

Review on new technologies in Art and Archaeology: The Vesuvian cities

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Abstract. The importance of Vesuvian archaeological sites goes back to the moment of their discovery in the eighteenth century, which since then has promoted a new perception of the antiquity that led to a systematic and scientific study of the cities. The continuity of the excavation work, as well as the interest which they have raised for more than three centuries, makes it possible to trace the evolution of the different initiatives through which technology has been exhibited to the service of archaeology. With the advent of digital technology, new means of study, diffusion, tutelage and accessibility are emerging which will certainly adopt this unique heritage as a subject of study. This paper analyses the different initiatives that have advocated the application of technologies that aspire to improve the visitor experience and to generate a greater understanding of the archaeological sites and their global relevance. It therefore highlights the activities carried out in the last decade, both in situ involving the MAV (Museo Archeologico virtuale, Ercolano, 2008), The *Grande Progetto Pompei* (from 2011), as well as those carried out at the international level, such as the exhibition *Carlos III y la Difusión de la Antigüedad* (Naples, Madrid, Mexico, 2016-2017). The limitless possibilities that technology and interdisciplinary collaboration offer to Heritage, as well as a critical, estimable analysis for future proposals, will also be highlighted.

1. Technology at the service of Archaeology: a historical overview

The importance of the Vesuvian archaeological sites goes back to the moment of their discovery which, from the eighteenth century, promoted a new perception of the antiquity that led to the systematic and scientific study of the cities. The continuity of the excavation work, as well as the interest aroused by these for more than three centuries, makes possible to trace the evolution of the different initiatives in which the technology has manifested itself in the service of archaeology.

The multidisciplinary, which might seem like a current demand, has always existed in an area as complex as archaeology. The discovery of the Vesuvian sites presented an unprecedented challenge: on one hand, the typology and nature of the terrain and, on the other, the unique circumstances that buried the cities. A process of excavation so difficult that continuous problems were emerging called for the collaboration of engineers, architects and restorers.

The toughness of the terrain, the excavation through tunnels under the city of Resina, and the vast number of finds preserved perfectly in their original context; both of great artistic value as well as those of daily life, assumed a revolution in the concept of archaeological heritage. Until that time it



was linked solely to art and collecting (which will never end to be eradicated). A material culture never before seen aroused the need to seek solutions never required until that time. This led to the development of new restoration techniques, the creation of laboratories and specific museums and new instruments such as the famous "Macchina di Piaggio", designed specifically to unwind the papyrus found in the Villa of the Papyri.

The systematic excavations included an archaeological record, the elaboration of a catalogue and an increasingly exhaustive control of all the activity related to the ancient cities; from the excavation, to the safeguarding of the different finds and their dissemination. The first reconstructions destined for these purposes, through the elaboration of plans, reconstructions and drawings by hand of great architects like Weber or La Vega, began to be carried out.

The exceptional nature of the discoveries soon acquired a didactic purpose, beginning in the first instance in a restricted and elitist character in Bourbon period and of a more democratic character in the time of Fiorelli. Publications, models and copies were made to enhance the study of sculptures and other findings. With the existing technology, plaster copies of the sculptures were sent to the academies of Madrid and Mexico in the eighteenth century which favored the development of the Enlightenment. Further models of the theatre of Herculaneum, made of wood and cork in 1808 by D. Padiglione, while models of Pompeii, were made by Fiorelli in the nineteenth century. This archaeologist also developed specific techniques that greatly increased the acquisition of archaeological information, such as the plaster casts of the victims of Pompeii and the establishment of the first initiative of an *in-situ* museum. Technology also collaborated during times when archaeology became a fundamental element of the foundations of new nationalism and cities were boosted as tourist attractions. In the nineteen thirties, not only were tunnels left behind to excavate Herculaneum, giving way to the assistance of mechanical excavators and electric arms, in addition, all kinds of technologies came into play in the promotion of the incipient mass tourism and the fruition of the cities. This included transport-related infrastructures as well as graphical and media documentation of the findings.

These past initiatives and technological advances which responded to the needs that the Vesuvian excavations required, are the precedents of what today's technology tries to contribute through 3d models, virtual reconstructions and *in-situ* immersive visits.

2. New needs, new technologies

Technologies have a fundamental role in the valorization of heritage. Previously, it has been presented that historically technology has been put to the service of archaeology as needs have arisen. In the same way, the technology today responds to the current needs of these sites, and the needs of our society in relation to culture and heritage. Some of these needs, despite the successive initiatives, have not changed. For example the conservation of the structures that remain *in situ* and the need to awaken an awareness of the importance of these cities to a society that is still far from assimilating the transcendence not only archaeologically, but also historically, linked to them. New needs arise however do arise which are typical of our time; such as the decontextualisation of objects and structures and the disastrous impact of human action as a result of mass tourism. Of course, the technological advances related to the diagnosis, conservation and restoration of heritage have acquired high levels of development increasingly specialized and that demonstrate a great advance in the time of safeguarding the remains of the antiquity, as shown by the Grande Progetto Pompei (from 2012) or the Herculaneum Conservation Project (since 2001), in collaboration with the Packard Humanities Institute.

With regard to the need to cultivate a society on the value of the Vesuvian cities from a didactic purpose, we see continuity through all the background evidence that the history of these sites allows us to trace; through plans, reconstructions, drawings and publications. Digital technology has allowed real and imagined reconstructions of the sites, with exact precision, each time with a wider scope for

interactive possibilities, which allow individuals to immerse themselves in antiquity in a way that does not necessarily require them to visit the physical site.

Most European initiatives in relation to artistic and archaeological heritage seem to go in this direction. Exhibitions and museums use multimedia facilities to offer visitors an immersive experience that allows them to understand what they are observing in an interactive way. An illustrative example of this is the *Van Gogh Alive* itinerant exhibition, which tries to gather all the work of the artist in a single space and present it to different cities of the world for spectators to view the artists work simultaneously. Other examples of highly illustrative technologies offering an immersive explanation are the *Domus Romane di Palazzo Valentini* in Rome or *Chiesa de Santa Maria Antiqua* in Rome (via Videomapping). An increasing number of varied interactive devices integrated by the vast majority of museums, such as touch screens, holograms, motion sensors and apps for smartphones and tablets, make the content offered by 3D models, 3D printings, photogrammetry and virtual reconstructions available to the user.

3. The Vesuvian Cities in the era of digital technologies

Vesuvian cities have also called upon digital technology. As they are among the most emblematic of archaeological sites and the first to undergo systematic excavations, they offer a huge amount of information valuable for this type of purposes. Below the most representative cases that highlight the interaction of digital technology with this Vesuvian heritage will be presented as they have always been the object of interest for the application of cutting-edge technologies.

It is presented in the first place those centers related to the deposits in situ or in the vicinity that correspond to the first initiatives. Next, exhibitions and international projects that try to recompose the material and cultural dissemination that these sites have starred in through the new technologies are described. Finally, it is expounded the most recent proposals for valorization and fruition, which show the direction to which the new trends are directed.

3.1. The first 'virtual only' archaeological museum

While the Italian government declared the state of emergency after the deterioration of the ruins of Pompeii (visited by 2.5 million people a year) in Herculaneum, the first Virtual Archaeological Museum (MAV) of the world was inaugurated. After three years of work, in 2008 the public was offered the reconstructions of the cities of Pompeii, Herculaneum and Stabiae with technologies of last generation (laser, virtual reality, scanner, three-dimensional screens) without displaying any archaeological findings, with minimal scenery and the use of immersive, interactive and invisible technology. The project was designed by Gaetano Capasso, an electronics engineer and expert in virtual reality in the field of cultural heritage. The museum is the first example of an immersive structure: the experience is based on virtual reality and interactive electronic installations activated by tactile digital interfaces or motion sensors, similar examples of which can only be found in theme parks (Figure 2).

The MAV was also proposed as a didactic instrument to be used in parallel to a more traditional museum trying to overcome one of the limits posed by the latter with the difficulty in understanding by the general public. Virtual reality allows a re-creation of what has been lost, bringing the visitor closer to the world of archaeological culture by directly involving the visitor's senses, an application that may lead to new synergies between traditional museums and multimedia research.

Despite of the museum concept and technological innovation, the MAV presents the usual problems of this type of museums, like the fast obsolescence of the devices and others like certain incoherence in the narrative of the different topics from the different sites. In addition, with the exception of some devices such as the interactive table, the user traverses the different spaces being a mere spectator, since the reconstructions are being projected on screens (Figure 1).

However, the idea to use modern technologies was already born in 2006 to re-propose, in the noble plan of the palace, the original image of the Herculaneum Museum and the cultural climate in which it was formed. The history of the excavations, their techniques and the procedures followed in the Bourbon age for the detachment of the frescoes were illustrated by multimedia projections or films. The Roman frescoes, once collected in the palace, were reproduced with the technique of the backlit paintings (Figure 3). A virtual reconstruction returns the theatre of Herculaneum, the first of the archaeological discoveries in the area. In the last multimedia room of the present museum stands the "Lanterna Magica" (Magic Lantern), a machine of vision that transports the visitor to the time of King Charles and his court. Inside are the wonders of the findings coming from the Vesuvian excavations (Figure 4).

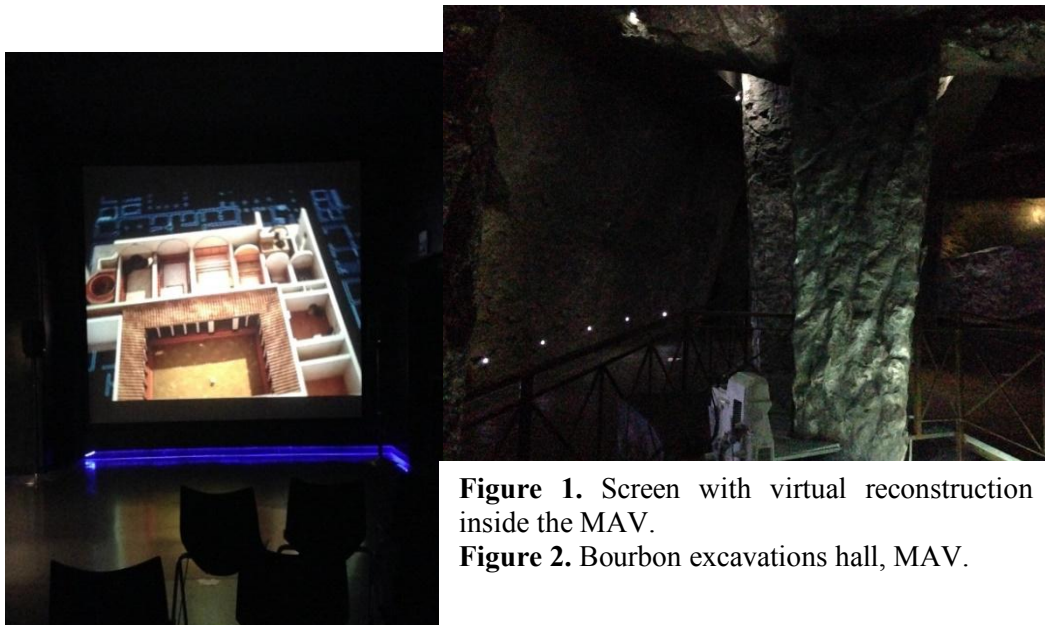


Figure 1. Screen with virtual reconstruction inside the MAV.

Figure 2. Bourbon excavations hall, MAV.



Figure 3. Collection of backlit paintings, Herculaneum Museum.

Figure 4. "Lanterna Magica", Herculaneum Museum.



3.2. *Breaking the geographical barriers*

One of the most striking aspects in the history of the excavations has been the uncontrollable dispersion of the findings, which was a constant concern on the part of the entities in charge of their tutelage. Some projects have demonstrated the capacity that new technologies have acquired in providing context to these scattered findings, as well as the connections that the displacement of these pieces have caused, creating cultural bridges between countries and continents.

An illustrative example is the reconstruction of the frescoes from Boscoreale "*The Villa of Publius Fannius Synistor in reality and Virtual reality*" (2010), made by the Metropolitan Museum of Art, New York. It attempted to relocate virtually all the frescoes that were extracted from their original site and place them in their context, providing an ornamental coherence (Figure 5 and 6). The most interesting thing is that it gathers frescoes that are found not only in the MET but also in different geographical points: from the Musée Royal de Mariemont, Morlanwelz, Belgium, from the Musée de Picardie, Amiens, from the Villa Kérylos, Beaulieu-sur-Mer, France, Musée du Louvre, Paris, Allard Pierson Museum, Amsterdam, Musée Bonnat, Bayonne, Musées Royaux d'Art et d'Histoire, Brussels and the Museo Archeologico Nazionale of Naples.

Another example is one of the most innovative initiatives carried out in recent years: the commemorative exhibition organized on the occasion of the tercentenary of the birth of the monarch *Carlos III y la difusión de la antigüedad*. This exhibition was organized from December 2016 to March 2017 at the same time in Naples (National Archaeological Museum), Madrid (Royal Academy of Fine Arts of San Fernando) and Mexico (Academy of San Carlos). The exhibition aimed to highlight the role of the king in the dissemination of archaeological discoveries from Herculaneum, Pompeii and Stabiae and the impulse he gave to the knowledge of antiquities. Through virtual reality there were three stories that narrated three different moments of the eighteenth century: The excavations in the area of Vesuvius, the drawing room at the Academy of Fine Arts in San Fernando and the arrival at the Academy in San Carlos de Mexico of the plaster casts sent from Madrid.

The true innovation of this exhibition lies in the use of technology that allows the visitor to see the real scope of the work done three hundred years ago with the media today. This made it possible for the exhibition to be carried out simultaneously in three rooms, in three different museums and in three different countries, giving spectators the possibility of being in one of them and virtually visiting the other two at the same time. The rooms, connected by the theme of the work of the monarch, presented a similar installation being interconnected in real time via streaming and used technical means as virtual reality, augmented reality and spherical photography (Figure 7). All information about the content of the exhibition and access to 3d images and videos 360 ° (Figure 8) was made available for consultation through the APP *Carlos III*, downloadable from Play Store (Android) and on the Web page.

This exhibition aimed to be the first step in the design of a virtual exhibition model, which invited the interconnection of museums and their collections, allowing the accessibility to pieces that are thousands of miles away and inviting the interconnection of museums and their collections.



Figure 5. Virtual relocation of the frescoes from Boscoreale "*The Villa of Publius Fannius Synistor*"



Figure 6. Virtual relocation of the frescoes from Boscoreale "*The Villa of Publius Fannius Synistor*"

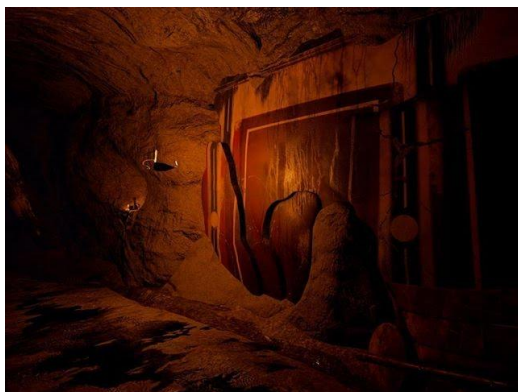


Figure 7. Augmented reality in *Carlos III y la difusión de la antigüedad*. Exhibition.



Figure 8. Access to 3d images and videos 360 ° in *Carlos III y la difusión de la antigüedad*. Exhibition.

3.3. Promoting awareness: Taking advantages of the possibilities of technology

The relationship between society and heritage has varied over time and education and understanding of the value of the latter has been a constant concern. The awareness of the value of the Vesuvian archaeological heritage is essential for its safeguarding, being on many occasions, despite the numerous initiatives, in deplorable conditions. In the last two decades, it has been tried to remedy through the two aforementioned important projects *Grande Progetto Pompei* and *Herculaneum Conservation Project*, with the collaboration of the Packard Humanities Institute. However, in parallel to the fruition of the ancient cities, the virtual era encourages projects of valorization that put, at the service of the society, a great quantity of accessible digital material that makes the understanding of the sites and its impact in the history of Archaeology easier.

The facilities arranged in the *Antiquarium* of Pompeii, re-opened to the public in 2016 are a good example of a natural integration of technologies to improve the understanding of visitors. Some screens were installed in a room that tried to show an immersive reconstruction of the moment of the eruption. Although the technology used is not the most innovative or revolutionary, it denotes the need for its use for any narrative in a museum context. Also, another good example of an attempt to integrate technological devices to attract attention to the Vesuvian archaeological remains of the museum is the video game produced by the Museo Archeologico Nazionale of Naples, “*Father and Son – the game*” (2017) (Figure 9), which tries to involve people in an exciting experience from the present to the past (<https://www.museoarcheologiconapoli.it/it/father-and-son-the-game/>) or the *Pompeii Touch app* (last updated 2018) (Figure 10) that provide the reconstructions of the ancient buildings in 3D with interactive GPS map in the smartphone or iPhone (<http://www.pompeiiitouch.com/>). Users can choose a photo of a location and, with a touch or brushing the finger on the screen it appears correspondent and reconstructive hypothesis of places.

The *Estándares para la edición multimedia avanzada en yacimientos arqueológicos* (2017) by The Real Academia de Bellas Artes de San Fernando (Madrid). This project has replaced the concept of free navigation through the concept of orderly reading the content of the websites. This system gives access in a sequential way, from different chapters, to the databases, videos, specific texts and to all that multimedia content that can contribute to the better comprehension of the archaeological site that is presented. The first example created in this system is the Casa de la Diana Arcaizante in Pompeii (<http://www.dianaarcaizante.com/>), and apart of virtual reconstructions, it includes other technologies such as photogrammetry, 3D models of the findings and digital documents from diaries and archives.



Figure 9. “Father and Son – the game”, Museo Archeologico Nazionale of Naples



Figure 10. Pompeii Touch app

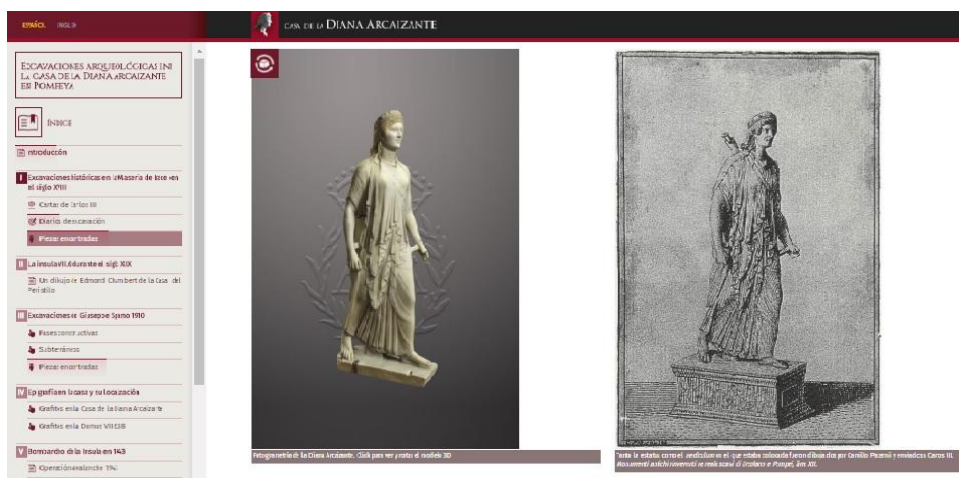


Figure 11. Casa de la Diana Arcaizante in Pompeii, *edición multimedia avanzada en yacimientos arqueológicos* by The Real Academia de Bellas Artes de San Fernando (Madrid).

4. Heritage and technology, an inevitable relationship

The repertoire of the exposed projects aims to analyse the links that unite them and highlight how virtual archaeology has been developed and consolidated around the Vesuvian cities. It has been widely verified that this discipline and new technologies are key allies for the documentation, interpretation and dissemination of heritage. The collaboration of different fields such as humanities and new technologies shows a natural consequence of the interaction with the past through the current language of society.

The potentiality of the Vesuvian cities not only concerns the material remains conserved, but encompasses a whole experience of valorization and dissemination of the heritage, from its discovery to the present day. Undoubtedly the Vesuvian sites are the most studied and those that have attracted more scholars, archaeologists and curious individuals who, over three centuries, have left a great amount of iconographic, photographic and documentary material that acquire new meaning to be exposed via the means that technology offers.

Research in this field should have as future objectives; the creation of new content and information and the increase of accessibility, facilitating the interaction with the remains of the past, parallelly alongside the development of new Digital devices that should make this possible. Through future technology, it will be possible to restore, not only how the current remains were in the past in their static state, but also a sense of time and history in such archaeological sites; allowing for

modifications, restorations, traces of the passage of time and the interaction with the environment, but also with society, of which the Vesuvian cities can certainly supply with an extensive source.

Seeing the stratifications of its phases, not only as a spectator but as participant in a immersive way will be possible. Devices will be able to satisfy not only visual but sensory experiences, awakening smell, touch, taste. It will be possible to establish a realistic link not with a single past, but with a sequence of past times and moments that have changed the state of the archaeological sites.

All the activity of valorization that happens around the cities Vesuvian shows a constant concern for improving its fruition, trying to remain one of the most important archaeological points, not only in Italy, but the world. This certainly positions these sites as strategic points where new initiatives can be carried out, allowing all the information which they can potentially offer to be extracted.

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