REPRESENTING AND VISUALIZING ARCHAEOLOGY.
THE CONTRIBUTION OF GRAPHIC SCIENCES TO RESEARCH IN ARCHAEOLOGY

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This article discusses the role of images in archaeological disciplines and the contribution that graphic sciences can make to research in this subject area.

In archaeology, and not only, 'visualization' differs significantly from the more commonly used noun 'representation.' In this sense, archaeological visualization is a practice of reconstructing and understanding the past rather than documenting and representing only the material remains that have come down to us.From archaeological drawing to virtual reality, numerous techniques and tools from the graphic sciences are applied in archaeology. Some of these can now be ascribed to the disciplinary tools, while others fall outside the specific skills of the archaeologist and require interaction with the disciplines deputed to visualization and, thus, with the graphic sciences.

In order to better understand the difference between visualization and representation in archaeology, the article uses prenuragic altar of Monte d'Accoddi as a case study to focus on the creation of different graphic-visual products starting from the same model, in order to demonstrate the role of different graphic artefacts.

INTRODUCTION

The relationship between archaeology and image pro-duction has a long tradition evidenced by the publication of several significant volumes, including *Antiquity depicted: aspects of archeological illustration* (Piggott, 1965, 1978) and *Archaeological illustration (*Adkins & Adkins,1989), but the tradi-tion of images in archaeology has an older history rooted in the archaeological finds of 15th- and 16th-century Rome (Pic-coli, 2017). These discoveries sparked the interest of human-ists and artists, who began to study the finds from the repre-sentation of their material remains (Barkan, 1999).

As emerges from a letter by Francesco da Sangallo, who witnessed the discovery of the Laocoon group in 1506 in a vineyard on the Oppio hill, the act of discovery was always accompanied by drawing: "everyone began to draw, while they were discussing ancient things" [authors translation from Italian[1]] (Da Sangallo, *Lettere su questioni familiari 6.2*, in Barkan, 1999, p. 3). This affirmation is confirmed by Giovanni Antonio da Brescia's engraving (Figure 1), which testifies to the missing arms of the three figures-Locoon and his sons-and the foot and right knee of the younger son, which were found separated from the sculptural group and integrated in later years, as is evident from the find now in the Vatican Museums.

During the same period, dealers-antiquarians commis-sioned artists to make detailed and often quoted drawings of antiquities, 'catalogue' drawings helpful in communicat-ing the necessary information about the characteristics of the objects for sale (Opgenhaffen, 2021).

With the development of scientific illustration between the seventeenth and eighteenth centuries, a graphic style for representing artefacts emerged (Fejfer et al., 2003). Creating this language for documenting objects was central to us-ing artefacts as 'data' that could be organized and analyzed to achieve knowledge construction in archaeology (Moser, 2014). Produced initially by antiquarians to document their

Fig. 1 Giovanni Antonio da Brescia, *Laokoon*, 1506-1520, Engraving, 28,3 × 25,0 cm, Retrieved January, 05, 2024 from <https://www.britishmuseum.org/collection/object/P_1845-0825-707>. The engraving shows it reversed, before the restoration of the right arm, and is probably the earliest print of the group.

collections, artefact illustrations were later adopted to represent the characteristics of ancient objects. With these representations, illustrators went far beyond mere recording, giving the drawings an interpretive dimension.

ARCHAEOLOGICAL REPRESENTATIONS AND VISUALIZATIONS

Archaeology can thus be considered, like other disciplines, a visual discipline in that from its origins; it has developed a distinctive visual language in order to communicate theories, technical principles and data (Moser 1992, 1998, 2016) that forms the very basis of the discipline of archaeology (Opgenhaffen, 2021). Indeed, archaeologists use a wide

range of visualization methods to record, organize, interpret, and reconstruct the past. Thus, the epistemological foundations of archaeology are built on visual elements, which is why how to visualize, represent, communicate, and share objects has become a central theme in archaeological research (Morgan & Wright, 2018; Moser, 2012; Wickstead, 2013). Visualizations are more than mere illustrations accompanying written texts; they build the documentary base on which to base investigations (Witmore, 2006).

In archaeology, 'visualization' differs significantly from the more commonly used noun 'representation.' Suppose representations have a present and actual state of affairs as their subject and require a certain degree of objectivity. In that case, visualizations have something not visible or somewhat no longer visible as their subject, which implies a creative and interpretative practice of reality (Huvila, 2018). In this sense, archaeological visualization is a practice of reconstructing and understanding the past rather than documenting and representing only the material remains that have come down to us (Opgenhaffen, 2021). Drawings of stratigraphic layers, plans of archaeological sites and their settlement patterns, and graphs of the distribution of artefacts can be considered representations (Adkins & Adkins, 1989), while illustrations depicting hypotheses and reconstruction drawings of sites and artefacts can be considered visualizations.

With the proliferation of digital media, their accessibility, coupled with the decreasing costs of visual forms of representation in archaeology, understood as representations of the existing, are expanding exponentially (Dyke, 2006). Visualizations, understood as cognitive and interpretive image processing, have not evolved significantly. Visual outputs often need more than the documentation of findings while forgoing their cognitive and interpretive function (Llobera, 2011).

When we talk about images in archaeology, we can mean two main groups with different purposes: representations aimed primarily at archaeological investigation and visual-

Fig. 2 Joseph-Philibert Girault
de Prangey , *Temple of Horus,
Edfu (167. ? Temple.)*, 1844,
Daguerreotype, 9,3 × 12 cm.
(Pinson, 2019, p. 112).

izations aimed primarily at dissemination. Archaeological
sketching, archaeological drawing, archaeological maps, 3D
models and virtual reconstructions belong to the first group.
Today, the latter also allows more accessible public involve-
ment through visual communication strategies such as visual
journalism (Cicalò et al., 2021). The following briefly describes
the different forms of imagery used in archaeology.

In archaeology, photography is necessary not only for the
systematic documentation of sources and artefacts but also
for the protection of cultural heritage. Photographic docu-
mentation (Figure 2) would provide greater neutrality and
impartiality to the representation of archaeological data
(Markiewicz, 2022). This is often used as a systematic docu-
mentation tool to accurately and thoroughly catalogue the
various finds and plays a crucial role in acquiring, preserving,
and disseminating archaeological information, even during
the complex excavation process.

Like architectural sketches, archaeological sketches
made during archaeological excavations are the most infor-
mal, rapid, and intuitive form of representation in archae-
ology. They are intended to record information that cannot

Fig. 3 John Aubrey (1675), *Plan of Avebury*. (Piggott, 1978, p. 41).
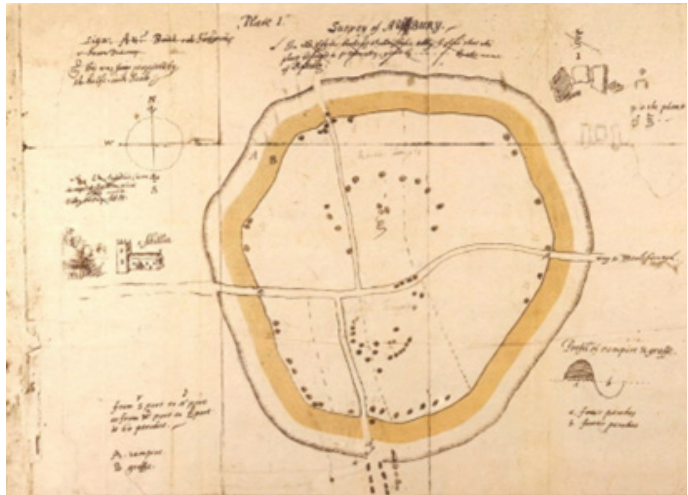
be distinguished in photographs of the context also made during excavations. In these sketches, plans, sections, and econometrics of individual contexts about excavations and findings are reproduced. These can be quickly consulted to understand the stratigraphy of the context (Morgan & Wright, 2018). Sketches help to quickly and immediately understand the spatial relationships between different elements within the context, such as the orientation of one structure relative to others or the position of artefacts relative to structures.

Archaeological drawing is a transformative act as a form of recording used expressly to replace through an image what is destroyed through excavation. During excavation, visual recording becomes the mediated expression of the archaeological resource. The destructive excavation process is followed by the creative process of drawing (Bateman, 2006). Archaeological drawing is divided into three general categories: plan drawing of areal excavation, section drawing, and larger-scale landscape drawings (Morgan & Wright, 2018). In this form of standardized conventional drawing, three-dimensionality is achieved through shading, stippling, and multiple views (Opgenhaffen, 2021). Archaeological drawing
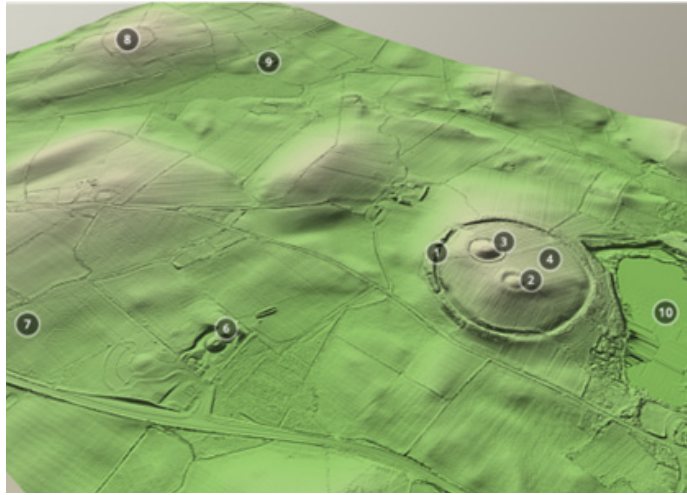
constitutes an accurate 'visual record' of artefacts, structures, and site features. This record can be crucial for archaeologists in subsequent analysis and interpretation, constituting a tangible representation of discoveries and allowing archaeologists to preserve knowledge of the past and share that information with other researchers (Figure 3).

Archaeological Maps make it possible to confine and order the interpretation of sites. The most advanced technological advances are being made in this field, transforming geographic information systems (GIS) from a simple data management tool to a data collection and interpretation device, also achieved through the use of unmanned aerial vehicles (UAVs), on which the modelling and three-dimensional restitution of sites is based (Landeschi, 2019). Archaeologists often use these maps to analyze archaeological data in a broader geographic and chronological context to identify patterns, connections, and areas of interest that are more difficult to assume with traditional tools.

With 3D models, highly detailed interactive models of objects and sites can be produced. This type of visualization can change how objects, the fundamental 'data' of archaeological research, are thought about and presented (Molloy

Fig. 5 Emanuel Demetrescu & Daniele Ferdani (2021), *Virtual reconstruction of the Temple of Mars Ultor in the Forum of Augustus.* (Demetrescu & Ferdani, 2021, p. 12).
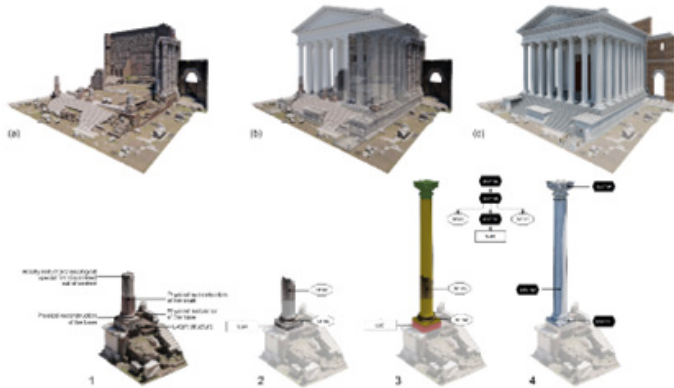
et al., 2016). Typically, this type of product, even usable through virtual reality, is commissioned from professionals outside the archaeological field, as the skills needed are outside of traditional training (Buccellati, 2015). 3D models, by allowing archaeological objects and sites to be depicted in a highly detailed and interactive manner, allow one to examine artefacts from different angles, focus on the most minor details, and even interact with the models to gain a deeper understanding.

Virtual reconstructions constitute a research strategy in which digital technology supports the documentation and interpretation of archaeological data (Beale & Reilly, 2017) through three-dimensional modelling of the original configuration of archaeological sites (Forte & Siliotti,1997). This interpretive method is often accused of producing images detached from the archaeological data due to the uncertainty of the data that can originate photorealistic representations of the past that are misleading or deceptive (Eiteljorg, 2000). A methodology is much debated in science because of the uncertain original configuration of some sites. These reconstructions are often based on conjecture or assumptions that are not always confirmed but simultaneously allow for the evaluation of hypotheses despite the degree of uncertainty (Figure 5).

Fig. 6 Fernando Baptista (2011), *Building Göbekli Tepe*. Retrieved January, 05, 2024 from <https://www.nationalgeographic.it/popoli-culture/2011/06/16/foto/come_nasce_la_religione-365340/10/#media >

Visual Journalism, while based on the most advanced 3D modelling technologies, is an approach to cultural heritage communication that returns information in the form of an illustration that can be easily read by a non-expert audience (Cicalò et al., 2021). The main goal of this visualization technique is to translate complex data and concepts into images and graphs that are easy to read in order to ensure, in addition to scientific dissemination, journalistic information and communication of cultural events where the public is not always familiar with the disciplinary issues (Figure 6).

REPRESENTING AND VISUALIZING THE PRENURAGIC ALTAR OF MONTE D'ACCODDI

The research illustrated below is aimed at the survey, modelling, graphic restitution and elaboration of immersive fruition projects of one of Sardinia's most peculiar monuments: the prehistoric altar of Monte d'Accoddi, the only monument in the whole of Europe and the Mediterranean basin. This can be traced back to the type of altar with steps sloping upward, morphologically similar to the better-known ziggurats, and is

Fig. 7 Mesh processed from the point cloud of the photogrammetric survey (graphic elaboration by Andrea Sias, GRA-VIS LAB - Laboratory of Graphic and Visual Sciences).

a candidate today, together with the regional system of prehistoric sites, for inscription on the UNESCO World Heritage List. Although the wealth of archaeological evidence in Sardinia has stimulated numerous experiments in recent years in the area of the application of digital technologies to the representation and enjoyment of the regional cultural heritage, the altar of Monte d'Accoddi has yet to be the subject of such actions with scientific value. The morphological peculiarities require the experimentation of an operational method calibrated to the specificities of the same site, which will be presented and discussed in this article. In addition, the experimentation presented seeks to respond to the need to promote the cultural accessibility of sites and the transmission of knowledge to different types of audiences with different abilities and levels of literacy, including digital literacy.

In this regard, an operational method is therefore proposed that is capable of using the most advanced surveying, modelling and restitution technologies both for high-tech fruition of the sites, aimed at users with a strong propensity to use digital tools, and low-tech, more appropriate to meet the needs of users belonging to other demographic and socio-cultural categories.

Fig. 7 Representation of the monument and its state of preservation (graphic elaboration by Michele Valentino and Andrea Sias, GRA-VIS LAB - Laboratory of Graphic and Visual Sciences).

The first result of surveying and modelling the site was graphic boards that accurately render the monument in its state of preservation. Subsequently, the model was used as the basis for virtual enjoyment of the site and the various reconstructive hypotheses for educational and recreational purposes. To this end, a possible mode of fruition of the site through Virtual Reality (VR) was tested. The survey

and modelling of the site were then used for the elaboration of visualization through the Visual Journalism approach of the altar of Monte d'Accoddi (Cicalò et al., 2023) and an answer to the new questions of accessibility and fruition of cultural heritage sites, with particular attention to archaeological ones, was sought. Moreover, the research seeks to adopt an inclusive approach by proposing different ways of fruition of a site using the same information base and operational path of information construction.

The research presents some innovative and original aspects in the field of graphic representation and visualization of cultural heritage, such as:

- Experimentation of an operational method. The research introduces an operational method of surveying, modelling, graphic restitution and virtualization of an archaeological monument that has not yet been investigated from this point of view and is specifically designed to adapt to its dimensional, morphological and historical-archaeological characteristics, requiring a definition and methodological experimentation calibrated to its peculiarities;
- Complementary system of representation and visualization. The research develops an operational method capable of systemizing the entire chain of methods and tools for representing and visualizing cultural heritage, starting from the photogrammetric survey and crossing 3D modelling, graphic restitution, VR, and AR, arriving at illustration and Visual Journalism. This approach allows for a narrative that engages audiences in different ways and deepens the understanding of cultural heritage;
- Different graphic-visual products. The research focuses on creating different graphic-visual products from the same 3D model about the need to make the subject site accessible to multiple audiences having different skills, abilities, and literacy levels. This allows the subject site to become accessible to a broader range of people,
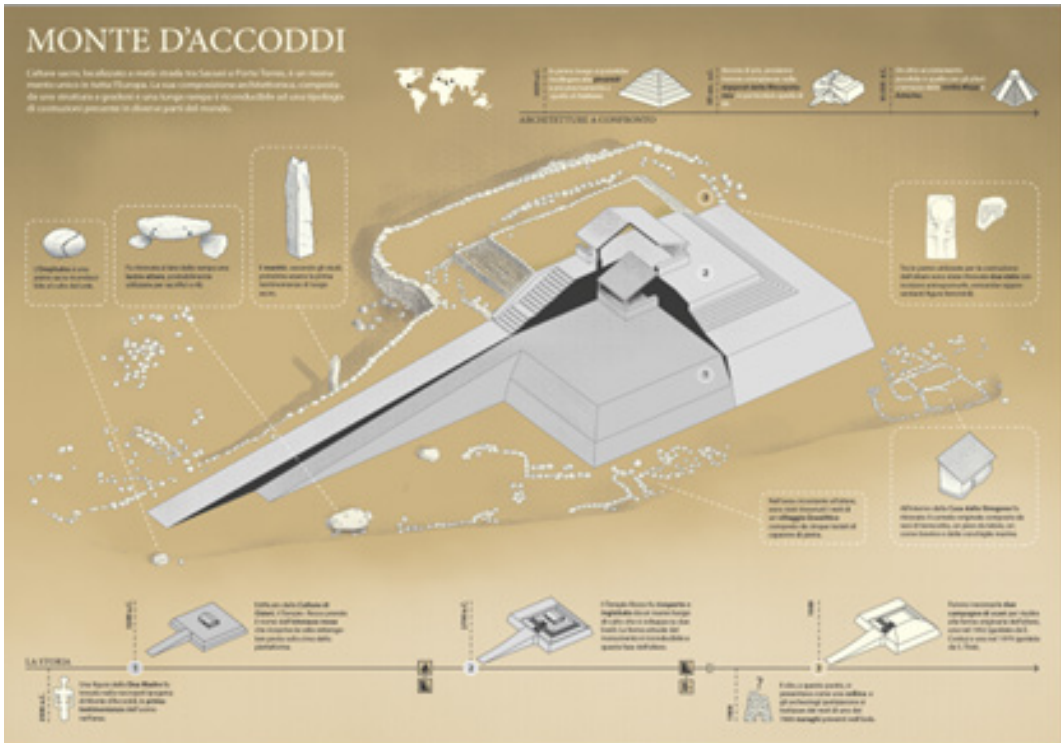
Fig. 8 Visualization of the monument using the Visual Journalism approach (graphic processing Chiara Zuddas, GRA-VIS LAB - Laboratory of Graphic and Visual Sciences).

helping to spread knowledge and appreciation of cultural heritage more inclusively and effectively.

Real and virtual, digital and analogue, high tech and low tech find through the proposed method a form of balance in which, within each dichotomy, each element does not compete with or replace its antagonist but on the contrary, supports and strengthens it. Only through collaboration among all the different components involved in the process is it possible to adopt an inclusive approach and truly foster the accessibility and enjoyment of cultural heritage and the transmission of knowledge related to it from a democratic and universal perspective.

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CONCLUSIONS

As the history of archaeology shows, the use of images and their production must be considered a constitutive part of the disciplinary tools aimed at constructing knowledge. The more traditional graphic tools and representation techniques have now become part of the profile of the archaeologist, who must necessarily be able to operate from a graphic point of view to translate the information necessary for archaeological investigation into images, visual notes, and technical drawings. On the front of visualization aimed at dissemination, starting from modelling for virtual archaeology up to graphic products for public communication, skills from other disciplinary fields and, in particular, from the graphic sciences are necessary. These can support archaeological investigation from the survey and graphic restitution aimed at three-dimensional modelling, virtual fruition, and dissemination through visual communication strategies appropriate to the new demands from different audiences and contexts, as demonstrated by the case study presented.

NOTES

1 The Italian text of the quotation is as follows: "tutti cominciarono a disegnare, mentre discorrevano di cose antiche" (Da Sangallo, Lettere su questioni familiari 6.2, in Barkan, 1999, p. 3).

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