The Role of Scientific Reconstruction in Virtual Archaeology.
Education, Communication and Valorization.
The "Pompei – Insula del Centenario (IX 8) Project"

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Abstract. The experimentation of Cultural Virtual Reality led by the "Pompei – Insula del Centenario (IX 8) Project" consists in representing the main area of the Casa del Centenario in Pompeii as it probably was just before its destruction in 79 A.D. The result is an hypothetically restored model, recreating the aspect of the domus with use of scientifically reliable and philological criteria. This methodology is based on the careful analysis of every available source, from the descriptions and sketches of the archaeologists visiting the house after the excavations, conducted in 1879–1882, to the most advanced acquisition data techniques.

This task involved the collaboration of experts in various disciplines, and led to significant developments in education, communication and valorization of archaeological heritage. It also promoted the skills of younger participants, chiefly in areas of specific interest (such as image processing and communications technologies) enhancing their professional growth, and implementing innovative methods for the virtual restoration of paintings.

1. The Virtual Reconstruction of the Casa del Centenario: General Outline

This paper presents the improvements derived from the experience of Virtual Archaeology developed among the wider scientific activity of "Pompei – Insula del Centenario (IX 8) Project" (Coralini and Scagliarini 2004), a research project led by the Dipartimento di Archeologia, Università di Bologna (Scientific Direction: Prof. Daniela Scagliarini Corlàita), in collaboration with other Italian Universities and with the Soprintendenza Archeologica of Pompeii.

The main aims of the Project are the documentation, the study, the restoration and the valorization of a large Pompeian domus, the "Casa del Centenario", discovered in 1879, for the 18th centennial of the eruption of Vesuvius. As in many similar cases in Pompeii, at the moment of its discovery, the house was in a good state of conservation (Fig. 1), but the uncovered structures suffered rapid degradation (Scagliarini, Coralini and Vecchietti 2003).

This experimentation of Cultural Virtual Reality, showing the main visual axis of the domus hypothetically restored, has two main features:

1 it was planned to be a "total" experience, from the data acquisition for 3D modelling, to the fruition system by means of a wide range of media, from the Virtual Theatre of CINECA, Bologna, and the Virtual Set of RAI – Radiotelevisione Italiana, Milan, to the mobile device for on-site fruition of Cultural Heritage WHYRE® (Scagliarini Corlàita, Coralini, Guidazzoli, Salmon Cinotti, Raffa, Roffia, Taboni, Malavasi, Sforza and Vecchietti 2003);
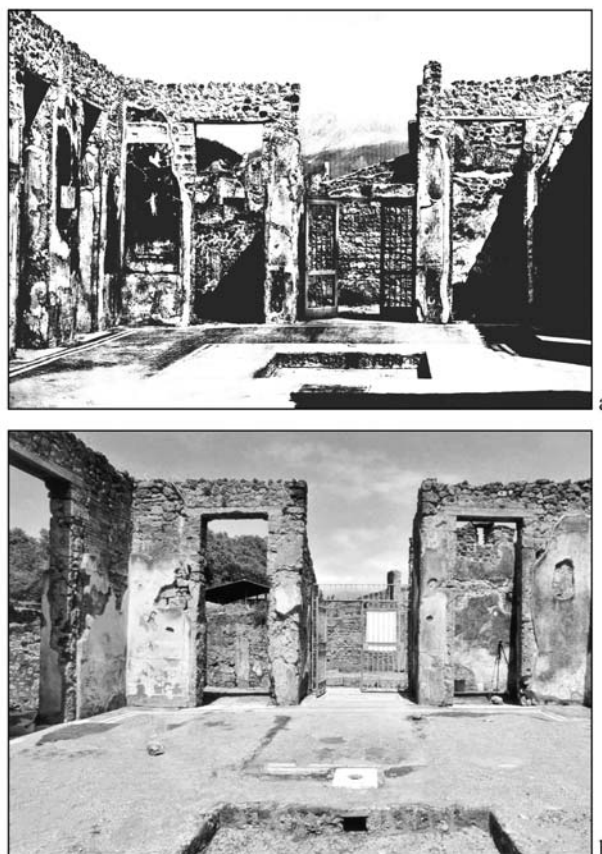

Fig. 1. Pompeii, Casa del Centenario (IX 8, 3.6.a), main atrium. The process of degradation caused by exposure to atmospheric agents after the discovery is clear when we compare an archive photo taken a few years after the excavation (a, PPM IX: 909, Fig 7. Deutsches Archäologisches Institut, Rom), and the state of conservation of the domus in 1999 (b, Dipartimento di Archeologia, Bologna).

2 as to the modus operandi, the 3D reconstruction was performed with very careful attention paid to a methodology inspired by philological research (Frischer forthcoming): the elements for which no documentation has remained are shown with conventional visualization criteria, while all the available documentation is gathered in an apparatus criticus, a survey of all the sources to enable complete knowledge of the architectural structure and decoration of the domus as it probably was just before its destruction (Coralini and Vecchietti forthcoming).

In particular, the goal of a philologically correct and scientifically authenticated reconstruction has been pursued by use of five main issues (Coralini and Scagliarini 2004: 121–127):

- through multidisciplinary collaboration between experts in various disciplines, from archaeology to chemistry, from structural engineering to information technology (computer graphics, multimedia communications);
- by implementation of the most advanced and careful techniques of in situ data acquisition (such as photogrammetry, topographical surveys and chemical analyses of pigments and types of mortar);
- promoting large scale research on documentary sources in the archives (textual descriptions of the first archaeologists excavating the domus, outline drawings and watercolours performed by architects and artists visiting the excavations during the last two centuries, old photographs documenting the state of conservation of walls, mosaics and frescoes from the discovery up to the present);
- the search for architectural and decorative parallels in Roman houses and wall paintings, mostly from the Vesuvian region;
- the development of a clear and convincing graphic standard to show types of hypothetical integration (Scagliarini forthcoming).

2. Beyond Virtual Reconstruction: Education and Growth of Professional Competence

The virtual reconstruction of the Casa del Centenario is a project born and developed in a university environment. All the phases of its realization were performed mainly by students in laboratories of the University of Bologna, exploiting all available traditional and technological structures. In particular, from the technological point of view, an effort was made to test as much software and devices as possible, taking care to choose the most popular and widespread methodologies of data acquisition and processing. This operative procedure provided the best conditions for an educational and training environment, promoting professional growth of younger participants, mostly in subjects of particular interest (such as CAD design, digital image processing, digital and traditional photographic techniques, communications technologies) for their personal and professional skills, for instance:

- Vidause of a scanner and digital camera for raster image acquisition and photogrammetry;
- RolleiMetric MSR® to obtain ortophotogrammetric images;

- Autodesk AutoCAD® for vectorial digitization of raster drawings,
- Adobe Illustrator® for rasterization of vectorial drawings;
- Adobe PhotoShop® for digital painting of textures;
- Adobe Premiere® and Macromedia Director® for editing interactive and multimedia animations.

This educational inclination, fundamental in a University institution, for which the improvement of the professional skills of students and young researchers is a primary need, completes the training started, within the Project, during the excavations in Pompeii, where participants learn, in a profitable and interdisciplinary dialogue, basic abilities of archaeological survey. In a wider context, they acquire professional "know-how" (which is often lacking in a University context).

3. Beyond Virtual Reconstruction: from 3D Experimentation to Scientific Research

It is important to note that, unlike a textual description, a 3D virtual reconstruction, with every object communicating through a visual code, appears to be a close and complete system, hiding its possible contradictions, or making them almost barely perceptible (Antinucci 2004: 17, 129).

For this reason, the main task achieved during the realization of the 3D virtual reconstruction of Casa del Centenario was its scientific value, and, consequently, the experimentation of graphic criteria able to communicate to the viewer the degree of reliability of all aspects of the virtual reconstruction. The effort aims at providing the most convincing "balance" that combines philological and communicative requirements, showing the lacunae (partial or total loss of pictorial surface or mosaic tesserae) and the arbitrary integrations clearly. That, in short, was to enable visitors to perceive the original stylistic and aesthetic features of the spatial and decorative distribution of the domus, and thus to guarantee understanding and appreciation of the content and form of the artistic artefact.

In order to find a convincing solution to the problem of graphic restitution of ancient decorative surfaces, many publications on ancient wall paintings were consulted. Nationally and internationally, the main experiences were those developed in the Centre of Studies on Roman Ancient Wall Painting (CEMPR) of Soissons, Paris (Fig. 2), and in "Hauser in Pompeji" Project (1977–1995), led by the German Archaeological Institute of Berlin, and afterwards by the University of Freiburg (Fig. 3). In the graphic restitution of the painted surface, hypothetical integrations are presented in outline drawing (Fig. 2), or displayed with the entire polychromy in greyscale (Fig. 3): both solutions are scientifically correct, and both can be implemented in order to satisfy the need of a realistic perception of ancient decorations.

On the other hand, among much experimentation on 3D virtual reconstructions examined during the realization of the Casa del Centenario 3D virtual model, only one dealt with the issue of visualization standards (Frischer forthcoming; Scagliarini Corlàita forthcoming) able to inform the user of what he is seeing: the 3D real-time virtual reconstruction of the so-called "Studiolo" in Augustus's private residence on the Palatine Hill, developed by Arch. Philip Stinson
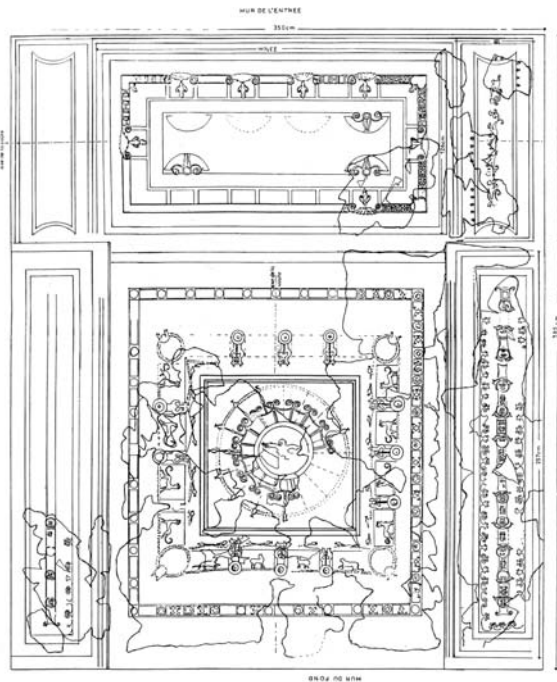
Fig. 2. Herculaneum, Casa del Salone Nero, cubiculum c. Graphic restitution in outline drawing of the painted decoration of the vault (Barbet 1985: 171, Fig 122).
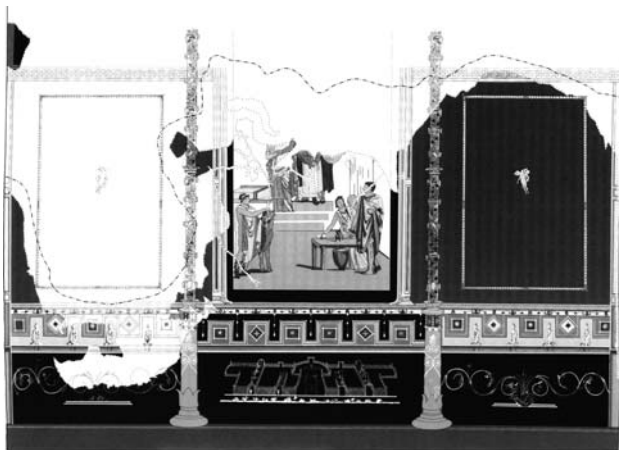

Fig. 4. Rome, "Studiolo" of Augustus's private residence on the Palatine Hill. Partial restitution of wall paintings at different levels of integration (detail: Stinson forthcoming).

Fig. 3. Pompeii, Casa degli Amorini dorati (VI 16, 7.38), exedra G. Graphic restitution of wall paintings with hypothetical integration shown in outline drawing and polychromy in greyscale (Seiler 1992: Fig 171).

convincing due to its closeness to the original tactile and chromatic characteristics of the painted surface. However, it is rather unsuitable for the case-study presented in this paper, the Casa del Centenario in Pompeii, the structure and decorations of which are in an incomparably worse state of conservation (Fig. 1). To overcome this problem, a graphic standard was studied and tested: the elements of which integration can be considered certain, such as confirmed by all sources, are shown in coloured layout. When no documentation (or only a part of it) has remained of its structure and decorations, they are conventionally shown in greyscale. This methodology can be considered a graphic standard of hypothetical restitution of frescoes and mosaics which gives the observer a clear and suggestive impression, responding to both scientific and didactic needs without misleading arbitrary integration (Fig. 5). This process leads to two important developments:

(CulturalVRLab, U.C.L.A., Los Angeles, U.S.A) with the Scientific Committee of Prof. Daniela Scagliarini Corlàita and Prof. Bernard Frischer (UCLA), and in collaboration with the Soprintendenza Archeologica di Roma (Stinson forthcoming). The main innovation presented in the 3D reconstruction of the "Studiolo" of Augustus is the attempt, successfully fulfilled, of partial restitution of the wall paintings, at different levels of integration, through textures based on digital photographs (Fig. 4). The methodology experimented in this virtual reconstruction fit perfectly the case of the "Studiolo", a small room entirely painted with an exceptionally refined fresco decoration. The excellent level of photo-realism was achieved thanks to the good state of conservation of the painted surfaces, recently restored by the Soprintendenza Archeologica di Roma. The methodology tested by Phil Stinson appears quite
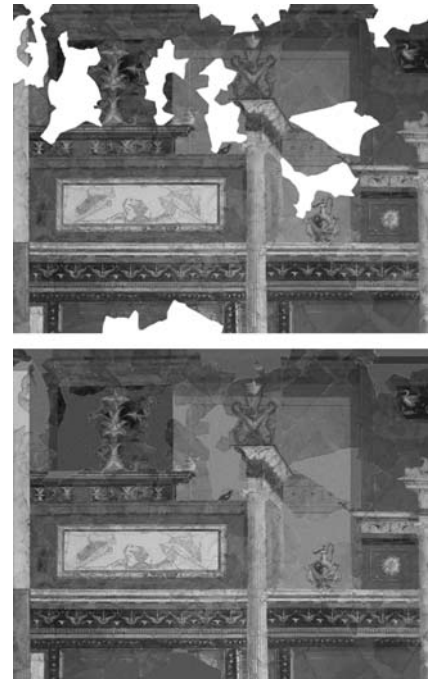

Fig. 5. Pompeii, Casa del Centenario (IX 8, 3.6.a). Main atrium. Virtual model showing the hypothetical reconstruction of the decorative apparatus. The integrations for which documentation is limited or lacking are shown in greyscale.

- firstly, the implementation of technical standards involves the professional training of experts in graphical restitution and digital representation of ancient decorative surfaces, thus carrying on the educational inclination of "Pompeii – Insula del Centenario" Project;
- secondly, the texturing process of the virtual 3D model of the Casa del Centenario aims at becoming a pilot-scheme both in virtual restoration, and in scientific edition of the decorative apparatus. In particular, the recently explored field of virtual restoration of decorative surfaces, especially wall paintings, still lacks methodological issues (Ferrarini and Saltari 2002): the experimentation of virtual restitution of frescoes and mosaics of the domus aims at being, even though outdated from the technological point of view, a guideline for future studies in the traditional fields of archaeological activity, fulfilling what Prof. Franco Niccolucci wrote in 2002: "virtual archaeology is more than a simple "application" and aims at being a part of the methodology of archaeological research" (Niccolucci 2002: 6).

Acknowledgements

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