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The development of a CAL multimedia tutorial system for archaeology undergraduate teaching

Ewan Campbell

(Glasgow University, Glasgow, UK)

31.1. Introduction

This paper describes the aims and work of the recently-formed Archaeology Consortium — a group of 15 British University departments of archaeology and art history — who are working together to produce introductory tutorials for university undergraduates. These tutorials will utilise hypertext, numerical data, image banks, graphics and motion video as appropriate in order to introduce students to basic archaeological concepts as well as computer-based methods of data manipulation. It is envisaged that the tutorials will form an "electronic ring-binder" from which departments can pick parts relevant to their widely differing syllabi. The material will be also adaptable to local authoring, for example enabling different datasets to be inserted, and will be structured to encourage interactive learning and self-assessment at a variety of levels.

31.2. The background to TLTP

In a letter of March 1992 the Universities Funding Council (UFC) announced a programme "to develop the integration of the new technologies into the mainstream of teaching and learning in Higher Education. The aim of the programme is to improve productivity in higher education through more efficient delivery of teaching and more effective learning." A fund of £5M p.a. for three years was set up and bids invited. The funding council laid out a number of criteria which would be taken into account in assessing bids, some of the most important of which were:

1. Transportability — attention was drawn to authoring standards as a key area.
2. Wide dissemination — single subject multi-institution consortia would be encouraged.
3. Productivity gains — evaluation and assessment of efficiency gains would be part of the projects.
4. Ease of use — the products must be acceptable and practical.

Although it was not explicitly stated, the programme was in response to the projected increase in student numbers in line with an Age Participation Index of 33% by the year 2000 (Davies 1992) and the concomitant increase in staff/student ratios. Much of this increase has already taken place, and, as Fig. 31.1 shows, some archaeology departments now have substantial numbers of first-year students. The majority of the students in the larger departments are taking archaeology as a subsidiary subject and will not continue with archaeology beyond the primary, introductory, level.

Bids for funding had to be in by the end of May, which left little time for planning. CTICH (Computers in Teaching Initiative, Centre for History, Archaeology and Art History) which is based at Glasgow University, decided to try to organise two bids, one for archaeology and one for history. Phil Perkins, the CTICH Research Officer, contacted all the British archaeology departments to ask for proposals to develop courseware modules. A meeting of representatives of 14 departments took place on 1st May 1992, a consortium proposal was drafted (and redrafted several times) and finally submitted on time. This rather bald outline hides a great deal of work, much of it carried out by Phil, and required a great deal of co-operative effort between departments, to an extent which has probably not taken place before in the subject. The bid was accepted in August 1992, with £120k being granted for the first of three proposed years.

It is worth looking at the composition of the other successful bids. In all 42 projects were funded, 11 of these being general bids on teaching or assessment methods and techniques, with 31 being subject-based as with archaeology. Table 31.1 shows that the subject areas were dominated by science subjects, with maths, science and engineering accounting for 21 of the 31 projects. Only four humanities projects were funded (the history consortium was rejected), and archaeology was the only single-subject bid approved. This may have been due to the perception that archaeology is an interdisciplinary subject, combining elements of science and arts teaching.

31.3. The Archaeology Consortium

Fifteen departments are involved in development of courseware: University of Glasgow (lead site); Birkbeck College, University of London; University of Bradford; University of Bristol; University of Cambridge; University of Durham; University of Edinburgh; University of Leicester; University of Leeds; University of Liverpool; University College London, Institute of Archaeology; University of Oxford, Institute of Archaeology; University of Sheffield; University of Southampton; University of York; and CTICH Glasgow (co-ordination). A further five sites will be involved in evaluation of the products: University of Wales, Aberystwyth; University of Nottingham; University of Exeter; University of Newcastle; and University of Birmingham. In total these include almost all the archaeology departments in British universities (archaeology is only rarely taught in what used to be the Polytechnics and Colleges of Further Education).

Bearing in mind the UFC objectives the Archaeology Consortium looked at how these might be best achieved in archaeology. It was decided to concentrate on the primary

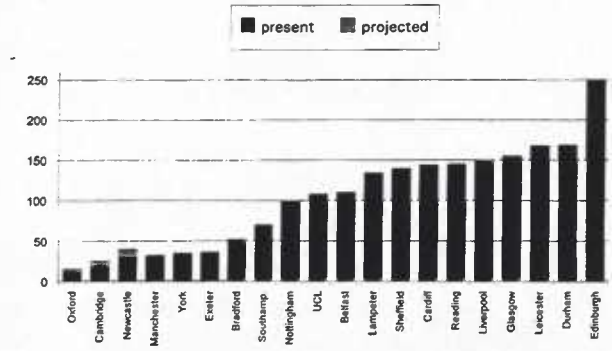

Figure 31.1: Numbers of first year archaeology students at British universities

or introductory level of archaeology teaching in order to achieve the widest use of the proposed materials. There is a core curriculum for archaeology which was outlined by the Standing Committee of University Professors and Heads of Archaeology departments (UGC 1989, p. 5), but this does not give any detail of the subject areas to be covered. A study of first year curricula has confirmed the subjective opinion that there is a wide diversity of subject matter, and that the same area can be taught in widely differing ways in different institutions.

Archaeology teaching is of three main types — lectures, tutorials/essays, and practicals. There was a consensus that lectures were an effective method of teaching large numbers of students, limited only by the size of lecture theatres available (though whether it is also an effective method of *learning* was disputed by some). In any case it would be impractical to replace lectures with Computer Assisted Learning (CAL) modules as there would be insufficient machines available in most departments. Tutorials, practicals and assessment seemed to be the areas most likely to yield efficiency gains, particularly where the same subject was taught repeatedly to small groups, by freeing lecturers to concentrate on higher level tutorial work. Even with increased use of postgraduates to take practical classes the increase in student numbers is already placing a strain on the system. As Fig. 31.1 shows, five departments already have more than 150 first year students, which means that tutorial groups of 10–15 students have to cover the same subject 10 or more times. This is both physically and mentally exhausting for teachers and cannot lead to good teaching practice. The other area of saving would be on physical resources, both objects (artefacts and ecofacts) and equipment (microscopes *etc.*), which need technical support to maintain and which suffer from increased usage. Tutorials on subjects such as bone and artefact identification, which are primarily image based and could include self-assessment systems, were therefore prime candidates for development. Another group of tutorials were introductory courses which would utilise the advantages of hypertext and multimedia to allow a more stimulating and student-directed way of learning (Martlew 1990). Another area in which the computer-based medium could enable new ways of learning is in the use of spreadsheet and database modules, where the student could be involved in asking and answering "what if?" questions. The value of these tutorials therefore, would not only be in producing more efficient teaching but in providing more interactive modes of learning, and also enabling some departments to teach subject areas which lack of qualified staff or physical resources had prevented them from doing in the past. The CAL tutorials therefore have the potential to improve the overall *quality* of teaching, and to introduce more balanced courses, as well bringing efficiency gains.

Although concentrating on the primary level of teaching the Consortium evolved a strategy of three levels of development of the tutorials, leading from Level 1 where students are introduced to concepts, through Level 2 where methodologies are learned using given datasets, to Level 3 where the students introduce and manipulate their own data. This has been described in more detail in another paper in this session (see Huggett in this volume) and will not be repeated here.

Subject group	*No projects*	*Subject*
Physical Sciences	7	
Maths/Statistics	6	
Life Sciences & Medicine	5	
Humanities	4	i) Archaeology ii) General humanities ii) Modern languages iv) Languages for Engineers
Engineering	3	
Social Sciences	2	
Business	2	
Law	1	
Music	1	

Table 31.1: The subject-based TLTP projects.

31.4. The products

31.4.1. Constraints and standards

The teaching of archaeology at present is primarily based on texts, concepts and images (of objects, sites and graphic relationships), with images forming a greater part of the input in archaeology than in any other humanities subject except perhaps art history. In addition, extensive datasets are drawn on in many areas of the curriculum. Multimedia solutions therefore seem ideally suited to satisfy the requirements of CAL tutorials in archaeology. The combination of any number of a set of text, hypertext, image banks, moving images, sound, graphics, databases and spreadsheets is possible, particularly using the delivery medium of CD-ROM. However in practice there are constraints on how these disparate elements can be combined, and standardisation is necessary to meet the criteria of transportability and ease of use.

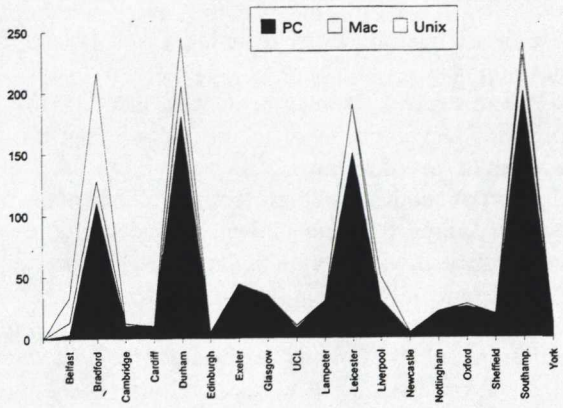

Figure 31.2: Platform types available to archaeology undergraduates (cumulative area graph).

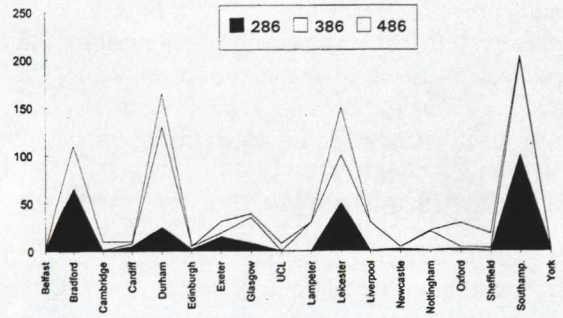

Figure 31.3: Types of PC available to archaeology undergraduates (cumulative area graph).

Firstly there is the problem of delivery systems. Fig. 31.2 shows the results of a survey of computer hardware available to archaeology departments. It is obvious that PCs are the predominant platform, and are available at all sites. Smaller numbers of Macintosh and UNIX machines are found in some departments. The Consortium decided that the requirements for a delivery machine which could utilise the CAL tutorials should be a PC with at least a 386 CPU, 4 Mb RAM and SVGA graphics. For new machines a minimum 486 CPU is specified, as the fall in price differentials will soon lead to the phasing out of 386s.

Fig. 31.3 shows the types of PC in use in archaeology departments, illustrating that many machines fall short of this target. In fact only around one third of the PCs fulfil the requirements. However, the provision of delivery hardware was specifically excluded from the remit of the TLTP projects, so this is a problem which will have to be addressed by individual institutions. On this specification we have to be careful that graphics do not slow down the presentation to a degree that frustrates the student. Although full screen motion video is now technically possible it would require the installation of new compression/decompression hardware on delivery machines and is therefore ruled out at present.

Although a Windows platform was adopted, the consortium decided that the products should be transportable, at least to the Macintosh platform. This was partly to ensure the widest possible distribution of the products (perhaps beyond Britain), but also so as not to lose the authoring experience of some projects which had been developed on other platforms. This brings us to the question of authoring standards. Along with other TLTP projects, the Consortium has been evaluating different authoring packages. So far only two proprietary products, Authorware Professional and Toolbook, seem capable of meeting our requirements of cross-platform adaptability and integrated combination of text and graphics, though both have drawbacks in particular areas of use. Other TLTP projects are in the process of evaluating software, and one or other of these two packages are being adopted as standard by some consortia, though others are developing there own software (Darby 1993). However there are several projects, including the Southampton MICROCOSM and the Leicester STILE, which may enable linking of material based on different authoring systems, so this may not be a problem in the future.

The delivery method is another area which is problematic at present, but which may be clarified by advances in technology. The large capacity of CD discs and their ability to combine text and images suggests that one or more discs combining the consortium products could be produced. At present there are four CD formats (CD-Audio, CD-interactive, CD-photo, and CD-ROM). There is a confusing variety of standards in use, and although the CD-ROM XA standard should permit more crossover it does not necessarily enable multi-session reading of Photo-CDs. Although the consortium believes that the CD-ROM route will be adopted, it seems unwise to make to make a firm decision on hardware at present. Similarly, it may be cost-effective for the consortium to purchase a CD-writer, but here again standards are in flux and it may be better to wait for some time. A new standard (the Frankfurt standard) is being worked on and may be available soon, but it will require new firmware and software updating. It may be possible to share the use of a CD-writer with other consortia.

Other areas of standardisation, such as formats for graphics and databases are being actively considered and should be decided on in the near future. The question of a house style and consistent use of colours, menus, fonts, buttons and layout is also receiving attention. These matters need to be clarified at an early stage of development to avoid laborious reformatting of material at a later date.

31.4.2. The projects

Table 31.2 gives a list of the projects which may be developed by the consortium. Some of these are projects which have already been developed, or are based on existing projects, while others are entirely new. A summary of the basic purpose of some of these tutorials is given below.

Metallurgy: basic concepts and principles in archaeometallurgy. It will include metallographic data on metals and alloys, and archaeological examples.

Human and sheep bone. Basic anatomy and bone identification, pathologies, lesions, criteria for ageing and sexing.

Institution	*Tutorial*
Birkbeck, London	Art History
Bradford/Leeds/Liverpool	Metallurgy
Bradford/Leeds	Human bone/sheep bone
	Ceramics
	Digging deeper - planning & heritage issues
Cambridge/Bristol/York	Spatial analysis/landscape archaeology
Durham	Scientific dating techniques
Edinburgh	Introduction to field research
Glasgow	Integrated tutorial shell
Institute of Archaeology, UCL	Statistics
Leicester	Lithics
	Image metastructures
	STILE project - concept structure
Liverpool	Artefacts & materials
Southampton	ENVARCH - environmental archaeology
	SYGRAF - excavation simulation database
York	Introduction to British Archaeology

Table 31.2: The Archaeology Consortium projects.

Ceramic technology and fabrics. From macro- through various stages of micro-analytical techniques such as thin-sectioning, SEM and NAA.

"Digging deeper". Simulates the impact of a modern development (a gas pipeline) on sites of a region. Introduces SMRs, planning constraints, cultural resource management.

Spatial analysis/landscape archaeology. Introduction to GIS analysis, statistical spatial analysis, site/landscape relationships. Structured using small number of datasets to increase familiarity.

Scientific dating techniques. Understanding the scientific basis for each method (Amino-acid, ^{14}C, dendrochronology, fission track, luminescence, palaeomagnetism, K-Ar, U-series dating). Evaluating the contribution of the method in solving chronological problems. Use of spreadsheets to predict behaviour, thus encouraging interactive learning.

Field research story-line. Uses one site to introduce students to the principles of archaeological field research in an integrated fashion by taking them through the natural processes by which an archaeologist would study a site. Will cover landscape, excavation, stratigraphy, artefacts, dating, environment and reporting at an introductory level. Funding has been obtained for a printed workbook to accompany the tutorial. Possible to substitute other sites and take to higher levels of analysis.

Tutorial shell. (Huggett, this volume)

Lithics. Materials, artefacts, techniques and typological development.

Image metastructures. Development of the LIVE video disc project. Development of metastructures that can be applied to sets of images.

STILE. Part of another TLTP project, development of concept structures to enable students to select information in an efficient way by creating knowledge links rather than learning information retrieval systems.

Artefacts and materials. Introduction to artefacts and materials, based on examples, exploring typology, identification, materials science, distributions. Building on systems being developed in museums.

ENVARCH. Introduction to environmental archaeology based on the Neolithic of the Avebury area. The use of soils, snails, pollen, seeds, and animal bones in reconstructing environments.

SYGRAF. The further development of an excavation simulation programme which is widely known.

Introduction to British archaeology. Using key sites to introduce discussion of concepts and problems. To be worked through at own pace, supplement to lectures, essay based. Copyright issues are being resolved.

31.5. Conclusions

The proposed Consortium tutorials hold out the possibility of putting archaeology teaching at the forefront of new teaching methods while at the same time improving the efficiency, and just as importantly, the quality, of undergraduate learning. Whether the promised benefits accrue will depend on a great deal of hard work by the Consortium members and a willingness to engage in academic co-operation. All the signs are that this will take place. As with most new technological developments in the computing field, multimedia CAL may provide unexpected benefits in some areas while not fulfilling expectations in others, but it would be an opportunity missed if archaeology did not take this chance to develop new teaching methods and materials which the new technology makes possible.

Bibliography

DAVIES, G. 1992. *Higher Education — What does the future hold?* Kellogg Forum Annual Lecture, Department for Continuing Education, Oxford.

DARBY, J. (ed.) 1993. "Teaching and Learning Technology Projects (TLTP)." *The CTISS File* 15: 27–70.

MARTLEW, R. 1990. "Videodiscs and the politics of knowledge". In Miall, D. S. (ed.), *Humanities and the computer*, pp. 39–48. Clarendon Press, Oxford.

UGC 1989. *Report for 1989.* University Grants Committee.

Dr E. Campbell,
Glasgow University, Department of Archaeology,
10 The Square, GB-G12 8QQ
Glasgow.

tltparch@dish.gla.ac.uk