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The development and implementation of a computer-based learning package in archaeology

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5.1 Introduction

This paper describes *Archaeology at Work*, one of the computer-based learning packages which has been developed under the auspices of the Teaching and Learning Technology Programme (TLTP). The aims and background of the TLTP have been discussed elsewhere (Martlew 1994); the project discussed here is a new version of a package which was originally produced for English Heritage and the National Council for Educational Technology (Martlew 1989). The package is written in Authorware Professional, for use with Windows on IBM compatible computers with SVGA standard graphics, and will be supplied through the TLTP as a run-time module.

5.2 Aims of the project

Archaeology at Work introduces students to an important aspect of the current work of professional archaeologists, and in so doing it allows students who may be new to the subject to explore it in an identifiable context. The package introduces the nature, scale and significance of archaeological evidence in the British countryside, and presents a wealth of factual knowledge in addition to developing basic concepts and skills. The simulation helps students to understand the tensions between demands for the destruction, preservation and investigation of archaeological sites arising from modern construction work. The aim is to convey a realistic impression of archaeological involvement in the planning process, while highlighting the main issues for students to consider. The package introduces fundamental concepts such as chronology and stratification, and basic techniques of locating, recovering and interpreting archaeological evidence from archival records.

The target audience is First or Introductory Level archaeology students, or those taking archaeology as a subsidiary course. The main reason for this, guided by TLTP policy, is that archaeology is not commonly taught as a school subject, and undergraduates cannot be expected to begin their studies with the same level of factual or conceptual knowledge which they will already have acquired in other disciplines. The preconceptions which students have about the subject can, for example, be heavily coloured by the way in which it appears in the media, as is suggested by the increase in recruitment to archaeology courses in the United States following the release of the Indiana Jones films.

It would be possible to counter this by constructing a relatively low-level computer program with checklists of what archaeologists do and what they do not do, and indeed this might be an interesting way of quantifying attitude changes during the initial year of study. However, such a low-level approach would do little to develop students' understanding of the role of archaeologists in any detail, or to develop their attitudes to the place of the 'archaeological heritage' in contemporary society. Similarly, it would provide few opportunities for the development of the intellectual skills appropriate to an undergraduate-level course.

Archaeology at Work operates at a more advanced level by simulating real-life processes of problem-solving and decision-making. Realistic problems such as this can be tackled at many levels, and the more sophisticated the audience the greater will be the need for accuracy in the simulation. At the level of the target audience for *Archaeology at Work*, a greater degree of smoothing of the model is justifiable in order to achieve specific educational goals. Some of the concepts are necessarily simplistic given the nature and scope of the package, and will be qualified subsequently as students pursue more advanced courses. *Archaeology at Work* aims to provide a foundation on which these further studies can build.

The package is designed to support the learning process by guiding students and by extending the range and complexity of tasks which they are able to carry out. While there is structure and order in the way in which students work through the program, there is no control over the decisions which they are asked to take. In effect there are no right or wrong answers to the exercise, and students are assessed on their ability to locate, evaluate and assimilate data, and on the effectiveness of the arguments with which they justify their decisions.

5.3 Outline of the simulation exercise

Archaeology at Work simulates the role which archaeologists currently take in processing planning applications to Local Authorities. The introductory section takes students step-by-step through the package, showing the resources which are made available by the computer, the goals which are to be achieved, and the skills which will be acquired. The main exercise is in two parts, each of which leads to a specific piece of student work which can be graded. In the first stage, students produce an archaeological impact assessment. In the second stage, they have to interpret excavation archives to show how work in advance of development has

contributed to the understanding of the archaeology of the region.

The exercise is based on a planning application to a fictional County Council in eastern Yorkshire for a gas pipeline from the North Sea gas fields to the National Grid. Three alternative routes are proposed, and the first stage of the exercise is for the students to assess the impact of each. The computer provides maps of the routes, and a database of known archaeological sites which simulates a County Sites and Monuments Record. A separate tutorial is included on the use of Ordnance Survey grid references, since this basic skill is essential for recovering information about the sites which are affected by the proposed routes.

The computer automatically assists each student to compile an individual dossier, under their own user name. Information about threatened sites is passed to this dossier as students work through the proposed pipeline routes, and it forms the basis of the report which they produce at the conclusion of the first stage of the exercise. In the report, students identify threatened sites, and specify the extent of archaeological investigation which they think should be carried out. Costings for three levels of work are provided: total excavation, partial excavation and watching brief, each generating different amounts of information for the different levels of expenditure. Students must also balance the overall cost of the work they propose against a target figure in order to submit a tender to carry out the excavations. If they specify the total excavation of every threatened site, for example, their tender will be unrealistically high and will be rejected; the program will not let them continue until they have submitted a realistic tender. Setting the level of acceptability for tenders is one point of artificiality in the simulation, and has more to do with influencing the outcome of the exercise than with the genuine range of options which may be available to a County Archaeologist. The specific principle, however, is wholly realistic: there is only a limited amount of money available, and this is insufficient to carry out extensive work at every threatened site. The aim of the exercise is, after all, not to train County Archaeologists or archaeological consultants, but to encourage students to consider the issues arising from the ways in which archaeologists currently work.

In the second stage of the exercise, students are able to examine excavation records for sites threatened by the pipeline, at the level of detail which they proposed in their first stage impact assessment. The computer program allows them to call up only the level of information for which they have received funding. A text file is included in the package which contains the basic skeleton of the final report, including section headings and brief guidelines as to how each section should be tackled. This provides a clear framework for the students' work, and leaves them free to concentrate on the archaeological issues. Illustrations of artefacts can be printed out or pasted into the file containing the final report, and excavation plans and sections are also provided as bit-maps

It is assumed that students are coming to this package with little understanding of archaeology in general, and little knowledge of the archaeology of eastern Yorkshire in particular. Support is given throughout to enable them to take decisions which are taken in real life by qualified, professional archaeologists. This includes access to an 'on-line textbook' entitled *Evidence from the Past*, which contains illustrations of all the artefacts which students encounter during the exercise, and which will enable them to place their excavated evidence into an appropriate cultural and chronological context. Access to the information in *Evidence from the Past* is made as flexible as possible. It is essentially a straight piece of narrative text, giving the current cultural and environmental interpretation of the archaeology of the region.

Drop-down menus supplement a detailed index to allow access by period, theme and subject, and words or phrases are highlighted as 'hot words', which allow glossary definitions of specific terms and concepts to be called up with a mouse click. One of the limitations of the authoring software used for the project is that these apparent links cannot be developed as true hypertext: once a 'hot word' has been defined it becomes active for every occurrence of that word throughout the text. An alternative approach is to define particular occurrences of the word by screen co-ordinates, but this inevitably makes editing and updating difficult. The implementation of hypertext features should be available in the next major upgrade of the software.

By simulating archaeological involvement in the planning process, the computer package is able to introduce students at first-hand to one of the roles of professional archaeologists in contemporary society. Not only do they see the subject in an identifiable context, they are at the same time introduced to the nature of archaeological evidence and how it can be used. The computer provides access to resources, guidance on progress and tools to help to produce work to professional standards of presentation. In order to make efficient and effective use of these facilities, the student must of course be familiar with the medium of delivery.

5.4 Computer-based learning and IT skills

Familiarity with the system on which the package is running is an obvious and essential prerequisite for computer-based learning, and *Archaeology at Work* requires a minimum level of competence in order to be used effectively. Students must know how to log on or start up the software, how to format and use diskettes and how to print documents, particularly if they are working on a local network. Familiarity with the Windows-style environment and competence in using a mouse are essential, and at least basic familiarity with a word-processing package is advantageous.

Authorware provides many useful routines for monitoring student progress and performance at a basic level, and some of these have been employed in the grid reference tutorial which is supplied with *Archaeology at Work*. It is clear from preliminary trials that the students who take longest over this exercise also obtain the lowest scores. This is due in part not to the difficulty of the content, but to a lack of facility with mouse operations and slowness in responding to screen prompts. Those students who are already familiar with Windows perform best, and in the small sample so far available this appears to be a more important criterion than the students' existing level of skill in using grid references.

The package has been designed so that most of the operations necessary to produce the required written work can take place on the computer. Text files are provided which contain outlines of the reports which students complete at the end of each stage of the main exercise. In order to take advantage of these files, students must be able to copy them onto their own disks or user space so that they can be edited using word-processing software. The package automatically compiles a gazetteer of the threatened sites which students have identified, and this information can be pasted into their impact assessment report at the end of stage one as an appendix. Maps and artefact illustrations can similarly be pasted into the final report. The end result is particularly gratifying to students: at an early stage in their course, they are able to produce two pieces of work to high standards of presentation, and despite the open-ended nature of the simulation exercise they have a clear idea of the areas which they are expected to cover.

The extent to which students currently possess the level of computing skill to achieve this at the start of their undergraduate careers is questionable. When a university department of computing studies has to allow for a significant number of students arriving without relevant computing experience, an arts or humanities department must expect a much greater need for basic skills to be taught. This situation should improve with time, and TLTP projects outside the Archaeology Consortium are addressing the requirement for basic computer literacy. Setting such remedial work aside, to run through the computer-based material alone in *Archaeology at Work* will take in the region of six to ten hours for a reasonably competent student. The amount of thinking and preparation time that students spend outside the package itself is at least equal to this, and is capable of being expanded considerably according to the level of detailed background reading and research specified by the tutor. The package could form a stand-alone exercise which complements other courses, or it could form the basis of project work running over a full term.

5.5 Assessment

The flexibility of the simulation exercise allows *Archaeology at Work* to be used by individuals, or by small groups of students working together. The strategy for assessing student progress combines computer-based and tutor assessment, as appropriate. The basic skills involved in using Ordnance Survey grid references, for example, are assessed using a computer-based test at the end of the tutorial. Facilities provided by Authorware allow student interaction to be monitored, including the overall time spent using the package and a log of the program modules which have been accessed. This type of operational information in this instance does not produce any pedagogically meaningful data, but may be of use if students experience difficulty in navigating through the exercise as a whole: preliminary trials suggest that this is unlikely to be a problem.

5.6 Discussion

Archaeology at Work is specifically tied to the archaeology of East Yorkshire, and has not been designed to allow the substitution of data from other areas. The ease with which the package may or may not be edited is also relevant in the context of keeping the material up to date. This applies to the realism of costings given for excavation work, as well as any changes in the interpretations and approaches to understanding the archaeology of the region. These issues reflect more general concern regarding long-term support for non-commercial CBL packages. If materials are produced by one-off, 'pump-priming' initiatives such as TLTP, it is difficult to see how they can be maintained and updated over an extended period of use. Computer-based material can in theory be more easily updated than textbooks, but the financial implications of this are, in the education sector, likely to give software the built-in obsolescence of print-based material.

The design of *Archaeology at Work* is closely related to the pedagogical approach which it embodies. Relevance in simulation exercises such as this is acquired through the use of realistic detail. There is an overall continuous scale from totally fictitious, abstract simulations to those which are embedded in one specific, detailed environment. The sites and the additional SMR data in *Archaeology at Work* are all real, with adjustments to adapt them to the purposes of the exercise. The facility to replace existing content with data from different regions is, in this case, less important than the credibility which is derived from the amount of realistic detail which the package presents.

The idea behind *Archaeology at Work*, however, is totally transportable and even transmutable: the pipeline could equally well be a road, an irrigation canal or part of a new cable network for an information super-highway. At this level, the approach can be implemented anywhere and in many different forms. All that is required is the time and expertise to assemble and package the data, but this would of course amount to a complete re-write of the program. Authoring software in general is not yet sufficiently flexible to make the substitution of content an easy task, without imposing considerable limitations on the original design. If the purpose of authoring software is, as is often claimed, to allow lecturers with little knowledge of programming to compile computer-based

tutorials, the current generation of software tools does little to support anything more than a relatively low level of learning activity. The complexity of user interaction in a package such as *Archaeology at Work* is such that current software tools can do little to elevate its implementation from 'programming' to 'authoring'. Unless future generations of authoring software can rise above what is essentially a screen-paging approach, the production of CBL materials which are pedagogically challenging will remain in the hands of specialist programmers.

At an introductory level, *Archaeology at Work* will give students an understanding of one of the current roles of professional archaeologists in this country. It raises important issues about the nature and use of archaeological evidence, and provides a foundation of knowledge and concepts which can support further studies. Preliminary trials have shown that the package is successful in its aims, and that, given adequate competence in using a computer, it encourages students to think, talk and argue about archaeology.

References

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