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## 3D plans of Mugarduia, a Tool for Interpretation

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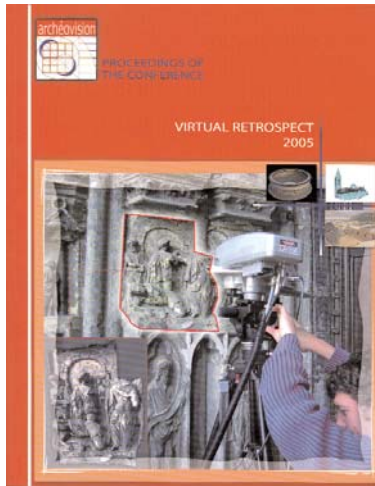
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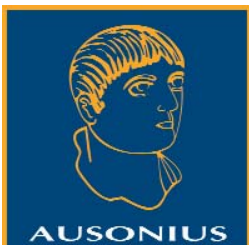
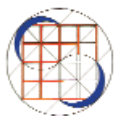
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## 3D PLANS OF MUGARDUIA, A TOOL FOR INTERPRETATION

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**Abstract :** Today archaeologists have begun to use 3D techniques to share the knowledge they have acquired in the field with the public and institutions. Sharing the knowledge in this way facilitates the public's understanding of archaeological sites and methods while at the same time making it entertaining. However, these new techniques are normally only used to publish the findings of archaeological studies, they do not constitute a part of those studies. At the Palaeolithic settlement of Mugarduia, as in other Palaeolithic open air sites, there are a number of pieces, but no structures, paintings or other works of art. In this case we assembled the pieces together in a 3D model. By using various symbols for the different kinds of artefacts in order to get as many maps as we required, we tried to understand the settlement and how the post depositional process had affected it. We then used realistic photo images previously taken of other settlements,

intended for publication, in order to make a tool for archaeological interpretation, in this way the 3D model becomes integrated into the archaeological process.

**Keywords :** 3D — mapping — planning — artefacts distribution — interpretation.

The present digital model of the Mugardia settlement is being made thanks to the funds of the Barandiaran research fellowship (grant) from the Eusko Ikaskuntza Society. This open air settlement dates back to the Gravettian period and was excavated by Ignacio Barandiaran and Ana Cava in 1987. It was discovered as a result of the building of a site hut for the workers of RENFE (Spanish Railway Company) who were cutting down beech trees for railway sleepers.

The stratification of the settlement is formed by only two natural strata which in some cases are more than two metres deep (fig. 1).

Given the situation there was a need to build a 3D model which could facilitate and speed up visualising the objects reassembled in their rightful place. The accompanying 3D environment made it possible to view all the different planes to try to identify both the stratum order and some kind of spatial distribution of the objects with a view of trying to work out some sort of spatial order of the settlement (fig. 2).

Using AutoCad I was assigned to draw a 3D model in which the pieces were placed in their right place and ordered in layers according to the type of object as well as to their level to see how they were spatially related to each other.

I was given the plans of the excavation which consisted of parallel sections every 33,3 cm. (fig. 3), as well as a database of all the objects and their coordinates, except for the carving

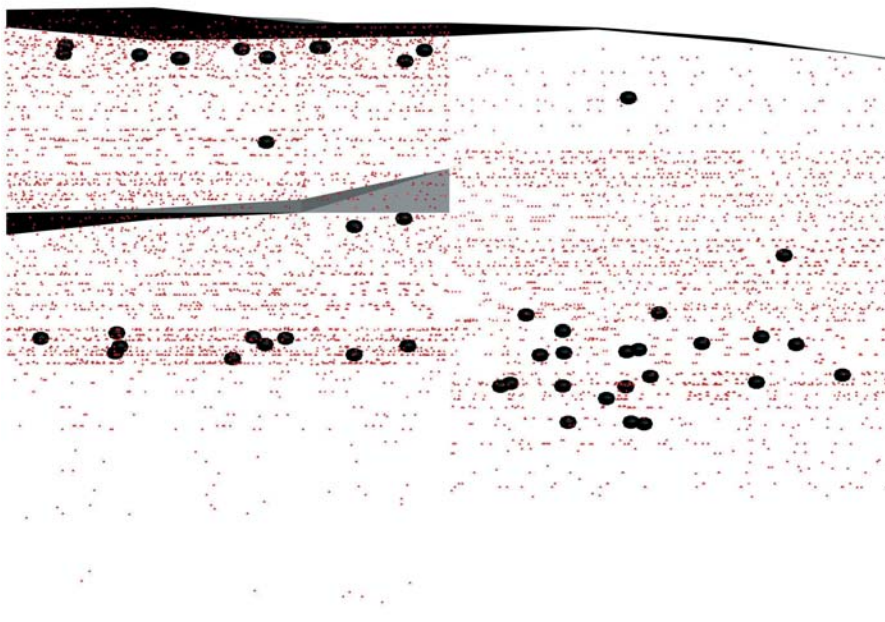


Fig. 1: The stratification of the settlement is formed by only two natural strata.

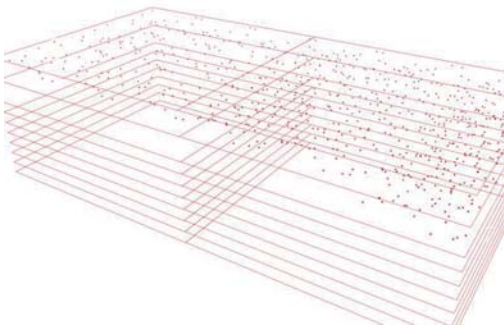


Fig. 2: There was a need to build a 3D model which could facilitate to identify some stratum order and some kind of spatial distribution.

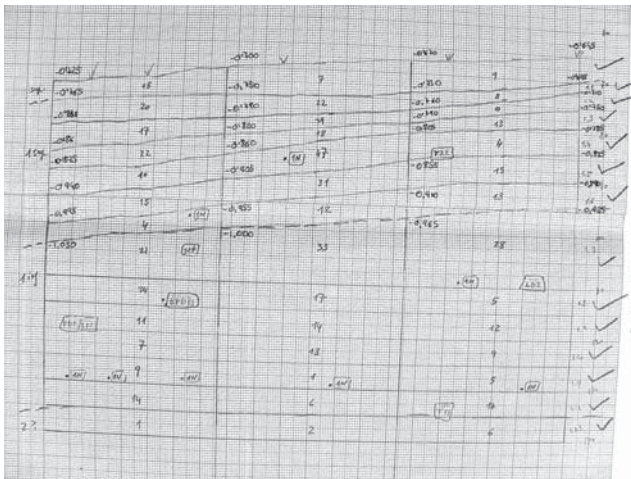


Fig. 3: The plans of the excavation which consist of parallel sections every 33,3 cm.

that were only located by the level and quadrant they belonged to.

The irregularity of these first levels as well as the great amount of sections led me to model the levels using a topographic approach. Instead of joining all the sections I had, I decided to model them as if I had been gathering data at the excavation itself, and pretend that all the levels were excavated at the same time throughout the whole excavation. Thus, taking as a basis the sections and the database mentioned earlier, I developed the coordinates of a group of dots of the surface of each level as if done with a theodolite, and generated the surface of each level with the topography software TopoCal (fig. 4).

Once the levels were modelled with TopoCal, I imported them to AutoCad where I was able to use them as the basis to generate the meshes of 1 by 1 m for each level. I then proceeded to introduce the different types of objects according to the coordinates given by the database or by the planes (fig. 5). The finished model was then exported to 3DMax (fig. 6).

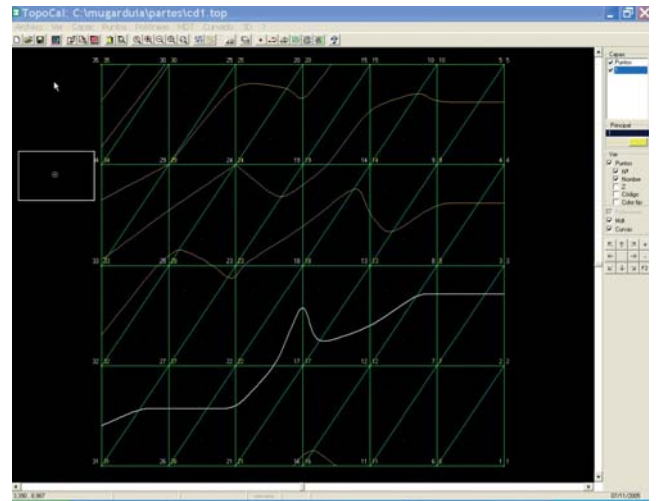


Fig. 4: We generated the surface of each level with the topography software TopoCal.

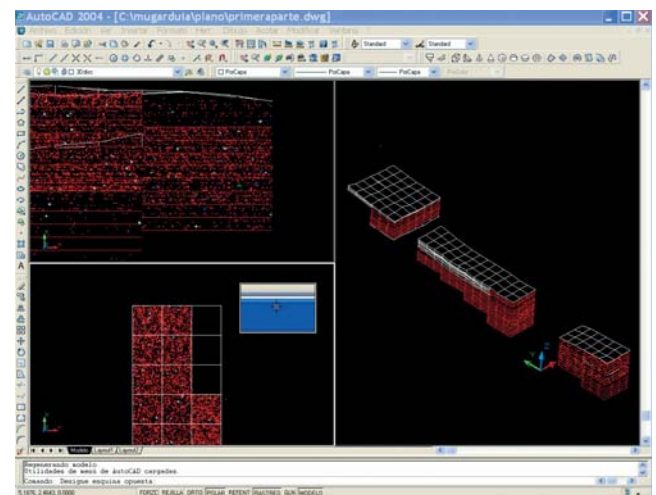


Fig. 5: The model is imported to Autocad.

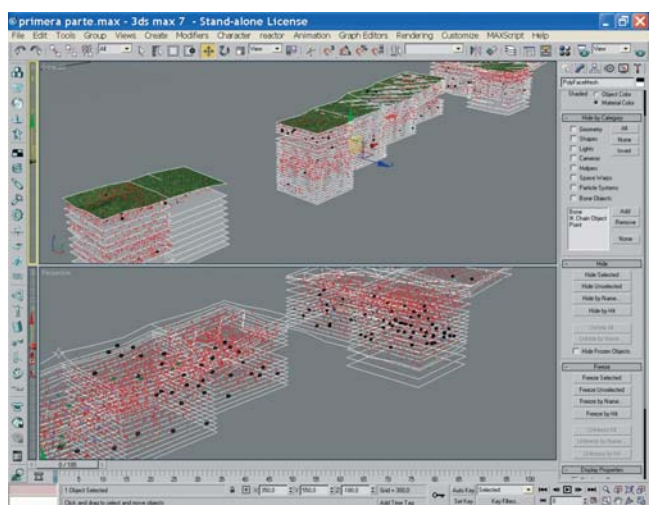


Fig. 6: The model and the objects are exported to 3DMax.

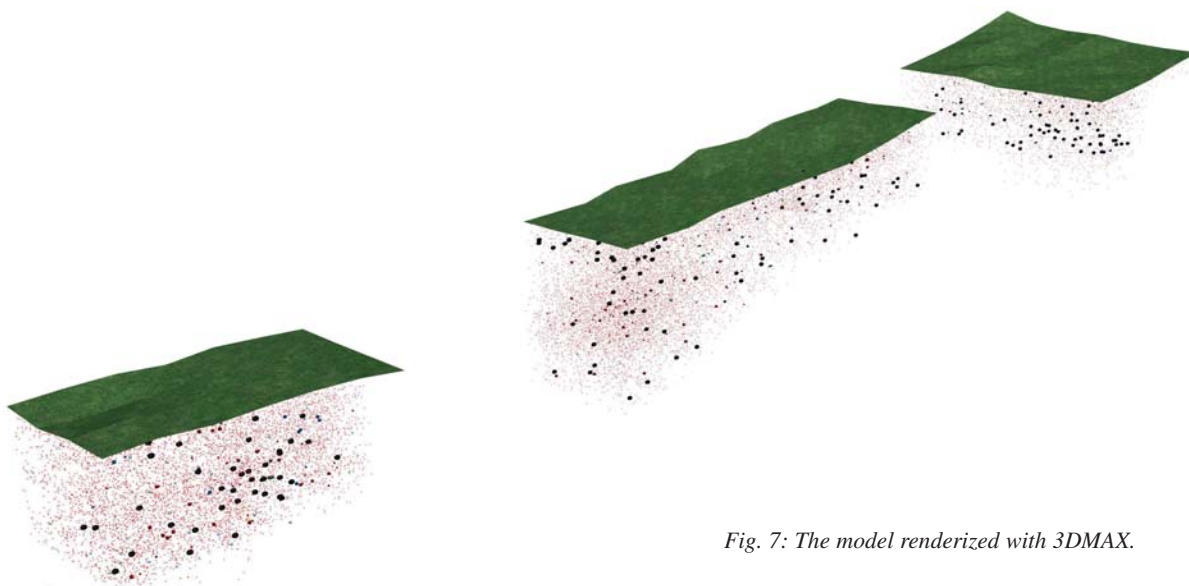


Fig. 7: The model rendered with 3DMAX.

In this way archaeologists have at their disposal a familiar working tool, AutoCad, and once they have decided which views they want to publish they can use 3DMax which offers better finishes (renders with a higher quality) (fig. 7).

It is in this way that we are trying to build a 3D model of Mugardia (fig. 8). In this particular case our main goal is not to rebuild a settlement to show to the public but to create a tool for archaeologists that allows them to interpret the spatial relations between different tools (materials) found in an excavation and to extract the planes they might be interested in, in a very easy and fast way (fig. 9 & 10).

The best case scenario would be to gather the data right at the very moment of the excavation while bearing in mind its possible 3D virtual reconstruction. In such a case we could virtually rebuild a given artefact as it is being excavated, having all the different planes or elevations of the excavation first hand, and being able to photograph and classify the material and link it to a database with the object of the 3D model. Unfortunately, I have not heard of any excavation where this process has taken place. However, the number of archaeologists interested in the matter and seeking advice on how to gather the data to later process it in 3D is growing day by day.

I hope that in a short time all archaeological excavations will be virtually rebuilt, as at present they are unavoidably destroyed by the process of excavating. This method would consequently lead to minimizing the destructive effect that the excavation process bears with it and so facilitate the tasks of interpretation, recording, planimetry and spreading knowledge.

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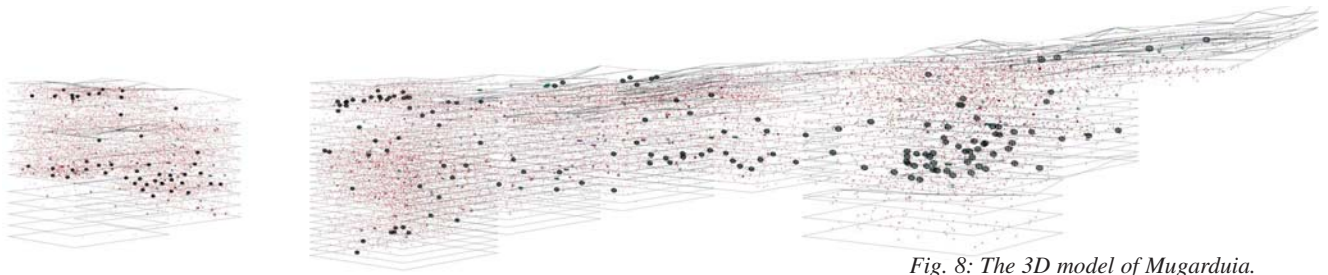


Fig. 8: The 3D model of Mugarduia.

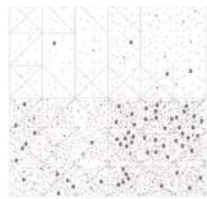


Fig 9: Plan of Mugarduia.



Fig 10: Section of Mugarduia.