



Cultural heritage survey and inclusive representation. The case of Villa Ottolenghi

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Abstract

The integrated models, conceived as the result of a process and not as a product of a particular software, allow to organize and manage the "survey project" and its execution, as well as to evaluate all the competing aspects in its realization.

The scenario that emerged from the analysis of the scientific literature shows how it is not possible to attribute to the technologies present on the market this value of comprehensive information collectors: on the contrary, this holistic approach constitutes the principle of integrated / advanced modeling, conceived within this framework. research as a process of representation of architectural knowledge, which is configured as a procedure and not as a computer software.

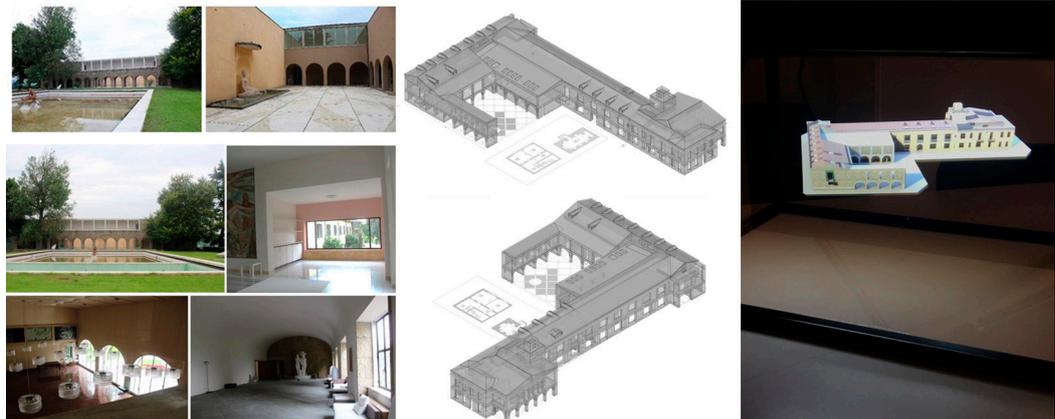
The case study of Villa Ottolenghi has an experimental intention and is a pilot project for a series of future developments where interaction is the cornerstone of use.

The realization of this research is the expression of the communication skills of survey and representation through the use of technological and interactive systems.

This research was born with the aim of experimenting and coherently adapting IT applications capable of displaying in a mixed environment, three-dimensional images and information data relating to existing and non-existing artistic and architectural cultural heritage, with direct application to the case study of Villa Ottolenghi in Acqui Terme and its visualization in a holographic environment.

Keywords

Survey, holograms, digital use



Villa Ottolenghi in Acqui Terme: photographic survey, three-dimensional graphic rendering and holographic visualization as part of the unified survey methodological process.

Unified survey and complex representation

One of the fundamental questions of this research is whether and how digital representations distinctively increase the perception and awareness of the value of cultural heritage, considering the active players – from the operational/technical point of view – and the receptive ones – from the fruition point of view.

Digital representation for the dissemination and learning of culture proposes to rethink communication strategies for the enjoyment of visual and cultural information. Tools such as virtual and augmented reality, interaction, device localization and multimedia technologies make it possible to transform the museum visit into an active and engaging experience. It is precisely in this perspective that the logic of the contemporary museum as a place of representation falls, a place par excellence where we move from being a space for conservation only to a place of representation and experience of reality in its innumerable forms.

The representation of cultural heritage involves safeguarding, preserving and planning through operations to obtain detailed, accurate and reliable information. Promoters, who are commonly interested in economic feasibility, and end-users, who are less and less 'passive' users and more assimilated into the figure of the 'cultural prosumer', also contribute to the meaning-making phases, and thus to the narrative itself.

The crux of the matter is the scientific quality of the methods, procedures, and techniques for both surveying and restitution for 3D modelling and visualization, responding to defined conforming principles such as interdisciplinarity, sustainability, complementarity, authenticity and usability. As technological resources have evolved in terms of geometric progression, more accurate and detailed models have been developed.

However, the process of identifying the most appropriate technologies to add value to cultural heritage is still unclear, given the resources available, the type of object, the scale of representation, data acquisition and specifications, interoperability and compatibility, and the quality of information in the areas of reliability, accuracy and consistency. This research, through a comparative process, is aimed at identifying a pathway to optimize the choice of visualization in the holographic domain with regard to the potential increase in the intrinsic value of cultural heritage. (fig. 01)

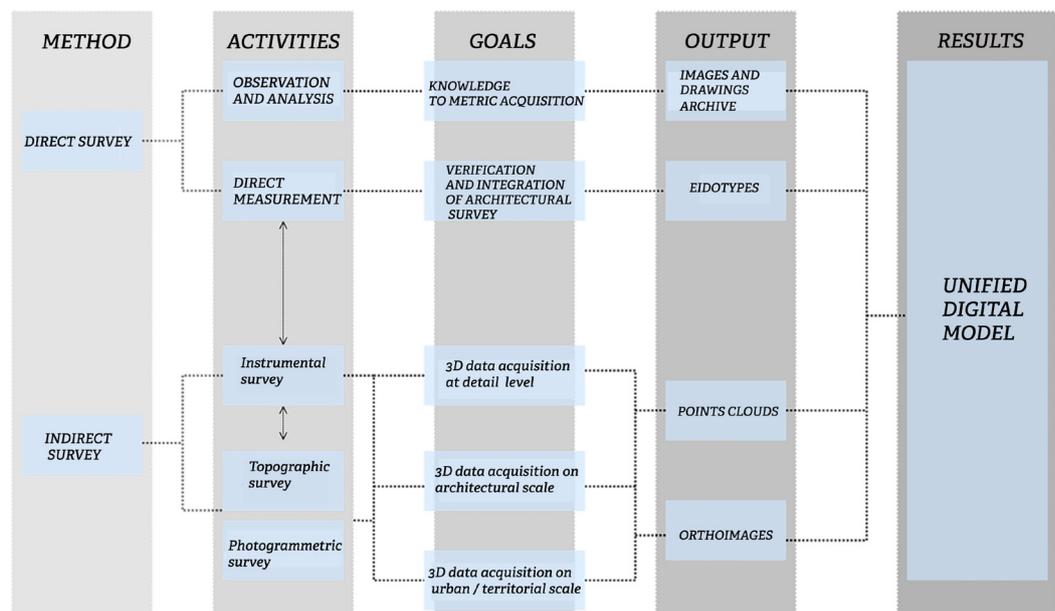


Fig. 01. Operational phases flowchart to obtain the unified digital model. (Flowchart's elaboration by authors).

Methodology

The methodology of investigation and survey, aims to demonstrate and verify an integrated and selective method to be able to detect, analyse and develop an exploratory-conceptual method of an architecture and, more generally of a cultural asset, in its complexity, also and above all by declining it in methodological and interdisciplinary applications.

In tackling the knowledge path in surveying, the method, in which the objectives are defined, follows a planned and systematized path, organized in stages, which makes it possible to arrive at the final checks, particularly in the field of cultural heritage as a complex system and which requires an initial methodological approach to cataloguing that develops into a complex and 'unified' knowledge project. (fig. 02) The objectives of the "unified" survey, deduced from ongoing research, include a philological-critical approach for the documentation, knowledge and management of Cultural Heritage as recognized by the Cultural Heritage and Landscape Code. Although the traditional concept of survey has been superseded in recent years, it still remains one of the knowledge tools with which, thanks to the observation of form, we are able to restore the characters that make up an architecture through an approach that uses the "art of drawing" as a means of understanding and communicating it. This study intends to implement current standardization and regulation of data collection, processing and visualization procedures in order to exploit and disseminate final scientific results, both in portable and streamlined applications and in more sophisticated three-dimensional visualizations. The scenario that emerged from the analysis of the scientific literature shows that it is not possible to attribute to the technologies on the market this value of all-inclusive collectors of information: on the contrary, this holistic approach constitutes the principle of integrated/advanced modelling, conceived in the context of this research as a process of representation of architectural knowledge, which is configured as a procedure and not as computer software.

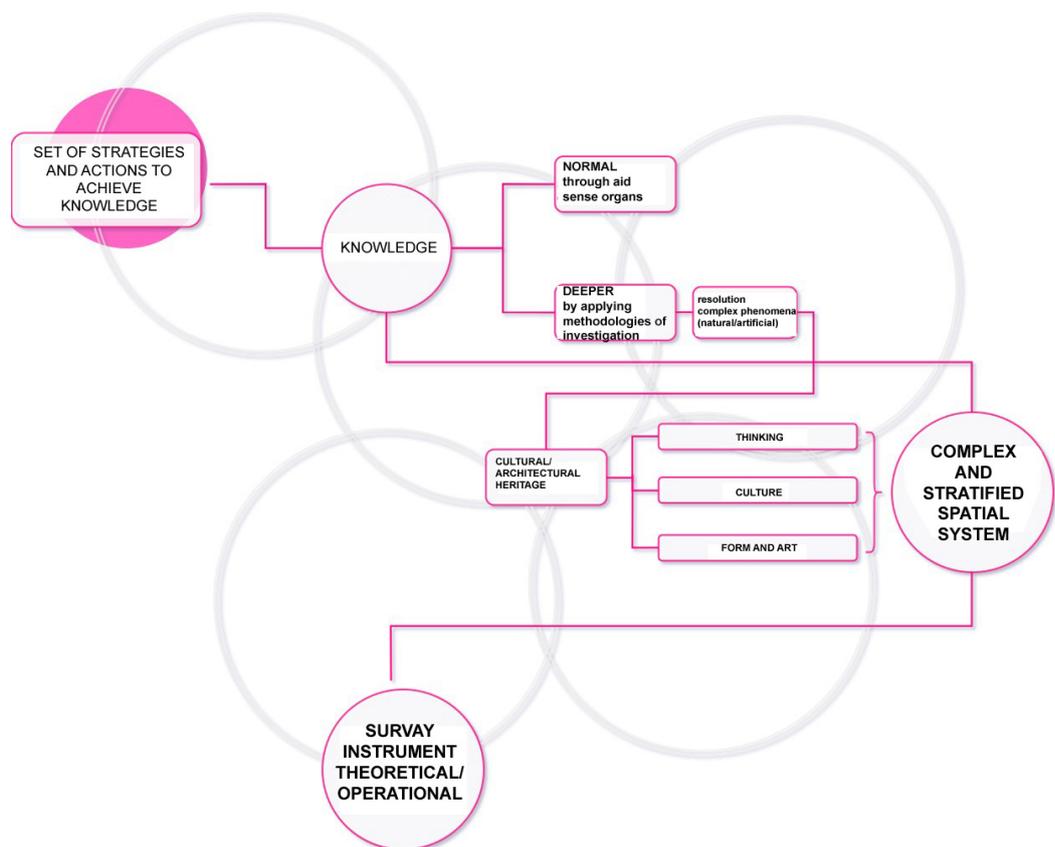


Fig. 02. The process of Knowledge: a set of strategies and actions aimed at its achievement. Through the analysis of this cognitive process, the treatises highlighted two different levels of knowledge: the normal one, reached through the help of one's own sense organs, and the profound one, which can be reached by applying investigation methodologies that make it possible to overcome the sensory limit. (Flowchart's elaboration by authors).

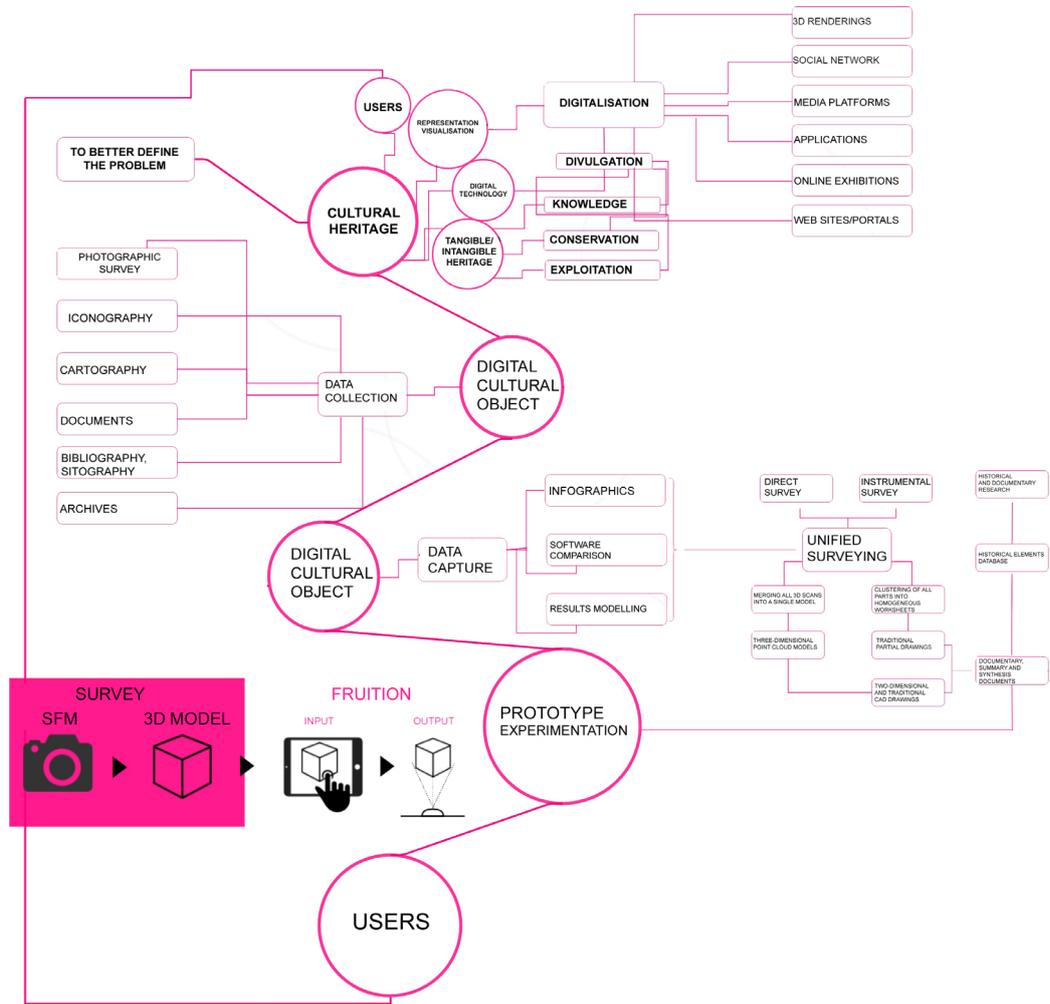


Fig. 03. Global flowchart of the search path describing the steps to obtain unified survey for the use of a cultural heritage by users.



Fig. 04. Villa Ottolenghi in Acqui Terme. Photos by authors.

The research stems from the conviction of the ever-increasing need to use digital content to realize alternative and inclusive forms of fruition of the places and learning dynamics of the target audience, also and above all through the juxtaposition of real and virtual elements, in the logic of the contemporary museum (real place) understood as a place of representation par excellence, whether static or dynamic, through holographic projections (fig.3). The objective of this research is to experiment and coherently adapt computer applications capable of visualizing in a mixed environment, three-dimensional images and information data relating to artistic and architectural cultural heritage, both existing and not, with direct application to the case study of Villa Ottolenghi in Acqui Terme. (fig.4). The virtual contents and the technological apparatus that supports them are intended to be an expression of the digital museum, which arouses suggestions and emotions as a vehicle of information and places interaction as the pivotal point of fruition.

Holographic applications: the operative steps

Holographic projections - free floating images - make it possible to alter perception by bringing the 3D model out of the monitor, transferring it onto surfaces in open spaces, even up to the three-dimensional representation of objects at scales close to reality, in empty spaces, replacing the traditional analogue model thanks to the innovative exploratory methods of the case, allowing the user to manage the recomposed image in empty space, as one could do

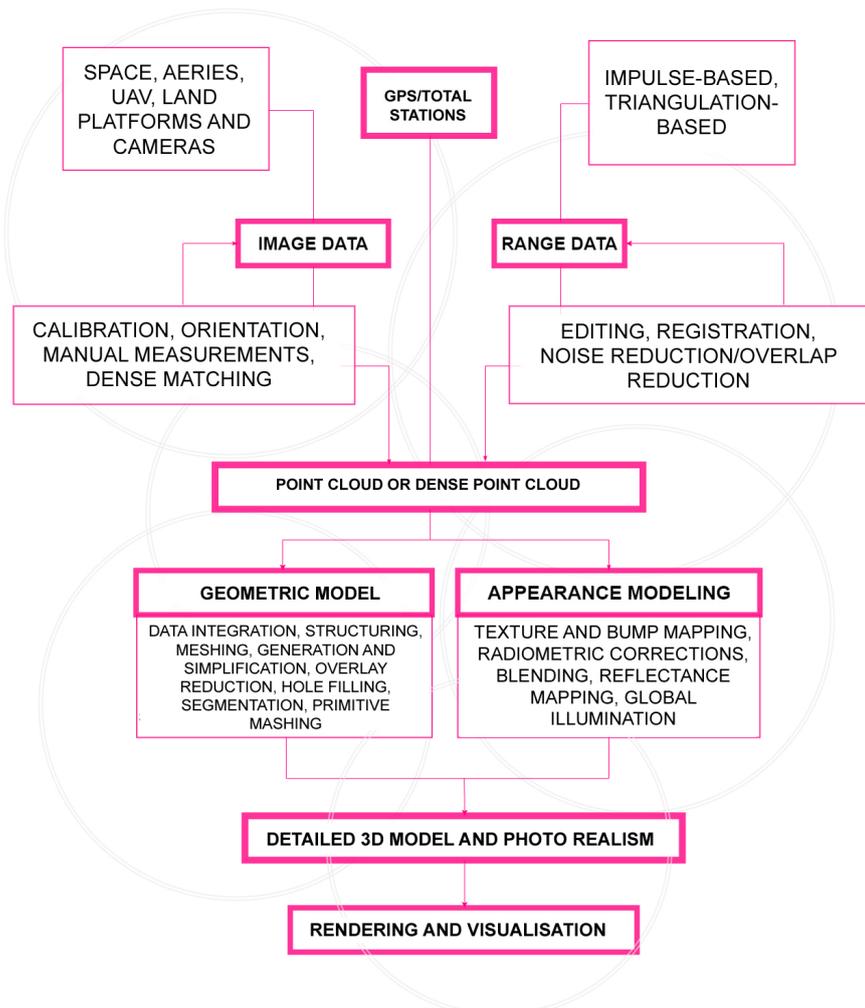


Fig. 05. The pipeline of multi-sensor, multi-resolution 3D modelling based on the integration of different techniques for the generation of point clouds and textured 3D models. (Flowchart's elaboration by authors).

with a classic plastic representation, managing visual perspectives autonomously. This is why the research aims to use this technology by focusing on the optimal size of the holographic image, the possibility of close interaction and the optimization of the three-dimensionality of the object to be communicated. The use of this type of digital narration enables the virtual reconstruction of lost works and allows them to be returned to their original locations. Narrative by means of holographic projections is, therefore, suitable for the application of the following case study, as the possibility of user interaction and fruition is innovative, achieving the narration of lost environments.

The drawing of the 3D floating representation of the Villa's furnishings stems from the close collaboration with the Holusion [1] research group, which designs and develops innovative visualization solutions based on digital holography technology, an illusion commonly known as Pepper's Ghost. In contrast to the photogrammetric process, in this case, the challenge of three-dimensional representation is to create a 3D model from a single image, with modest dimensional information. The theme of representation is conceived as that whole series of elements that collaborate to give value to the representation, also to the extent that the reproduction manages to interact in a positive and innovative manner with the user. One begins to orient the representation and the way of drawing and communicating with respect to the user's interest and degree of understanding and appreciation. Contents and issues related to digital representation relate transversally to history, computer science and communication theories. The research project made use of a transdisciplinary perspective that is able to find convergent solutions to problems related to contemporary museology, which generate complex cognitive dynamics based on the spatial exploration of data and the systemic understanding of processes and relationships (fig.5). The search for possible solutions and the systematic application of current surveying, data cataloguing and digital restitution tools made it possible to compare parametric/assisted three-dimensional modelling software with computational/generative design software along a real application path. The dual nature of the Villa Ottolenghi complex, which combines architectural and plant elements, requires a hybrid approach to the virtualization process and a methodological structuring capable of handling the problems that may arise (figg.6,7). The aim is to analyze both the implementation paths and the results obtained through the critical use of digital tools, comparing the outcomes and resources required. The research tested the potential of individual digital tools through an evaluative process of reverse modelling applied to emblematic case studies in the field of both architecture and design. Through a survey of what can be considered the fundamental operations of IT survey, different categories were distinguished:

- Software for territorial mapping and modelling; they allow the definition of spatial information referring to objects that make up a territory or landscape and their reciprocal relationships. This category includes those programs useful for the realization of three-dimensional works aimed at the digital reproduction of the territory.
- Software for photogrammetry; the use of instrumentation such as laser scanners and photogrammetry allow data to be collected in increasingly expeditious timescales, both at a spatial scale and represented in 3D through point clouds or polygonal meshes.
- Software for organic modelling and software for virtual animation and 3D floating image visualization allow information to be visualized and shared in multiple contexts (RV, AR, MR), adapted to the process of heritage valorization, dissemination and enjoyment, and are emerging as new tools for the dissemination and valorization of cultural heritage.

Next, we present the process of processing and sharing 3D entities related to the case study developed from the integrated survey with the use of terrestrial laser scanners and Structure from motion to then better define the visualization solution for all those 'physical' artefacts that no longer exist, except for the only information that has reached us which consists of the Finarte auction house catalogue. In the field of holographic representation and visualization, and on the basis of experimentation and related research, the following comparative scheme was drawn up, establishing Blender software as the choice for 3D modelling, which allows the creation of models with a low number of vertices, edges and faces, to which two-dimensional textures can be assigned by means of UV mapping, Unwrapping. Through the systematization of the data relating to these paths, an applicative reference scheme could be defined that would

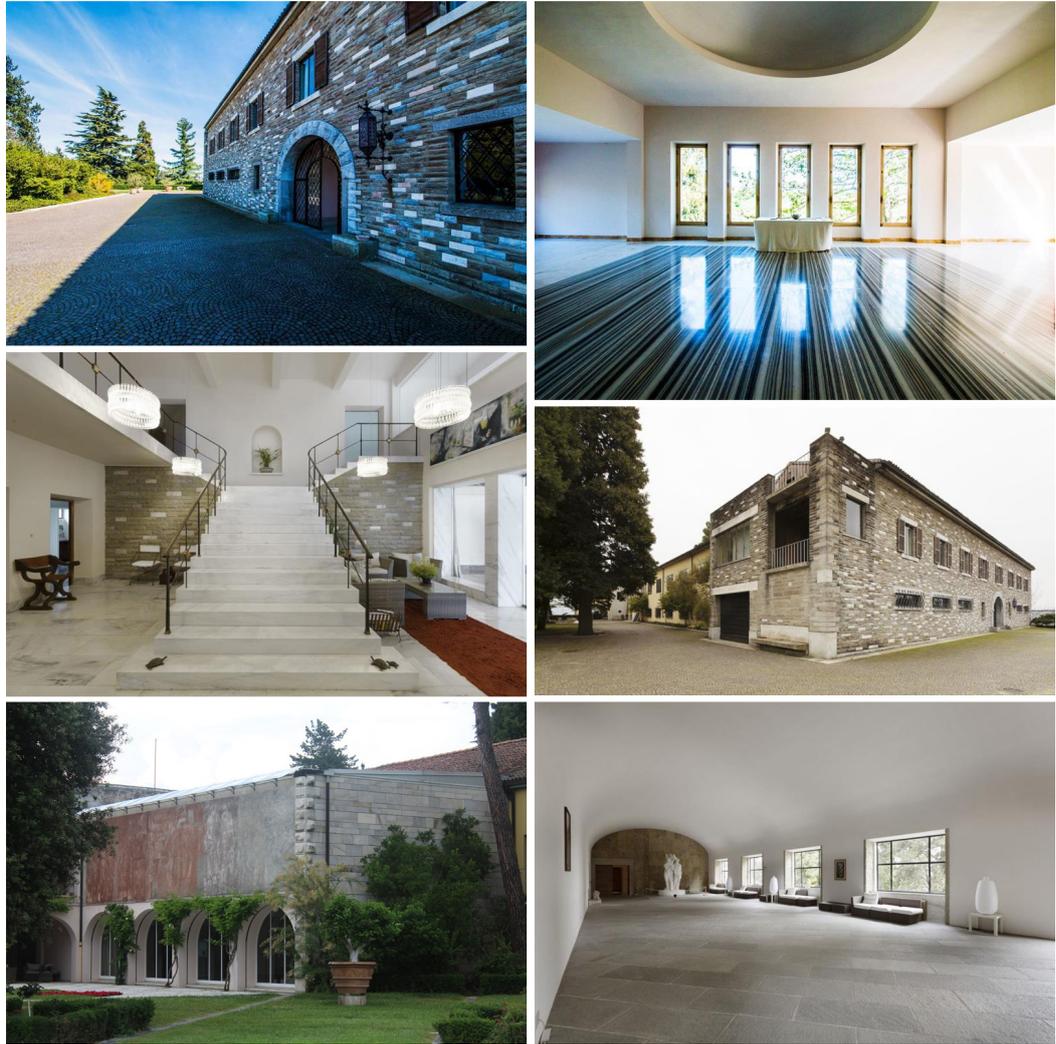


Fig. 06. External and internal different views of Villa Ottolenghi complex. Photos by authors.

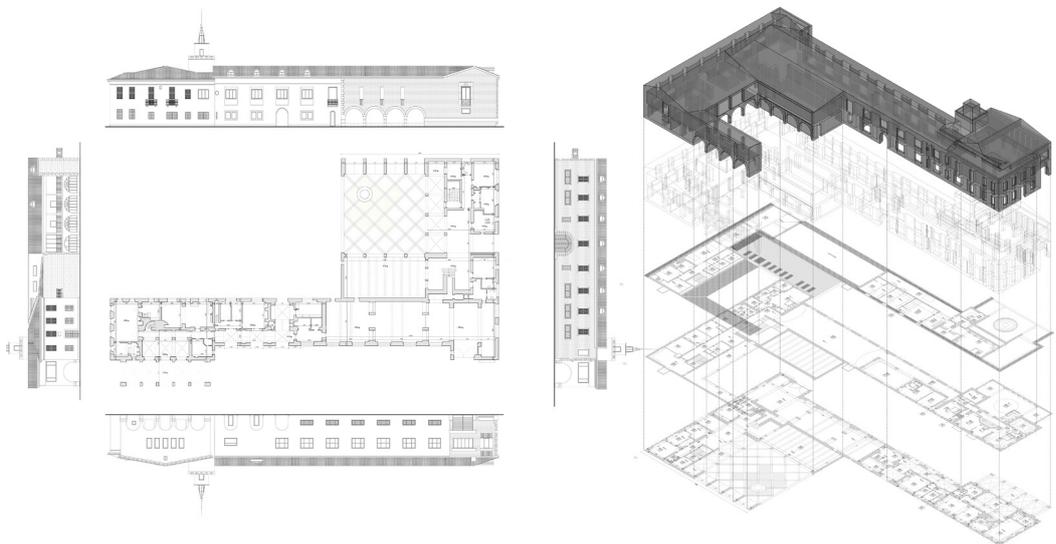


Fig. 07. Graphical restitution through european projections and axonometric explosion of the architectural survey of Villa Ottolenghi. Drawing by Eriche S

provide indications on the most appropriate areas of use in the field of communication (visual/informative/graphic), against a careful analysis of the state of the art of national and international digital culture and the comparison of integrated metric-geometric survey systems with the experience of infographic modelling of metric data acquired for the analysis of the historical-architectural heritage in integrated procedures for conservation, protection and valorization through multi-projection techniques.

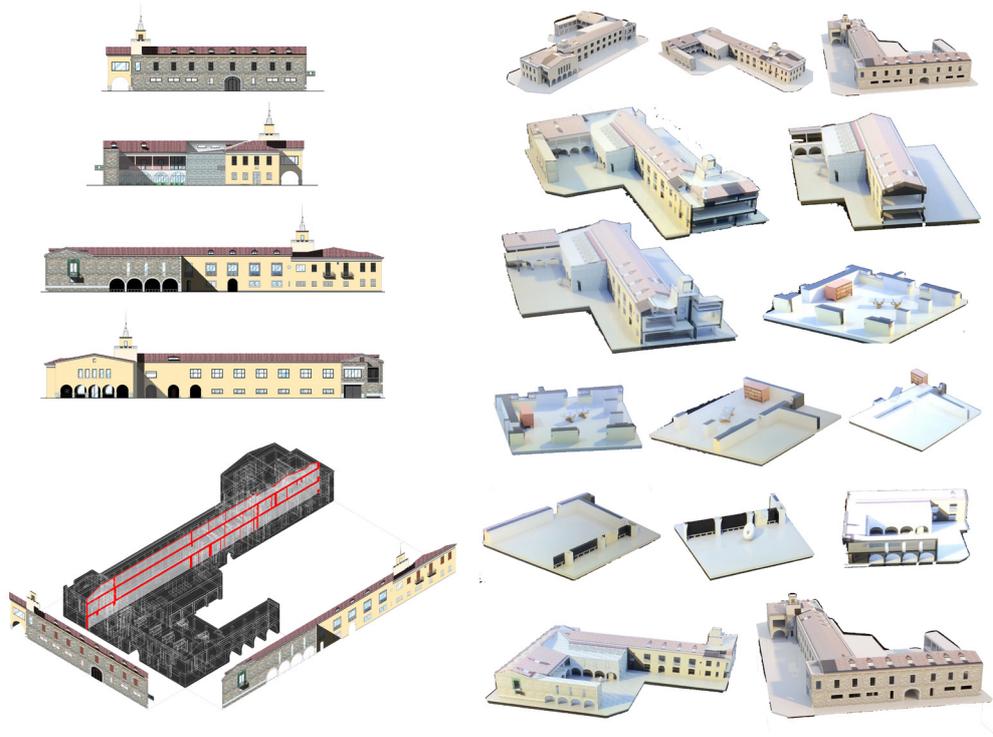


Fig. 08. On the left: Metric-geometric restitution of the architectural survey of the main elevations of Villa Ottolenghi. On the right: 3d processing of models virtual animation for holographic visualization of Villa Ottolenghi complex. Drawings and holograms by Eliche S.



Fig. 09. Redrawing on a photographic basis of La Salamandra, vase with lid in polychrome majolica, decorated with marine motifs. Height 52 cm. On the left: Finarte auction house catalogue image and blender 3d model; on the right: prototype holographic texturized visualization. Drawings and holograms by Eliche S.

3D floating projection makes it possible to replace the original artefact by simulating its three-dimensionality in space and guaranteeing a complete 360° view. To achieve a good level of detail representation and thus of user perception of the object represented, it is necessary that the projection system is optimized in terms of materials and form. (figs. 08, 09)

Conclusions

Delving into topics belonging to the disciplines of drawing, in the broadest sense of its meaning, closely linked to the inescapable component of advanced cultural communication in the field of cultural heritage in a museum environment, this research aims to demonstrate, specifically, how digital technologies for three-dimensional visualization can be used as a method of knowledge and dissemination aimed at preserving knowledge in a museum environment:

- The virtual museum proposes a series of inclusive/interactive 'settings', contemporary in the literal sense of the term (not just works and/or architecture reproduced on a screen, but subjects that speak, talk to each other and interact with the visitor).

- The works are chosen on the basis of thematic criteria and/or relating to the identity of the specific museum.

This path led to the outlining of the virtualization project of Villa Ottolenghi, with the aim of creating a virtual model, including the design furniture and artistic works, now lost, in order to recreate the reality of the Villa as an incubator of cultural events of the highest level. The combination and systemization of the results obtained from this research, as shown in fig. , effectively responded to the initial hypothesis where the dissemination and learning of culture propose to rethink the communication strategies of a cognitive method aimed at enhancing the cultural heritage according to a new user-oriented fruition. The desired result at the end of the journey is a profound interactive understanding of the work by all visitors, and the possibility of global sharing on platforms. [2]

Notes

[1] Holograms are used to highlight products, images and objects by materializing them before the eyes of the public. Installed since 2014 in a cluster of digital creativity excellence, Plaine Images, Holusion produces a line of interactive holographic devices Made In France.

[2] While sharing the positions expressed in the article, the result of theoretical approaches and common elaborations, the paragraphs "Introduction" and "Methodology" are attributed to Giulia Pellegrini, the paragraph "Holographic applications: the operative steps" to Sara Eliche, "Conclusion" to Giulia Pellegrini and Sara Eliche.

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