# Virtual Poggio del Molino:
# Communicating the Archaeological Excavation
# to the Public

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## Introduction

Archaeology analyses material culture to understand the past; structures and artefacts, and in particular their material structure, their shape and decoration, influence the archaeologist's thought and work, hence guiding its interpretation. Archaeological research is constantly driven by a visual and haptic interaction with artefacts and structures, which directly influences how history is interpreted and then how it is communicated to the public.

This constant interaction led to the development of a highly standardized visual language for representing material culture in scientific print publications.[1] The standard practices for drawing and photographing artefacts are thought to facilitate an understanding of the object for those who cannot analyse it in person but at the same time are familiar with the conventions used to represent it. Although these conventions facilitate scientific research, their potential for communicating with the public is more limited: in fact, because archaeological illustration is highly conventional, it is hardly intuitive to non-specialists and it has not been created for that specific purpose.

However, archaeology's value as public asset is only as strong as its ability to maintain a communicative relationship with the community which supports it.[2] In the recent past archaeological investigations have been trying to find ways to communicate its discoveries, by using the remains of ancient cultures as visual and narrative media to present history. To this end, virtual environments and archaeological 3D digital models are actively used to engage the public and craft new forms of interaction with the past. In fact, all visual computing technologies can and must be used to enhance accessibility, by offering communication tools that permit an effective support to the visit, both to archaeological sites and museums.[3]

As part of this movement, archaeologists at Poggio del Molino, a Roman settlement in the territory of Populonia, Italy, are using digital technology to open the archaeological site to the public and to provide an alternative view of the archaeological remains on and off site. The use of 3D content, in particular, serves as a stage for creating new forms of interaction between the archaeological site and the members of the public community.

## The Archeodig Project at Poggio del Molino

Poggio del Molino is a Roman settlement which lies on the northern side of a promontory between the Gulf of Baratti (Tuscany, Italy) to the south and the Rimigliano beach to the north.[4] The archaeological site was occupied from the 2nd century BC to the 5th century AD, and is located on a plain 22 m above sea level which dominates a wide stretch of sea, as well as the hinterland, within the territory of the ancient Etruscan city of Populonia.

After a century of the dominion of Rome over Populonia, around the 2nd century BC a quadrangular fortified building measuring about 55 × 56 m with towers[5] was positioned on the plateau of Poggio del Molino. Its aim was to defend the territory from pirate attacks and to control the territory of the ancient Etruscan city.[6] In the first half of the 1st century BC, with no more danger from the sea, the fortress was re-purposed as a farm with an adjoining *cetaria,* which produced *garum* and *salsamenta.*[7] Around the middle of the 2nd century AD, after a thorough renovation, the building took on the characteristics of a maritime villa[8] with a peristyle garden around which were a residential quarter,[9] a domestic quarter,[10] and a private bath complex.[11] The villa underwent a slow impoverishment from the middle of the 3rd century AD, resulting in the abandon-



Fig. 1: Location of Poggio del Molino: view from the north-east with the promontory of Populonia in the background.
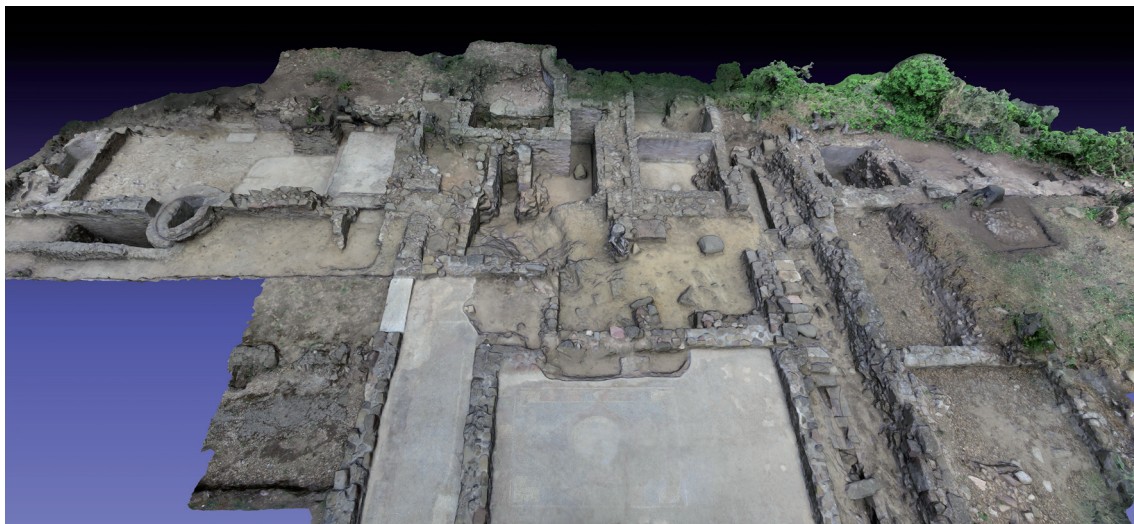
Fig. 2: Poggio del Molino. Detail of the excavation area from 3D model.

ment of the building around the beginning of the 4th century AD. It was only between the late 4th and late 5th century AD that the site was inhabited by a community that dismantled the villa's construction and the decorative materials, recycling everything into new products.[12] Furthermore, archaeologists at Poggio del Molino identified the presence of a gathering place, maybe connected with early Christians, in the residential sector of the villa.

The archaeological site of Poggio del Molino, which has always been part of the territory of ancient Populonia, forms a key piece of evidence in understanding the development of the Etruscan and Roman historical context.

The archaeological excavation of the Roman settlement was carried out for four years by the University of Florence in the 1980s, only to be interrupted due to lack of funds. The cultural association "Past in Progress" resumed the excavations in 2008 with a new archaeological field project, Archeodig. Since the very beginning, this project has united the work of professional archaeologists and Cultural Heritage specialists with international students and volunteers. The excavation is conducted in collaboration with the Superintendence of Archaeological Heritage of Tuscany, the EarthWatch Institute,[13] as well as with Italian and foreign universities.[14]

Other than the scientific aims of the research on and off the field, the Archeodig project emphasizes interaction with the public, from which it has always sought support. Public events and lectures, as well as local conferences and guided tours of the excavation site have been the backbone of the project's activities since its inception. Volunteers and students from all over the world participate in the excavation and interpretation of the site, making Poggio del Molino a site of instruction as well as research.

Financially, Archeodig is tied to private sources of funding (and public funds such as the Art Bonus or the 2 × 1,000 among others), as well as the network of support es-

tablished through the years by its parent organization, the "Past in Progress" cultural association.[15] One of the main aims of Archeodig is to return the generosity of its supporters by making its operations open and accessible to the local community.

In fact, since 2008 the area has always been open to every visitor eager to learn about the discoveries and about the archaeological field operations. In 2016, in this spirit of accessibility, the Archeodig project began developing an infrastructure to support visitors onsite, which in the near future will lead to the creation of a shared archaeology park, or PArCo (Parco di Archeologia Condivisa).[16] The aim of this project is to create new common spaces for archaeologists and the community, guided paths, and integration with the touristic routes that cross the territory of the ancient Etruscan Populonia and the Etruscan coast.

Besides this, accessibility in terms of learning and information is constantly being addressed through many different strategies such as active coordination with local museums and high schools. The main goal of the PArCo project at Poggio del Molino is to dismantle the barriers between archaeologists and citizens, making the area an open excavation site where all the aspects of research will be continuously shared with visitors on and off the site.

## 3D Documentation at Poggio del Molino

After ten years of field operations, the archaeological site appears to be widely excavated, and many structures, belonging to different phases of the site, have been cleared of the soil that preserved them. Rooms with mosaic floors occupy the south-west corner of the villa, while a grand bath complex is still visible all across the northernmost area.[17] Many of the structures around the area have been built, destroyed, used and repurposed throughout the centuries, thus complicating their correct interpretation and placement in the chronology of the site.

Yet, walls and pavements are what is truly helping archaeologists to understand the story of the Roman settlement, with the constant visual and haptic interaction that defines every aspect of archaeological field research. The accurate and complete documentation of structures and materials found during the excavation are thus indispensable to understanding the story of Poggio del Molino, as well as to communicate it to the wider public.

In 2015, the Archeodig project started exploring the potentials of 3D modelling as a way to complement existing classical methods[18] to document the remains of the past and to record a higher amount of data in less time. Amongst the many possibilities to record 3D data on archaeological excavations, Archeodig chose to document its discoveries with the Structure-From-Motion photogrammetry (SFM), thus taking advantage of the items already used in the field for standard documentation purposes. 3D digital photogrammetry is a cost-efficient method for generating 3D models from sequences of
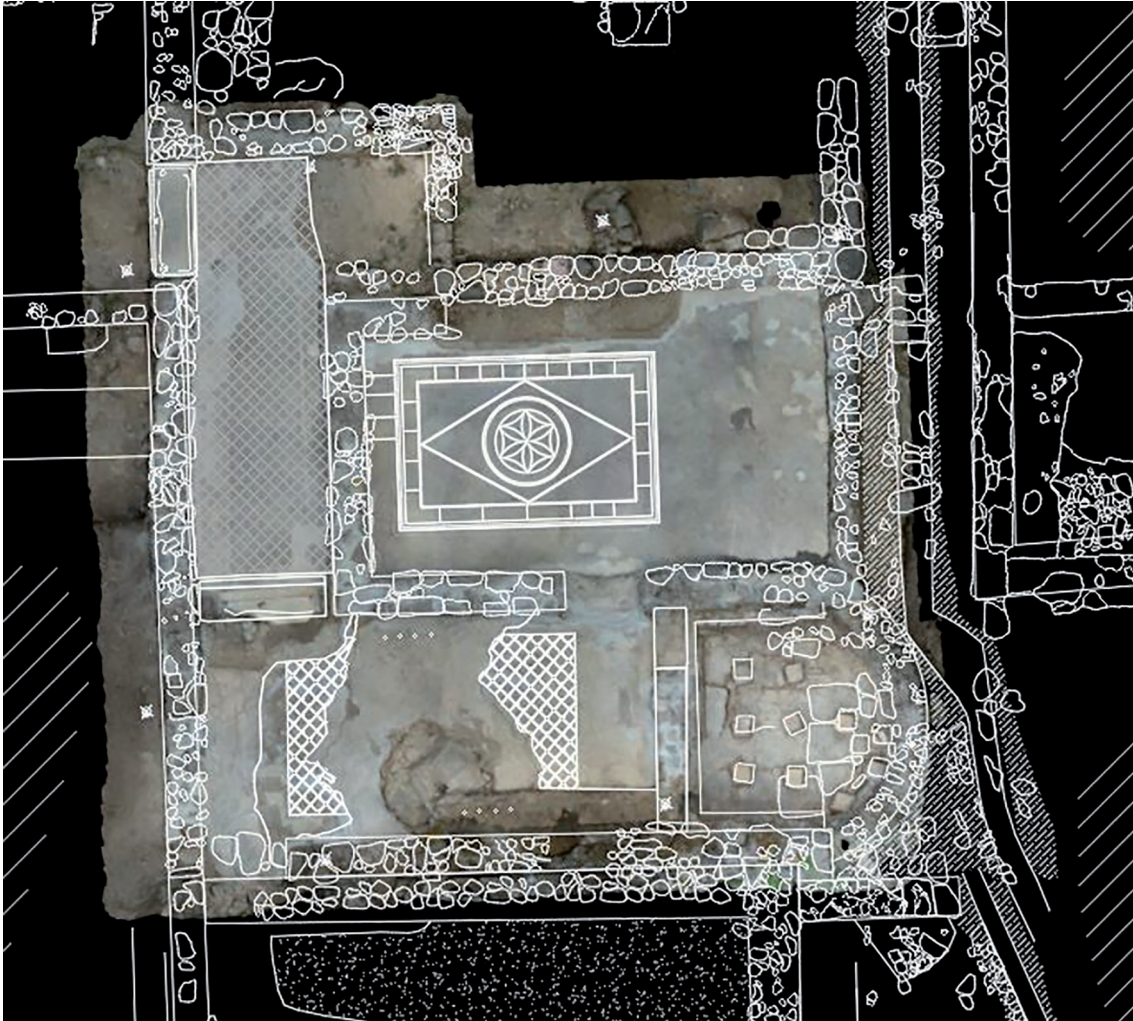
Fig. 3: Example of an orthophoto from a 3D model imported in AutoCAD. Poggio del Molino.

2D images, and it has helped Archeodig to create detailed 3D records of structures and artefacts discovered on site.

The choice to adopt SFM as the field documentation technique and to integrate it in the classic documentation workflow had many different motivations. Operating under a relatively accessible workflow, using SFM to document archaeological remains requires no more than a standard digital camera and a total station to survey the remains topographically. The sorts of 3D models produced by this method are highly accurate and render both the geometry and colour of the remains in exceptional detail. The whole process is automated by the software,[19] it is non-labour intensive and, compared to traditional archaeological approaches like hand drawing, is extremely efficient in terms of time.

In general, the benefits of SFM have been noted widely in archaeological literature[20] as the technology becomes increasingly common in field projects across the world.[21] Perhaps most importantly, 3D models are a great asset for the kind of analysis and interpretation of archaeological sites that occurs after the field operations. In fact, 3D digital data further allow professionals of Archeodig to observe the excavation site from new and different points of view. 3D models are indeed having an impact on the way archaeologists understand the site's overlaying structures and the order of actions that shaped them.

At the same time, the potential of an approach like 3D digital photogrammetry is not limited to scientific or academic benefits only. At Poggio del Molino, 3D models are becoming an indispensable tool for public outreach, with the potential to provide an engaging and informative experience to members of the public visiting the site.

## Archaeology and Communication at Poggio del Molino

Archaeologists and the public have been in contact at Poggio del Molino since the very inception of the research project in 2008. The efforts Archeodig made to communicate its discoveries to the community, both at a local level and beyond, shaped the scientific communication approach as well.

The support of volunteers and students has been indispensable and forced the professionals at Archeodig to think carefully about how archaeology is communicated to non-specialists. For most of the people visiting the site to learn or help with research it is their first experience with field archaeology; their success on site depends on Archeodig's ability to explain the complexities of the site and involve them in the process of its documentation and interpretation. Also, the excavation site is open free of charge to visitors, therefore further motivating the project's interest in how to communicate archaeology and field operations to a wide audience.

Between the many issues of archaeological communication,[22] Poggio del Molino needs to face at least two apparent obstacles to deliver information to the wider public. The archaeological research on site is constantly driven by the physical interaction with the historical remains, which archaeologists can easily read to gain information and interpret history, but that perhaps can be less obvious to non-specialists. As a result, Archeodig tries to use the narrative aspects of the physical remains to communicate its discoveries to the public while focussing on how archaeologists produce that narrative from the remains themselves. Also, there are many individuals that cannot physically visit the site, and for this reason Archeodig wishes to develop a strong presence online with the goal of disseminating its findings to the global community.

Poggio del Molino's 3D contents can be used as tool to address both challenges, providing a unique form of mediation between users and material remains, supplying a reflexive user experience with ancient materials. Photorealistic 3D models, such as
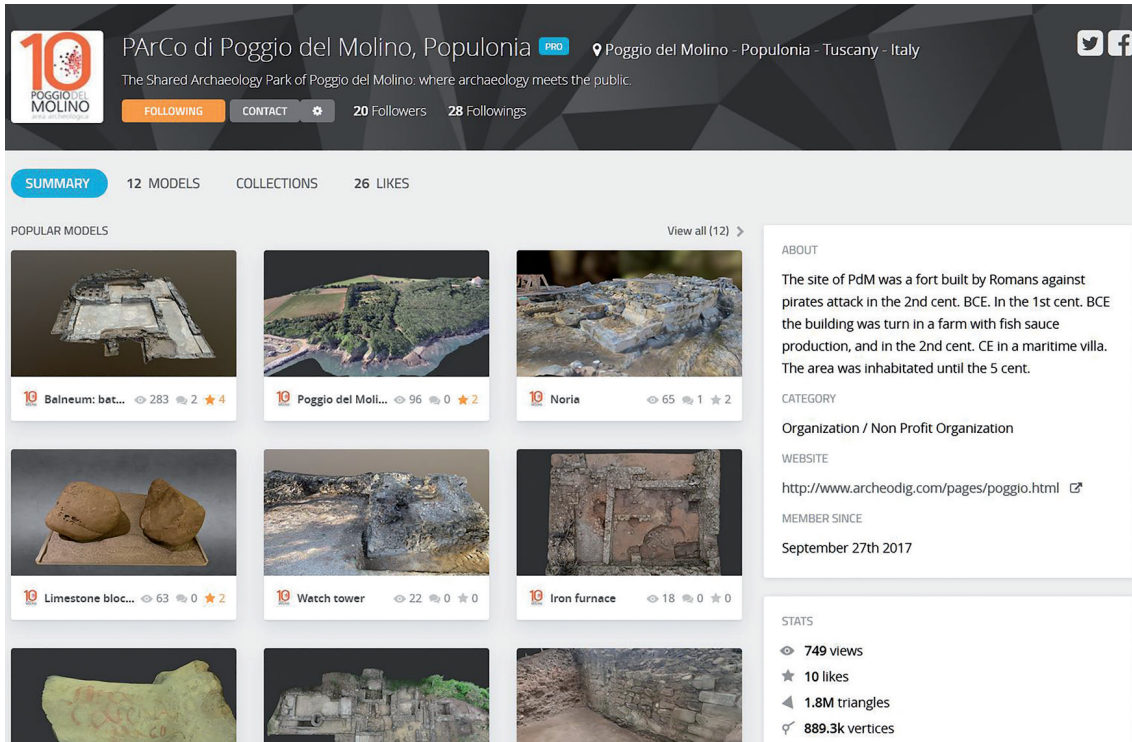
Fig. 4: Poggio del Molino Sketchfab page.

those produced on site, can in fact be packaged into user-friendly digital interfaces which guarantee the creation of immersive forms of navigation and exploration of virtual environments. These can take visitors as close as possible to the type of interaction archaeologists experience in their work every day.

### 3D Contents Publication. The Poggio del Molino Approach

The virtualization project presented in this paper aims to take the visitor as close as possible to the scientific effort that the archaeologists of Archeodig are making to reconstruct the life of the Roman settlement.

3D models can be used to craft new forms of experiences with archaeological materials but cannot be published uncritically because, despite their vast appeal, their use remains somewhat problematic. In fact, as a method of research and communication, 3D approaches must always address theoretical uncertainties and technical limitations.

Theoretical criticisms of 3D content in archaeology are frequently oriented around questions of fidelity, representation, and user experience.[23] Furthermore, when an archaeological project is designing a digital communication strategy, it must face a variety of technical decisions and challenges.
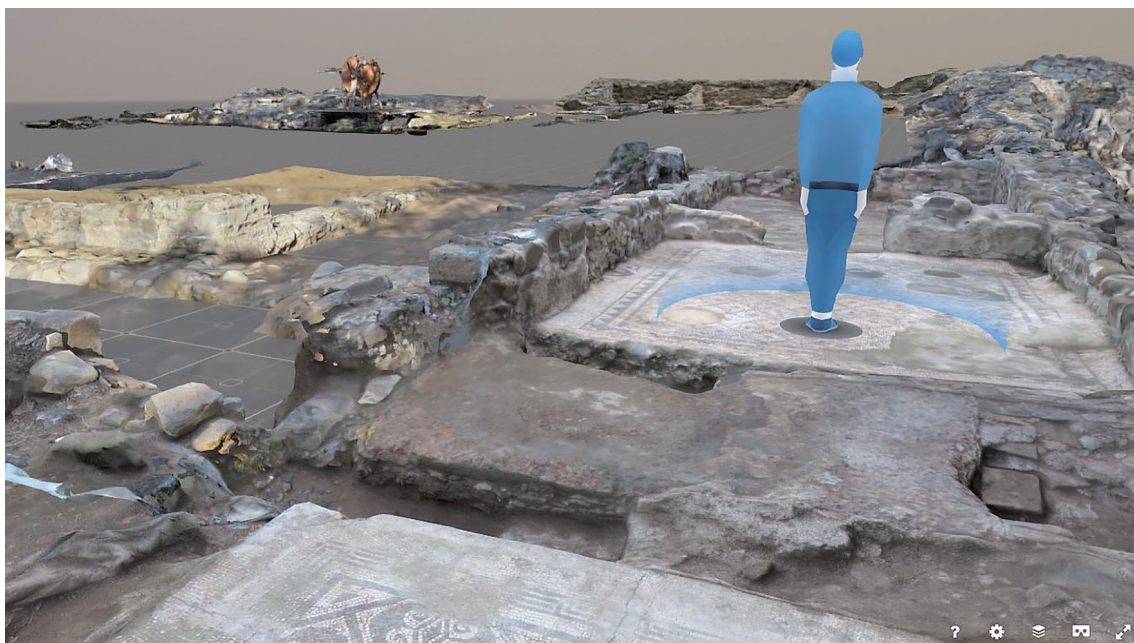
Fig. 5: Poggio del Molino. Sketchfab VR settings of a 3D scene.

Archeodig's approach to 3D content publication strives to balance these many concerns by following a strategy that seeks to be helpful to members of the public, as well as responsibly dealing with the theoretical concerns raised by academic archaeology.

The theoretical criticism of 3D content takes a variety of forms, orbiting for example around questions of fidelity and accuracy, which are partially responsible for the adoption of ever-increasing tools for gathering 3D data, such as SFM photogrammetry or laser scanning. Archeodig's team of professionals is conscious that 3D models are items which depend on the quality of source data and their post-processing, "including decimation, trimming and other modifications to the actual models that are produced".[24] However, recent advances in 3D digital photogrammetry guarantee high fidelity results in the 3D models produced at Poggio del Molino, with minor margins of error that fall within a few centimetres at most. When talking about large areas such as Poggio del Molino, this degree of fidelity is much higher than that reached in traditional hand drawn archaeological illustration; possible minor margins of error in accuracy are compensated for by their vast communication potential for public enjoyment and educational purposes.

Still, questions remain in terms of representation (how to present 3D content to a broad audience, which platforms to use and how to present 3D models), and user experience (embodiment, space and place, etc.).[25] Archeodig's 3D content representation strategy guarantees 3D models that are rich in detail and capable of actively engaging members of the community. This strategy also takes into account financial and time commitments, which are key issues for any archaeological research project.

## Poggio del Molino Dissemination Strategy

Archaeologists at Poggio del Molino have taken a dual approach to disseminating archaeological 3D content to the wider public: the free online and ready-made platform Sketchfab,[26] and the game engine Unity 3D.[27] The latter is currently a work in progress and is developed to craft virtual environments and offer an immersive experience to archaeologists and visitors on and off site.

Sketchfab can potentially serve as more than a simple, but engaging, tool for updating the public on new discoveries and what happens in the field. In fact, the publication of 3D content online allows the Archeodig team to craft new forms of experiences between the visitor and archaeological materials, and it is meant to encourage exploration, critical examination, and fun for the public via graphic user interfaces.

This approach guarantees low technical demands from the archaeologist and provides immediately visible results which can be easily enjoyed through the ready-made accessible user interface. On the other hand, free websites like Sketchfab limit the flexibility in terms of template and formatting, and, to a certain extent, constrict the first-person navigation experience of the 3D models.[28]

3D models online on Sketchfab can be visualized and navigated through a simple user interface similar to what YouTube offers for videos. Sketchfab offers full interaction with the 3D model on any mobile device and computer browser with no need of installing an app or special software of any kind: the 3D digital copy can be explored in detail orbiting around a pre-set centre that can be changed at will. The navigation buttons are intuitive and change depending on the interface device used: the classic 'click&drag' with the mouse, and the 'touch', which offers an easier navigating experience.

In any case, it is easy for everyone to freely interact with the three-dimensional scenes, which are equal in form, colour and size to the physical counterparts found during the excavations. The visitor is guided through the online contents by descriptive captions in both Italian and English directly below the 3D model and by dynamic annotations on its surface that provide the necessary information to understand what is shown.

Archeodig relies on Sketchfab as a 3D content viewer to give visitors the chance of a live interaction with the in-person visit, given that it is possible to find more information on the structure right in front of them or with the artefact that helped the researchers to understand the history of the site.

In order to offer a multimodal and immersive experience that involves the visitor, Archeodig has made a fixed station with VR headset available on site at Poggio del Molino to navigate the three-dimensional copies published on Sketchfab in virtual reality. In fact, the website provides a built in Virtual Reality experience which fits Archeodig's need to transport people to the excavation quickly and easily while at the same time preserving the ancient remains.

Without replacing close contact and direct perception of the material under any circumstances, Archeodig wants to provide an immersive virtual experience that stimulates visitors by favouring the process of reading and interpretation, which are fundamental moments for the correct communication of the history of the archaeological material.

## Conclusions

The destruction that archaeological excavation necessarily implies must be compensated for by an accurate documentation of the site, as well as by its communication to both academic and public audiences.[29] In fact, communication determines the transmission of culture and information at every level, and if archaeology fails to communicate its discoveries to the public it will not carry out any cultural function.[30]

The graphic restitution in archaeology, more than just being an important part of the research process, gives a more human idea of the spaces and a realistic image of the site. It is for this reason that Poggio del Molino's 3D visual contents are used to display this process to the wider public by crafting new forms of virtual interactions. Archeodig's 3D virtualization project aims at transmitting the knowledge acquired on site to a vast and diverse audience at many levels of interest and comprehension.

## Notes

[1] Adkins – Adkins 1989 above all.

[2] Baione et al. 2018.

[3] Gabellone 2015.

[4] A 3D view of Poggio del Molino.

[5] Sandstone blocks with inscriptions from Poggio del Molino show the dimensions of the settlement. See here for the 3D model. The internal area of the Roman site was of about 3,145 sqm.

[6] Megale 2016; Genovesi et al. 2016, 1–7.

[7] The farm belonged to Caius Cecina Largo, a member of the Ceacina family originating from the Etruscan city of Volterra. The name of the owner is painted on the neck of a Baetic amphora found at Poggio del Molino.

[8] De Tommaso et al. 1998.

[9] The residential sector at Poggio del Molino, 3D model.

[10] The domestic quarter at Poggio del Molino, 3D model.

[11] The bath complex at Poggio del Molino, 3D model. See Bueno et al. 2012 for the analysis of the mosaics.

[12] The lime kiln built in one of the baths of the villa at Poggio del Molino, 3D model.

[13] <https://earthwatch.org/Expeditions/Unearthing-Ancient-History-in-Tuscany> (08. 06. 2020).

[14] <https://www.archaeological.org/fieldwork/afob/2510> (08.06.2020) for more information about the field school program at Poggio del Molino.

[15] Megale 2015.

[16] To know more about the PArCo: <http://www.archeostorie.it/che-cose-il-parco-di-archeologia-condivisa/> (08.06.2020).

[17] Here is a general view of the north sector of the archaeological site.

[18] Molloy – Milić 2018.

[19] The Archeodig project utilizes Agisoft Photoscan Professional Edition to create georeferenced 3D models of the archaeological site.

[20] Green et al. 2014, Lopez et al. 2016 or also Pollefeys et al. 2003 among the others.

[21] Forte et al. 2012 and Opitz 2015 for example.

[22] For a review of archaeological communication see e.g. Bonacchi 2017.

[23] For an overview and discussion of some of these and other concerns, see Olson – Caraher 2015.

[24] Molloy – Milić 2018.

[25] Friedrick 2014 and Hodder 2014 amongst others.

[26] <https://sketchfab.com/PArCo-poggiodelmolino> (08.06.2020).

[27] For a more detailed explanation of the Unity3D project, please refer to Baione et al. 2018.

[28] This is one of the main reasons why Archeodig is crafting immersive experiences with a game engine.

[29] Manacorda 2007.

[30] Antinucci 2014.


## Image Credits

All figures and images by author.


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