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# Proceedings of the first ArCo Conference



## **Art Collections 2020**

Design and Museum Design,  
Digital Heritage, Historical Research,  
Posters

### **Editors:**

Francesco Valerio Collotti,  
Giorgio Verdiani,  
Alessandro Brodini

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## 1<sup>st</sup> ArCo – Art Collections

Cultural Heritage, Safety and Innovation  
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# Art Collections 2020

## Design and Museum Design Session

### (ARCO 2020, DMD)







Art Collections 2020, Digital Heritage (ARCO 2020, DH)

## The archaeological survey for the conservation of memory, the first step of the Volterra in 3D Project

Paola Puma

*University of Florence, Department of Architecture, Piazza Ghiberti 27, Florence 50121, Italy*

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### Abstract

The New European Agenda for culture adopted by the EU in 2018 promotes the vision of a broader involvement of stakeholders in all the topic from acquisition to dissemination to the enhancement of cultural heritage. In this framework the preservation of the cultural heritage is therefore understood also in its memory meaning, as we have conceived it in the Volterra in 3D Project aimed at documenting the archaeological heritage starting from roman remains of a villa, whose two big mosaics are exhibited in the old *Museo Etrusco Mario Guarnacci* in the Etruscan city of Volterra (Tuscany, Italy).

Since the finds are exhibited far from their origin context (and it itself is no longer visible today), it is very difficult for the visitor to imagine its original environment. Then the two mosaics have been measured, processed, and presented in traditional and new representations to proceed with the virtual reconstruction of the villa facilitating the understanding of their provenance and the architectural context.

## **1. Framework of the Volterra in 3D Project**

Accordingly with the definition already present in the Italian Code of cultural heritage and the landscape since 2004, cultural heritage includes assets to be protected and enhanced to preserve the memory of the communities and promote the cultural development of territories. In addition to the main meanings, cultural heritage is therefore specifically defined by being one of the most powerful identifying elements of the community, especially those typically linked in historic Italian settlements and cities.

In the “Declaration of Paris on Heritage as a Driver of Development” (the “Paris Declaration” from the 2011 ICOMOS Symposium entitled “Heritage, a driver of development”) heritage is defined a fragile, crucial and non-renewable resource that must be conserved for the benefit of current and future generations. The declaration includes an effort to address the role of cultural heritage in development and to identify the actions needed not only to protect heritage, but also to ensure that its use, its promotion and enhancement, and its economic, social and cultural value are aimed to the benefit of local communities and visitors.

Therefore, the New European Agenda for culture adopted by the EU in 2018 makes explicit in the “Work Plan for Culture 2019-2022” the vision of a broader involvement of stakeholders in all the topics from acquisition to dissemination to the enhancement of cultural heritage.

This vision it's divided into five priorities forming the public debate in a new, broader direction for which the Cultural Heritage is not only a way of preserving the memory of the past but part of an organic system projected into the future, where cultural policies must be linked in terms of competitiveness to the social cohesion and well-being, to the job policies, to the environment.

The preservation of the cultural heritage is therefore not to be understood only as the protection of material assets but it also constitutes itself the defense of the intangible values of identity, sustainability and resilience, making cultural heritage an important driver for the life of the communities.

This vision represents the framework of the Volterra in 3D Project, aimed at documenting part of the archaeological heritage of the ancient Etruscan city of Volterra (Tuscany, Italy), to reinforce its knowledge and preserve it from the rescue of a fruition in old approach, actually not completely deploying all its cultural potential in the territory.

The project is designed to apply the best practices of virtual archaeology on the relevant archaeological heritage of the city working on some artifacts of the Guarnacci museum and on the traces of archaeological area from which the finds came.

## **2. The context and the case study of the project**

The Museo Etrusco Mario Guarnacci in Volterra is one of the oldest public museums in Europe and was born from a first collection in 1732, then it was formally founded by Pietro Leopoldo in 1786 as "Public Museum and Guarnacci Library". The most famous finds of the museum and the most significant of the whole collection are "Il coperchio degli sposi" (1st century BC) and the other symbol of the Museum and of Etruria in general, the elongated ex-vow of a boy known as "Ombra della sera", a bronze work considered one of the masterpieces of Etruscan sculpture of the III century BC.

The Guarnacci Museum houses an impressive collection of about 600 ossuaries, Etruscan sculptural masterpieces, important ceramic collections, bronzes, goldsmiths, coins, materials from the Roman Volterra and many Roman imperial mosaics from many surrounding archaeological sites (Fiumi, 1976).

A real systematic cataloging operation of the mosaic floors began only in the second half of the 1900s when was born the reawakening of the interest in the mosaic production of Central and Northern Etruria, an operation that brought to light the process of Romanization of the Tuscan territory and during which the geometric decorative themes spread to Lazio and Liguria.

The case study of this paper includes two mosaics from the museum coming from Villa Segalari, located near Castagneto Carducci (Livorno, Tuscany).

Both the mosaics came from the prestige domus and villa built in the roman Imperial age called Villa Segalari, which is no longer visible due it was re-buried, as it was in use in the second half of the 19th century, immediately after being brought to light during the archaeological excavation.

The only news of its existence has come down to us thanks to the drawing in an article published in the *Gazzetta Ufficiale* of 1876 by the archaeologist and numismatist Gian Francesco Gamurrini containing a drawing from which we can assume to reconstruct it as organized with a peristyle with columns around which the rooms with mosaic floor were arranged (Bueno, 2011).

The timeframe of the two mosaics (1st century AD for the first mosaic and 2nd century AD for the second one) is coherent with the periodization of the villa, which goes from the Augustan age to the Hadrian period.

The first mosaic is the one that in the Gamurrini plan may have covered the left wing of the "triclinium with two wings" of the villa and now exhibited in room XVIII of the museum.

The mosaic has a "rivestimento in tessellato a decorazione geometrica ornato da una composizione a reticolato di fasce suddivise in rettangoli e quadrati nei punti di incrocio. I rettangoli e i quadrati sono resi in nero profilati da una linea doppia bianca e decorati rispettivamente da un quadrato sulla diagonale e da una losanga sdraiata. Il reticolato individua quadrati bianchi più grandi, delineati da una linea semplice nera: questi presentano un quadrato delineato in nero inscritto sulla diagonale e decorato da tre motivi differenti combinati in sequenza sempre diversa" (Bueno, 2011).

The second mosaic is the one exhibited in room XIV of the Guarnacci museum and, according to the identification proposed by Ciampoltrini (Ciampoltrini, 1994), was connected to the room that Gamurrini calls "a rectangular room of 8x 3.60" ml.

The geometric decoration tessellation is "bordato da una treccia a tre capi policroma con andamento meandriforme resa in tessere bianche, verdi, gialle, rosse, marroni e azzurre. Il campo presenta una composizione ortogonale di stelle a otto losanghe", whose larger squares are characterized by plant themes framed by a braid and meanders (Bueno, 2011).

### **3. The Virtual archaeology strategy of the project**

The current potentialities of virtual archaeology allow the general public, archaeologists and museum curators to well understand the contexts and somehow retrieve, with modern technologies and languages, the highly imaginative aspect of the reconstructive representation.

Moreover, the 3D visualizations and the virtual reconstructions based on the data collected during the architecture's surveying campaigns offers the possibility to make interactive simulations and thematic interpretations of an archaeological context and to display complex information in visual way using a communication tuned on a wide and diversified audience of users.

Although virtual archaeology finds its theory in numerous statutory documents (ICOMOS, 2008; Denard, 2009; Principles of Sevilla, 2011) the state of the art cannot yet be considered settled and various reasons (being a complex discipline that requires strong interdisciplinarity, the lack of a shared methodology, some unscientific approach in the use of a too "game designed" visual language) contribute to keeping this activity too often in the context of graphic expression only.

The great potential of virtual archaeology remains fundamental in defining the common terrain of analysis and interpretation of the archaeological heritage when it is the subject for all material aspects of study by joint groups of architects and archaeologists, as important projects show in one of the first exemplary pilot cases (see the Swedish Pompeii project).

In the case of the Guarnacci Museum, the original museum exhibition -itself an historical memory of the museum culture at the time of its establishment- has recently been added by another more didactic one (Catani, 2011), with a chronological path conducting the visitor through the long historical event of the Etruscan Velathri.

The documentation and Virtual Archaeology work carried out on the two mosaics of Villa Segalari goes precisely to support this new path, suggesting a possible digital relocation of the mosaics in the original context which is now inaccessible.

In scientific terms, the operations carried out on the two mosaics correspond to the definitions given in the Seville Principles and expressed as Virtual restoration ("this involves using a virtual model to reorder available material remains in order to visually recreate something that existed in the past).

Thus, virtual restoration includes virtual anastylosis") for the integration of the lacunas in the mosaic of room XIV and Virtual reconstruction ("this involves using a virtual model to visually recover a building or object

made by humans at a given moment in the past from available physical evidence of these buildings or objects, scientifically-reasonable comparative inferences and in general all studies carried out by archaeologists and other experts in relation to archaeological and historical science.”) for the 3D modeling work of the Villa Segalari.

#### **4. The methodology of the study**

The workflow of the data acquisition, modelling and virtualization was organized in 3 phases, carried out in about 4 months of work.

The survey campaign was carried out in twenty working days spent using a combination of technology starting by hand measurements and sketches for the acquisition of the main dimensional characteristics (Chiavoni, Filippa, Docci, 2011; Bertocci, Bini, 2012; Brusaporci, 2015;) and photogrammetric methods such as point cloud through 3D stereoscopic couple of pictures, panoramas etc. for the SfM.

The photographic campaign was aimed at creating an archive of digital images to be processed with the Structure from Motion technique: the photo shoots were processed with appropriate photo modelling software and referenced using the data obtained from direct survey; these data were finally used to product textured 3D models and high resolution orthophotos.

The SFM method has been then used to realize 3D models with photorealistic textures, the combination of which made it possible to document the geometric and material aspects of the artefacts by working on a digital basis (Remondino, Campana, 2014; Fazio, Lo Brutto, 2020).

To survey the mosaic carpet with coloured details it was necessary to define a workflow that could guarantee an appropriate degree of color control both in the acquisition and representation phases (Santopuoli and Seccia, 2008; Versaci and Cardaci, 2011).

Although we worked on objects exposed to controlled light conditions, the workflow was set to obtain the correct colour sampling and the parameterization of the acquisition characteristics that could guarantee homogeneous captures even if carried out by different cameras (therefore with a yield of the RGB values influenced by the characteristics of the different sensors).

One of the advantages offered by the digitalization of photographic acquisition processes is certainly represented by the possibility of taking images in Raw: this format represents, in fact, a method of data acquisition in which no interpretation and modification processes have been carried out by the capture sensor. In the case of digital images, it means to obtain a photographic shot that does not suffer any loss of data due to compression and allows therefore to intervene, in the post-production phase, on the aspects that more than others define the good quality of an image. Once the preliminary white colour's balance phases were carried out, the samples were then created from which to extract the colour profile characteristics to carry out the subsequent adjustments by overlapping a colour checker on the items to be photographed (in our case the Kodak Colour Control Patches ) whose printing characteristics were known. The images where the checker was present have been converted into DNG (Digital Negative) format and then analysed with the Adobe DNG Profiler Editor software making it possible to check the RGB values of the individual colours present in the checker itself and make the appropriate corrections for bring them closer to the reference parameters.

Once the samples were corrected, it was therefore possible to generate the corresponding colour profiles to be used for the normalization of all the Raw images (Volker, 2010).

The different photo shoots were processed and assembled for the subsequent production of high-resolution screenshots aimed at the production of the graphs in the usual architectural detail in 1:10 scale.

The first mosaic in room XVIII measures 297x510 cm (12x25,5 Roman feet), and includes 4x7=28 black and white square patterns. The second mosaic room XIV measures 353x757 cm (10x17,5 Roman feet), and includes 9x3=27 circle and square polychrome patterns.

The graphics were produced following a traditional workflow (Ippoliti and Meschini, 2011; Pescarin, 2016; Puma, 2018), including 2D drawings descriptive of the dimensions (quoted), of the morphology (geometric) and of the photorealistic characteristics of the artefact by integrating the CAD drawings and 3D textured models by SfM; the representation of the two mosaics has been completed by the metric-proportional interpretation of the mosaic's patterns and schemes.

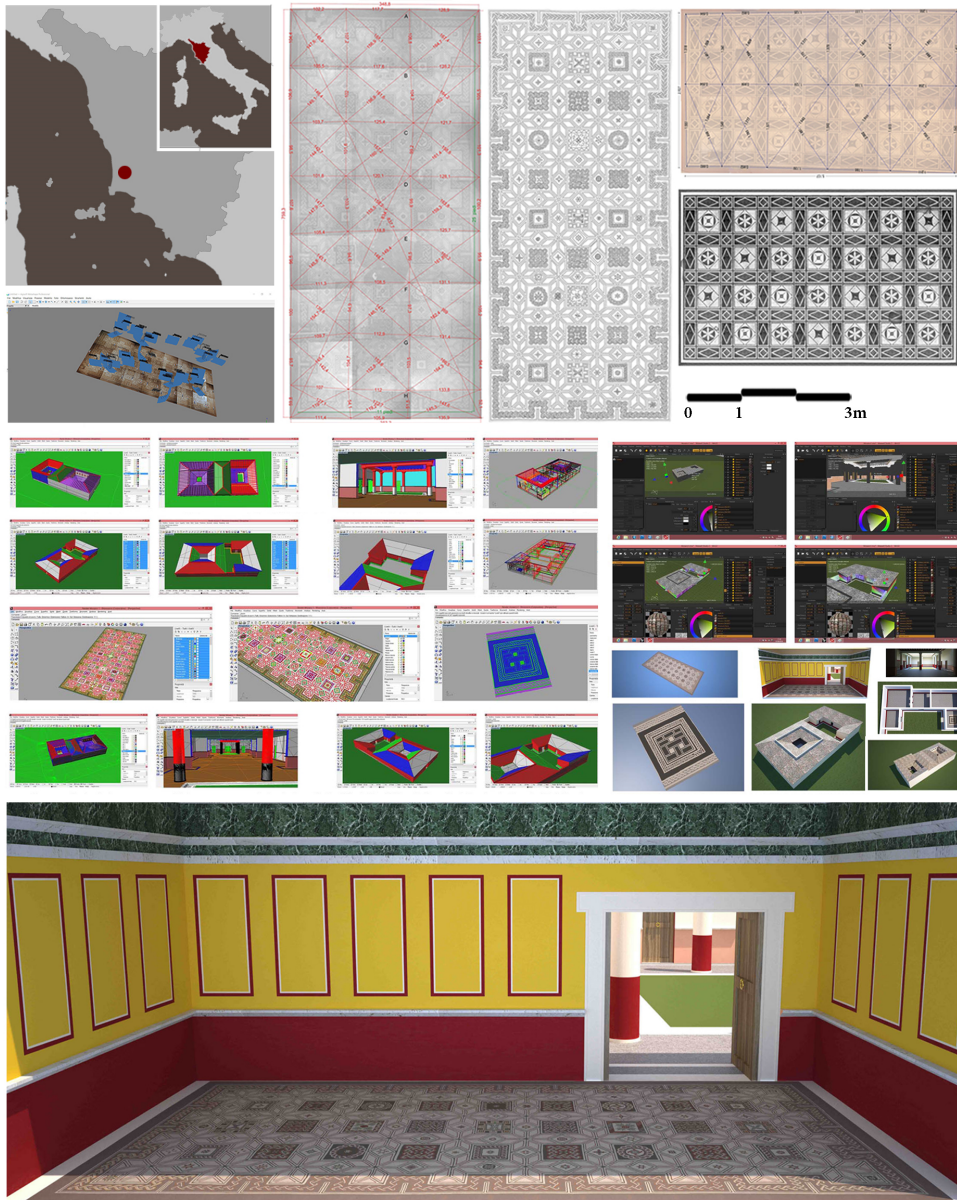


Fig. 1. The case study location (left side: the mosaic in room XVIII, right side: the mosaic in room XIV), the documentation of the two mosaics, the workflow.

## 5. Conclusions

The virtual archaeology application consisted of two phases: in the first phase by photo editing work, it was possible to carry out the digital restoration by reconstructing the lacunas in the first mosaic in the areas damaged by use and time, thus obtaining the final image of the floor as similar as possible to the original one. In the second phase we worked to visualize in a 3D model a hypothetical reconstruction of the Villa Segalari including the relocation of the two mosaics, setting the work according to the scientific and the archaeologist's guidelines.

The 3D model has been conceived by modelling the Gamurrini's map and integrating his indications with the typological scheme typical of the villa spread during the Romanisation phase of central Etruria, to suggest the

imagination of the museum finds in their origin context.

A short video was finally made for communication issues and useful for a first spreading about the study carried out and about the mosaics, on which visual studies had never been carried out on graphic documentary bases before today (Fig. 1).

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