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GIS as an Interpretative Tool in Greek Archaeological Research

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1. Introduction

The spatial information technology known as **GIS** (Geographical Information System) has emerged as one of the most flexible and comprehensive analytical tools for handling archaeological data and exploring the human space (Wheatley 1996). Geographical Information technology enables the archaeologists to record, convert, analyse and represent vast amounts of complex spatial data in a homogeneous manner (Gaffney-Stancic-Watson 1995). When the archaeological community gradually started to exploit some of the GIS inherent functional advantages like the potential to handle space as a continuous surface (raster approach) and the ability to allow a human scale to be incorporated in spatial modelling (visibility studies), it became obvious that GIS technology within the discipline of archaeology is de facto theory-laden, since it is tool of "social reproduction of knowledge" (Harris-Lock 1995). Consequently it demands an underlying reflexive spatial theory to sustain it. This new "theory of place" (Wheatley 1996) can allow archaeologists to:

- ***develop an adequate concept of landscape and encourage a multiperspective envision of the past***
- ***deconstruct the traditional archaeological categories (like site) and define alternatives to the ones found lacking***
- ***define an analytical path that will relate individual scale to patterns observed in larger scales***
- ***devise a way to represent the historical sequence of change.***

Equipped with this theoretical underpinning GIS platforms offer the possibility to *experience* the past, by testing different questions and approaches. This theoretical framework clearly upgrades GIS from a simple calculating machine, used for creating prediction schemes to an analytical tool of contextualised archaeology (Gaffney-Van Leusen 1995). As a result the standard way of viewing, analysing and approaching the past has changed.

The primary goal of this paper is to show how GIS technology in the context mentioned above can be applied in Greek archaeological research as a sophisticated visualization platform and as a functional interpretative tool. The most significant aspect of the project is that is archaeologically oriented. It was devised focusing on a series of archaeological problems, questions, and needs. Once this framework was established, GIS tools were used in order to find solutions and provide new paths to archaeological research.

The on-going project presented here deals with two forms of archaeological GIS applications:

- The "intra site" GIS applications dealing with spatial analysis confined in the context of a single excavation or archaeological site
- a "macrospace" GIS applications (birds-eye view) dealing with and analyzing spatial correlation in a network of archaeological sites, covering large scale areas of archaeological interest.

2. The archaeological site of Karabournaki in N.Greece: A case of intra site GIS study.

2.1 Intra site GIS studies

In the sphere of intra site GIS analysis, archaeologists are mostly focused on the creation of spatial databases and the correlation between architectural space and finds. In practical terms, that means the creation of highly sophisticated distribution maps of archaeological data (e.g. coins, pottery), which can be retrieved and examined at will. The possibility of dynamic searching in a spatial database and the visualization of the results on accurately digitally designed multilayer maps of the archaeological site can evolve in an on going exploration tool for field archaeologists and researchers. Furthermore it can produce guidelines in order to plan the course of action for future excavation and in addition to help choose new areas to devote time and labor for fieldwork.

2.2 Karabournaki

The archaeological site located at Karabournaki (Tiverios, Manakidou, and Tsiafakis 2005; Tiverios, Manakidou, and Tsiafakis 2003) in the region of Thessaloniki (Figure 1) is one of the few cases of active excavations in Greece, where a meticulous project of digitization and archiving of finds has taken place. This project has occurred for the last three years (Tsiafakis 2005; Tsiafakis, Evangelidis, Tsirliganis, Pavlidis and Chamzas 2004; Tsiafakis, Tsompanopoulos, Pavlidis, Papadopoulou, Tsirliganis, Evangelidis and Chamzas 2003).

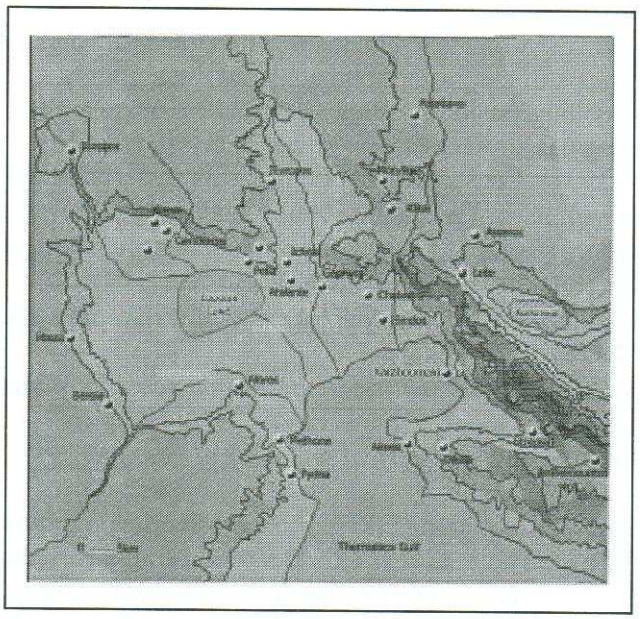
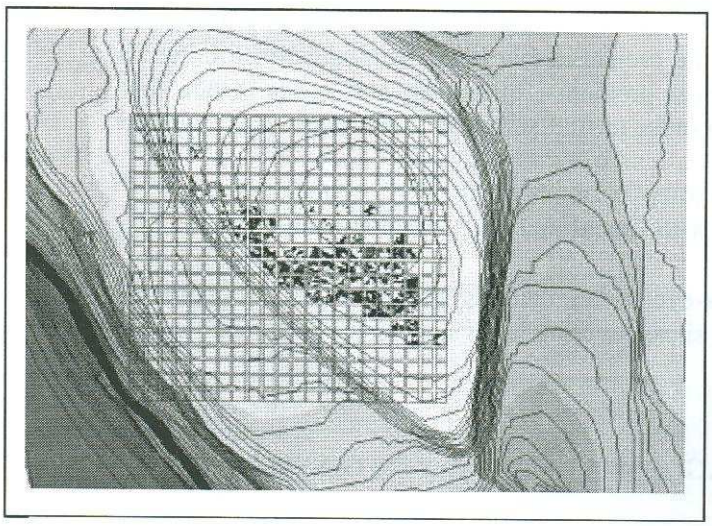


Figure 1. The archaeological area of Thermaic Gulf.



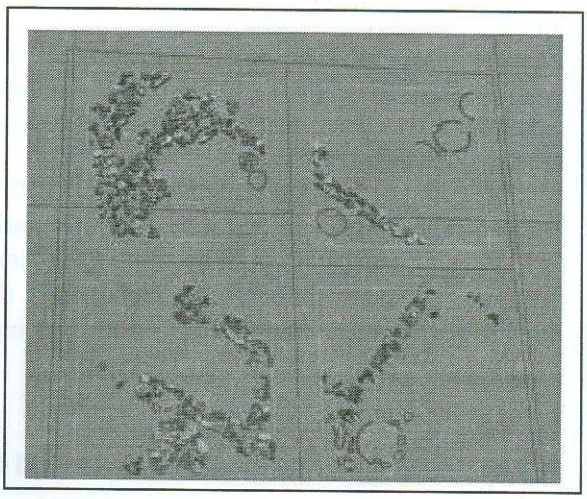


Figure 2 and 3. Topological map of the site and plan of a building.

The digitization process (executed with Computer Aided Design) has produced a complete digital mapping of the landscape and the architecture of the archaeological site, providing high quality topological maps and architectural plans (Figures 2 and 3). The products of this digitization have evolved to become a digital record of the different stages of the excavation and they are constantly renewed with new data and finds. However the most important aspect of the digitization process is that it has allowed us to gain for the first time an overall perspective of the site and provided us with the necessary base in order to move to the next stage: the initiation of a GIS project.

GIS applications have become increasingly popular in archaeological projects but it is doubtful that this is due to the analytical abilities and functionality of the technology but instead as a result to its high quality visualization tools that impress the "techno phobic" archaeological community. In the case of Karabournaki, one of our initial research goals was to devise a way to correlate architectural space with finds, in particular pottery (Figure 4).

The potential offered by spatial databases and the high quality visualization techniques promise something more elaborate and flexible than a mere distribution map. The experimentation with different GIS platforms showed that a new interactive/dynamic research tool has emerged that can allow scholars to ask questions, retrieve data and produce high quality 2D or 3D visualization (Figure 5). In practical terms this means that we managed to:

- Check the concentration of pottery and reveal areas of archaeological interest
- Have a clear view of the distribution of different pottery types and reveal possible habitation patterns
- Produce maps of pottery distribution for different time periods
- Ask questions about particular areas, while viewing the map and retrieve answers in the form of 2D and 3D distribution maps
- Devise a way to organize and study smaller contexts like different excavation trenches (Figure 4), deposit pits or the interior of a excavated buildings.

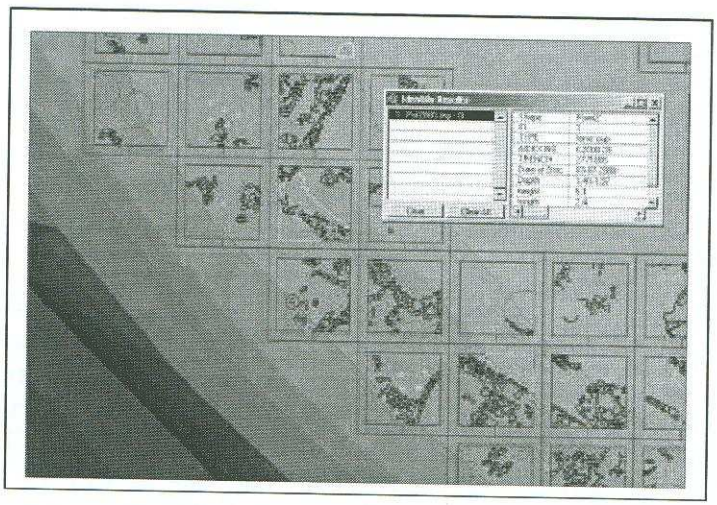


Figure 4. Research the spatial database.

Furthermore, taking into consideration the ongoing development in the Web based GIS, the project aims to the creation of a web platform that will offer access to the excavation data. In that way GIS technology evolves something more than an intra site sophisticated database: it becomes an explorative tool and a theory testing system.

Finally, another very important aspect of the whole project is the correlation between finds and space and the possibility of asking questions or testing theories, which may produce a tool that will allow us

to determine new areas of field research.

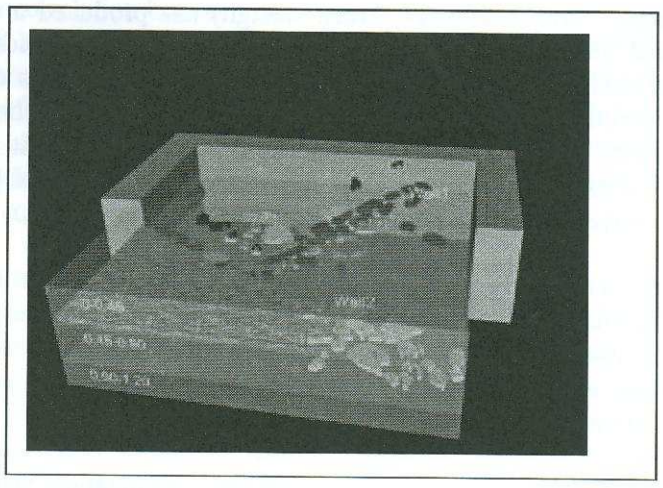


Figure 5. 3D reconstruction of stratigraphy.

3. A case of macrospace GIS

3.1 Macrospace GIS

The engagement of GIS in archaeology is a form of archaeological process that goes beyond the restricted idea of bounded archaeological site and helps to approach the complexity of human spatial behaviour. Visibility studies (like viewshed analysis) or least cost path analysis can help researchers to abandon the role of an extra-spatial (decontextualised) observer and adopt that of a participant in a cognitive landscape. Developing such a framework, places can be viewed through social, political and ritual factors and restrictions, that affect not only the decision making process but also the collective memory of the people (for instance establishment of socially restricted ***-taboo***-places like ceremonial sites, cemeteries or even places regarded as "haunted"). As Wheatley (Wheatley, 1996) showed, this departure from Cartesian viewpoints, instead of being condemned, should be encouraged because it allows landscapes to be viewed as a series of places from the human scale perspective.
This Theory laden archaeological GIS is therefore a cognitive analytical spatial tool that can allow us to overcome the functional limitation of large scale areas and approach a human space in a multiperspective (and hopefully multidimensional) manner.

3.2 The Thermaic Gulf area project

The Thermaic Gulf is an area of great archaeological importance. It is comprised of a network of archaeological sites dated from prehistory down to historical times. A great number of those settlements were united to form a new city called Thessaloniki by the Hellenistic king Kassander in 316BC. Thessaloniki turned out to be a great urban centre that dominated the entire region over the subsequent periods. The ancient site located in Karabournaki relates to ancient Therma, one of the most important settlements in the area before its unification of Kassander (Tiverios, Manakidou, and Tsiafakis, 2003). Therefore it is of extreme importance for the study not only of the settlement but also of the study of the entire area to comprehend the ways that the different sites were interconnected. The relations developed between the different sites controlled the life of the entire area for centuries.

One of the obvious outcomes of the project will be the creation of a GIS based map of the entire area. This map will be the basic platform where future projects will be incorporated in a truly functional manner of handling and extracting information.

Viewsed analysis can be used as a cognitive tool in order to reveal some habitation patterns like the intervisibility between sites (Van Leusen, 1998). Visual contact was very important between sites

that obviously belonged to a network and were dependent on each other. That means that an analytical tool of a spatial technology platform like viewshed analysis can be used in order to reveal not only habitation patterns but also the decision making process of choosing where a settlement will be built.

The creation of a large-scale GIS project can effectively help

- to check the distribution of different sites in different periods of time
- to check the visual contacts between the sites
- to trace tracks between the sites and reveal new sites
- the creation of a GIS based map of the area where in the future each geographical point on the map (representing archaeological sites) will lead to functional geographical databases.
- the engagement of analytical techniques as described will allow us to reveal habitation patterns of the human space.
- the creation of a tool that will provide the archaeological community with an efficient way of managing (Cultural Management) an extremely multivariate environment.

The Thermaikos Gulf project is unique in Greece as it is the first to be conducted on such a wide scale. Once completed, it will cover an extensive area of great archaeological interest, allow access to vast amounts of data, and enhance the archaeological analysis and research.

4. Acknowledgements

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Biography

Dr. Despoina Tsiafakis is archaeologist and the Head of the Cultural Heritage Unit at CETI. Her *publications regarding ancient Greek Art and application of modern technologies in the field of Culture, have been published in international volumes and journals. Her current interests involve ancient Greek pottery and architecture, archaeology of the Northeastern Aegean and the application of new technologies in Cultural Heritage.*

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