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Teaching the Visualisation of Landscapes – Approaches in Computer based learning for Archaeologists

The Visualisation of Landscapes project is a University of Bristol funded teaching initiative. This project is an inter-disciplinary exercise into the interpretation of archaeological data with the aid of computer technology, in order to visualise landscapes: from those that exist in the broad physical geographic sense, to those that make up the internal features of an individual archaeological site. The eventual results will be packaged so that they can be used in first and second year undergraduate teaching.

This paper will describe the details of the project and the implications that multi-disciplinary collaboration have for the future of archaeological education.

1 Introduction

1.1 The Visualisation of Landscapes Project

The Visualisation of Landscapes Project (VLP) is a University of Bristol (UK) funded teaching initiative. It is an interdisciplinary exercise in the development of computer aided interpretation of primary archaeological data. Essentially, the visualisation of landscapes in the full spectrum of scales, from that on the largest scale of physical geographic data to the smallest of the more specific internal features of an individual archaeological site. The impetus behind the initiation of the VLP was the desire to amalgamate the expertise available in several interdisciplinary research projects currently underway within the Departments of Archaeology, Computer Science and Geography. As much of the data of these projects is of a spatial nature it can be thought of as representing a variety of levels of landscape; from the highest level in the 'traditional' geographic based regional landscape, to the medium level, represented by an archaeological feature or site, right down to the smallest level, that of individual finds within an archaeological excavation.

1.2 Aims and objectives

To maximise the potential of these projects the VLP was initiated with the long-term objectives involving the development of the following:

- Computer aided visualisation of landscapes.
- Teaching initiative for first and second year archaeology students.
- Increased computer literacy of archaeology students.
- Greater understanding of archaeological implications and technical parameters for Geography and Computer Science students.

2 The VLP package as Computer Based Learning

2.1 PC based tutorials

The VLP package is being developed as a series of PC based multimedia, interactive tutorials (CBL – Computer Based Learning). Time and development costs permitting, the package will consist of three separate modules covering the concepts and techniques available to archaeologists when interpreting and visualising archaeological landscapes. These tutorials are to be used in conjunction with, and as a supplement to, more 'traditional' practical teaching sessions. Although produced as stand-alone packages, each tutorial will be accompanied by a printed workbook that will put the computer based information into context and act as a source of background reading.

2.2 Integration into current curriculum

The introduction and usage of the tutorials will be fully integrated into the established curriculum and will introduce students to the concepts and ideas behind the visualisation of landscapes and different levels of archaeological data. The inbuilt experimental interaction within the tutorials will allow a 'hands on' approach to the techniques available in the interpretation of archaeological landscapes; enabling staff to create a need to know amongst students, ensuring greater retention and more student responsibility for learning.

2.3 Multimedia ToolBook 3.0

The tutorials are being developed in Asymetrix Multimedia ToolBook 3.0; a relatively simple and easy to learn multimedia authoring package. This particular software has been adopted in many such CBL projects and has been used in Bristol before within the bounds of the TLTP (Archaeology Consortium) central government funded initiative. Issues of screen design and functionality have largely been tackled before and are not the subject for

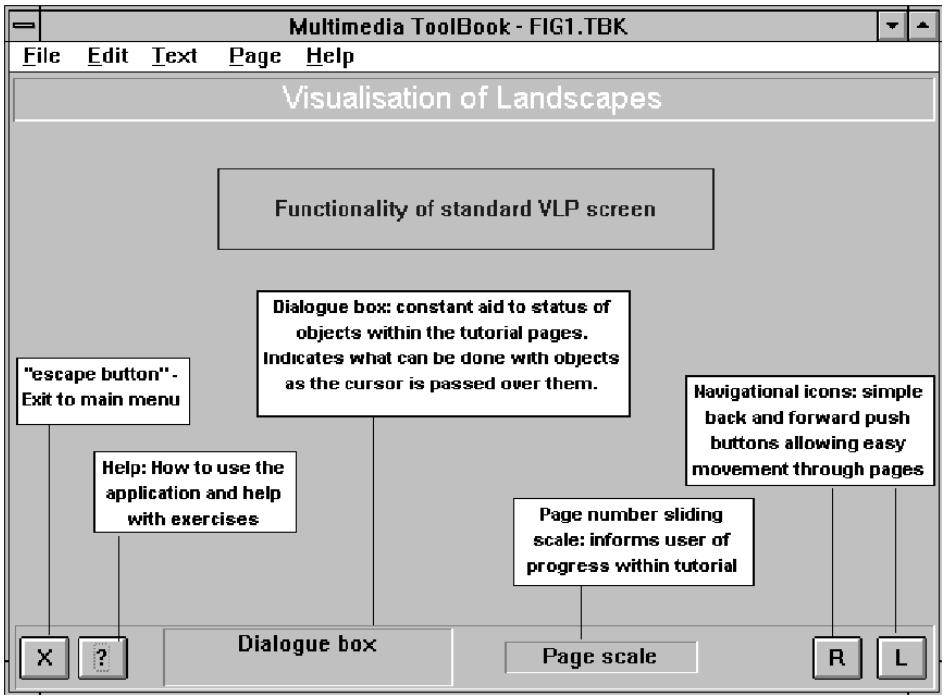

Figure 1. VLP standard page layout and functionality in ToolBook.

discussion here. However, a sample screen is shown as an indication as to the basic presentation and working medium.

2.4 Experimental interaction

Because of the nature of the material, a degree of interaction can be built into the VLP tutorials that is often detrimentally missing from CBL. This interaction will consist of problem solving and 'original' experimental visualisation by each user. Examples of such experimental visualisation might be in the visualisation of, say, Maltese temple structures by a variety of different techniques, or some simple GIS analysis new for each user, as they select which sets of data to use in the visualisation. Because of technical parameters, the number of test landscapes that can be viewed by a user will be limited, as each computer graphic landscape will have to be rendered before inclusion in the tutorial. Hence the experimental landscape viewing will be from a limited data set, although how each student uses this data will appear original. The final result is to produce interaction that genuinely keeps the users' interest and stimulates further investigation into more detailed applications of visualisation.

3 The visualisation of landscapes

3.1 Approaches

One of the primary aims of the VLP is to integrate and present the techniques already being utilised by several research projects currently underway within the university. These projects draw heavily on the interpretative value of visualising archaeological data: the INSITE project (Archaeology and Computer Science) looks at reconstruction of archaeological structures as an aid to interpreting ritual (although it also has much wider implications), while the GIS based interpretation of archaeological data (Archaeology and Geography) in central Italy has a large visual content. One of the aims of the VLP is to introduce archaeology students, particularly first and second year undergraduates, to these techniques and concepts. These areas of visualisation are to be supplemented by more traditional methods, as well as some further computer based physical and natural environment visualisation. A series of subject landscapes (in the widest geographical sense) will be used as case studies to show the suite of techniques available to archaeologists that can help them visualise the variety of different scales of landscape, as well as acting as an aid to interpretation of archaeological data.

3.2 Areas involved in the VLP

3.2.1 Gozo, Malta

The temple structures on the islands of Malta form the central thrust of the research within the INSITE project (Chalmers/Stoddart 1995; Chalmers *et al.* 1994). Their computer based reconstruction and analysis will be one of the central parts of the visualisation tutorial for this region. A developing environmental and regional study for the location of the excavated sites will form a further aspect of

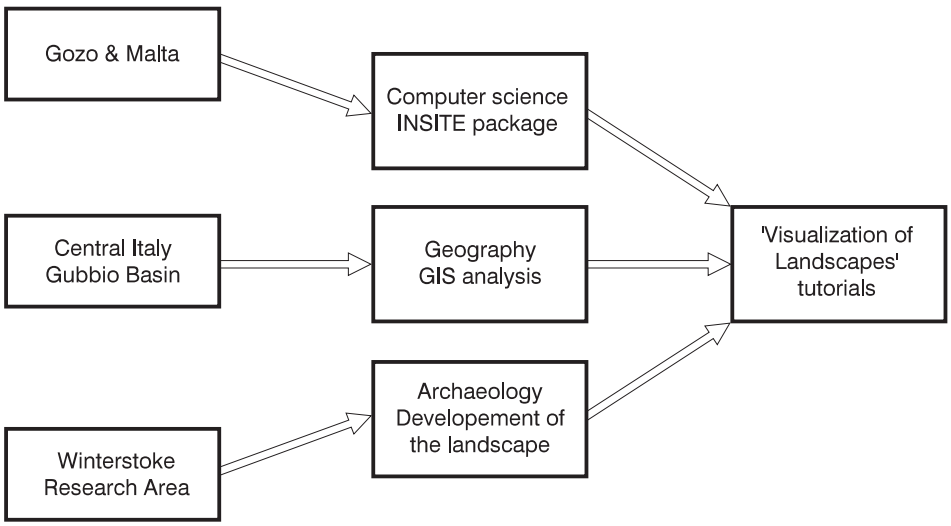

Figure 2. Interdisciplinary links and the visualisations project.

the visualisation, placing the centres of in-depth archaeological research within their wider context of a landscape setting.

3.2.2 South Etruria, Central Italy

The emphasis on visualisation in this area will be on introducing students to GIS and supplementing many of the GIS based analytical images with descriptive and interpretative text and complimentary images. Three-dimensional landscapes will also be modelled (with the data obtained by palaeo-environmental and geomorphological research projects currently underway), producing different landscape and vegetation models for different periods.

3.2.3 Winterstoke research area, Avon and Somerset, UK

The techniques and ideas developed in the previous two projects are to be utilised and built upon in this long term local research project (University of Bristol 1995), resulting in a fully integrated local landscape visualisation methodology. As in the preceding projects a large body of archaeological survey and excavation data is available for setting within its landscape.

4 Inter-disciplinary approaches

4.1 Inter-disciplinary links

The landscape visualisation project makes use of the most up to date analytical tools from a range of disciplines, and thus requires a high degree of inter-disciplinary collaboration (fig. 2). Through the use of the teaching package, students will be introduced to and become familiar with the dynamic inter-disciplinary interaction necessary in order to maximise the information gleaned from the primary archaeological data. Each tutorial will be centred on a geographic area of university research and will utilise a specific set of analytical tools to aid in the interpretation of the associated data. As the projects and VLP proceed a full set of analytical tools will become available for each area. Ultimately each area will contribute a varied approach using the same visualisation techniques which, when incorporated into the computer based tutorials, will facilitate a better understanding of the concepts behind the techniques being employed.

4.2 Input and Benefits

4.2.1 Computer Science

Recent developments in computer graphics have made it possible to construct virtual environments on a computer and view images of these scenes. It is possible, therefore, to recreate an archaeological site on a computer and provide the viewer with an accurate representation of the actual remains. Furthermore, geometric modelling techniques enable extrapolations from existing evidence to reconstruct the site as it may have appeared to the original inhabitants. Photorealism enhances the quality of computer generated images and thus greatly improves their visualisation value.

Computer graphics is taught to final year undergraduate and Msc students within the Department of Computer Science. As well as covering the fundamentals of computer graphics, the course also examines the photo-realistic techniques of: ray tracing; radiosity; and, particle tracing. The value of any computer graphics course is not, however, merely the understanding of the mechanics of the underlying graphic models. To appreciate truly the benefit of photo-realistic computer images, the students need to see

the techniques applied to real problems. The visualisation of archaeological sites is one such problem. The VLP tutorials will enhance the learning experience of Computer Science students. They will be able to investigate the computational complexity and subsequent effect of different graphic techniques in the interpretation of archaeological sites. This will enable them to understand better the applicability of each method, and see for themselves how photo-realistic visualisation may help in the interpretation of computer modelled virtual environments.

4.2.2 Geography

Landscapes are of particular concern of Geography, and Geographic Information Systems (GIS) are a particular specialisation of the department. The department of Geography and the department of Classics and Archaeology have already been involved in the implementation of a TLTP project concerning GIS (Blake *et al*. 1995). The VLP is building upon this experience, and extending the use of the existing tutorial to first and second year undergraduate teaching in Geography. Here, in particular, it will enhance existing computer-based practical teaching in GIS and spatial analysis by providing a dynamic application of landscape analysis and visualisation. The addition of an archaeological dimension to geography teaching in this way will add important material which illustrates the principles of planning, cultural resource management and regional analysis.

4.2.3 Archaeology

It is around primary archaeological data that the other research projects are built. It is with this data analysis that the archaeologist is chiefly concerned. By introducing archaeology students to the full suite of visualisation techniques available it will facilitate a better understanding of landscape visualisation and analysis. The VLP also serves the purpose of introducing archaeology students to a dynamic inter-disciplinary environment.

5 Discussion and conclusion

5.1 Discussion

The idea behind students using the VLP tutorials is not to produce archaeology graduates who can produce 3-D models of landscapes and sites, or who are experts in GIS. Neither is it the aim to produce archaeologists from Computer Science and Geography students. Rather, it is to introduce the students to the concepts and techniques behind such visualisation by showing them some of the tools and facilities that are available. If they wish to take this further they are then familiar with the tools available. This will enable archaeologically based visualisation projects to be undertaken by third year students for their final year dissertations.

The benefits for both Computer Science and Geography students are based primarily on an introduction to a dynamic application to what otherwise are often predominantly theory based areas of their study as well as on introducing users to a variety of different applications of specialisms within their field.

These tutorials will also have the complimentary benefit in that they facilitate the development in users of transferable skills for careers outside archaeology. The familiarity of computer use, database management, use and manipulation of data will be skills acquired by users of the VLP, producing archaeology graduates confident with computer applications, something all too often lacking in Arts based graduates.

5.2 Conclusion

The Visualisation of Landscapes Project has several important contributions to make towards education in archaeology. It presents a suite of integrated technologically explicit techniques in visualising landscapes and archaeological data, within an interactive PC based environment, for use in undergraduate teaching. It also demonstrates a simple and effective inter-disciplinary project in terms of both education and research.

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