

Discovering ancient Metapontum:

Technologies and Methodologies from Past to Present for a virtual Visit Proposal

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Abstract: The results of this work are in the project related to the virtual visit to the Greek colonies of Herakleia and Metaponto. It was promoted by the “Soprintendenza ai Beni Archeologici della Basilicata”, in order to offer multimedia products and pathways of knowledge that articulate from the remains visible on the ground surface to the digital reconstruction proposals. This work is done in 2006 with the publication of an interactive CD-ROM to be installed inside the National Museum of Metaponto, but this experience continues today, thanks to a continuous review of 3D models recalculated with modern photo-realistic rendering algorithms.

Since 1964 Metaponto has been the subject of intensive archaeological research. The abundance of recovered materials documenting the peculiarities of local artisan production, the variety of architectural decorations engaged in major public buildings of the sanctuary and agora and the Mediterranean dimension of trade. There are few equals in quantity and quality of data in the landscape of the Greek colonies of southern Italy. Despite missing the third dimension, as in most of the archaeological sites and visibility on the ground is often reduced to a few structural elements such small traces that create complex layouts. The ancient Metaponto virtual visit was based on the above premises and it is developed in relation to the methods concerning the reconstructive archeology, now widely accepted by the scientific community. The main purpose of the virtual visit is to provide information, not only on what is directly comprehensible by a direct visit of the monuments, but also and especially on those items that are difficult to understand. Each reconstructive hypothesis is aimed to enhance both the educational value of archaeological items and to, responds to the need to make this understandable to the public. Through a systematic study of past and present documents, traced in a transparent and intelligible way, this experience of virtual archeology intends to give to the public the interpretation results with the high scientific rigor.

Keyword: Virtual reconstruction, unbiased render, scientific transparency, 3D

The finality of this work and first results on Herakleia site

The project presented here is related to the virtual visit to the Greek colonies of Herakleia and, in particular, Metapontum. It was promoted by the “Soprintendenza ai Beni Archeologici della Basilicata”, in order to offer multimedia products and pathways of knowledge that articulate from the visible remains on the ground surface to the digital reconstruction proposals. This work is done in 2006 with the publication of an interactive CD-ROM to be installed inside the National Museum of Metaponto. The realization of our multimedia product does not present any particular elements of scientific interest because it was created using commercial software for the authoring (i.e. Adobe Director). However, this case study posed some interesting questions

in terms of evaluating the communicative effectiveness in museums uses and on the reusability of digital resources, 3D models, paradata and database, in the broader context of scientific transparency of the reconstructive studies. Although the discussion of these issues has been developed especially around the reconstructive study of Metapontum, this experience starts at the same time with the reconstruction of Herakleia (Fig. 1). This ancient city was founded by Tarantini and Thurioti peoples around 434 BC, after a war that had seen them as enemies. The city is located on the plateau between the Agri and Sinni rivers and in 374 BC was chosen as the capital of the Italiota League instead of Thurii, which had fallen into the hands of Lucani. Subsequently was created an urban area near the coast named Siris. In 280 BC the city was the scene of the Herakleia battle between Taranto and Rome.



Fig. 1 – The urban area of Herakleia

Furthermore around 280 BC the Romans proposed to the city of Herakleia a special treaty of alliance, being able to remove it from the influence of Taranto and become it as confederate city of Rome. The archaeological area is currently open to visitors and within the visit it is essential to visit the adjacent National Museum of Siris in Policoro, which preserve most of the artifacts found in that city. The lower part of the city may include the Temple of Athena, which remains the foundation and the Temple of Demeter. Over the acropolis there are the remains of the city that are well preserved. Here is possible to see the urban plan formed by orthogonal roads. To the west lies the ceramic quarter with houses and attached furnaces. To the South and West are located the necropolis. With the reconstruction study presented here, thanks to the fundamental scientific contribution of Liliana Giardino, Professor of “Urbanistica del mondo antico” at the Faculty of Cultural Heritage - University of Salento, we intend to give a comprehensive idea of the ancient Greek city of Herakleia, but also offer an overview of earlier settlements in the archaic period, which have interesting characteristics. In particular, in the West area were found remains of archaic groups of huts, inhumation burials and evidence of productive activities. In an exceptional context was found part of an house with ancient mudbrick walls rested on a stone base.

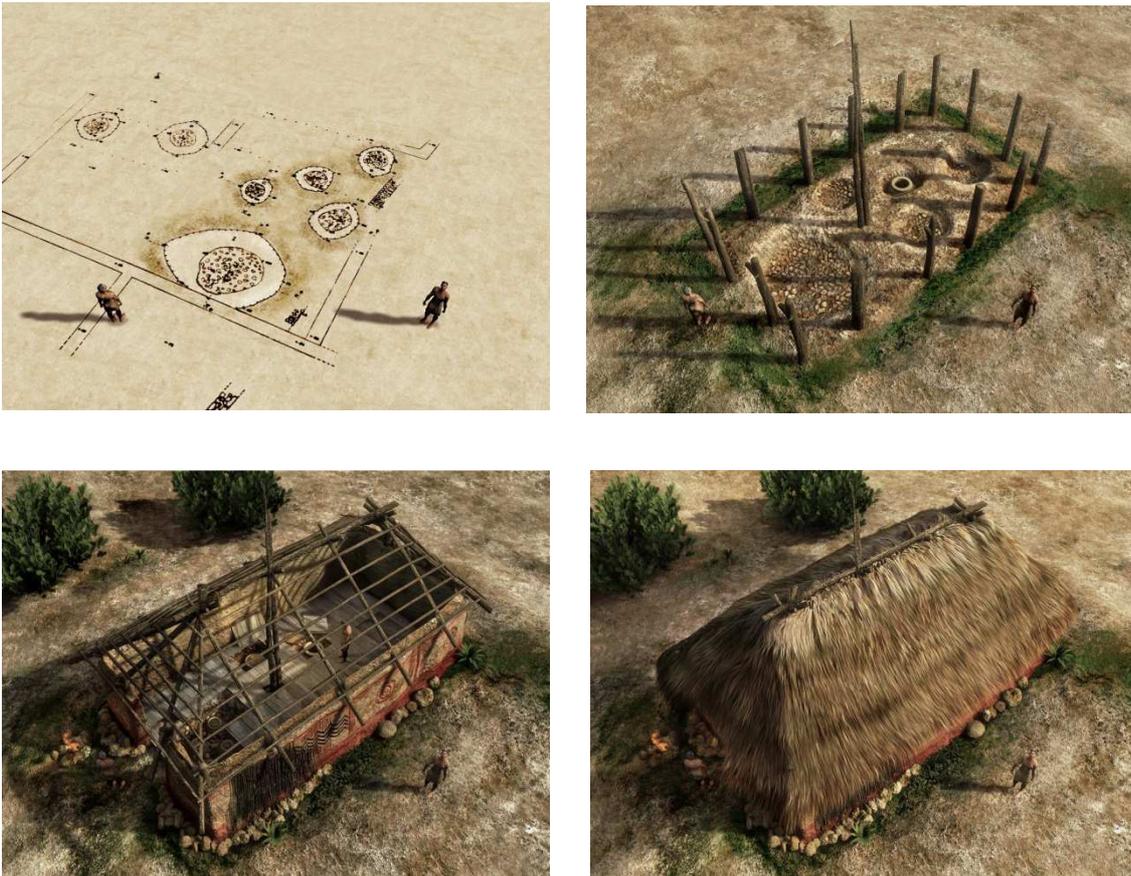


Fig. 2 – The rectangular hut with wattle and daub roof

Below these structures are the remains of pits dug in the ground that document the presence of a rectangular hut, probably built with perishable materials (wattle and daub) and exterior walls protected by a thick layer of plaster (Fig. 2).



Fig. 3 – The virtual reconstruction of ancient Herakleia

The fig. 3 shows the orthogonal plant of Heraclea. In the Western District (Zone C), due to the greater width of the terrace, isolates (*insulae*) and minor axes (*stenopoi*) were carried out on both sides of the artery EW (*plateia*). In this area is located a complex of six modular houses with courtyard and internal portico with a different plan (Fig. 4). The houses are not communicating with each other, they have a portico with pillars on the main street (*plateia*) and consists of a succession of three rooms: the *tabernae*, the arcaded courtyard and the master bedroom. The models of housing certificates in the two districts (Zone A and Zone C) allow to distinguish two types of houses: one characterized by central courtyard with portico (Fig. 5) and the one with peristyle. The "lower city" is the largest sector of the city. The plateau, very regular and with a natural slope towards the sea, is appropriate for the setting. The urban layout of this area is unfortunately archaeologically not known and only on the basis of the examination of aerial photos was possible to rebuilt a orthogonal and regular pattern that adheres perfectly to the three sides of the city fortification. The rectangular blocks had to be oriented in direction of the sea and be marked by the usual major and minor roads.



Fig. 4 – The modular houses with courtyard and internal portico

Ancient Metapontum

The second DVD was created in 2006 and concerns the Metapontum virtual visit. Since 1964, the ancient Metapontum has been the subject of intensive archaeological research. Excavations and extensive studies have allowed us to identify and delineate the ancient town planning, from its foundation in the 7th century B.C. until the Roman conquest and the subsequent gradual abandonment in late imperial age. The abundance of recovered materials documents the peculiarities of local artisan production. At the same time, the variety of architectural decorations engaged in major public buildings of the sanctuary and agora demonstrate the Mediterranean dimension of commerce. There are few equals in quantity and quality of data in the landscape of the Greek colonies of southern Italy.



Fig. 5 – 3D reconstruction of typical Greek house, with central courtyard and portico



Fig. 6 – 3D reconstruction of Metapontum

The city, rebuilt in the figure 6, is represented in its moment of greatest economic growth, demographic and urban development in the second half of the fourth century BC. The complete urban area is occupied by roads and houses, in accordance with the regular geometries already determined previously. Private homes have different types and sizes, the larger ones have a garden or a central open room while the workshops have a separate entrance.

The big road that runs along the north-south axis, the *plateia*, can be considered as the true axis that brings order inside the urban plan. It starts from the port on the Basento River, through the housing quarters

arranged in regular geometric forms, and comes with a straight path to the monumental center, located in the northern part of the urban area. This is where are located the areas that characterize a Greek city, the sanctuary and the agora. The sanctuary preserves the memory of the origins and gives a religious identity to the entire community. The great temples dedicated to Athena, Hera, Apollo and Artemis occupy the north-eastern side of the sanctuary (Fig. 7). Before them the open space is intended for sacred rites and the passage of processions. The square is occupied by a few structures, the public banquet hall used both for Authority and the distinguished guests; the theater where they are carried out the assemblies. The building, one of the world's oldest Greek, has the cavea developed on an artificial hill and the outer wall decorated with columns and frieze of triglyphs and metopes. South oriented, like other similar buildings in the world Greek, theater overlaps to a first circular building dedicated to the public meetings, the *ekklesiasterion*. The access to the upper area is guaranteed by six ramps located between the embankment and the facade.



Fig. 7 – 3D reconstruction of Metapontum sanctuary. (2012 Rendering)

Along the outer perimeter of the city, drawn in part from the Bradano and Basento river bends, the symbolic archaic perimeter wall is replaced by a massive fortification built with a large blocks structure, surrounded by a ditch. The necropolis is located outside, along the access roads to the city. Three kilometers from the town, along the right side of the Bradano River is located the temple of the Palatine Plates. The building owes its name to an ancient popular tradition that seen in columns the tables of paladins, the legendary Charlemagne's knights.

The temple, indeed dedicated to Hera, was on a street which, like that exists today, linking the area Siris-Heraclea with that of Metapontum and led to the centers of indigenous people to the North of Bradano.

The reuse of digital data: a problem of scientific transparency

From the urban study, as described above, this work proceeds with the construction of a product for a virtual visit of the individual monuments, combining floor plans, specific information about the sites and objects explored in real time. The work plan provides for: the documentation through interactive QTVR of the main areas of the city; the acquisition of historical survey of the Superintendence; laser scanning of some architectural terracotta and the subsequent texturing techniques based on camera mapping; three-dimensional modeling (Maxon Cinema 4D) to reconstructive study and the rendering of scenes.



Fig. 8 – The sanctuary area of Metapontum. In the foreground the temple A and B (2012 Rendering)

As frequently in most of the archaeological sites, the third dimension is often reduced to a few traces on the ground, few structural elements that create complex layouts. For this reasons the main purpose of our work in 2006 was to provide information, not only on what is directly comprehensible by a direct visit of the monuments, but also and especially on those items that are difficult to understand. Then, the virtual visit of the ancient Metaponto was based on this premises and it is developed in relation to the methods concerning the reconstructive archeology, now widely accepted by the scientific community. Each reconstructive hypothesis is aimed to enhance the educational value of archaeological items and, at the same time, responds to the need to make this understandable to the general public. All this can be achieved using all the digital techniques and the most expedient possible to involve scholars, not professionals, but also providing a new image of the city to specialists. The virtual visit was designed primarily for the use within the National Museum of Metaponto, but due to the delay of the works for the museum arrangements, today it has not yet been officially presented to the public. Therefore, in this last year is highlighted the need to update the 3D models made in 2006, in order to adapting them to the new rendering algorithms (Fig. 8). This requirement has highlighted an important issue in the field of Virtual Archaeology, concerning the transmission of digital content. In this case the problem is centered on the reuse of 3D models and all information, thoughts, thinking, and deductions that have been produced and collected during the

reconstruction study. The porting of three-dimensional models, as all the digital content, is affected by different computer platforms and especially by differences among formats, which over the years may have compatibility issues, as known. This technical limitation is easily solved with the adoption of generic interchange formats that are less affected to technological advances, I am referring for example to VRML, OBJ, DXF, formats.



Fig. 9 – The kerameikos of Metapontum

But the most important thing is that the basis of this work is then derived from the studies of the past, and the latest technologies have made it possible to represent this site with even greater accuracy and realism. The tools used in 2006 and in 2012 are basically the same. But the new computational capabilities and the new rendering engines, at the present, they have allowed a faster calculation of extremely complex scenes, in 2006 are difficult to calculate with our computer, particularly scenes that include the entire city. This is a purely technical aspect, but the difference between the two scenes is very clear, in particular for the difference in the calculation of the light within unbiased rendering engines. Instead, the most problematic aspect of this "process of transferring data" is related to the transparency of scientific information referring to a project of Virtual Archaeology. This is an issue discussed in the London Charter, the charter for the computer-based visualization of cultural heritage, and recently within the Principles of Seville. In particular, the principle N. 7 of the Charter of Seville declares: All computer-based visualization must be essentially transparent, i.e. testable by other researchers or professionals, since the validity, and therefore the scope, of the conclusions produced by such visualization will depend largely on the ability of others to confirm or refute the results obtained. In effect, through a systematic study of past and present documents, traced in a transparent and intelligible way, our experience of virtual archeology intends to give to the public the interpretation results with the highest realism, with highest scientific rigor, but it is also necessary to transfer

this data together with 3D models. The evolution of techniques and methods has led to major improvements in virtual archeology. We should therefore expect that this will continue even in the future.



Fig. 10 – The river harbor of Metapontum (2012 Rendering)

For these reasons it is important to share experiences and methods, and of course that these 3D models must be available in large databases. The existence of a 3D database thus conceived, with data that are available and declared, would make it possible to solve one of the most significant problems with archaeological research, which is to create a large database with formats and standards that enable future generations to make modifications to past studies. Too often researchers find themselves in the frustrating situation of not being able to make full use of past experiences - due to the lack of continuity and safeguard of other people's information - reflections, suppositions and interpretations. What must be avoided in reconstructive studies is having to starting the work from scratch, precisely due to the lack of a digital support of proven reliability. Any scientist must be access the digital documentation created for a monument and continue with the reconstructive study, revising what has already been produced. The full transparency of the methods, techniques and accompanying documentation of a virtual archaeology project, is necessary in order to define standards of quality that raise the scientific value of a discipline which promises to inform, amaze and fascinate with ever greater effectiveness and scientific rigor.

Technical workflow

From a purely technical point of view the work is started from the study of old published documents. In particular, very valuable were the reconstruction drawings of Dieter Mertens, with the two-dimensional reconstructions as result of the extensive work conducted by the Archaeological Superintendency of Basilicata. This basis of information has been reworked completely in 3D in order to refine and complete



Fig. 11 – The temple of Hera with superimposed wireframe model (2012 Rendering)



Fig. 12 – The sanctuary of Metapontum. Simulation at different times of the day (2012 Rendering)

this old reconstruction. This study conducted in the 3D software Maxon Cinema 4D has allowed to obtain numerous improvements to previous reconstructions, by providing an original representation of the entire city and the sanctuary. The 3D models are the main basis of the interactive application, fully managed within Adobe Director, a highly programmable software, but with basic tools also suitable for non-experts. In more



Fig. 13 – The sanctuary of Metapontum (2012 Rendering)



Fig. 14 – The ancient Metapontum (2012 Rendering)

recent times the old models were rendered within 3D unbiased software, mainly using Next Limit Maxwell Render, in multi-node rendering. The communicative approach has been developed starting from synthetic

storyboards in accordance with the requirements of the Superintendency, in compatible way with the concepts of usability in the museum visit.

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