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GEOVISUALIZATION AND ARCHAEOLOGY: SUPPORTING EXCAVATION SITE RESEARCH

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Archaeology is a science where geographical space as well as time, are of significant importance; in this sense Archaeology provides an interesting link to geovisualization applications and research. Archaeological excavations, being conducted in three-dimensional space, generate large amounts of data, with complex structures in the three-dimensional spatial domain and of various extend in the temporal domain: an ideal data environment, therefore, for applying geovisualization methods and tools, in order to assist archaeological interpretations in excavation site research. The work presented in this paper concerns the development and implementation of a geovisualization environment created for use by archaeologists in situ i.e. in an excavation site. It is currently being implemented in the prehistoric excavation site of Paliambela, in Northern Greece. Since it is already fully operational, it is used on a steady basis in the excavation field. The system was designed for multi-scale use i.e. for viewing in detail any available piece of archaeological information, as well as for allowing overviews of various extends, according to user selections. For this purpose, the archaeologist/researcher can create his/her own paths in querying and synthesizing information. Furthermore, such an environment assists the archaeologist in observing, analyzing and synthesizing the information freely and gives the options for saving any concluded interpretations. The geovisualization environment presented in the paper attempts to fulfill the need for designing custom tools based on principles of archaeological methodology and theory, in order to assist the task of archaeological interpretation

The design of the visualization environment followed successive steps of analysis in conceptual, operational and implementation levels, according to the needs of archaeological interpretation and a plethora of tasks resulting from these needs. The main objective of the developed visualization tool is to support the archaeological interpretation process; in this context, reasoning proceeds from the part to the total, as the understanding of the overall configuration of the site is reached in the final stages of archaeological analysis. The analysis starts with posing questions at a local level (such as the analysis of the material of a single layer), proceeds with queries in an intermediate level (e.g. locate certain characteristics among several trench layers) and concludes with questions in an overall sense (e.g. identifying "phases" in the history of the site). In this respect it is very much in accordance with the well-known reading levels in Cartography (local, intermediate, overall). Four general categories of questions can be distinguished, posed in all three reading levels / stages of development: spatial, thematic, temporal and hierarchical queries.

The most important tasks that were addressed deal with: 3D modeling and visualization of the excavation data e.g. observation units, excavation features etc; Presentation of temporal characteristics and relationships of archaeological data; Presentation, correlation and comparison of the thematic, spatial and temporal attributes of archaeological data; Formation and execution of complex queries for assisting the interpretation reasoning; Dynamic searching and filtering of the archaeological information; Creating custom tools for archaeological stratigraphic analysis (stratigraphy defined as the study of 3D soil layers, also known as strata); Designing a custom, archaeologically centered interface, enhancing user interaction with the data (e.g. facilitating navigation-orientation in 2D and 3D space, querying and displaying the attributes of excavated elements, updating the system with new information as the excavation proceeds etc.)

The tool developed was successfully applied in real time conditions of an on-going prehistoric excavation; the methodologies followed in all the various stages (data collection, processing, visualization) are fully compatible with archaeological excavation methods and adapted to the archaeologists' special needs. In this way, the system is site-independent, since the basic methodological characteristics are constant and only minor customization will be necessary for possible future design actions, regarding interface components. Furthermore the application proved to be a low-cost one, introducing thus an economically attractive methodology for the usually low budget archaeological excavation programs.