violent downpours and snow slides. In the Northeast, the first village of the *Ushguli* community is *Zhibiani*, followed by *Chvibiani*, *Chazhashi*, and finally, *Murkmeli*. Unlike the first three settlements, *Murkmeli* is located in the North margin of the *Enguri* River. The middle settlement, *Chazhashi*, constitutes the World Heritage property, and due to its status, it is regulated by more rigorous regulations. The three other settlements are integrated on its buffer zone. *Chazhashi* also has the territorial characteristic of being located in-between the affluence of the smaller *Qvisiri* River and the *Enguri* river. This water line course junction creates an insular platform, forming a natural defensive barrier that involves the settlement's lower area. The *Chazhashi* village occupies the adjacent East slope, developing its dwellings according to the land level curves around the insular promontory, resembling to a medieval defensive structure surrounded by a water moat (ICOMOS-Georgia, 2000).

The four settlements present very similar configurations and dimensions. The buildings are concentrated into rough elliptic shapes cores, occupying mostly the southwest slope of the hillock and taking advantage of its biggest sun exposure and leaving the remain highest areas for the forest, an important economic resource and a barrier to prevent the habitual avalanches to reach the villages (Mardani, 2014).

The *Ushguli* area represents the highest point of human occupation, before the permanent snowed mountain range that separates the Georgia from the Russian territory. Therefore, the climacteric conditions are harsh and severe, particularly during the winter period, conforming one of the most isolated communities of the region. The resulting lack of cultural transferences produced a very particular social structure, based on family ties and clan dispute. The local habitants, the Svan people, are described as a combative community with warrior habits. The conflicts with invaders and between them-

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**Plan of the World Heritage site of Chazhashi village, Upper Svaneti, Ushguli community**
(© *Ci-ESG, 2020*)

**3D interactive model - village aerophotogrametric model**
(© *Ci-ESG, 2020*)

selves were intense and regular. This behaviour is clearly reflected by the defensive position of the clusters, their structure and their inherent typologies (Pavan, 2011).



**Localisation of Upper Svaneti, Georgia**

## The historical background

This strategic position is influenced by the site history. Due to its richness in important natural resources, such as copper and gold, Georgia was strongly disputed by some of the major empires of the ancient world (Persia, Greece, Rome, and Byzantium). Another important factor that made this region such a disputed land was its strategic position, namely in terms of commercial routes, as some of the major routes with the orient passed through the Caucasus Mountain to reach the Black Sea (Mikaberidze, 2007; Pataridze, 2017).

But the progressive global climate cooling that took place after de 6th century closed all the possibilities of crossing the Caucasus, leaving the Svaneti region in isolation until global warming opened the Caucasus passages again around the 10th century. However, this warming did not reach the same temperatures of Ancient times, leaving the passages to the Black Sea with a very challenging access (Tevzadze, Vacheishvili, 2014). Therefore, the possibility of communication with the North region of the Caucasus was not without danger.

By this period, the Georgian kingdom was already established in the region. Svaneti was the most advanced border in the country with the North Caucasus. Therefore, between the 10th and the 13th centuries, there was a defensive need of closing this border from their northern neighbours. The defensive clusters are in line with all the major crossing passages of the period, so that all potential means of assault were blocked (Tevzadze, Vacheishvili, 2014).

**Chazhashi settlement, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

The hard access to this region, together with the fearless character of its people established the Svaneti region as the ultimate defensive redoubt of the Georgian kingdoms. During the worst conflict periods, it was common that the rulers established their refuge and lay their treasures there. This fact, despite their small dimensions, enhances the historic importance of the *Usghuli* villages and its inherent value within the Georgian culture.

## Community and governance

The striking isolation of Svaneti due to a high-altitude implementation, whose access historically was of great complexity, strongly defined its social structure and their governance organisation. In fact, the high valleys of the Caucasus have always served as an admirable dwelling and a safe refuge for those people that desired to live in seclusion.

As a result of poor conditions and little contact, unusual ways of living were established, which made Svaneti a unique place to live. Until the early 20th century, ancient customs were preserved, while the language and the polyphonic songs are being practiced till today. The basis of the society was through self-governed commune, and the individual members were firmly linked together by the bond of strong communal feelings, represented mainly by the unusual towers that have defined the landscape of this settlement.

Actually, these structures represented a corporate group that had specific functions of ritual, economic and political unity. In house societies like the Svaneti's, all types of socio-political manoeuvring were disguised under the kinship cover (Lévi-Strauss, 1981). However, the commune was of much greater importance than the family, and the obligation to perform the duties relating to it was much more binding on the people's conscience.

**Chazhashi valley view, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

**Fortified tower, Chazhashi, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

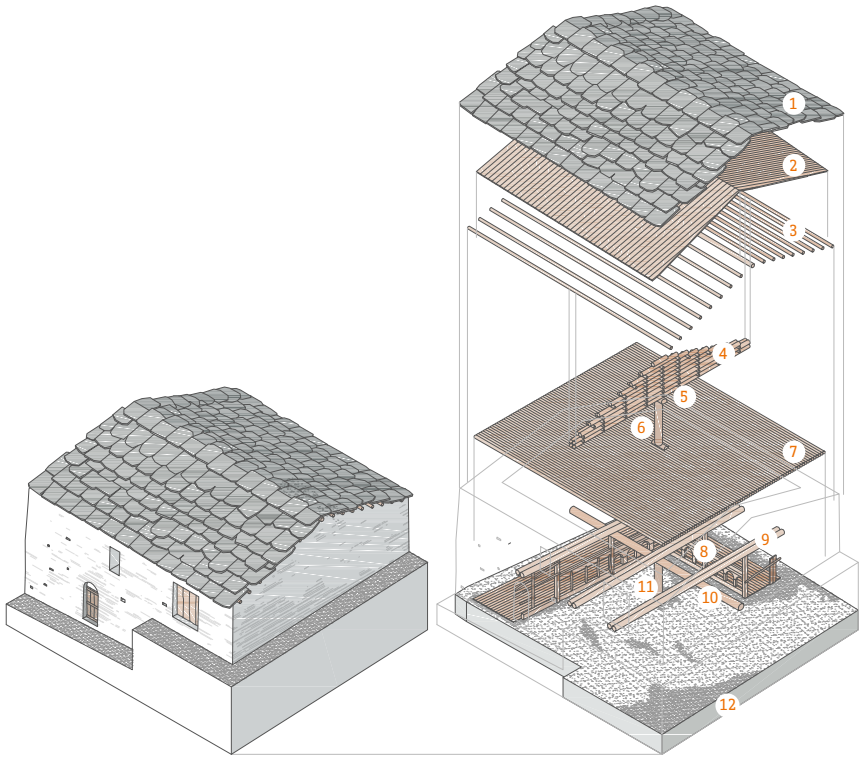
**Vernacular buildings and towers, in Chazhashi, Upper Svaneti, Georgia**
(© *M. Correia, 2018*)

## Settlement aggregation and dynamics

When observing *Chazhashi* layout, one can state that the aggregation of the built units did not correspond to any traditional urban element. The urban layout did not present an articulated network, neither an evident hierarchic structure. The overlapping between public and private space was constant, therefore conditioning the direct access to the ancient buildings. The development, between the 8th and the 9th centuries, of a feudal system in Georgia, took, in Svaneti, a peculiar character. As usual, the lords appropriated the land, as well as the public and the religious spaces (Tuite, 2002). Therefore, it is very likely that the settlements had their origin in isolate buildings, dwellings and towers, gradually evolving trough an aggregation and densification of an organic system, towards the occupation of the slope land steps, regarding mostly to the defensive criteria and/or trying to face the best sun exposure.

The houses were built in the rockier and infertile land, mostly adjacent to the river, and the farms were on the more productive slopes. To some extent, the shortage of fertile land explains the settlement dispersion, and this diffusion, in its terms, justifies the impossibility of building an enclosing wall, and therefore, the use of fortified towers as the main defensive mechanism (Mardani, 2014).

The buildings are isolated or grouped in smaller clusters, ranging from 2 to 5 units, with surrounding vacant space, exposing most of the building's facades, expected in the case of the inner adjacent walls. Sections of fence walls usually bound most of the clusters into bigger ones, segregating some of the building's residual periphery areas from the circulation network, reinforcing what can be interpreted as a very primitive urban block, without the concept of urban grid. Therefore, the established concept of street, in its typical medieval channel shape, crossing the thick built density and conditioning




**Building systems in a house (machubi), Chazhashi, Upper Svaneti, Georgia**
1.Schist overlapped tiles; 2.Clamp branches/ceiling boards; 3.Ceiling longitudinal beams; 4.Roof support structure; 5.Joint connection piece; 6.Central post; 7.Wooden platform; 8.Wooden decorated partition; 9.Transversal beams; 10.Longitudinal beam; 11.Central post; 12.Foundation stone slab
(© *Ci-ESG, Escola Superior Gallaecia, G. Carlos, T. Bermúdez de la Puente*)

*opposite page*
**Building systems in a defensive tower, Chazhashi, Upper Svaneti, Georgia**
1.Schist overlapped tiles; 2.Clamp branches/ceiling boards; 3.Ceiling transversal beams; 4.Roof support structure; 5.Joint connection piece; 6.Central post; 7.Wooden platform; 8.Platform trapdoor; 9.Transversal beams; 10.Stone slab; 11.Wood formwork; 12.Ridge beam; 13.Stone chanel trapdoor; 14.Removable stairs; 15.Foundation stone slab
(© *Ci-ESG, Escola Superior Gallaecia, G. Carlos, T. Bermúdez de la Puente*)

**Building systems in a tower house, Chazhashi, Upper Svaneti, Georgia**
1.Schist overlapped tiles; 2.Clamp branches/ceiling boards; 3.Ceiling longitudinal beams; 4.Ceiling transversal beams; 5.Ridge beam; 6.Joint connection piece; 7.Transversal beams; 8.Wooden platform; 9.Platform trapdoor; 10.Transversal beams; 11.Longitudinal beam; 12.Central post; 13.Stone stairs; 14.Stone slab; 15.Longitudinal beam; 16.Joint connection piece; 17.Transversal beams; 18.Foundation stone slab
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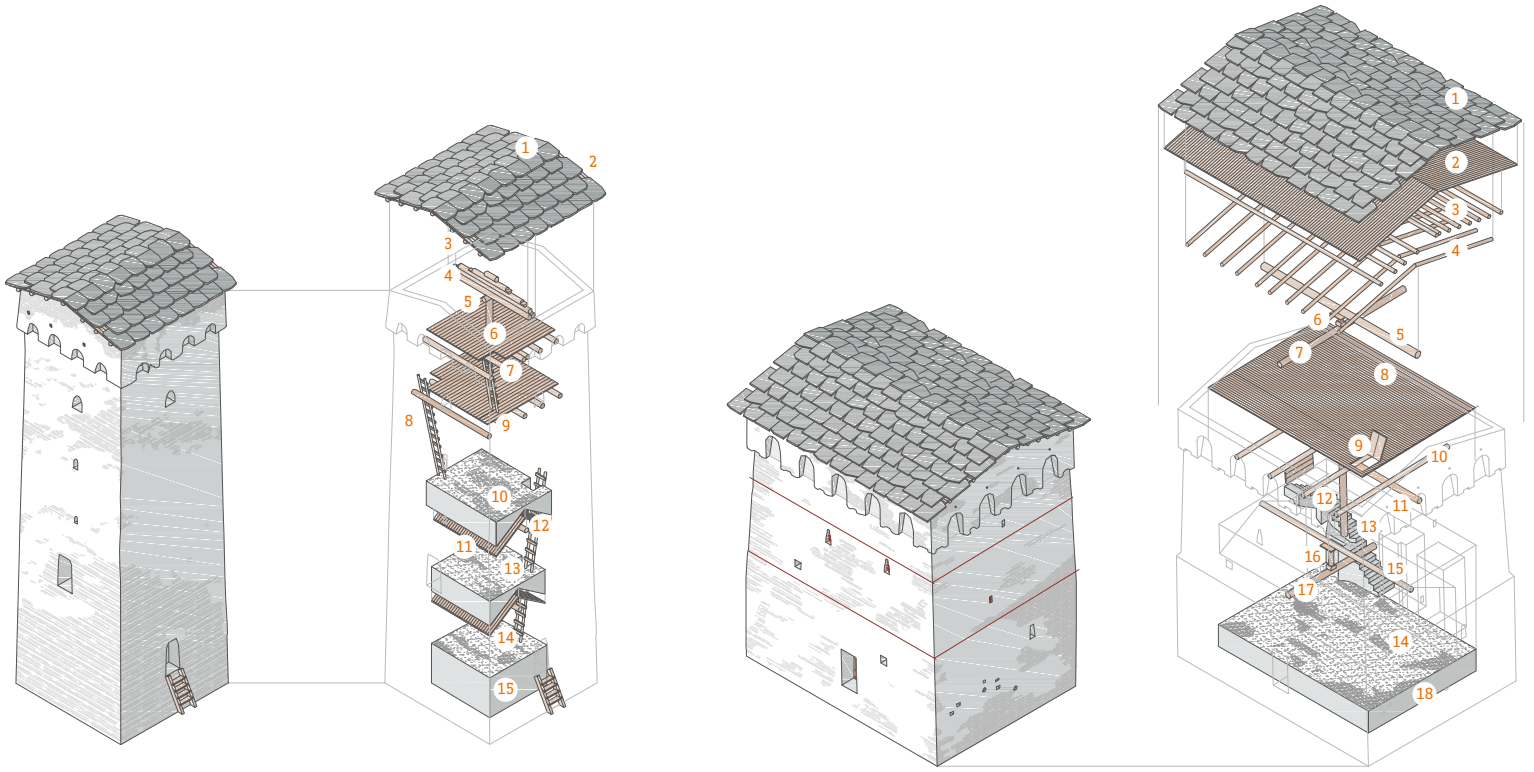
the urban layout, does not exist in this case. The concept of public square is also not present, as there is no defined redoubt for the gathering of the community, articulated with the communication network. The only exceptions are the small temples and its walled enclosures. This also justifies the fact that the buildings do not present a dominating façade or other types of composition hierarchy towards the exterior (ICOMOS-Georgia, 2000).

The 'public space' is rather the consequence of the interception of all the periphery area of the isolated buildings and built clusters, comprising a network of spaces and passages of different sizes and configurations. Another important feature of the circulation paths is its function for water drainage. Subject to heavy rain most of the year, the non-built space usually coincides with the natural ridgelines, tempting to minimise the substantial ground erosion. In some points, one can find transversal logs in the ground between buildings, in order to act as a form of containment. The recent and intensive use of the car originates evident conflicts regarding the circulation spaces. The elevated erosion increases the soil permeability, compromises the land, builds instability and creates areas for water accumulation.

Nevertheless, some distribution itineraries can be clearly identified on the village structure: the two surrounding itineraries that bound the three land platforms of the mount, the connection passages after the three bridges, and the permeable central space that crosses the platforms from the lowest West level to the East part of the settlement, can be identified as the main circulation elements.

Two isolated religious buildings dominate the highest area, located in the East area of the mount, where there is no presence of other dwellings. However, despite this singular feature and their social




importance, their smaller dimension and the prominence of several fortified towers clearly minimise the impact of these churches as village references. These small churches, from the same period than the defensive tower construction, were probably built as family churches, in the context of the feudal appropriation of public and religious space (Tuite, 2002).

## Architectural typologies

Despite the different volume aggregation systems, one can clearly identify three key typologies in *Chazhashi*: tower, house and tower-house (ICOMOS-Georgia, 2000).

**Tower** (*Koshki*):

According to the official sources, the tower (designated in Georgian as *Koshki*) dates back to the period between the 11th and the 13th centuries. The tower spatial organisation reveals the traditional socio-economic structure of these communities, well adapted to a traditional economy based on agriculture and cattle breeding. Formerly, this typology had a defensive use, evident in its architectural features. The tower was also well adapted to the dimension and social structure of local families. Each family built their defensive tower near the house, so these defensive and vigilant mechanisms were autonomous and scattered in the urban layout (Mardani, 2014). This kind of use was reflected in the type of openings located at the top of the tower, which gave the possibility, when needed, of throwing stones and shooting arrows.

**Tower house, in Chazhashi, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

**House (machubi), in Chazhashi, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

The tower interior structure and organisation allowed to stock up projectiles at the lower levels and to launch them to the enemy from the higher levels. Towers could be part of an ensemble, composed by small volumes, or built as isolate buildings. While part of an ensemble, they combined housing and defensive use. The defensive role of these hermitic buildings served as refuge for the owner's family against foreigner bandits, as well as against other family clans, with whom it was common to be in dispute (Pavan, 2011).

The tower typology is characterised by a slender shape due to its considerable height and its progressive narrowing. The tower presents several internal levels conformed as chambers or platforms, with removable vertical connections between them. The tower is composed of a squared plan configuration that reduces in size along its vertical development. Its appearance could be more or less slender, as well as more or less robust or refined, depending on the particular case. In most cases, the tower is topped by machicolated parapets crowned with arches; a solution that seems to be of renascence influence (UNESCO-WHC, 2004).

Usually there are only two entrances to the tower, both situated at the lower levels, one on the ground floor and the other one in the first floor. This typology could have between four or five levels composed of different material partitions, which change the constructive system depending on the level height. In the lower levels, the division between levels is done through a multilayer stone slab laid over a pitched wood formwork. Surprisingly, in some documents they are called as 'dummy' vaults, although they are not built with concentring stone rings or primitive arched elements. The upper levels are divided through lighter horizontal wood platforms, supported by transversal beams, recessed in the façade's opposite walls. There is no permanent vertical communication inside the tower between levels. The passages between levels resort to small trapdoors and thin retracting ladders. These elements are always positioned in the angles of the rooms. Obviously, the intention was to isolate completely each level, to increase the resistance capacity during the tower assault.

When towers are connected to houses, the communication between buildings could be made through the upper floor of the house. The presence of windows is almost imperceptible because of its very reduced size, obviously due to defensive reasons and the building structural capacity. The towers pres-

**Sociocultural features, in Chazhashi, Upper Svaneti, Georgia** (© *A. C. Merten, 2018*)

**Traditional little church, in Chazhashi, Upper Svaneti, Georgia** (© *A. C. Merten, 2018*)

ent two kinds of openings located along the walls, devoted for air circulation and light, integrated in the machicolated parapets. Later, after the trivialisation of the firearms use, smaller openings were added, namely at the highest levels, to work as shooting holes. The minor size and random position of these elements did not produce significant impact in the tower composition.

**House** *(Machubi)*:

This typology constitutes the traditional building for family and animal shelter. Developed in two levels, without internal communication, it is usually composed by a single volume, of rough quadrangular plan. Partial buried, it solves the soil high significant differences, assuming two different land platforms according to their double level (ICOMOS-Georgia, 2000).

The ground floor of the house (*machubi*) is composed by a single space with a fireplace without chimney. An oak wood pole, which supported the central double beam of the upper level floor, was located in the geometric centre of the space. The inhabitants and their animals used this level simultaneously in the winter, in order to optimise the temperature. The cattle were separated by a wooden vertical partition, creating a peripheral corridor, surrounding the central space. These partitions of carved oak wood, richly decorated, allowed the animals to introduce their heads in individual frames facing the central space. The partition, no more than 1,50m high, did not touch the ceiling. Therefore, it did not constitute a segregated compartment. In some areas, they presented wood covers to serve as platforms for tools or for food storage. Obviously, the family, which could reach up to 10 elements, slept close or above the animal stalls, to take advantage of the warmth produced by animals. The window openings were scarce, small and high, in order to avoid the snow accumulation.

The upper floor (*darbazi*) was mostly used as residence during the warm periods. It was composed by a single open space without any partition, since the animals were not admitted inside. The floor was made of wood, constituted by a platform of parallels logs. The room was open towards the roof structure, exposing the massive log 'truss', supported by a central oak (or pine) pole. The upper level pole was positioned over the middle double beam; accordingly aligned with the inferior pole. In some cases, the houses integrate an external corridor (*gubandi*) to improve thermal insulation to the house and

to protect the entrance. This corridor connected to the house through an entrance located at the upper level (Pavan, 2011).

**Tower-house or fortified dwelling:**

The tower-house combines the features of the house and of the tower in the same building. The tower-house is apparently similar to the Svaneti towers, but with variations in its proportions. It has a less slender shape due to its lower height and its greater width, therefore presenting less overlapped levels. There are just a few tower-houses in the *Usghuli* villages.

The tower-house combines defensive and residential uses. The three existing levels were used to different activities. The ground floor of the tower-house (*machubi*) combined both winter residence and animal shelter; while the first floor (*darbazi*) was used for summer residency and storage. Additionally, the third level had a defensive role, and the machicolated openings allowed throwing stones against enemies. The entrances were located on the ground floor, while other openings could be located at each level, but always with a very reduced size, due to defensive reasons. Unlike the *machubi* the tower-house could present internal vertical communication between the lower levels. However, the communication between the last levels was solved through trap doors and removable wooden stairs.

Currently, there are only 4 cases left at the *Chazhashi* village, and the most prominent tower-house accommodates the local museum (ICOMOS-Georgia, 2000). The exceptionality of this typology, the particularity of the current function, and the significant reconstruction intervention during the Soviet occupation compromised the authenticity of the building, not allowing a reasonable interpretation of its original features.

## Typological complements

**Machicolated parapets crowned with arches**

This was one of the most characteristic elements of the Svan defensive buildings. This element allowed for the top horizontal openings to be projected out of the façade wall. Therefore, enabling the stone throwing without excessive exposition, and reducing the vulnerability to the arrows. The fact that machicolated parapets crowned with arches were a defensive technique developed in the renaissance, implied that towers in *Chazhashi* could be associated to different historic periods, in the Middle Age, that resorted to normal openings in the façade and those, of more recent periods, that adopted this war technique innovation.

**Stone chambers with gable ailing**

One of the most distinctive elements of the towers was the stone chamber of the lower levels. These massive structures resorted to thick stone floors that were assembled above a wood gable ceiling, resembling to a collaborative slab. The resulting space suggested a negative shape of a pitched roof. The sim-

*opposite page*
**Defensive tower, Chazhashi, Upper Svaneti, Georgia**
*(© M. Correia, 2018)*

ple geometry, small dimension, wall thickness and the lack of natural light imputed a rather austere atmosphere to this element. The oldest gable ceilings presented a dark colour due to smoke exposition. This element was made of two slated panels, operating as a lost formwork, constituted of long boards with one central beam positioned under the ridgeline. Curiously, sometimes they were described as a 'dummy vault' solution (UNESCO-WHC, 2004).

### The *machubi* decorated partitions for cattle

The wooden partition, which formed the animal stalls inside the *machubi* ground floor, constituted a very characteristic element. Built with one or two sides, segregating the central space from the façade walls, it formed a surrounding corridor. Unlike the rest of the stone walls, the inner part of the partitions was decorated with elaborated patterns, based on the repetition of simple geometric forms, symbols or botanic inspiration elements. This contrast accentuates the partition's expression and their importance in the interior atmosphere. They remarked the skill of local wood carving, and the tradition of the Svan artisans with pine, oak and walnut wood, which could be also express in other important elements like the temple doors, some of the doors of the *darbazi* level, and the iconic chair of the head of the family, as depicted by Kalatozov's movie (1930). The partitions were composed by horizontal logs, connected by vertical smaller poles, and infilled with wood panel boards in-between them. The elements were usually framed by the carved motifs. The bigger elements are assembled by fittings, although it was possible to find some cast iron binders too. Along the inner side, facing the holes for the animal heads, another smaller partition existed that served as manger.

## Construction systems and elements

Both of the typologies resort to the same construction system as well as the same basic structural principles. Despite the structural adjustment to the buildings different high, or to a specific defensive function, the construction procedures and techniques do not evince significant changes (Pavan, 2011).

The stability of the buildings takes advantage of the mountain rock surfaces of the ground to raise the structures. The concept of building foundations is not entirely applied, following the medieval approach, only adjusting the ground rocks to raise the biggest layers of stone, therefore avoiding creating underground elements.

The external walls constitute a bearing envelope of quadrangular shape. The thick walls, which can reach up to 1,00 m width, are made of limestone and schist masonry. They resort to long blocks of different sizes which became smaller and thinner along the wall height, following the reduction of thickness until the top of the building. The wall pattern is uneven, although it presents some horizontal regularity amongst the same layers.

The presence of mortar was significant, namely in the joints of the higher layers. In some cases, it was also used in the surfaces as a plaster covering. Apparently, the objective was to consolidate the

**Vernacular wood work, Chazhashi, Upper Svaneti, Georgia** (© *G. Duarte Carlos, 2019*)

**Wooden roof suport structure, Chazhashi, Upper Svaneti, Georgia** (© *G. Duarte Carlos, 2019*)

most fragile parts of the structures or punctual reinforcement of crack repairing. The mortar presents a yellowish colour and a rough texture, indicating a high percentage of dry sand in its composition. The easy desegregation of many plaster sections also implies the lack of a strong binding element. The original composition of the mortar is not consensual; there are some opinions that infer the use of cow manure, and others that admit the use of lime. As observed along the project missions, all the recent construction interventions resort to industrial cement.

The structures that support the rooftops are extremely interesting. A triangle made of horizontal logs is placed in the middle of the roof, perpendicular to the ridgeline, like a traditional truss. On the top, smaller beams, from smaller logs, were perpendicularly displayed from façade to façade, covering all the building area, creating two roughly symmetric eaves. The rooftop was then covered of thin schist plates. The plates had a quadrangular shape and were overlapped as shingles, from the top to the bottom of the eave.

According to Kalatozov's movie (1930), it is possible to identify the former presence of a layer of beech branches, before the schist display, acting as small hooks. This was one of the solutions found to minimise the problem. Nowadays, the slates are not fixed by any complementary element, and are placed directly on the top of the wooden grid, relying only on their own weight to stand on the same position, or simply by being secured through nails. The observed vulnerability of this system means that the original knowledge is no longer present in the Svaneti building culture.

## Strategies for conservation and sustainable management

The Upper Svaneti World Heritage property is protected around the main listed component, Chazhashi village, by a 1km radius. Under the National Law on Cultural Heritage in Georgia, all four

**View of Chazhashi from Murkmeli, Upper Svaneti, Georgia** (© *M. Correia, 2018*)

vernacular villages *Zhibiani* (also known as *Jibiani*), *Chvibiani*, *Chazhashi*, and *Murkmeli* (also identified as *Murk'meli*) are listed as national monuments. This law only allows appropriate interventions on national monuments, and provides the highest heritage protection in the country. As the four villages are national monuments, there is a 500m safeguard area around each one of them that further increases their protection (UNESCO-WHC, 1996).

The rising of international tourism in the last years, and the demanding for more accommodation at Upper Svaneti, brought a higher pressure to the property, added to the lack of local management capacities and the insufficient conservation skills that were already, for a long time, a risk to the property (UNESCO-WHC, 1996). In recent years, the National Agency for Cultural Heritage Preservation of Georgia developed a more active assessment, monitoring and managing of the property, which has been a real difficult endeavour, especially due to the region's remoteness, winter snow isolation, difficult road access, and economical challenges faced by the country.

The pro-active attitude of the National Agency was just possible through a more continuous and step by step method, which resulted in some improved maintenance, conservation, and restoration interventions in the property. During the last years, the National Agency carried out several national funded interventions in the four villages, and in particular at *Chazhashi* village. The interventions included mostly the reinforcement of foundations, the removal of vegetation from the walls, the arrangement of hidden reinforcements at the roofing levels, the installation and waterproofing of wooden roof structures, the restoration of slate stone roofs, the demolition of instable parts and the restoration of main walls (National Agency, 2020).

Through a more strategic and sustainable approach, the National Agency developed regulatory measures to address the conservation, the restoration, and the rehabilitation of the traditional dwellings in the *Ushguli* community. Additionally, the Ministry of Regional Development and Infrastructure, in collaboration with the National Agency also prepared the "Development Regulation Plans in the Ushguli community", which includes the four villages, and the buffer zone of the World Heritage Upper Svaneti property. In the last years, the National Agency built bridges and entailed a more insightful communication with the local communities and international organisations as the WHC and ICOMOS - an open dialogue that is bringing positive outcomes towards the sustainable safeguard of *Zhibiani*, *Chvibiani*, *Chazhashi*, and *Murkmeli*.

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# Building the future of European Vernacular World Heritage

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The vernacular architecture of any location characteristically arises close to its original natural surroundings and materials. It extracts materials available nearby and uses them for construction, with barely any transformation, to erect buildings and complexes wisely adapted to the local climatic conditions, providing responses to human needs. The beauty of this architecture lies not so much in carefully considered projects or preconceived aesthetics, but in the direct answer to the needs adapting its materials and constructive solutions. This architecture, manufactured in the etymological sense of the term, is the cumulative result of centuries of trial and error. Each natural setting, filtered by a given culture and the idiosyncrasies of its way of life, needs, types of social relations, etc., generates a different vernacular architecture, which in turn becomes a sign of identity for its inhabitants. Thus, vernacular architecture, with its multiple variants, is an expression of the cultural diversity of the world (ICOMOS CIAV, 1999).

*opposite page*
**Historic center of Pienza**
(© *CHM Lab, DIDA, UNIFI, 2019*)

## Risks and threats

The advent of the industrial revolution and post-industrial society led to mass migration from rural nuclei to large cities. This depopulation has put the survival of these rural nuclei at risk. Some are in ruins, as a result of abandonment, while others continue active thanks to the mechanisation of agriculture. Others have become destinations for tourists and second-home owners to varying degrees. Recovery from ruin, as in the first case, the more or less prosaic repair of an inhabited dwelling in the second case, or retrofitting an existing building as in the third, updating them all to contemporary installation and comfort standards, without a doubt brings with it difficulties.

Faced with this situation of abandonment and lack of social recognition one wonders what meaning the conservation, restoration and retrofitting of this architecture might have today. Vernacular architecture is a highly valuable tangible and intangible cultural heritage as it represents the history of settlement and adaptation to a given place, social and productive organisation, development of customs and traditions, etc. At the same time, this heritage is currently under threat from natural factors (earthquakes, floods, rainfall, storms, etc.), climatic factors (drought, torrential rain, rising temperatures, etc.), accentuated with the present climate change (CCHWG, 2019), and social factors (depopulation, abandonment, changing ways of life, personal aspirations, decline in rural economy, etc.), which speed up its functional obsolescence, social discredit and poor valorisation.

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**Although it has a certain autonomous activity, the city of Cuenca (Spain), declared a World Heritage Site by UNESCO, has become above all a tourist destination**
*(© L. Chisari, B. Rossi, 2018)*

The intervention, restoration, retrofitting and maintenance actions of this vernacular architecture can sometimes become threats and factors leading to its deterioration. At all times, these interventions should try to remain faithful to the character of the architecture and the place, as the introduction of foreign constructions, elements, materials, techniques even non-native vegetation can disrupt the harmony with its surroundings. The homogenisation of treatments resulting from globalisation and tradition falling into oblivion completely disrupts the diversity and subtlety of solutions, while the frequent intellectualisation and aestheticisation of a project can quash this spontaneity and naturalness made of few gestures (Loos, 1910). An excess of design does not fit into the succinct and unaffected language of vernacular architecture (Doglioni, 2008).

The coexistence of a vernacular architecture nucleus with a dazzling natural enclave or admirable monument does not always lead to better preservation. Some vernacular municipalities, placed in very beautiful craggy surroundings, run the risk of thinking that this overwhelming natural presence may seemingly condone possible deficiencies in the treatment of traditional architecture. On occasion, the same is true of vernacular settlements, with castles or major monuments subject to much tourist attention and efforts at restoration, which may show a poorer conservation of the surrounding town that provides them with meaning and context. In both these situations the risk lies at times in the greater insertion of modern architecture, standardising the treatments of façades or the replacements of historic buildings or renderings, more than in other towns, where vernacular architecture is the only value to be defended. Therefore, the field of conservation cannot focus only on the material conservation of architecture and must analyse traditional architecture from a comprehensive perspective, taking into consideration tangible and intangible aspects. These include constructive materials and techniques, structural stability,

the functionality of spaces, and the productive, social, economic, and development processes which affect vernacular architecture directly and indirectly (Mileto, Vegas, 2011).

## An integrated strategy

The global strategy to be developed is multi-faceted and must be closely coordinated. Firstly, it is necessary to activate economic policies to promote and revitalise agriculture and other local activities, so in order to prevent the progressive abandonment of vernacular nuclei and their possible ruin. Secondly, it becomes necessary to work on the urbanistic protection of the nucleus and its natural or built surroundings, as well as to rediscover both urbanism values and vernacular dwellings, with their traditional materials and techniques, disseminating their physical, chemical and aesthetic compatibility. Thirdly, it is advisable to strike a balance between the preservation of its pristine character, linked to local materials, to the point of constituting a built landscape, and the tourism, which could lead to economic revitalisation but also tertiarisation, the homogenisation of offer, and in extreme cases, the expulsion of the original inhabitants.

### Revitalisation through management

A good example of the promotion of rural life and agricultural activities, which also respects the existing vernacular architecture with extraordinary results, is the work carried out by the Mihai Eminescu Trust in the Transylvania region (www.mihaieminescutrust.org/home). This foundation has also made a major effort to relearn traditional trades so that residents can use traditional materials and techniques to repair and restore their vernacular dwellings (Hülsemann, 2012), retrofitting them as dwellings or to open small businesses or guest houses.

The promotion of cultural life and heritage and the improvement of transport, both internal and external, together with other nuclei, and access to internet, make life easier for visitors, but especially for residents. In larger rural populations, transport must not harm built heritage and solutions adapted to individual cases must be drawn up. In towns with steep slopes, it becomes necessary to consider whether and where mechanical stairs, mobile ramps or elevators should be added, given their impact, in order to avoid overwhelming the overall appearance.

It is also vital to promote small businesses in these settlements as opposed to larger commercial establishments, which are sometimes located near or in the nuclei, occasionally joining up several plots and emptying them. It is also advisable to avoid uncontrolled external growth, which will end up emptying the historic centre of residents. This is about the defence of the life and occupation of vernacular nuclei by residents, preventing them from becoming museums in themselves. It is also advisable to regulate the offer of tourist flats to prevent speculation, emptying of inhabitants, and consequent gentrification.

In larger nuclei, management can become complex enough to require the creation of a consortium of different local, regional and national administrations to oversee all possible subsidies, conservation and re-

**The historic center of Old Rauma (Finland)**
**It has a buffer zone of transition to the modern city. This buffer zone has successfully protected the area from new architecture and activities that are foreigner to its historical context**
(© *F. Vegas, C. Mileto, 2018*)

**The old city of Rauma (Finland)**
**It is listed as a World Heritage site by the World Heritage Committee has its own life and autonomous economic activity apart from tourism**
(© *F. Vegas, C. Mileto, 2018*)

vitalisation grants. The association between protected nuclei into commonwealths, networks with other similar settlements, can have a positive impact on the implementation of joint actions and policies.

### Revitalisation through urbanism and architecture

It is convenient to establish urbanistic protection of the nucleus and its natural or built surroundings. The rediscovery of the values of urbanism and vernacular dwelling, as well as of traditional materials and techniques, and also dissemination of its physical, chemical and aesthetic compatibility when repairing a building should be also promoted.

Once the equilibrium governed by domestic economy and the continuity of constructive tradition is broken, it becomes necessary to create urban protection plans for the vernacular settlements and historic centres of the cities, creating buffer zones in the surrounding nature or constructions. This document includes a plan with catalogued architectural complexes, Assets of Cultural Interest and their protection environment, inventoried buildings, elements of interest and critical points in the landscape. In addition, this document may include the regulations necessary for correct government and management in terms of restoration, conservation and treatment of existing buildings, assigning uses, functions, commercial businesses, etc. Above all this plan must be respected and complied with. A document such as this would eliminate any concerns about breaking the skyline of the complex, as there would be no possibility of building tall new buildings in conserved surroundings.

This urbanistic action framework could be combined with best practice manuals showing examples of the restoration or adaptation of existing buildings to current standards. It would also be necessary to raise awareness among residents, so that they could appreciate the value of their homes. The differ-

**The city of Porvoo (Finland) As beautiful and well preserved as Rauma, it suffers an invasion of tourism that has emptied its historic centre of its own activity**
*(© F. Vegas, C. Mileto, 2018)*

ent stakeholders in interventions (owners, craftsmen, specialists, developers…) should also be aware of the compatibility of constructive techniques and materials in the short-, mid- and long-term in historic buildings.

In addition, conservation in general and the use of traditional materials and techniques in execution has a very positive impact on the local economy for two reasons. Firstly, because it resorts to local craftsmen and artisans, rather than to the more predominant prefabricated industrial products of new construction. Secondly, even assuming that the overall costs were equal, conservation would entail a greater investment in labour from local developers, compared with new buildings, so that most of the money spent on the work would go straight back into the municipality.

In Finland, the old city of Rauma does not reject tourism, although it could be said that it lives independently from it. The protected historic centre, paved with traditional cobbles, is occupied by its own residents. There is a well-defined buffer zone between this historic centre and the modern city, which has been key in its conservation. Most of the buildings are original and some replacements with modern materials from the last hundred years can barely be made out, and in any case have been so discreet that they have not increased the main volumes. Little tertiarisation is detected. In general, businesses and shops are small, and limited to the surface of the specific building. There are two museums of traditional life in Rauma, but the city cannot be said to be museumised at all, as it is bustling and full of life. Fundamental to this quite exemplary conservation of the historic complex has been the creation of Tammela, an information centre for the dissemination of knowledge of local traditional materials and techniques, which provides materials, courses, education and free advice to local residents for the conservation and updating of buildings (Jämsä, 2012; Caruso, 2020).

**Pienza, Italia**
*(© CHM Lab, DIDA, UNIFI, 2019)*

The other side of the coin is the city of Porvoo, also in Finland, and another of the jewels in the crown of the country's vernacular architecture. Despite its good physical conservation, Porvoo is subject to a tourist invasion, which has emptied, tertiarised and banalised the historic centre. While the city also has a protection plan and watches over the preservation of its historic centre, in this case it has been overwhelmed by tourism.

### The dilemma of tourism

Excessive tourism can also ruin the built substance and the life of vernacular historic centres, so that they are emptied of residents outside peak hours for visitors, or transformed into theme parks of themselves. It can also lead to a loss of traditional materials and techniques applied to the repair and maintenance of buildings, even keeping façades and emptying the floors and interior distribution, banalising the real values of the complex. Often, emptying the interior structure and replacing it with a new metal or reinforced concrete is justified given the poor conservation of the historic wooden structure and the new heavier loads due to use. However, this almost always reveals a lack of knowledge of the historic wooden structure and its possible consolidation and reinforcement.

It is interesting to note how far the economic blessings of tourism are to be assumed in vernacular settlements with limited resources, if they are not to become a burden to their essence and architectural character. There is no single answer, and this will depend on each specific situation and level reached until this point by tourism in the town. Although not impossible, it would be very difficult for the local population to recover the dwellings occupied by already ongoing tourist activity, and the vernacular architecture which has already been restored.

Difficult accessibility has also been shown to be a good system for defending the genuine nature of vernacular settlements. This relative lack of communication may be the result of geographical conditions, as in the case of islands, or of a conscious decision, as in the case of Viscri (Romania), where the access track has been maintained in good condition, but has not been asphalted. As a result, anyone visiting the town can do so with a conscious awareness, almost like an accomplice militating in this philosophy, which has allowed it to be maintained in pristine condition. In keeping with this, the streets are paved with cobblestones, well-cared for, dry and properly maintained, but with grass on the side, along which lines of geese walk, guarding their surroundings. The paradise-like appearance of this vernacular enclave would not be easily compatible with standard paving. This isolated condition, whether natural or induced, already discourages many tourists who would be unable to appreciate its original rural beauty. Life in the better-conserved nuclei goes on independently from tourism, which does not overshadow the agricultural and usual commercial activities, or at least it does not do so at the expense of traditional life. In the case of Viscri, a tourist information office or specific maps or signposting are not needed so that the village is discovered in a pleasantly surprising drift, spontaneously, revealing bakers, threshers or smiths at their usual tasks. There is a need for major psychological approach to explaining the conservation of these buildings, the maintenance of vernacular dwellings with traditional materials and techniques, and the discreet conservation of local monuments. Upon closer inspection, the effort of the search for harmony is revealed by concealing litter and rubbish bins, and discreetly positioning notices and signposting.

In this and other well-conserved villages there are small hostels and guest houses run by locals in existing vernacular buildings. There are also some scattered restaurants in existing buildings, even working with set and prearranged menus to avoid the need for excessively large kitchens, stores or refrigerating

**Viscri is a Saxon town in Transylvania (Romania) It has managed to preserve its character and adapt its vernacular architecture to contemporary life, while controlling the entrance of tourism to avoid losing the spirit of the place**
(© *F. Vegas, C. Mileto, 2017*)

**The main street of the town of Viscri (Romania) It has managed to combine its natural charm with the eventual visit of tourists**
(© *F. Vegas, C. Mileto, 2017*)

chambers, which would make new or additional constructions necessary. Existing dwellings are used and adapted for any needs and functions arising. Existing tourism is discreetly absorbed and sacrificed voluntarily to these limitations to the benefit of the conservation of local character. This effort undoubtedly leads to a tourism that is of higher quality and respects the surroundings, rather than inevitably to mass tourism.

## Strategies for the conservation of vernacular settlements

In short, and in view of these considerations, several recommendations could be made for the conservation and maintenance of these vernacular settlements and towns. The responses to each specific question are not identical or unique given the difference in size, the state of conservation/transformation, and their current level of integrity or the presence of tourism. However, the following general conservation strategies could be proposed for vernacular settlements:

- The promotion of rural life and agricultural activity in keeping with the conservation of existing architecture.
- The promotion of culture, and local crafts and trades, through the restoration and conservation of the built heritage and specific grants.
- The carefully considered improvement of communication with the exterior to make residents' life easier.
- The promotion of small businesses, restaurants and guest houses within the settlement's built fabric, respecting the existing architecture.
- The possible association with other similar vernacular settlements to exchange experiences and seek joint conservation policies.
- Compliance with a specific protection plan with a perimeter buffer zone, in order to regulate both material conservation and tertiary uses.
- The protection of the skyline, vantage points and lines of access to and from the settlement with the invisible or simulated strategic location of occasional industrial estates, factories, silos, strategic parking for tourists, etc.
- The drafting of best practice manuals to be used as guide, example and reference for interventions to be carried out.
- The establishment of municipal advisory offices for owners, developers, tradesmen and specialists in the restoration and conservation of traditional dwellings.
- The promotion of the values of both vernacular architecture and vegetation and renewed learning and recovery of traditional trades.
- The dissemination of traditional techniques and materials for restoration, repair or maintenance through courses and conferences.
- The defence of the lifestyle, activity and occupations of residents taking tourism into consideration without being overwhelmed by it.

**The well preserved female monastery of Zoodochos Pege in the historic settlement of Chorá (Greece), built in the 17th century**
*(© A. Manzi, I. Montoni, 2018)*

- Avoid excessive signposting, notices, placards and the excessive museumisation of buildings, both individually and in groups, as well as immoderate urban lighting and urban furniture.
- Avoid the proliferation of urban elements and industrial paving; discreetly place and strategically distribute and conceal litter bins and rubbish bins; bury urban cables underground, so that they are not left hanging or affixed to façades; and, if feasible, collectivise antennas and take advantage of optic fiber to distribute signals, sparing more cables to the cityscape.

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# ASSESSING AND MITIGATING IMPACTS OF CHANGES ON CULTURAL HERITAGE

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## Transformation and changes of vernacular heritage

*opposite page*
**Detail of a chimney in the Chorá of Pátmos**
(© *L. Montoni, 2018*)

The vernacular heritage is characterised by its strong link with the physical, social, cultural and economic context of which it belongs. The vernacular settlements, the morphology of the buildings and the construction techniques depend on the natural resources available, the limits and potential of the territory, the type of society, the economic and social conditions, the culture that influences the way of life of a given society. When one of these factors change (environmental, social, cultural or economic context), vernacular architecture inevitably undergoes a transformation, to adapt to the new context. For this reason the vernacular heritage is intrinsically much more vulnerable than the monumental one, as it is strongly dependent on the transformations of its surroundings. In many countries, the lack of specific regulations for the conservation and protection of the vernacular heritage further increases its vulnerability. But in a broader view, the vulnerability characteristic of vernacular architectures is determined by their ability, widely tested, to adapt to the changing needs of both inhabitants and the community: vulnerability lies more in tacit knowledge, inadequate or lost, applied in management of change or pressure for adaptations beyond their transformative capacities.

The fast and recent changes in the global environment and within human society determine a range of new pressures that are quite different to those experienced in the past. Consequently, the heritage management practices will have to evolve to reduce the impact of novel threats and to recognise the need for a shift from damage mechanisms, like climate changes, epidemic disease, socio-economics, cultural context changes, and the potential requirement for radical interventions.

## Main changes affecting World Heritage

The transformation actions of a World Heritage Site are harmful, as they can endanger the values that have given the worldwide recognition. In 2008, the World Heritage Committee approved a list containing 14 risk factors leading to changes that can adversely affect a site's OUV (Outstanding Universal Value). When a World Heritage property presents one of the risk factors identified on the list, it can be inscribed on the List of World Heritage in Danger. These factors may correspond to cases of ascertained or potential danger, and are the result of transformations due to natural disasters (earthquakes, volcanic eruptions, fires, cyclones, etc.), to climate change (floods, desertification, sea level rise, etc.), or to anthropogenic causes (effects of regional planning project, lack of conservation policy; armed conflict, etc.) (Francini, 2019).

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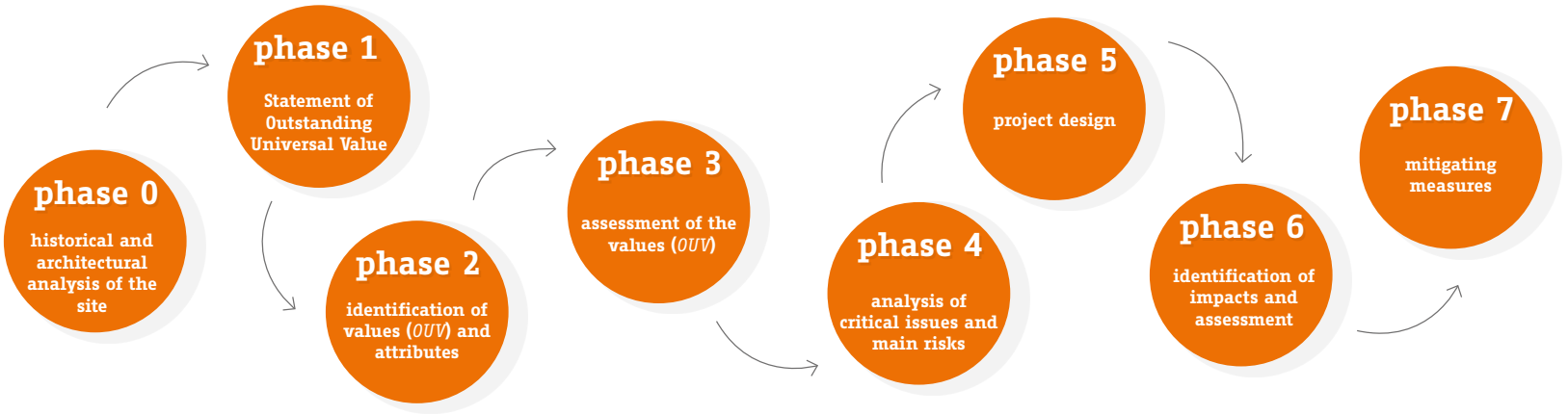
Due to the enormous impact of natural disasters, many studies focus on the vulnerability assessment and on the risk management in cultural heritage affected by natural hazards (Jokilehto, 2000; UNESCO, 2007; UNESCO et al., 2010; ICCROM, 2016). Indeed, natural disasters pose risks not only to the heritage physical attributes, but also to the life of communities and visitors, as well as having obvious negative consequences for the local economy. The tools for reducing disaster risk are concerned not only with protecting the property from major hazards, but also with reducing underlying vulnerability factors, such as loss of tacit knowledge, inadequacy of scientific and technological knowledge, lack of maintenance, inadequate management, progressive deterioration, or ecosystem buffering that may cause hazards eventually to become disasters (UNESCO et al., 2010).

With regard to the impacts of climate change on cultural heritage, in recent years, the most important institutions that address heritage management policies have released numerous studies and analyses on the subject (Australian National University, 2009; Markham et al., 2016; UNESCO, UNEP, 2016; ICOMOS, 2019; Gravari-Barbas, 2020). The report *World Heritage and Tourism in a Changing Climate* (UNESCO, UNEP, 2016), analysing 35 sites in 31 countries, shows how climate change is growing and affecting sites in all types of environments and in all regions. All the World Heritage sites are presumably impacted by climate change, but some are more at risk than others. Rising water levels, for example, threaten to cause the disappearance of World Heritage properties near the coast. Extreme weather events cause considerable damage to other properties. We need, therefore, to better identify the climate vulnerability of World Heritage Sites, identifying those that are most at risk and assessing the climate threats to their OUV, integrity and authenticity (UNESCO, 2007). It is also necessary to understand how to prioritise our efforts in those sites, identifying which ones need measures and interventions more urgently. Changes due to causes of anthropogenic origin, which have also been growing in recent years, can determine a very wide variety of negative impacts on OUV, especially in the vernacular heritage, strongly influenced by the social and cultural context. Furthermore, man-made transformations that do not respect the territory or heritage can increase the vulnerability of sites and consequently the risks caused by natural disasters or climate change. The threats to heritage caused by changes of anthropogenic origin are highlighted in the report "State of Conservation of World Heritage Properties" (Veillon, UNESCO, 2014). Based on the analysis of 2600 reports on the state of conservation drawn up between 1979 and 2013, this document demonstrates that the factors that had a greater negative impact on World Heritage properties related primarily to management aspects (75%), then to the presence of buildings or development plans incompatible with the property (50%), to changes in the social / cultural uses of heritage, including impacts of tourism (30%), and to the development of transportation infrastructures (24%).

## World Heritage management and impact assessment tools

The main tool for the proper management of World Heritage sites is the Management Plan, which has been made mandatory since 2002 by the World Heritage Center. The Management Plan is a strategic




**Process of Heritage Impact Assessment** (© *L. Montoni, Here Lab-UNIFI, 2019*)

and operational document aimed at guaranteeing the conservation of the OUV of the property for present and future generations. It is a tool capable of analysing, through the involvement of various subjects and stakeholders, the cultural and socio-economic context, in order to promote coordinated and shared actions of protection and enhancement able to face the threats that interfere with the maintenance of OUV (UNESCO, 2013).

The basic tool for coordinating management actions is the Periodic Reporting. It is required every six years. It provides a periodic review of the effectiveness of the management system and an assessment as to whether the Outstanding Universal Value of the properties inscribed on the World Heritage List is being maintained over time.

Risk analysis is a process that is adopted in the phase of developing a site management plan, in order to reduce the risk factors that could change the processes and management systems with respect to the planned results. Considering likelihood vs severity of a potential hazard makes it possible to undertake risks assessment and setting priorities. To reduce or eliminate risks, measures should lead to the mitigation of the severity of the damage (with protective measures) and / or likelihood (with preventive measures).

In light of the growing threats on heritage caused by transformations, wrong policies, inadequate management and excessive or inappropriate tourism, ICOMOS has proposed the adoption of a specific tool for assessing the impacts on WH properties. The Heritage Impact Assessment (HIA) is a methodology created as support for the managing of WH properties in circumstances, where some form of change may affect the OUV of those sites. This tool can be used also very early on in a planning process, in order to inform the development design in a pro-active rather than in a reactive manner. It is an adapted version of the EIA to the heritage, focused on the values of the OUV. It was introduced by ICOMOS within the *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS, 2011), and allows it to respond to the transformation needs of the sites in a systematic and coherent way. The guide provides general indications for the assessment, tables for the classification of the attributes used for the assessment, and for the evaluation of the weight of the change. The combination of these factors allows to identify the potential significance of the impact (adverse or beneficial) on the site. The aim of this tool is to safeguard the values that allowed including the site on the World Heritage list. The results and conclusions of the HIA are therefore integrated into the planning and decision-making process, to mitigate the negative effects and improve the positive aspects of a project on the Outstanding Universal Value (OUV) of a property (Francini, 2019). The strength of this assessment tool lies in its being multidisciplinary, recognising environmental, cultural and social aspects as part of the identity culture of a Heritage.

| CATEGORIES | VALUES (OUV) | ATTRIBUTES | GRADING |
|---|---|---|---|
| CULTURAL / RELIGIOUS / ARTISTIC | The continuity of the teachings of the Greek orthodox church since 1713 *(authenticity)* | Modern-day activities of the Patmiada School. | ● |
| | Amasing treasure of manuscripts and printed books *(authenticity)* | Monastery library. | ● |
| | Religious ceremonies that date back to the early Christian times are still being practised unchanged *(criterion III)* | Ritual of the Washing of the Feet in Easter Week. | ● |
| | Museums *(potential OUV)* | Circuit of the Museums (Nikolaides House, Simandiri House, museum of the monastery Saint John, museum of the monastery Zoodochos Pege). | ● |
| | High concentration of sacred art *(potential OUV)* | Collections of representative ecclesiastical objects and monumental Byzantine paintings preserved inside the Monastery of Sain John and the various churches of Chorá. | ● |
| ARCHITECTURAL / RESIDENTIAL | The material fabric and design features of the significant elements and their organisational patterns provide an authentic and credible expression of the site's stylistic and typological models *(authenticity)* | The simple cell, called *monospito*, with the four variants. | ● |
| | The alterations that have taken place through the ages and under the influence of the historical conditions allow the visitor to see even today the distinct phases *(integrity)* | Distinct characteristics between Byzantine buildings and buildings with neoclassical influence. | ● |
| | Construction of three windmills strarting from 1588 *(potential OUV)* | Three windmills located at the northeast of Chorá. | ● |
| ARCHITECTURAL / RELIGIOUS | *Greek Orthodox pilgrimage centre of exceptional architectural interest (criterion IV)* | Monastery of Saint John the Theologian, the Cave of the Apocalypse and the settlement of Chorá. | ● |
| | Large number of churches distributed within the Chorá *(potential OUV)* | St. Apostoloi, St. Lesvia, St. Vasileios and Thalaleos, St. Demetrios, St. Anna, St. Ioannis Theologos, St. Chrysostome. | ● |
| HISTORICAL LANDSCAPE | Relationship between human and natural landscapes *(potential OUV)* | The entire settlement of Chorá with the Monastery of St. John stand at a dominant position of the island and mark the profile of the hill (The landscape is protected by the provisions of the Archaeological Law 3028/2002 and the ministerial decisions No. 407/2007). | ● |
| | 19th century urbanisation processes *(potential OUV)* | Connection between Skala and Chorá built in 1819 as the first public road, named Aporthianos Road. | ● |
| ENVIRONMENTAL | Integrity of the natural landscape and morphology *(potential OUV)* | The mountain slope of Pátmos, defined by the present end of Skála and the settlement of Chorá, is recognised as being of *"special natural beauty"* under the authority of the 4th Ephorate, in 1968 legislation. | ● |
| | High variety of botanical species *(potential OUV)* | Varieties of native botanical species (*Olea europaea, Citrus, Vitis vinefera* ...). | ● |
| HISTORICAL / ARCHAEOLOGICAL | The town of Chorá on the Island of Pátmos is one of the few settlements in Greece that have evolved uninterruptedly since the 12th century *(criterion III)* | From the Monastery, built in 1088, to the last residences built in the 20th century. | ● |
| TECHNICAL | Conservation of morphological characteristics and construction techniques *(authenticity)* | • Grey granite stone from the Manolakas quarry (now abandoned) and beige-ochre limestone from the Megalo quarry;<br>• the structure of the openings is made using the technique of the architrave system, called *mantoma*;<br>• stratification of the slabs with: cypress logs called fides; reeds; lobsters (dry bushes) and algae; earth;<br>• flat cover;<br>• white plaster externally. | ● |
| CULTURAL HERITAGE | The community through which it is possible to safeguard the artistic and intellectual values of the monastery, traditions and rituals *(authenticity)* | Activities of the monastic community. | ● |
| | Sites where was composed two of the most sacred Christian works: the Gospel of St. Jhon and the Apocalypse *(criterion VI)* | The Cave of the Apocalypse and the Monastery of Saint John. | ● |
| | *Heritage of productive and artisanal techniques (potential OUV)* | Realisation by some workers of the typical tile of Pátmos, still used in the houses of Chorá. | ● |
| | Strong religious feeling *(potential OUV)* | Important pilgrimage destination. | ● |

## HIA applied to the Chorá of Pátmos

The HIA methodology was applied to the case study of Pátmos to assess the impacts of possible rehabilitation scenarios, and evaluate the most appropriate intervention for the enhancement of the vernacular heritage. The assessment tool supported the design process, collaborating in defining intervention priorities to reduce the potential risks of the site, minimise negative impacts and maximise positive effects on the OUV (Dipasquale et al., 2020).

In a first phase, the information deriving from interviews, direct observation of the site, recommendations and evaluations of the 2014 Periodic Reporting were processed, in order to identify safety needs and risk factors. A Risk-Based Thinking approach was adopted, in order to direct the strategies towards rehabilitation projects capable of minimising the main risks for the preservation of the identity of the site. In Chorá of Pátmos the main factors of risks emerged are: depopulation; seismic risk; decay of some areas; potential loss of local crafts; potential impact of mass tourism. The risk assessment revealed that the main threats for the preservation of the identity of the property are the loss of residents in Chorá, and the possible extension of areas of degradation due to the neglect and carelessness of an absent citizenship. Based on these elements, a regeneration project of a degraded area, with the key objective of improving the quality of life of citizens and promoting a sustainable development, has been hypothesised.

The first step of the HIA process has been to identify the attributes that transmit the Outstanding Universal Value of the property. The attributes can be physical qualities and natural, social or cultural processes that influence the value of the property. They have been classified by eight reference categories: cultural/religious/artistic, architectural/residential, architectural/religious, historical landscape, environmental, historical/archeological. Values that are not explicitly mentioned in the OUV, but are considered important for the authenticity and cultural richness of the site, are identified as potential. The importance of each value is classified on a rating scale, from very high to negligible. For each attribute, all the effects of the changes have been assessed in relation to six impact categories: visual and perceptual, functional and intended use; socio-cultural, historical and artistic, environmental and intangible impacts. The effects of the changes may be adverse or beneficial and their severity - from major to absent -, should be judged taking into account their direct and indirect effects and whether they are temporary or permanent, reversible or irreversible (ICOMOS, 2011). The overall impact on an attribute is a function of the importance of the attribute and the severity of the effects of changes. The result of the HIA process is the Scoping report, on the basis of which the evaluation committee draws up a report containing any recommendations and mitigating measures to reduce the impact on heritage. In the case of Pátmos, the application of the HIA supported the process of designing a rehabilitation project capable of promoting sustainable development of the area, with benefits for the local community. The process of evaluating the key elements of the OUV and the potential attributes has not detected negative impacts on them, and even where the impacts are relevant and very relevant, they are always to be considered as positive impacts.

*opposite page*
**Table of identification and assessment of the attributes that convey OUV in the World Heritage site of Chorá, in the Island of Pátmos**
**Gravity:**

- **very high**
- **high**
- **medium**
- **low**
- **negligible**

(*© L. Montoni, Here Lab-UNIFI, 2019*)

| ATTRIBUTES | IMPACT'S CHARACTERISTICS | SCALE & SEVERITY OF IMPACT | PROTECTIVE MEASURES TAKEN AND CONSIDERATIONS |
|---|---|---|---|
| MONASTERY OF SAINT JOHN, THE THEOLOGIAN | 1. Visual and perceptive impacts | ● | The maintenance of existing trees will not change the overall visual perception from above. The plan previews the requalification of an area partially visible from the monastery. |
| | 2. Functional and intended use impacts | | |
| | 3. Socio-cultural impacts | | |
| | 4. Historical and artistic impact | | |
| | 5. Environmental impacts | | |
| | 6. Intangible impacts | | |
| THE SIMPLE CELL, CALLED *MONOSPITO*, WITH THE FOUR VARIANTS | 1. Visual and perceptive impacts | ● | Creation of a new view towards the southern landscape through the reopening of the window on the front road currently buffered and the demolition of a portion of the masonry. |
| | 2. Functional and intended use impacts | ● | Recovery of the housing envelope for public and exhibition space. |
| | 3. Socio-cultural impacts | ● | The project will offer a recreational location and a new meeting and sharing point for the community and visitors. |
| | 4. Historical and artistic impact | ● | The architectural structure represents a variant of the basic typology of traditional dwelling. |
| | 5. Environmental impacts | ● | Insertion of a green space and removal of debris and limestone within the area. the recovered materials obtained with the partial demolition of the masonry will be reused for a part of new flooring and for new seats. |
| | 6. Intangible impacts | | |
| | 7. Other: architectural impact | ● | Rehabilitation of the base cell by removal of the crumbling roof slab. |
| CIRCUIT OF LOCAL MUSEUMS AND ART GALLERIES | 1. Visual and perceptive impacts | | |
| | 2. Functional and intended use impacts | ● | Strengthening of the museum circuit through the inclusion of a public and exhibition space located in an area of low attendance. |
| | 3. Socio-cultural impacts | ● | The intervention may be the occasion to implement the existing cultural offer of the museum circuit. |
| | 4. Historical and artistic impact | | |
| | 5. Environmental impacts | | |
| | 6. Intangible impacts | | |
| MEDIEVAL SETTLEMENT OF CHORÁ | 1. Visual and perceptive impacts | ● | The intervention does not change the general historical structure of Chorá. |
| | 2. Functional and intended use impacts | ● | Transformation of an enclosed plot into a public green space flexible to the needs of the community. The plot is an exception of public space within Chorá as there are no other green spaces. |
| | 3. Socio-cultural impacts | ● | The redevelopment of the area currently degraded offers the possibility to strengthen the social relations of the district, in particular through the organisation of events and activities (involvement of the citizenship). |
| | 4. Historical and artistic impact | | |
| | 5. Environmental impacts | ● | Recovery of a degraded area and insertion of a green area. |
| | 6. Intangible impacts | | |
| | 7. Other: architectural impact | ● | Alternative of roads and urban renewal respecting the historical characteristics of Chorá. |
| | 8. Other: urban impact | ● | Intervention respectful of the traditional morphology of Chorá. |
| LARGE NUMBER OF CHURCHES DISTRIBUTED WITHIN THE CHORÁ (CHURCH OF ST. CHRYSOSTOME) | 1. Visual and perceptive impacts | | |
| | 2. Functional and intended use impacts | | |
| | 3. Socio-cultural impacts | | |
| | 4. Historical and artistic impact | | |
| | 5. Environmental impacts | ● | The insertion of the green is adjacent to the masonry of the church of S. Chrysostome. |
| | 6. Intangible impacts | | |
| VARIETIES OF NATIVE BOTANICAL SPECIES | 1. Visual and perceptive impacts | ● | Visual changes are made and new plant species are introduced in a homogeneous manner and in line with the existing context. |
| | 2. Functional and intended use impacts | | |
| | 3. Socio-cultural impacts | | |
| | 4. Historical and artistic impact | | |
| | 5. Environmental impacts | | |
| | 6. Intangible impacts | | |
| | 7. Other: environmental-climate impact | ● | Maintenance of existing tree species and inclusion of new aromatic and shrub collections compatible with the climatic and environmental conditions of the site. |

| | | | |
|---|---|---|---|
| CONSERVATION OF CONSTRUCTION TECHNIQUES:<br>• GREY GRANITE STONE;<br>• ARCHITRAVE SYSTEM FOR THE OPENINGS;<br>• TYPICAL STRATIFICATION OF THE SLABS;<br>• FLAT COVER;<br>• WHITE PLASTER | 1. Visual and perceptive impacts | ● | The existing stone will be enhanced through cleaning and consolidation of the portion of masonry maintained. The reuse of the recovery stone inside the flooring and the seats will add new elements not existing before giving a new key to the interpretation of the use of the material.<br>On the street front the white plaster that characterises the elevations of the entire street, will be maintained and the window will be reopened with the typical technique of the architrave system, called *mantomata*, to offer a direct view of the landscape to the south. |
| | 2. Functional and intended use impacts | ● | |
| | 3. Socio-cultural impacts | ● | |
| | 4. Historical and artistic impact | ● | |
| | 5. Environmental impacts | ● | Stone cleaning and weeds removal will bring environmental improvements. |
| | 6. Intangible impacts | ● | |

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*opposite page*
**Scoping report for the the World Heritage site of Chorá in the Island of Pátmos**
**Negative / Positive impacts:**

- ● ● **very high**
- ● ● **high**
- ● ● **moderate**
- ● ● **minor**
- ● ● **negligible**
- ● ● **no changes**

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## Introduction

*opposite page*
**Drone survey equipment, Chazhashi, Ushguli, Svaneti, Georgia (© *G. Duarte Carlos, 2019*)**

Cultural Heritage has long been established as a fundamental asset of the European civilisation. The progressive recognition of its value for communities and society was established by the Faro Convention (2005), as states agreed to protect cultural heritage and the rights of citizens to access and experience this heritage. The need for its safeguarding became fundamental, which was foreseen by the increase of published legislation dedicated to protect and preserve cultural heritage. The recent publication of the European Quality Principles (2020) becomes a step forward strengthening conservation principles and standards for the comprehensive adoption of quality measures for intervention in cultural heritage.

Until recently, preservation was focused on the authenticity of the cultural asset itself, on the development of interventions, and on the intervention methods which would assure its continuity. Fundamental questions emerged from a historical and technological dilemma, as from other professionals: the main concern was to establish a balance point for physical intervention. The tendency for action over cultural heritage, following international charters and European and international conventions, resulted, in more recent years, in a general concern for a minimal intervention impact, with a maximum preservation concern, adopting less-intrusive measures. However, some economical groups have a different approach, more focused only on preserving the building exterior walls, and creating a new and contemporary building core.

## Intervention in cultural heritage

The creation of national institutions specifically in charge of heritage protection and preservation, empowered by the state's official administration and supported by state resources and technical experts, constituted the usual strategic approach towards the benefit of cultural heritage. With the rising increase of interventions in cultural heritage, national heritage institutions had to face a rising challenge of lack of resources, and an increasing number of obsolete and vacant buildings degrading rapidly. These institutions turned to opportunities proposed by economical groups, resulted in more political involvement and less technical work, and brought an evident disruption between the heritage legacy and the local communities' involvement.

The rising cost of construction and rehabilitation became integrated in capitalised markets, resulting in an approach totally disengaged from traditional technology, and from local building cultures. Lo-

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**Earthen architecture workshop at Escola Superior Gallaecia** (© *M. Mourão, Ci-ESG, 2011*)

**Stone construction workshop at Escola Superior Gallaecia** (© *T. Correia, Ci-ESG, 2017*)

cal communities did not manage to compete with new and expensive building systems, dominated by industrial materials and components with a non-sustainable approach. As a consequence, there have been processes of disinterest and disinvestment towards inhabited heritage, whose survival tended to depend almost exclusively on public initiative. This resulted in an increasing difficult access for communities to improve their quality of life.

The 'dehumanisation', but also the abandonment of several buildings in European historical centres is, perhaps, one of the best examples of this phenomenon, where companies address extensive interventions for high-class economical groups, which collides with the individual needs for the local inhabitants. The delicate standing of this issue, the dynamic of the actual society, and the rapidly changing economic paradigm, constitutes an enormous pressure on communities who inhabit these relevant historical centres comprised of traditional dwellings, with tangible and intangible sources of local building cultures.

## The way to go forward

Due to the lack of possibilities from the State to help addressing heritage intervention actions, such as conservation or rehabilitation, and to avoid celling to economical funds or groups that would alter the heritage authenticity of the cultural asset, some home-owners prefer not to act than to contribute to incorrect interventions. For home-owners to address pro-active solutions it is fundamental that the State develops and implements instruments, resources, and financial support, that will prevent cultural heritage from degradation and abandonment. It is also absolutely mandatory, to engage the local communities and home-owners in the process.

The wide diversity related to the different types of heritage is likely assumed as an intrinsic benefit of the cultural richness of the European region, but it also constitutes a true dilemma when implementing transversal actions and measures for the benefit of communities that live in this threatened heritage. The Hangzhou Declaration (2013) refers that cultural heritage should be repositioned as a reference for social and economic strategies, in which the benefit for the local community is crucial, and the political involvement is determinant.

**Wooden architecture workshop at Escola Superior Gallaecia** (© *T. Correia, 2017*)

The European Agenda for Culture, adopted by the European Commission in 2007, introduced an orientation towards an integrated approach, seeking to reinforce cultural heritage as a common asset of shared responsibility, throughout a significant contribution in three main objectives: (i) The promotion of cultural diversity and intercultural dialogue; (ii) The promotion of culture as a catalyst for creativity; and (iii) The promotion of culture as a vital element of the Union's international dimension. This contributed to an open and inclusive approach with a holistic vision of culture and heritage.
The New European Agenda for Culture (2018) addresses the positive and unique contribution that culture brings to Europe's society, its economy and international relations. The New Agenda consists of embracing culture in three strategic areas: The Social dimension regarding its social cohesion and well-being; the Economic dimension based in education and innovation for jobs and growth; and the External dimension through international cultural relations. As a result, each member state will need to define priorities for cultural policy, integrated in Working Plans.

## The potential of cultural heritage

When addressing cultural heritage, specifically historical sites and heritage buildings, the actual concept is based on the fact that its contribution to the economic and social sector is still very far from its true potential. According to the World Tourism Organisation (UNWTO, 2018), the tourism sector contributed to 5% of Europe's total GDP-Gross Domestic Product in 2010; but in 2018, it increased to 10% of EU total GDP. According to the European Construction Industry Federation (BPIE, 2016), the European Building Sector had 27.5% of its activity dedicated to rehabilitation and maintenance of buildings in 2013. Adding these values to the increasing number of visitors to places, where cultural heritage is a key-factor for tourist destination, it is clear that many of the possibilities for heritage to be developed as an asset are still ignored or are undervalued.

The culture and creative sectors are often seen as an unexplored field, of great potential to the sustainable development of a region, which can offer diversity and can complement the visitor's experience. Nevertheless, it is always vital to refer that no matter the scale of the contribution, and the implication of the creative sector, in general, the cultural sector does not jeopardise heritage authenticity, and it should not compromise expected conservation interventions or, at least, it should not overlap its sustainable capacity.

## Cultural heritage enhancement through digital technology

Creative actions related to cultural heritage have an effective contribution to the local communities' prosperity, without compromising its identity, which constitutes a true challenge, according to main conventional approaches. 3DPAST project was based on the perspective that digital technologies could be used as a creative tool to value cultural heritage.

As stated by the Norms of Quito (1967), when addressing the protection of sites, heritage has a great potential regarding economic and social values. Digital technologies have the same potential, allowing for the enhancement of heritage concerning cultural awareness, in an innovative way and without physical intervention. Digital reconstructions can therefore be developed, in parallel with heritage maintenance and preservation, and without prejudice for scientific operative accuracy, encouraging creativity by the user's interactivity - a scanning component, completely identified in an informed manner.

Some institutions, such as major European Museums, have been successful adopting the digital technology, which have a direct impact on the revenue due to an increase in museum visitors. However, it has not been the same regarding the application of digital technology in inhabited dwellings, which remains sporadic and superficial, as no direct revenue is immediately foreseen. The 3DPAST project based its approach on the rich cultural diversity of vernacular dwellings in World Heritage Sites across Europe, and established a methodological approach, crossing over different vernacular contexts. Furthermore, it valued vernacular heritage best practices, and tangible and intangible know-how, identified in World Heritage properties, which inspired non-classified heritage to reintegrate local traditions and local know-how, therefore contributing to heritage preservation, diversity, and the strength of local identity.

## Cultural heritage safeguard through awareness and training

The development of awareness activities through workshops, as well as practical training through capacity building courses can contribute to a systematic and consistent approach regarding the rising of consciousness for the importance of traditional cultural heritage among students and citizens. For instance, the development of technical workshops on stone, wood and earth construction, can prepare university students, citizens and even building professionals to be aware of traditional materials potential and value. This is of most importance, when there is a rising increase of lack of expertise, regarding conservation and maintenance of vernacular heritage, but also lack of knowledge on how to work with

**Digital mapping workshop, organised at Cuenca by Polytechnic University of Valencia** (© *M. Correia, 2017*)

traditional materials and building systems, and how to intervene using traditional building cultures. Engaging university students, local communities, and interested citizens on learning from craftsmen can be a pro-active approach addressing awareness and safeguarding of traditional building systems and materials, which is possible by organising hands-on practical and technical workshops. Other potential possibility is to organise scientific workshops with a more theoretical approach towards heritage; but also, digital technology workshops, to contribute for capacity building regarding heritage and new technologies. All these potential opportunities of capacity building can be organised by universities, but also by NGOs, as ICOMOS. This was the case of the different workshops developed under 3DPAST framework, by Escola Superior Gallaecia (Portugal), University of Florence (Italy), and Polytechnic University of Valencia (Spain). ICOMOS-Portugal has also been also organising hands-on workshops on how to address maintenance of traditional windows on the World Heritage Historic Centre of Porto, in Portugal.

## Conclusions

Relevant to mention it is also the mainstreaming of public that this kind of outcomes can reach in the future. This would be possible through the design of activities developed by an interdisciplinary team composed of professionals (such as cultural managers, historians, archaeologists, architects, scientific researchers, etc.), working in key-entities and institutions (such as universities, traditional build-

**Drone survey, at the World Heritage site of Upper Svaneti, in Georgia (© *G. Duarte Carlos, 2019*)**

ing ateliers, software companies, three-dimensional modelling companies, interactive technical support companies, etc.). With the contribution of cultural professionals (such as multimedia artists, support services experts, education institutions members, among others), the interdisciplinary team and the key-entities and key-institutions, the implementation of traditional hands-on workshops and digital technology workshops directed at heritage preservation, could benefit in the medium and long term,

local communities, but also local craftsmen, and local traders that still inhabit cultural heritage. This would help to re-position the focus and re-addressing the attention for a people's centre approach regarding cultural heritage and its protection.

The main aim of the project *Living and virtual visiting European World Heritage* was to share the quality of vernacular architecture through a transdisciplinary approach, possible by interconnecting architecture, history and intangible heritage through digitisation, creativity, and communication. This was feasible by reaching different audiences, and fully enhancing the opportunity brought by digital technological tools. This approach connected the cultural and the creative sectors with the need for European heritage awareness. It also contributed to stimulate new possibilities and competences of services and products. The dissemination of the work outcomes enhanced the unique value of vernacular architecture in different European contexts, contributing for the inter-connection of heritage across the continent, and making it widely accessible in the actual digital era.

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This publication brings together the results of the project *3DPAST: Living and virtual visiting European World Heritage*, co-funded by the Creative Europe EU programme. The research highlighted the exceptional character and quality of living in vernacular dwellings found in World Heritage sites. This was possible by seizing the cultural space of European vernacular heritage, located in Pico island (Portugal), Cuenca town (Spain), Pienza (Italy), Old Rauma (Finland), Transylvania (Romania), Berat & Gjirokastra (Albania), Pátmos (Greece), and Upper Svaneti (Georgia).
New digital realities grant the possibility to visit and to appreciate those places, to non-travelling audiences, who lack the opportunity to experience this unique heritage in situ. Creative potential is highlighted in 3D models and digital visualisations, which associate outstanding local knowledge with the vernacular expression of World Heritage.

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