INTO THE BLACK ART: ACHIEVING COMPUTER LITERACY IN ARCHAEOLOGY

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Archaeological computing is now entering a second generation.   In the 1960s and 1970s the black art was confined to relatively few technical whizz-kids who used computers for isolated and often esoteric projects and talked about ROMs and programming in machine code late at night.   In the 1980s, however, we are witnessing a new breed of archaeological computer users.   With decreasing costs and increasing awareness of information technology, computers are being used in a routine and holistic manner.   They are no longer confined to specific projects of the weird and wonderful variety but are now encountered in many complimentary aspects of archaeological work.   They may be used in all areas of a unit's activities, from on-site excavation recording, through finds processing, to payroll administration and preparation of reports.   Most archaeologists can now expect to have to deal with a computer at some stage in their career. Increasingly, job advertisements specify some level of computer experience as a pre-requisite for the successful applicant.   One consequence of this is that we should shortly see the death of the computer archaeologist as a special breed, as the division between those practising the black art and those outside is broken down.   Microcomputers today are far more user-friendly than the mainframe which was the province of the computer-junkie.   However, some considerable degree of expertise is still required in order to get the most from a computer.

Hardware advertisements stress the accessibility of new computers to ordinary mortals, in order to maximise sales of desk-top machines to the business community.   New microcomputers incorporate several gimmicks, such as ikons of filing cabinets for those who don't know what a file is, mice for managers who think that a keyboard is what secretaries use, and multi-taking to mirror the chaotic working day more accurately.

Yet they should not fool the archaeologist into thinking that computing is child's play.   In the rush to become computerised, the computer system is usually acquired before the person who will have to use it.   The hardware will sit unused in the corner, until it is recognised that some expertise is required to exploit it.   With a computing officer in post it will then be realised that the equipment is anyway inappropriate for the tasks which were envisaged.   This situation is frequently encountered in the business world and quickly leads to disenchantment and disinvestment in computer technology.

Archaeologists must be trained in the use of computers and this paper will examine the level of training required and how it should be conducted.

From the start I should like to distinguish between two levels of computer competence, which I shall term computer literacy and computer expertise.   For virtually all archaeological applications it will be adequate for the archaeologist to be computer-literate.   Archaeologists are end-users which means that they do not need to know the nuts and bolts of how a computer works, although they do need some knowledge of its potential and limitations.   No one imagines

that in order to use a radiocarbon date one needs to know how the dating equipment works, but knowledge of the principles involved and of the implications of a standard deviation is desirable. We should not be trying to turn archaeologists into computer scientists, just as we would not dream of turning them into physicists or environmental scientists. We borrow the services of the appropriate specialist as and when required.

The following list forms a very tentative description of the areas of knowledge which should constitute computer-literacy. There are probably further areas which should be added, or some on this list which could be struck off, but it is included as a basis for discussion.

An understanding of the rudiments of systems analysis. That is, the ability to define a problem in a manner in which it could be approached by a computer. This will be beneficial whether or not a computer is actually used.

An understanding of the basic components of a computer system, including what the of hardware and software does.

The ability to use a computer keyboard efficiently.

The ability to implement and use an existing applications package, for example, construction of a record structure for dBASE II or writing a program in an ultra high level language, such as an SPSS control program.

The ability to use a word-processor such as WordStar.

The ability to write a simple program in a high level language such as BASIC or Pascal. Whilst not essential at this level, some limited programming knowledge would be useful in the simple manipulation of data files. For example, reading in a file according to one format and writing it out in another.

I would consider that knowledge over and above this brief list might be helpful but would not be essential for the archaeologist who wishes to be a computer-user. Supplementary knowledge would go some way towards allowing an archaeologist to qualify at the second level of computer-competence, that of computer-expert. The computer-expert should have:

a good understanding of systems analysis and design

a comprehensive up-to-date knowledge of the elements of a computer systems

an understanding of data structures, database design and management

the ability to design and implement major computer programs

mastery of at least two programming languages, chosen from a list including BASIC, C, COBOL, FORTRAN and Pascal

In other words, the level of knowledge required of a computer-expert should be such as is only acquired through a three year undergraduate or one to two year postgraduate course in Computer Science or Information Technology, or through many years of practical experience. It will be apparent, therefore, that very few archaeologists can be expected to acquire it. Indeed, it is arguable that major tasks of computer programming should be left to professional programmers, to be consulted by archaeologists on a commercial basis.

From this I conclude that it is not possible or advisable to train all archaeologists to be computer experts. The small number required can be expected to be recruited from those individuals who combine an interest in Computing and Archaeology. Where possible existing commercial software should be used, rather than a new system being designed.

On the other hand, we do need to make all archaeologists computer-literate. The widespread introduction of computers has been so sudden that present staff lack the necessary knowledge and even new archaeology graduates are frequently computer-illiterate because of the lack of university teachers with the appropriate skills. However, computer literacy is not beyond archaeologists. It requires no special skills and, contrary to popular belief, it does not demand numeracy. A willingness to experiment, freedom from fear of the computer and a lot of patience, are more important than any special aptitude.

What, then, needs to be done? Firstly, computer literacy should be seen as an essential component of an Archaeology degree. University courses designed specifically for Archaeology undergraduates must be organised. Secondly, day and weekend schools must provide for the needs of qualified archaeologists. Unit managers must be encouraged to recognise that these are a necessary part of in-service training and should be prepared to second staff to them.

Currently, there is little consensus about how computing should be taught to archaeologists. The following questions need to be answered:
 What can be taught using computers?
 Who should do the teaching?
 How should it be done?

Most of my remarks will be specifically aimed at teaching computing to Archaeology undergraduates, but much of it also applies to the teaching of qualified archaeologists, perhaps through courses run by Adult and Continuing Education departments.

What can be taught using computers?

I have already outlined areas of knowledge which I considr appropriate for someone to be considered computer-literate. However, we are not just concerned with teaching people about computers, but we are also concerned with teaching people with computers. In other words we should not simply consider the computer skills which should be passed on but should also look at which areas of Archaeology are suitable for the application of computer-aided learning techniques. For example, an on-line question-answer system might be a useful tool for the acquistion of basic facts about archaeological sites. The Acornsoft Tree-of-knowledge program, which runs on a BBC micro, might be a useful means of teaching the principles of typology. Statistical packages, such as MINITAB, can be used to demonstrate sampling theory.

In an Archaeology degree I would hope that the following skills are developed in students: thinking, reading, writing, searching and counting. It appears that computers can be applied to most of these areas:
 Thinking – students still have to do this for themselves, although
  advances in artificial intelligence may change this.
 Reading – information systems, such as library searches.
 Writing – word processing packages.
 Searching – database management packages.
 Counting – statistical packages.

Who should do the teaching?

It is essential that students are introduced to relevant computing, rather than innoculated against it through exposure to a general users course. Similarly,

commerical business courses appear inappropriate to the finds administrator. Therefore courses must be taught by archaeologists, or those familiar with Archaeology. It helps if examples are taken from archaeological contexts. Archaeology Departments may have to be prepared to recruit staff capable of offering computing courses. For small departments this may mean sharing a computer expert with an Arts or Social Science background with other Departments. Generally, those courses offered in Geography or Sociology Departments teach appropriate computing skills, whilst courses offered in History or English Departments may be less useful because of their emphasis on textual analysis and bibliographies.

How should it be done?

The questions to be considered include whether mainframes or microcomputers should be used, how much time is required and the manner of teaching.

Generally, microcomputers are preferrable to mainframes where possible. The overheads of learning a particular computing system are far smaller, and new users are less likely to be intimidated. Above all, archaeologists are most likely to encounter microcomputers in their work. Unfortunately, the limitations of solitary microcomputers might make them inappropriate for some teaching purposes. An ideal teaching system might be to use a network of BBC microcomputers running Econet and sharing a common hard disk and printer.

The amount of time to be set aside for the teaching of computing also needs to be considered. A minimum of ten contact hours, including practical sessions, appears to be realistic, although this assumes that students will gain additional practical experience in their own time. A ratio of practical time to lecture time of at least 1:1 will be found to be essential. A ratio of demonstrators to students of at least 1:6 is also necessary.

Finally, there is the question of the best way in which to teach computing skills. Certainly, the use of practical exercises is an essential part of the learning process. One useful technique, which has been applied in Leeds and is illustrated in Figure 1, is to incorporate computing into a long-term practical project rather than attempt to teach it in an abstract manner. Thus students might be involved in the processing of finds from an excavation. They should do the manual sorting and identification of material and, in pairs, should then be responsible for typing the data into the computer. They gain familiarity with the operating system and with the editor. They can then be shown how this data may be manipulated and required to perform some analysis of it, using existing software packages, such as MINITAB. They may finally be encouraged to produce a word-processed report of their experiences.

In this manner students see a project through from start to finish and gain hands-on experience of a realistic example with useful applications. They gain experience in all the areas which qualify them as computer-literate.

In conclusion, if the full potential of computers in archaeology is to be realised, then we must train archaeologists to use them. It needs to be done now, or it may be too late.

DESERTED MEDIAEVAL VILLAGE POTTERY ANALYSIS

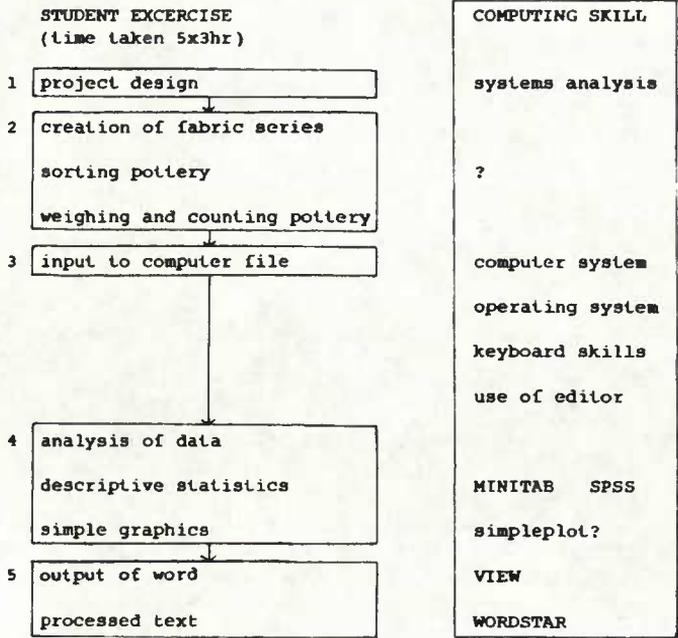| STUDENT EXCERCISE (time taken 5x3hr)	COMPUTING SKILL
1 project design	systems analysis
2 creation of fabric series	
sorting pottery	?
weighing and counting pottery	
3 input to computer file	computer system
	operating system
	keyboard skills
	use of editor
4 analysis of data	
descriptive statistics	MINITAB SPSS
simple graphics	simpleplot?
5 output of word	VIEW
processed text	WORDSTAR

Figure 1: Suggested technique for teaching archaeological computer-literacy.

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