

## USING 3D MODELS IN MUSEUMS: THE POTENTIAL CASE OF "CASTRO DE ROMARIZ 3D" PROJECT

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**ABSTRACT** Romariz Castro is a proto-historical settlement that was inhabited up until the roman age. Located in Aveiro district, this archaeological site shows superposition of constructions throughout the ages, demonstrating significant reformulations in architecture. Between 2011 and 2013, the "Castro de Romariz 3D" project took its first steps during the Master's degree in FLUP, by studying architecture and urbanism and reconstructing the historical village using 3D computer generated models. This project is part of the interpretation of Romariz Castro and the information can be accessed by the public through its dedicated website. Achieved by means of a computer gaming platform, this technology shows great potential in museums, as it can be used by the public, in a 'learning by entertainment' experiment. Discussions about the impact of media and technologies in museums tend to take this impact as an opportunity for the museum to reinvent itself and ensure its survival in the XXI century. The reconstruction of archaeological sites in 3D and its exhibition in museums fulfils this paradigm; that visitors should develop knowledge through interactive activities. Likewise, a gaming platform like the one used in the project can maximize the physical and real experience of public by reducing the exceeding amount of quantitative perception of the historical information and by answering the most common questions in a playful way: how was this site in the past and how did its society organized itself? Is it possible to understand the 'Romanization event' by looking at the village's architecture? This gaming technology gives museology a new theoretical light - the impact between the real-world of the present and the virtual-world of the past in museum's visitors.

**KEYWORDS** Archaeology; Museology; Technologies; 3D Models; Castro de Romariz

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### **A brief archaeological context of the Romariz Castro**

The Romariz Castro is located in the district of Aveiro, more specifically in the surroundings of the Romariz Village, in the municipality of Santa Maria da Feira (Military Letter of Portugal, page n.º 144). This archaeological site, which has height levels between 360 to 375 meters, is implanted in the vicinity of Inha, Ul and Uíma rivers, surrounded by an exquisite landscape: the Casal do Monte and Monte Alto mountains in the north; Monte de Goim in the east; in the west by the peaks bordering lands of Bajouca and Gândara towards south to Gaiate. There is also, toward the south and southeast, a flat land which currently locates the villages of Romariz, Vila Nova and Mouquim.

According to Almeida (1984), it is possible to define the Castro Culture of that time as the first stone civilization or the first petrified villages: for the author, this is more coherent than to call it an iron culture. The plans of these populated settlements were, more or less, circular and delineated by walls or curbs. These were relatively small villages, located at the top of hills with a low or average height, not far from rivers and fields, with peculiar organization of the infrastructures (Almeida, 1984; Silva, 1986). The interior spaces of these villages were composed of buildings also with circular or elliptical shape. As for the urbanization, these sites show two main evidences: a planned manner, wherein there is clearly a major axis, as in the case of Citânia de Sanfins (with older occupancy levels dated to about 500 BC); or a spontaneously manner, in which the Castro would suffer interventions over time in a self-organizing form of the population, as in the case of Romariz Castro (with older occupancy levels dated to about 1 000 BC).

According to Centeno (2011), the archaeological work carried out in

the Romariz Castro revealed that the occupation of the site remount the last phase of the Late Bronze Age (around 900-700 BC). For some authors of the historical-culturalism school, the Romariz Castro, as it is patented today, was formed along with new regional planning after the arrival of a peculiar people coming from the south of the Iberian Peninsula designated "Turduli", who settled in the southern bank of the Douro river around the 5<sup>th</sup> century BC (García and Bellido, 1986; Silva, 1986). However, the only archaeological data that might feature a single or 'concrete' fact of this story is just a *tessera* from 7 AD that mentions *Turduli Veteres* as a family or maybe a community name (Silva, 1986). With no sufficient archaeological data to address an issue or a concrete history of the origins of the Romariz Castro, we can keep on with the study of the available age determinations, artefacts and all kinds of records. As it referenced by Centeno (2011, p.11), "to the earliest stage of the settlement's occupation, few data have been revealed by archaeological excavations", since most of these recent excavations have been effectively incident on the last occupation phase of the Castro, that ends around the first century AD.

Despite the few archaeological data for older chronologies of the Romariz Castro in 1843 and 1940-46 excavations, the existence of buildings overlays was observed, demonstrating significant reformulations in the local architecture (Centeno, 2011). These overlays refer to buildings that were destroyed, corresponding to the initial stage of petrification of dwellings which, according to the author, appear to have occurred during the second century BC. Also, in earlier periods most of the housing structures would even be built only by perishable materials (Silva, 1986; Centeno, 2011), demonstrated by the results of excavations carried out in 1980 and

the following years.

Another phase of the Romariz Castro coincides with the time of change of the political system in the center of the Roman Empire, particularly during Augustus. It is at this time that we first start to see a 'Romanization' of this village. However, this event does not seem to have influenced the Castro's urban organization, but contributing only to a better definition of some streets and even its flooring (Centeno, 2011). During this time, we also see a new type of housing, which has been adopting a more regular style in terms of shape and introducing plaster and paintings on the walls, as well as the roof, gradually replacing the previous perishable materials permanently. The abandonment of the Romariz Castro will have been given-from the end of the first century.

### **The 3D technologies in archaeology**

The 3D modelling is a technique of representation of something, by developing a model. These models are in turn designed to study and scientifically describe a phenomenon. A mathematical model is the representation of a specific phenomenon through variables and functional relationships between these variables. Thus, Computer Generated Models consists in the development of a mathematical model to represent certain aspects of a phenomenon or real system (Bianchi, 2006). When the computer representation of a real system introduces graphic shapes that mimic how this phenomenon occurs, we then have a computer simulation. To have some guarantees of properly representations of the ambient that these simulations purport to represent, these must be based on a mathematical and computational model correctly designed. So, there are simulation programs specifically designed for most of the scientific and

technological academic areas, whether for its didactic nature or of a more technological nature, to study or demonstrate its mechanisms of operation.

Only in the last six years, the 3D modelling has been recognized in archaeology for its potential in terms of studying the archaeological sites and, most importantly, its aptitude and capability when it comes to attract the attention of the public and simultaneously disclose the historic information and knowledge. However, the biggest impasse on archaeologists to adopt this technique is precisely the lack of its acquaintance by most archaeologists. Nevertheless, it has been noticed in recent times an effort from the archaeological community to catch up in the world of new technologies, even if by a transdisciplinary work. Proof of this is, for example, the increasing use of panoramic photography and its treatment with 3D effect.

The most common way to create objects in three dimensions is using pre-defined geometric shapes (spheres, cylinders, cubes or pyramids) in three-dimensional design programs such as Autodesk 3ds Max Studio. The user then applies the necessary manipulations on these objects to give rise to the desired model. Once elaborated the three-dimensional models, a full simulation is applied, giving the necessary coverage on surfaces with textures. These can be based on solid colours, conferring a flat appearance or with simulated reality images. What we could call of ‘last phase’ of the three-dimensional modelling is the process called rendering: this process is done through the creation of a digital 2D image (or an animation from another virtual model), which it represents the output of the data that constitute the visibility of the details of the created model. The duration of the rendering process can last from

a few minutes to several days, depending on the amount of textures that have to be created or the quantity of models that have to be added.

Virtual reality and 3D virtual worlds are usually created to be viewed on screens and may include more or less interactivity with the user. These applications are undertaken in numerous areas, such as car and flight simulations, equipment for surgical operations, creation of models in engineering or architecture, games and other forms of entertainment. As already mentioned, within the framework of archaeology in Portugal, this computer technique has recently given its first steps. One example is the compendium of Morais (2012), whose 3D illustrations of the Roman city of Bracara Augusta, serve to support the description of the city elements.

### **The 3D reconstruction of Romariz Castro**

Any reconstruction of an archaeological site (or a portion thereof) in 3D assumes that this site is properly understood. The study of the archaeological record is undoubtedly one of the most important aspects of the archaeological interpretation and investigation. It is this study that identifies the quality and degree of preservation of the archaeological contexts, and the relationship between artefacts, structures and samples for dating and other analyses (Bicho, 2006). That is, the log formation process of the archaeological record is essential, since the archaeological context suffers a number, greater or lesser, of changes from the time of its deposition and decay. So is the archaeologist's primary task to identify changings, register them and then explain them. These tend to become more complex since most archaeological sites not only corresponds to a single use of the same space or to a single

placement site, but it is mostly a palimpsest of occupations and uses of the same space (Bicho, 2006).

To make a correct 3D modulation, it is strictly necessary that the requirements of a good archaeological practice are met. Above all, the archaeological site is the place where archaeology exercises its methodologies: it is the environment in which are preserved the remains, the set of artefacts and environmental and spatial records which the archaeologist must endure to register during its excavation campaign. For the Romariz Castro, two distinct realities are exposed: the results of the excavations carried out between 1843 and 1946 and the scientific research elapsed from 1980 to the present day under the direction of Professor Doctor Rui M. S. Centeno and Professor Doctor Armando Coelho da Silva from the Faculty of Arts and Humanities, University of Porto. Naturally due to the lack of registration methods, which are used today and the lack of scientific accuracy in general, the results of the first excavations in Romariz Castro require a critical analysis on the ground, since the current location (presumably *in situ*) of the foregoing structures and their contemporaneity may be put in question. It is important to mention that the 3D reconstruction provides an important aid in this type of research, since there may be doubts between a structure that is being rebuilt and its surroundings with the already rebuilt structures.

Rebuilding in archaeology means to assign an image to the past that will qualify its look and functionality. Moreover, by 3D modelling the architecture of what might have existed in the Castro Romariz (and other archaeological sites) is to retrieve an architectural memory, with its urban spaces and paths that no longer exist today. Simultaneously, archaeology contributes not only to the study of

the relationship between materiality and memory, but also has an active role in the formation of these same memories (Hodder and Hutson, 2003). For example, the experimental archaeology has yielded valuable information about techniques performed by the people of the past with the material world around them. Written up by empirical and quantitative issues, this area corresponds to the line of a good scientific practice which states that any experience must be based on repeatable and reproducible data (Dunn and Woolford, 2012). Nevertheless, it is clear that the reconstruction by digital technologies has a significant role in experimental archaeology and this will certainly tend to grow in the coming years.

This 3D reconstruction project was theorized throughout 2013, during the 2<sup>nd</sup> year of the Masters in Archaeology in the Faculty of Arts and Humanities, University of Porto, with the supervision of Professor Doctor Rui Manuel Sobral Centeno. The project, that has a dedicated website<sup>2</sup>, was divided in five main stages: (1) The analysis of the geo-archaeo-spatial registration by surveying the site; (2) The vectorization of the structures or 2D drawing and the later 3D reconstruction; (3) The modulation of the Romariz Castro's terrain and its involvement in the gaming platform; (4) Inclusion of the simple models of all the infrastructures in their proper location and position; and (5) Total reconstruction of both indigenous and typically Roman infrastructures based on the intensive study of a vast bibliographic list (Silva, 2013).

### **A virtual tour in a museological context?**

Contemporary discussions concerning the use of multimedia and

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<sup>2</sup> <http://pedro.dirtycoding.com/Romariz3D>



technologies in museums tend to take radical differences between the impact of both virtual and material world, a difference that is conceived through a series of oppositions (Witcomb, 2007). In general, the introduction of multimedia items is seen as a threat to the traditional concept of culture and established museum practices but, on the other hand, is seen as an opportunity for the museums to reinvent themselves and ensure its survival in the XXI century. Those who argue that technology in museums is a threat, usually indicate that the ability to distinguish between the real and the copy will be reduced, which will inevitable end with the death of the material object and the reduction of knowledge through the imposition of information (Witcomb, 2007). Theorists that argue in favour of technology constantly point to the favourable reduction of institutional authority, which will, in turn, end with an increase of knowledge in popular culture, as also with the recognition of multiple meanings and lore, and, finally, the extent of the media sphere to the museum's space. This would mean that the scope of culture would significantly grow and expand. More importantly, the use of technologies in museums automatically results in adapting the information and knowledge resources to the new generations which consequently, and contrary to what the critics point, would keep the material world quite present and even more reachable by the masses.

According to Geary (2006), there are affordable technologies that can be used in the reconstruction of possible appearances of original artefacts (either movable or immovable) for 3D visualizations in full-realistic colour in the field of conservation or cultural heritage. To Bahn (1997), the ultimate goal of archaeology is the communication of its findings to the public. This is also

stressed by Renfrew and Bahn (2008), when the authors defend that archaeologists have a duty to both colleagues and the general public, to explain what they are doing and why. Fundamentally, this means publish and disseminate findings of their results to be available to other academic members and, simultaneously, to be appreciated and understood by the general public. The reconstruction of monuments and other archaeological sites fulfils this paradigm that visitors should develop scientific skills through interactive experimental activities (Semedo, 2005).

The question that arises is, how do these scientific technological approaches create impact in a musealization context? As it was mentioned before, the ultimate aim of archaeology is the communication of its findings and historical productions to the public as well as the scientific community itself. In recent decades, archaeologists have realized through the theoretical discussion that, by its choice of artefacts, themes and approaches in museums constantly reflects and projects either consciously or unconsciously image of their own prejudices and beliefs. And indeed, all the multiple factors included there give the colour of their own version of the past. Through the idea that a visitor is an individual who seeks to impose sense and meaning of the materials exposed in a museum, the development of a 3D modelling project and its application in a gaming platform gives some answer to this question. That is, to help the public understand some of the scientific explanations by the visual sense of a particular site, a window would be open to support people understand better about their world and, in this context, about their history (MacDonald, 2002).

According to Bahn (1997), it is necessary to achieve a delicate

balance between education and fun, and museum studies over the last twenty-five years has been important in this aspect by the complexity of the issues involved in the selection and arrangement of the material for the public. Leask and Fyall (2006) point that it will also be inevitably to think about the relationship that museums have with the tourism industry to consolidate archaeology and, thereby, realize economic gains that should serve to enrich this scientific area and even the very regions where the museums are inserted. In fact, the use of a gaming platform with a reconstructed archaeological site, like this one of the Romariz Castro 3D, reflects the idea of the Interactive XXI Century Museums. Above all, it has been inevitable that these new museums have recourse to new technologies to transmit their contents that have a participatory manner to thus attract the attention of their audience.

## **Conclusion**

The history of museology considers the constant theorizing about the studied exhibits, always with the purpose of revamping them and, thus, to cause and provide an appropriately pleasant visual impact to visitors. Likewise, a gaming platform can maximize the physical and actual experience in museums. That is, the experience gained from this computing device enriches the knowledge of a proto-historic settlement and Romanised, like Romariz Castro, by a playful way through experience and which will reduce the quantitative perception of information. Nevertheless, its applicability also gives museology a new theoretical discussion: the impact between the real world of the present and the virtual world of the past.

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