



KNOWLEDGE, ANALYSIS  
AND INNOVATIVE METHODS  
FOR THE STUDY AND THE DISSEMINATION  
OF ANCIENT URBAN AREAS



Proceedings of the KAINUA 2017  
International Conference in Honour  
of Professor Giuseppe Sassatelli's 70<sup>th</sup> Birthday  
(Bologna, 18-21 April 2017)

edited by  
Simone Garagnani, Andrea Gucci

ARCHEOLOGIA E CALCOLATORI

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*All'Insegna del Giglio*

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### 3D TECHNOLOGIES FOR A CRITICAL READING AND PHILOLOGICAL PRESENTATION OF ANCIENT CONTEXTS

#### 1. THE TOMB OF *KHA*, THE CHAPEL OF *MAYA* AND THE TOMB OF QUEEN *NEFERTARI*

The exhibition hall dedicated to the architect *Kha* and his wife *Merit* in the Egyptian Museum in Turin accommodates all the findings of an inviolated tomb discovered in 1919 by the well-known archaeologist E. Schiaparelli. The exhibition offers an exciting visit experience, but it is strongly affected by the complete de-contextualization of the funerary equipment. A movie aims to fill this gap, retracing the various phases of the discovery and offering a complete overview of the entire site, starting from what Schiaparelli considered the first clue about the presence of a tomb, namely the chapel dedicated to *Kha* (SCHIAPARELLI 1927). Starting from it he reached, after a long passage, the famous funerary room. To emphasize the moment of the discovery, the scene that was represented with photos taken when the last door was opened, has been animated. In particular, the photographic plans have been broken down and animated with camera mapping techniques to provide the sensation of entering and living the environment really unveiled (Fig. 1). Moreover, techniques of close range photogrammetry have allowed the 3D survey of findings to create digital copies faithful in shape and color to offer an immediate cognitive combination between what is really shown in the museum and the share of them that is present in the movie, in which the findings, also visible from other points of view, appear in their true essence and use (GABELLONE, FERRARI, GIURI 2015; GABELLONE *et al.* 2016a).

In 1905 Schiaparelli discovered also the funerary chapel of *Maya* in the necropolis of Deir el-Medina, a famous painter during the XVIII<sup>th</sup> dynasty. All tempera paintings that decorated the environment were detached and transferred to Italy to be reassembled in the Turin Museum where they are actually visible. However, the small size of the chapel (185×145×225 cm) together with the fact that it is not accessible, allow the observation of the paintings only from a single point of view. In the movie realized thanks to the use of computer graphics and relief Image-Based techniques, we give the chance to explore the chapel inside, to open and section it, offering a privileged observation of the paintings (GABELLONE *et al.* 2014). The proposed video integrates the actual visit with a virtual path from the necropolis of Deir el-Medina, leading visitors to discover the funerary chapel, in its typological organization and knowledge of funerary rituals illustrated in the wall decorations. Starting from comparative studies carried out on other chapels



Fig. 1 – Tomb of *Kha*, 3D reconstruction of the burial chamber.



Fig. 2 – The tomb of *Nefertari* modelled using the 3D reconstruction of E. Schiaparelli wooden model.

of the same necropolis, it was possible to integrate the gaps with outlines able to offer an exhaustive vision. The overall view describes the contents of the registers after the order of reading and allows to observe the ritual procession horizontally, in accordance with its natural development. Increased zoom over the figures allows to appreciate the features and stylistic details, with the addition of reconstructive drawings that complete, as far as possible, the description of the ritual.

One of the exhibition halls of the Egyptian Museum is dedicated to Queen *Nefertari*. Here there is the wooden model of her tomb built by Ernesto Schiaparelli (1905). This is a perfect reproduction of the original model (scale 1:10). It was built to give the opportunity to understand the architectural development of the tomb and the magnificence of the wall paintings, replicated

with special care. The documentary movie produced by IBAM ITLab aims at replicating the communicative message desired by Schiaparelli, offering a virtual tour, according to new perspectives, enriched by short and concise captions to facilitate the reading of the paintings and illustrating the *post mortem* journey which led the Queen *Nefertari* to her deification, also better known as “solarization”. The virtual tour begins and ends with the digital model of the tomb (GABELLONE *et al.* 2016b). Techniques of close range photogrammetry have allowed the 3D survey starting from the acquisition of different high-resolution photographic data set with a full frame camera (Fig. 2). All photos have been processed with Agisoft PhotoScan in order to obtain a digital model with texture; the accuracy was verified with the data coming from the direct survey. Special attention was paid to the photographic restitution of the paintings respecting the original colors and size, creating orthorectified images on the detected metric data before mapping on the 3D model. Image-based technologies have also been used to reproduce the remaining part of the sarcophagus, whose pink granite coverage, although fragmentary, is still exposed in the Egyptian Museum: it was the fulcrum around which the funerary complex dedicated to the greatest queen of Egypt was arranged.

## 2. THE HOUSE OF *OCTAVIUS QUARTIO* AND THE HOUSE OF THE GOLDEN BRACELET IN POMPEII

On the occasion of the exhibition *Visions of Egypt* two movie documentaries were produced about the House of *Octavius Quartio* and the House of the Golden Bracelet, two important *domus* characterized by the presence of paintings and sculptures inspired by the Egyptian culture. In both cases,



Fig. 3 – The House of the Golden Bracelet, 3D reconstruction of the garden.

starting from the representation of the *status quo*, the work aimed to relive the lost atmosphere of beautiful and leafy places, focusing the attention both on the presence of typical iconographic insertions of Egyptian art (which fascinated very much the Romans), and the suggestive continuity between the painted vegetation and the real one present in the garden in front of the *domus*. In fact, thanks to the reliefs and paleobotanic analyses, it was possible to reconstruct the development of the areas as well as the type of tree species present. IB/SfM techniques allowed the 3D survey of all the sculptures found and currently stored in warehouses of the Parco Archeologico di Pompei. For some of them techniques of digital sculpting have been used in order to obtain the virtual restoration of the original shape. Moreover, the House of the Golden Bracelet (Fig. 3) presents a garden with a large *triclinium*, a *nymphaeum* and a big semicircular fountain with a pergola. Unfortunately, nowadays it is not possible any longer to see some of the decorations of the Augustan period as well as the mosaic decoration of the cave that was detached in the 1970s. Therefore, the reconstruction offers a new vision of the space with all the equipment replaced and virtually restored (GABELLONE *et al.* 2015). In particular, hand-made modeling techniques have been used to reproduce all the objects visible in old photos and supported by historical descriptions.

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## ABSTRACT

This paper demonstrates how low cost 3D visualization techniques can be easily used for the transmission of historical and cultural content in museum communication strategy. Specifically, we used computer 3D animation graphics to present information about Queen *Nefertari*, the *Maya* chapel and the tomb of *Kha* in the specific exhibition in the Egyptian Museum of Turin. Movie documentaries support the thematic itineraries of the rooms and offer a virtual trip to the places where the goods displayed were found. The same approach was used for the virtual reconstruction of two Pompeian contexts: the House of the Golden Bracelet and the House of *Octavius Quartio*. Our research allowed us to create an accurate representation of gardens, statues, architectural spaces, and pools with fountains and frescoed rooms, all virtually reproduced in their original context, using communication methods that combine technology with a synthetic and emotional approach. Techniques of close range photogrammetry made it possible to conduct a 3D survey of sixteen statues and other architectural elements; lost artefacts were reconstructed and areas destroyed by the eruption of 79 AD were evoked. The eruption was partially represented, with fluid dynamic simulations and computer graphics effects in order to transmit accurate scientific information in a simple and immediate language developed by lengthy technical experiments. The synthesis imposed by the short duration of the movie required matching all this information with a self-explanatory approach, which allows the visitor to understand the characteristics of the archaeological goods displayed in the exhibition in a general view that repeats colours, sounds and suggestions of the environments destroyed two thousand years ago.

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