

Lessons from the past, architecture for the future. Coupling historic preservation with sustainable architecture

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Topic: T1.4 Sustainability of vernacular architecture

Abstract

Restoration of built heritage can serve not only to preserve historical documents of the past but also to provide models for new sustainable architecture. Vernacular and, more generally, historic architecture is by its nature sustainable and resilient. It is largely the result of experience and acquired knowledge, and shows how local resources can be used in a thoughtful and rational way in new construction. For this reason, it can inspire low-energy solutions necessary to address the current climate crisis. Conservation projects, in their turn, allow us to analyze the fabric of historic buildings, to understand which materials were used, how they were transformed and assembled, and how they offered the best response to the needs of use and resistance to the elements and natural hazards. In this paper, conservation of traditionally-built architecture and new sustainable architecture are discussed as two partners pursuing the common goal of reducing the effects of climate change. The author investigates the way conservation and analysis of historic buildings allows us to interpret the complex and articulated reality of regional architecture. By retrieving the analysis of historic construction as a fundamental component for understanding architecture and adopting manual graphic records as a tool for expressing the complexity of the fabric of a building, it is possible to identify local building traditions and inspire new sustainable architecture.

Keywords: preservation, building culture, traditional architecture, craftsmanship, building archaeology.

1. Introduction

At a moment when discussion of sustainable architecture is critical for adaptation to and mitigation of the effects of climate change, the role of traditional architecture must be reconsidered. Traditional buildings are not merely a testimony of a past that needs to be protected but they can contribute actively to meeting the goals of the Paris Agreement, the international treaty on climate change adopted in 2015. As pointed out in C. Elefante's famous sentence "*the greenest building is....one that is already built*" (Elefante, 2012), existing heritage has a lot to offer to current discussion on sustainability. Preservation of existing building stock and its refurbishment can achieve the goal of reducing the carbon footprint generated by the building sector, provided that accurate evaluations are conducted. At the same time, recent

policy documents, such as ICOMOS' *Future of our Pasts* (ICOMOS, 2019) and the *European Cultural Heritage Green Paper* (Potts, 2021) highlight the untapped potentials of cultural heritage to contribute to climate action. In the last few years, the active role of traditional buildings in meeting the needs of sustainability and resilience and, more generally, the Sustainable Development Goals set by the United Nations Agenda 2030 has been studied within the perspective of the use of traditional practices in new buildings, as for instance in the work of Anna Heringer. However, one aspect that has not been fully acknowledged is how much conservation and reasoned recording of heritage can contribute to regenerating traditional practices that have been lost. While many traditional building trades are still practiced by some artisans, many others have been forgotten and remain documented only in historic buildings. This

is the case in regions where the building industry has succeeded in replacing traditional building trades entirely and offers building solutions which appear to be more advantageous in terms of cost. Restoration works offer an opportunity to investigate historic construction in depth; learn from the building culture that generated it; and come to know about materials, crafts, technology, buildings, and settlements that were less energy demanding. Structures are analyzed, materials are investigated, and building techniques that otherwise would be left covered by plasters and other finishes are exposed. Until recently, this knowledge was considered useful only for purposes of preserving the past. What we now propose is to use that knowledge to inform the construction of new sustainable buildings. To that aim, we consider that there is a need to adopt the methodologies used for analyzing built heritage developed by Building Archaeology – *Archeologia dell'Architettura* in Italian- a discipline with strong ties to conservation and originating from the stratigraphical archaeological disciplines (Brogiolo, Cagnana, 2012). The study of the *anatomy* of a building is meaningful in the process of *rediscovering* traditional architecture, because its methods help in identifying local building traditions and rules in construction. Thus, it can be a strong tool for recovering historical knowledge and practices in architecture.

2. Climate crisis and traditional buildings

The contribution of traditional architecture in achieving the goals of the Paris Agreement has not yet been entirely acknowledged beyond the circle of those who work on historic heritage. The building sector, one of the major contributors to the climate crisis, continues to offer solutions to reduce energy consumption and the carbon footprint mainly by developing new technologies and innovation, applied at a global level. The contributions of historic building cultures, which were inspired by a sustainable use of local resources, is still not being taken into consideration. These cultures were based on a participatory approach in which knowledge about rules, trades and technologies was shared and resources were rationally sourced and used (Davis,

2006, p. 131). Against the belief that nature is an inexhaustible resource, as the consumerist approach suggests, traditional building processes were aware of the material resources that were used in construction, where they came from, their properties, and their best use. Having become unaware of the origin of our products, the way they are transformed, and the processes that are used in their production, we have lost our capacity for thrift or for responsibly avoiding waste.

Necessary change must be achieved taking advantage of the technological progress gained in the last decades, but also reconsidering the role of new materials and technologies in terms of their longevity and sustainability. Among the many topics that need to be addressed are mass-produced, low-cost materials, short-term life-cycle products and artifacts, high-energy production processes, long-distance sourcing that increases transportation, design that disregards functionality, and individualist design approaches that aim to glorify the designer even to the disadvantage of the user. In contrast, traditional buildings sourced materials locally, thus reducing transportation, allowed reuse of materials, and were community-centered.

Less-privileged countries will be heavily impacted by global approaches promoting new and rapidly changing technologies. They will depend more and more on industrialized countries. The threat of increased social inequality in fragile contexts is proportional to the current trend in migration to urban centers as the countryside is more exposed to the consequences of extreme meteorological phenomena and natural hazards (The White House, 2021). In this context, we urgently need to identify alternatives and more nature-based approaches without losing the progress gained by humanity in the last hundred years. Again, the study of traditional architecture can contribute to identifying viable solutions, as it allows us to learn from building cultures which were in balance with nature, and varied from region to region. One of the most significant obstacles in revitalizing traditional building practices lies in the loss of craftsmanship, expertise, and all the intangible culture that supported them. Traditional buildings resulted from

processes that used knowledge gained through experience, trial and error, and know-how transferred through training from generation to generation, elements which are not directly or easily deducible from the study of the buildings. Take, for instance, the renowned gypsum plasters in Paris (plaster of Paris mortars) documented since the Middle Ages and used for external surfaces with impressive aesthetic and mechanical properties. These plasters were progressively abandoned in the nineteenth century, when industrialization focused on the use of lime as a binder (Le Dantec, 2019). Since then, the higher energy and carbon footprint lime technology replaced gypsum plasters and expertise was lost. Today, as we begin resuming their use, we understand that these plasters resulted from a know-how that we cannot easily retrieve. However, with the need to preserve the facades of the historic buildings of Paris, research was promoted aimed at recovering the quality of traditional gypsum plaster techniques (Le Dantec, 2019, pp. 378-381). Thus, preservation projects can inspire and lead the recovery of lost practices. As the French writer Françoise Choay wrote, “we restore to recover our competence to build” (Choay, 2001, p. 176).

3. Learning from Preservation

At the Conference of Athens (Athens Charter, 1931), modern materials and technologies were admitted in historic preservation, following the wave of excitement for their mechanical properties and versatility. Since then, materials which were alien to historic masonries, such as iron, cement, and resins, were employed in structural interventions, replacing or reinforcing traditional masonry buildings (Jokilehto, 2018, p. 291). It was only when these interventions started to fail for lack of material and mechanical compatibility that their invasive character became apparent and traditional building techniques were resumed. Today, one of the core principles of preservation is the “like for like” principle: damaged masonry must be replaced with new masonry similar in materials, composition, and technique of the original.

One of the early examples of this approach is offered by the restorations of the Domus Tiberiana on the Palatine Hill of Rome (fig. 1), which, in the first phase of intervention, included several structural masonry works (Giuffrè & Martines, 1988; Vitti, 2006). Here, for the first time since the the Second World War, materials and building techniques for the restoration of Roman masonry were inspired by the ancient materials and practices, including the manufacture of *ad hoc* bricks, such as the *bipedaes*--large square bricks measuring 2x2 Roman Feet (60x60 cm).



Fig. 1. Reconstruction of a Roman arch with *bipedaes* at Domus Tiberiana, Rome. (Source: Vitti)

The philosophy behind the intervention was to identify the “*regola dell’arte*,” an Italian term expressing *conformance to best practice*. The preliminary study consisted of surveys that examined the way the materials were selected, manufactured, and assembled, so as to reintroduce them in the conservation project, removing all those shortcomings that typically can occur when the *regola dell’arte* is translated into construction by the masons.

In this context, it is useful to highlight that in the 1980s Paolo Marconi promoted the recording of regional building traditions and the recovery of expertise and know-how that had been lost due to the prevailing faith in modern materials and techniques. His visionary approach resulted in a series of Manuals, the first one published in 1989 (*Manuale del recupero del Comune di Roma*, 1989) meant to record building traditions in regional contexts.

The new conservation practice made it possible to re-use building techniques that otherwise had all but disappeared. Some masons who had built arches, vaults, and traditional masonry earlier in their careers retained the expertise and know-how that could be successfully employed in conservation projects. Over four decades, much expertise in the building trades was retrieved in Italy through conservation projects and, currently, numerous contractors are capable of applying skilled workmanship and traditional building techniques.

However, in Italy as in many other countries, most of the surviving traditional building practices are directed to the conservation of monumental architecture, a consequence of the nature of funding, mainly public or controlled by public administrations. Notwithstanding the recognized value of monuments and their need for protection, vernacular architecture continues to be mutilated by users who adopt materials and techniques offered by the current building industry and professionals who promote invasive structural interventions, mostly to adapt traditional buildings to current codes. A few exceptions to this are owed to architects who recognize the values of vernacular architecture and intervene according to the original materials and building techniques, as in some interventions in Germany (Bocco Guerrieri, 2020, pp. 76-89) or in the Valencian Region (Mileto *et al.*, 2021; Villacampa Crespo *et al.*, 2018). Also in Italy, a country with an exemplary tradition in conservation, vernacular architecture is mostly preserved for its external/aesthetical values, and the “like for like” principle is not applied to the fabric of buildings. The path shown by Giuffrè in his studies for vernacular architecture (Giuffrè & Carocci 1997; Giuffrè & Carocci 1999) and codified in the “*Codici di Pratica*” -manuals promoting the use of traditional building techniques in historic centers- did not prevail over the faith in modern materials and techniques. Conservation and renovation continue to resist interventions that reproduce the “weak bonds” of most vernacular architecture. For this reason, traditional earth-mortar masonry, as the one employed in England (Morton-Little, 2015), is not recognized as a potential solution for new buildings.

4. Assessing the identity of a building and learning the local tradition

The seminal work of Marconi and Giuffrè was principally focused on the preservation of heritage. They understood the importance of traditions and local practices, with their adaptations to building rules. Once we acknowledge that preservation can inspire sustainable architecture, we can further develop the ideas of our predecessors and assign to restoration not only a passive role focused on the preservation of the “documents of the past” but an active role as a tool for learning from the past and inspiring new architecture.

To that aim, it is necessary to approach the local building traditions through an intensive work of analysis, documentation, and interpretation, going beyond the limited variety expressed in the manuals. The manuals are a codification of disciplinary expertise and give general instructions on construction according to the *regola dell'arte*, but generally do not include deviations from it. The reason is simple: there are infinite local variations to the *regola dell'arte* due to adaptations, misunderstandings, or simply unskilled workmanship that are not considered in codifications whose purpose is to define best practice. However, these variations are of particular interest to us, since they can express the traditions developed locally after a more or less long trial and error process.

In principle, high-quality construction will be compliant with the “ideal model” (the *regola dell'arte*) and its structural behavior will be at a higher level than a construction that deviates from the *regola dell'arte*. However, most of our vernacular heritage does depart from the *regola dell'arte*, as it truly expressed local building cultures. Thus, understanding the model and the way it was translated in construction is fundamental for assessing how vernacular interpretations occurred in the process of applying the *regola dell'arte*. Understanding the specificity of a place is important, as it can inspire new construction according to the *regola dell'arte* as well as adaptation to the local context.

As we depart from the principles of current (unsustainable) construction and its dependence on strong structural bonds – as in iron and concrete construction– and strong binding mortars, vernacular practices become meaningful, showing us how they achieved sound construction using weak structural mortars based on lime or gypsum and frequently mixed with earth, particularly in their core (Markley, 2018). Lime and gypsum were used parsimoniously in vernacular construction, either because they were expensive or because raw materials were scarcely available. We can learn from this how to satisfy our need for low-energy construction processes and circularity.

Solutions vary from place to place and each building tradition reveals how solutions were tailored to the availability of local materials and responded to the local climate conditions. We can appreciate the appropriate choice of the setting of the buildings and their structural behavior, designed to stand local environmental loads. In other words, the buildings expressed the result of long-term processes in which methods were adapted and innovated as needed, expressing resilience and sustainability through the thoughtful use of resources and capacity to change.

Our historic centers, villages and country buildings have plenty of such examples that are worth studying and learning from. Why should we not retrieve this amazing knowledge for our future sustainable and resilient architecture?

5. Graphic analysis and the role of education

In Italy, the importance of recording building techniques as a fundamental component of the identity of historic architecture, beyond formal, spacial and structural matters, dates back to G. Giovannoni (Esposito, 2005) and connects to the French and German nineteenth century scholarship of scholars such as Choisy, Viollet-le-Duc, and Durm. Drawings were and remain the best way possible to achieve this task.

As a fundamental tool of the architect, drawings have always had an important role in guiding the learning/interpretative process of architecture. The graphic analysis of construction, taking advantage of the cognitive process activated by hand drawing, shows building elements in a critical way and thus is of paramount importance if we want to recover building traditions that are lost. The interpretation of a construction process and its building phases means understanding the way materials were selected, transformed, and assembled and the process which was adopted, not differently from the Building Archaeology methodology in analysing historic buildings. Such diagrams need to be created on site, since they are developed through a close analysis of the building. They can be a useful means of tracing building processes of past building cultures. As such, they can become a useful tool in defining our capacity to reconnect to the past and define the future of architecture. As it happens, the past meets the future. We can use laser scanners but, at the same time, we should not forget how important hand drawing is!

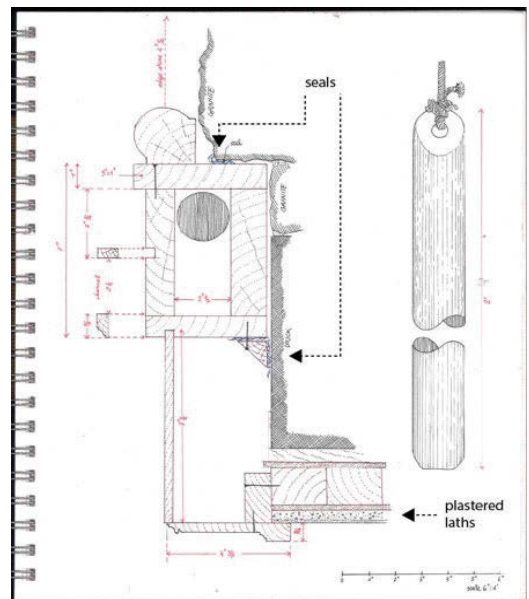


Fig. 2. Detail of the casing of a sash-window in a 19th century house in South Bend (IN-USA). The diagram shows the plastered laths employed to insulate the interior stone wall and horsehair and vegetable fibres to seal joints. (Source: Vitti)

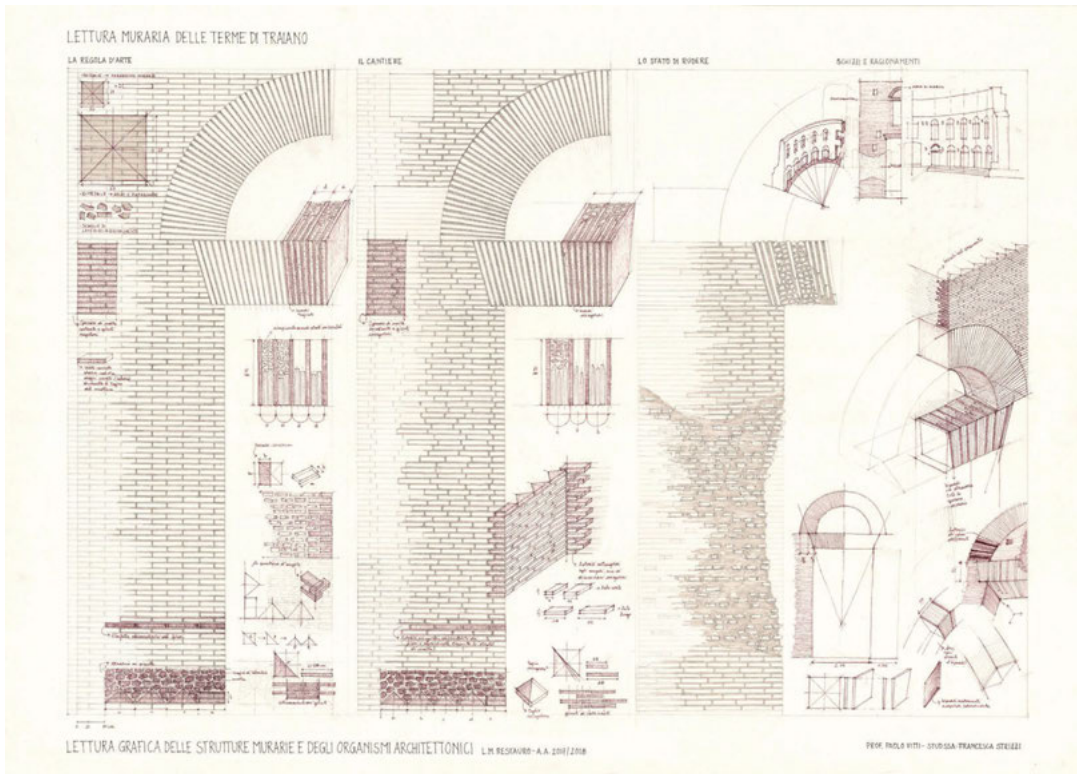


Fig. 2. Diagram of the archaeological remains at the Baths of Trajan in Rome (Source: Strizzi)

As an example, I would like to show the student work conducted on archaeological buildings (fig. 3). The graphic analysis aims at identifying the materials that were used, the way they were transformed, and then how they were assembled. The drawing in the middle shows the wall facing as executed. Bricks used in the actual construction were not uniform. Their length varied because bricks were made by cutting square bricks into triangular ones. Small differences in the thickness made the mortar joints irregular. The diagram on the right shows the relationship between the facing and the core, thus giving all the relevant information on the core of the wall. This includes the dimension and density of mortared brick fragments, the careful placing of the fragments in horizontal layers, and the lack of cavities, showing that the material was tamped to achieve a higher density. The left diagram shows the model which stood behind the execution.

The same critical approach can be adopted also for the analysis of buildings belonging to a more recent past to understand, for instance, how the insulation at the openings was traditionally addressed (fig. 2).

Reasoned drawings can be used also to analyse parts of a building through three-dimensional diagrams, as to understand the relationship between the different structural elements (fig. 4).

Axonomies were similarly used by Auguste Choisy. The difference is that Choisy focused on the "model", whereas we are interested in the actual execution. This makes it possible to develop a hermeneutic process and, at the same time, customize the intervention in the best way possible for the preservation of built heritage. It also gives a lively understanding of how local materials influenced local practice.

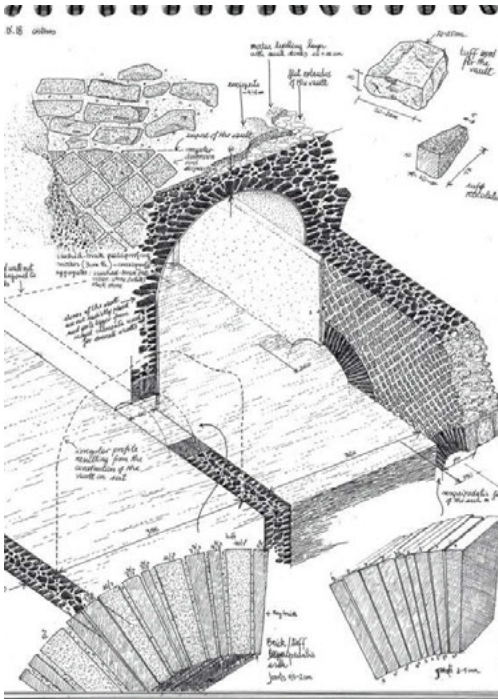


Fig. 4. Three-dimensional diagram analyzing the construction of the cistern of the Roman Villa at Capo Sorrento. The drawing shows materials, the way they were transformed and assembled. (Source: Vitti)

Graphic analysis guides the understanding of a building culture and becomes a fundamental tool in our attempt to reconnect with the past. For this reason it is necessary to train new generations of architects to develop their skills not only in understanding the specificity of earlier building cultures, but also in using appropriate methodologies for analyzing built heritage. By a matter of fact it is necessary to form a new class of architects who can identify and understand local building practices, the materials used for construction, and the way they were used to form buildings, starting with increasing their capacity to analyse and record existing heritage, prevalently in vernacular architecture. This will allow architects not only to preserve heritage in the most appropriate way, but to establish new approaches to the design of new buildings and new codes reflecting local traditions. Ultimately, the goal will be to encourage the employment of traditional construction in contemporary architecture and support regional building solutions and local craftsmanship.

As a matter of fact, local craftsmanship who practice local traditional building techniques are a substantial resource for sustainable architecture. Not only do they keep the trades alive by passing their know-how from generation to generation, but with their expertise and knowledge they can address the execution of new forms of architecture in continuity with the lessons of historic building cultures. An example is given by the tile-brick vaulting tradition in Bétera – Valencia, Spain. Expert masons, such as Salva Gomis and his brother Jesus, who were trained within the practice of tile-vault staircases in concrete buildings, have become an inspiring resource in the construction of demanding tile-vaults, where forms express new architectural ideas (fig. 5).



Fig. 5. Salva and Jesus Gomis working at the construction of an inclined sail-vault reinforced with ribs. This tile-vault has a 7:30 m span and a rise of 25 cm on the back and 12 cm on the front. (Source: Vitti)

6. Conclusions

While many voices acknowledge the role of culture and cultural heritage as drivers in climate action, we recognize that it is time to establish ways to reinforce their role in developing sustainable architecture. The tangible and intangible components related to past building cultures need to be incorporated into the narrative of contemporary architecture. To that goal, we believe there are two fundamental actions that can positively contribute. The first is developing studies on built heritage which are based on graphic analysis of the buildings, as to determine their local character (materials, technologies, typologies, ways to relate to the geomorphological context) and the way they developed best practice. The second is to use

knowledge gained into conservation projects, in which historic construction is analyzed in depth and traditional building techniques are reintroduced, to recover intangible knowledge and train new specialized workmanship in traditional trades. These actions may stand at the base of a new approach to architecture, where building codes and local practices are reintroduced against the trend to globalization, and the “poor” dimension of vernacular architecture is reincorporated into building practices. Ultimately the aim is to reconnect architecture to the collectivity and its capacity to determine, control and produce architecture.

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