Archaeoscope – interface for 3D stratigraphy visualisation

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ABSTRACT

Archaeoscope is meant to be easy to operate, web based stratigraphy application. Proposed method of 3D visualisation of archaeological sites provides information about geographic and geometric properties of the unites and relationships between unites and layers. Web based client will allow to access application from any computer platform connected to the Internet. Application is directed to modern archaeologists with ideas to add the 3-rd dimension to the stratigraphy diagrams. The initial thought that every field archaeologist should be able to do clear stratigraphy drawings and GIS analisys, presented to the Heritage Board and investors. The main aim in choosing the software is possible to create acceptable 3D application based on the X-VRML language, presented to a user results vithin standard VRML browser plug-in like f.e. Cortona produced by ParallelGraphics. Stratigraphy of archaeological site with unites situated in spatial model of terrain will understood for more persons, especially for non archaeologists.

1. INTRODUCTION

The Department of Archaeology, Ancient and Medieval History at the University of Zielona Gora in co-operation with the Department of Information Technology at the Poznan University of Economics has started investigations over application of the X-VR approach in modelling and visualisation of Harris Matrix data in the spatial form. The Harris Matrix was invented in 1973 by Dr. Edward C. Harris and for the first time provided archaeologists with a means to view stratigraphic sequences in the diagram form. Harris's system has been accepted by many archaeologists as the "industry standard" with regard to stratigraphic methods, especially recording, used by archaeologists. Each archaeological site is an unique time capsule and the Matrix is the only universal way in which the unique calendar of each site can be displayed in relative time order (Harris, E. C., 1992). Modern X-VR technique makes it possible to produce 3-dimensional visualisations. Applications for archaeological stratigraphy provide 2-dimensional data visualisation. Only a few projects are interested in the 3-dimensional stratigraphic views (Day, W.; Cosmas, J.; Ryan, N.; Vereenooghe, T.; Van Gool, L.; Waelkens, M.; Talloen, P.; 2005). It is important to start work on a simple modern archaeological application with the third dimension in mind for such important work as Harris diagrams which are daily produced on hundreds of sites and are well-known to archaeologists.

2. TECHNOLOGY

The X-VR technique enables developing active database-driven virtual reality applications by building parameterised models of virtual scenes that constitute an application, and dynamic generation of the instances of virtual scenes based on the models and current values of model parameters, queries provided by the user, user privileges, user preferences, and the current system state. A high-level model of the virtual worlds can be stored in a database for convenient management of data, high performance, improved security, and multi-user access. The X-VR technology enables building virtual reality applications in fields of e-commerce (e.g., virtual shops), electronic guides, cultural heritage, scientific visualisation, geographical information systems, CVEs, interactive television, etc. The X-VR technology has been used by the Poznan University of Economics and further developed in multiple projects including PISTE[a], ARCO[b], Periscope[c] and iTVP[d]. The technology has been patented at the European level.

3. VISUALISATION OF ARCHAEOLOGICAL STRATIGRAPHY

3.1 CLASSIC 2D DIAGRAM

The Harris Matrix is a tool used to assist in the examination and interpretation of the stratigraphy on archaeological sites. Stratigraphy does not define exact chronology, but only relative chronology. The Harris Matrix is a diagram that depicts layers, structures and features, with their relationships and sequence, in an abstracted and clarified form. In the form of a flow-chart going from the latest (top) to the earliest (bottom), a matrix has lines linking boxes, inside which are written the context numbers of the layers which they represent. These help in the process of recording, clarifying and understanding the build-up of deposits which an excavation encounters. Computer applications for building the Harris Matrix date back to the 1970's. Several programs are still shareware, obtained from the authors under license to distribute them, some are distributed in commercial versions and it is also possible to download good-quality freeware software[f]. With the help

of specialised software it is possible to relate stratigraphical data. Applications mostly store data of the contexts and their stratigraphic relationships in an internal database and support interactive and automatic checks in order to detect inconsistent, missing, or contradictory relationships. The Harris Matrix 2-dimensional diagram (drawn by the computer application or by hand) is a convenient form of stratigraphy graphical report acceptable to almost every archaeologist. The result of classic visualisation can illustrate vertical position of contexts. The context is described by a big number of attributes, such as soil properties, inclusions, interpretation, grid or geographical location – important horizontal position, links to drawings, photography, finds, samples, etc. These characteristics are not included in traditional diagrams, because of the limited space for presentation. For collection, analysis and presentation of these descriptive attributes archaeologists use databases.

3.2 PROPOSAL 3D DIAGRAM

The perfect complete framework for field archaeologists should allow them to create real digital modelling of the excavation, present all descriptive data, stratigraphy in spatial form and hyperlinks to plans, finds, photos, samples etc. Applying the X-VR approach in modelling stratigraphic data, allow them to construct dynamic 3D data visualisations.

It is important to create a multi-user web based solution, especially for wide area excavations, where data are collected at the same time by numerous archaeologists. The traditional Harris Matrix application uses personal databases for storing all information; a better solution would be to utilise a multi-access database system. Network management will accelerate the time of data access considerably, solve problems with transmission of data files over longer distances as well as standardise the data value; any data changes will visible immediately to all users of the system after entering the information by one of them. Modern databases offer huge possibilities of analysis as well as multidimensional data processing, their utilisation is well-known from GIS solutions, they constitute a perfect tool for archaeologists for topographical positioning of any excavated elements, GIS is a very effective menthol and permits operations which were practically impossible before this technique and the computers started to be used (Harris, E. C., 2001). Apart from the basic information of relating stratigraphic reports, the spatial database also contains context position oriented in geographical space, additional information includes all descriptive data relating to the archaeological context. Situated in a 3-dimensional virtual world, visualisation of data can add more information and dynamism to stratigraphic diagrams. The application can work as a standalone desktop configuration as well as a web based servlet configuration. It is possible to produce a multi-user specialised web service. Visualisation can work only on Internet browser with installed Sun Java plug-in and Cortona VRML browser plugin produced by Parallel Graphics[g]. The application can be used on excavations on portable computers (e.g. handheld PDA's or notebooks). The X-VR technology does not require a broadband Internet connection and can be run on GPRS connection. The X-VR technology enables convenient, high speed access to the system without terminal installation, whether you are at home, in the office or on the go. You just plug your computer to the GPRS card or cellphone with a GPRS modem and let it choose for you a locally available wireless Internet access connection. The system can work on modem speed low cost wireless Internet access.

4. CONCLUSIONS

The proposed computer application is a solution which relies on a dynamic database relating archaeological objects, contains stratigraphic position and spatial localisations as well as descriptive data underlining specificity of the context. This dynamic tool will permit users to execute the choice of information and adapt the appearance of the diagram. The process of visualisation will depend on users' needs and interests. The solution will facilitate groupage, selection of details and view of contexts. The application will open the way to making a virtual tour to a symbolically presented archaeological site. The spatial visualisation of stratigraphy is particularly useful in field archaeology and as a teaching tool for students of archaeology. The initial thought is that every field archaeologist should be able to do clear stratigraphy drawings and GIS analysis to be later presented to the Heritage Board and investors.

ENDNOTES

a http://piste.intranet.gr/

b http://www.arco-web.org/

c http://periscope.kti.ae.poznan.pl/

d http://www.itvp.pl/

e Information about X-VR technology obtained from Dr. K.Walczak (Poznan University of Economics). Numerous research papers describing this approach can be found at: http://www.kti.ae.poznan.pl/krzysztof_walczak.html -> link bibliography.
Thanks to the courtesy of Poznan University of Economisc, Department of Information Technology.

f http://www.stratify.privat.t-online.de

g http://www.parallelgraphics.com/

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HARRIS, E. C. (1992) – *Principles of Archaeological Stratigraphy*. Second reprinted edition, Polish edition. Translated by Zbigniew Kobyliński. Warsaw: Ośrodek Dokumentacji Zabytków.

DAY, W., *et al.* (2005) – Linking 2D Harris Matrix with 3D Stratigraphic Visualisations: an integrated approach to archaeological Visualisations, CAA 2005, *Book of Abstracts*, Tomar, p. 66-67.

HARRIS, E. C. (2001) – The only way to see. In Harl, O. (ed.), Workshop – Computer and archaeology, Vienna

FIGURES

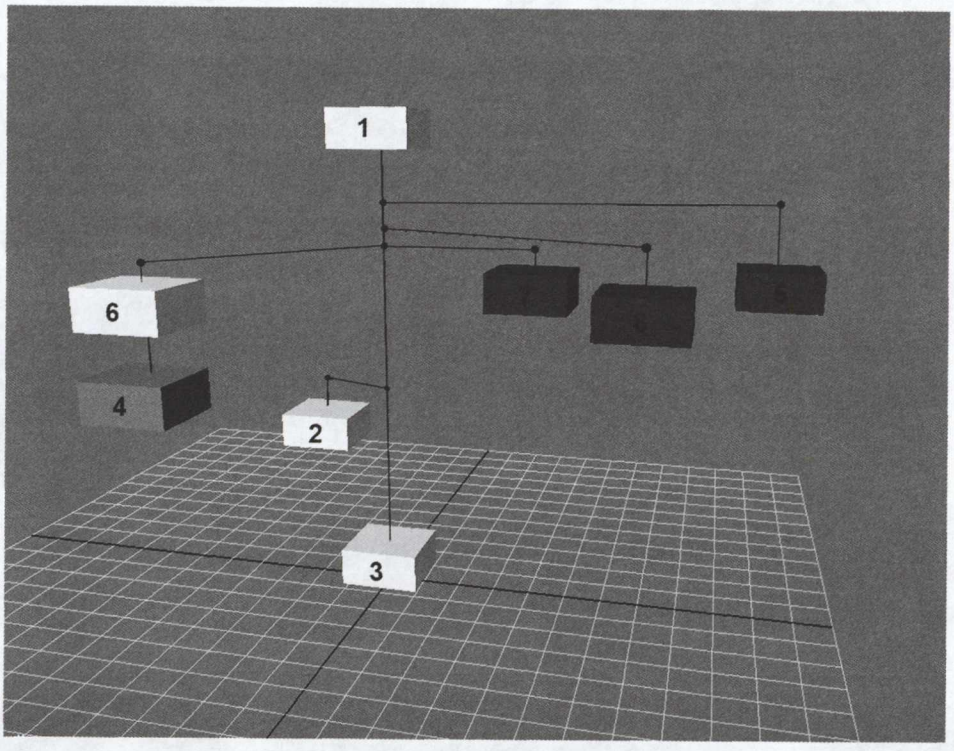

Fig. 1 – Archaeoscope – 3D visualisation of Harris Matrix.