

Problems in Archaeological Computing

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Introduction

The personal micro-computer revolution has made archaeologists aware of the potential of the computer. More and more archaeological organisations are now using computers. These new users will be impressed by their capabilities and they will also learn, the hard way, the many dangers and the shortcomings of their use. This article aims to pinpoint some of those problems. Many of them are not caused directly by the computer itself but are the result of the way we use (or abuse) them. Like all tools the computer can only be efficiently used if the user works within limitations. This requires good knowledge of their capabilities and how to maintain them. It is also necessary to ensure that the computer forms part of a comprehensive and integrated tool kit designed for the job in hand.

Lack of Computing Experience.

The lack of trained staff is one of the major problems confronting archaeology. In particular this affects the setting up of archaeological computer systems, which requires the combination of 2 skills detailed archaeological knowledge and a wide knowledge of computing.

It is difficult to find staff who meet both these requirements. Advice from experts may be sought but this can also be difficult as computer experts from universities, county councils and commercial environments usually have different experience to that required by archaeology. Archaeological computing is most often concerned with the manipulation of text while universities are more used to dealing with numerical data; county councils and businessmen with stock control and pay slips. Although this situation is rapidly changing it can mean that it is sometimes difficult to get exactly what is required from a conversation with a computer expert. You may not be talking the same language. Computer staff are often committed to their own

pet project and believe, sometimes contrary to all reason, that their system is the best and is bound to be able to deal with your problem. You find out the truth later!

Computer people also have a habit of underestimating the amount of time it takes to complete projects. Often they are right about the amount of time to do the project. They forget that other projects, computer breakdowns, holidays weekends etc all get in the way of the completion date. It would be wise to adopt the following maxim: It will take a programmer twice as long as he/she said it would to produce half of the work done not quite as originally intended.

Complexity of Data

Part of the problem is the complexity of the archaeological task. Data entry is mostly straight forward but unlike many business applications the individual fields of archaeological data frequently require a multiplicity of links with other fields of data. Many of these links may not be foreseen at the beginning of the project. This causes problems for many traditional databases. Relational databases can overcome many of these problems, but suffer from other deficiencies, such as a slowness of operation. Above all else an archaeological computer facility needs to be very flexible if it is to provide a decent service. Archaeology is a subject which has as many different approaches as there are archaeologists. This makes it difficult for off the shelf commercially produced packages to be completely satisfactory. Buying software is a potential minefield for the unwary. To avoid the risk of an ill-advised choice try to get advice from a professional computer expert who is acquainted with archaeology.

Training and Advice.

Although computer training at Universities is increasingly common there are a large number of archaeologists in post with no experience of computing. Many of these are in the positions from which the crucial policy and expenditure decisions need to be made. Further progress depends upon training. This can be both 'self-help' in the form of the purchase of a personal computer or attendance at conferences. It is also necessary to increase the number of training weekends and courses designed to get the archaeologists to get their hands on computers to see how they work and learn some of the problems involved.

An improved training scheme in the medium term is likely to produce archaeologists able to understand and use computers. But it may not produce archaeologists able to set up computer systems efficiently. It is vital that there is easy access to professional advice. At present this advice is available if you can presume on the advice of

one of those experienced in the use of computers in archaeology. This is not good enough as it can become extremely time consuming on those who are constantly being asked for advice. They may not be readily available at all times. There should therefore be an archaeological computing advisory centre to help people setting up and using computer systems. The centre would be controlled by an academic management committee consisting of the leading lights in archaeological computing. This committee would form policy, coordinate research projects and seek funding. For example there is need for a standardised graphics system and matrix solution program which could be achieved by coordinating research degree studies. The committee should help set standards and seek to become a unifying force in terms of computer languages and systems and equipment used. The committee would coordinate a small team of professional computer experts who would give free day to day advice on the purchase of computer equipment the software available for archaeological work, on programming, and be able to arrange for the transfer of data between different computer systems and storage media. This is crucial for the further advance and coordination of archaeological computing.

The outlook for archaeology is not bleak as archaeologists are eminently capable of understanding how to use computers but the process would be far more efficient if coordinated more than it is at present. It should not be necessary for archaeologists to become involved in the technicalities of the computer as the following story illustrates.

Benjamin was listening in fascination to the new transistor radio with his aged but wise grandfather

"Grandad" he said "Isn't it marvellous. But how does it work when there are no wires?" Grandad shrugged and said "My boy, with wires you'd understand?"

There is much in modern life which we do not really understand but nevertheless have the ability to use.

Planning

Detailed planning is necessary to maximise resources and to initiate the computing effort in a sensible manner. There are considerable problems in attempting to computerise an entire recording system at one fell swoop. There are several disasters on record. One museum after 2 years of work on the computer system had set up all their data entry programs but hadn't managed to get any data retrieval working. It would have been far better to have got several complete data entry and retrieval systems going as soon as possible. It is therefore a good idea to start with a project with a small data set which can be set up and carried out in a relatively short period. This will help maintain the

feeling of momentum and help persuade staff of the utility of the computer.

Systems Analysis and trial runs.

One of the most difficult tasks to do properly is to analyse a manual system to produce a suitable scheme for a computer system. It will necessarily be time-consuming. The major problem to guard against is insufficient or inadequate information from those proposing the project. It will usually be found later on that various important factors have been left out and a far more complex situation pertains than previously thought. Several unstated exceptions to the general rule are usually discovered at the last minute.

Widening the circle of consultation beyond those immediately involved may help but can itself cause problems. A project can begin as a simply conceived program. After discussion with colleagues it will become refined. Colleagues will find exceptions and possible additional future uses. Often this will help clarify the situation and make a realistic workable system. But occasionally the analysis can become so convoluted as to be practically unusable. The analyst must produce a realistic and workable solution. More often than not this will be a simple approach.

Because of these problems it is vital to have a trial run before planning to put the project into everyday use. This trial should be of a cross-section of the data and should be run over a period of time by a number of people. This is important because it is necessary to know not only that the program is comprehensive but also that it is easy to use. It will be obvious that many of the problems of systems analysis relate to the human element. This is often the case but it is usually caused by misunderstanding or confusion about the role of the computer. The analyst will only be in a good position to produce good work if he or she understands both the computing and archaeological problems.

The organisation of staff.

There should always be one member of staff in overall control of the computer service. In large units the person appointed may have to withdraw substantially from day to day archaeological work in the same way that trained photographers and draughtspersons do. This means persuading the DOE to provide the money for funding to provide adequate computing backup. Ofcourse it also means providing yet one more backroom boy at the expense of the field workers.

At the Museum of London we set up our computer systems based on the computer experience of the author (helped by Dr Graham and Jonathon Moffet at the Institute of Archaeology) and by hiring 2 members of staff on a BSC scheme. This

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worked very successfully and showed that the museum needed a computing staff of 3 to provide a service for the whole museum. As it happens the DOE reduced the Department of Urban Archaeology budget. The Museum itself was unable to provide the money required and two well trained members left at the end of their one year of service leaving an undermanned system.

The problems of Funding.

Computer systems take a long time to set up properly and cost a lot of money before they become costs effective. So funding bodies must provide special funds if archaeology is to take advantage of the new technology.

The cost of computer hardware is such that archaeological organisations are purchasing micro-computers. However the amount of data used in archaeological work is more appropriate to the use of mini-computers. The only reasonable way around this problem is to plan purchase of computer equipment so that flexibility and ability to upgrade are possible. In subsequent years when further funding becomes available the money can be spent to augment the equipment currently available without any waste in redundant equipment.

In the Museum of London we have adopted a policy of purchasing micro-computers for data entry and initial data analysis while using a mini-computer to hold the data base and more complicated retrieval requests. The micro computers can thus be purchased one at a time to increase the number of data entry stations. This still means an increment cost of 1600 pounds per station. We were investigating upgrading the micros to multi-users systems which would reduce the unit cost to nearer a 1000 pounds but DOE cuts put paid to this idea.

To provide a comprehensive computer system other equipment is also necessary. Unfortunately it is all expensive, denying the prospect of longer term cost saving. Particular savings are possible by using computer graphics and data entry equipment. At the Museum of London we do not have a graph plotter despite having graphics programs, graphics data entry pad and a system for computerising archaeological plans. Nor do we have a magnetic tape device which makes communications with other computer installations relatively simple and helps make the fundamentally important backup of data easy and cheap. Data entry devices such as touch screens and data pads can considerably reduce the amount of time spent entering data and can reduce errors to an absolute minimum as well as cutting out the time consuming transfer of data from a paper form to a computer record.

Access to Computer Terminals.

A further bottle neck is caused by frequent delay in obtaining access to the mini-computer. This has forced us to perform more analysis on the micros. In terms of ease of programming this is not to our advantage. Many computer applications will only work if the entire process is computerised so that ready access to a computer terminal is essential. A unit possessing only one micro-computer which will be used mainly for word-processing data-entry and program development will find that there is little time left on the computer for data retrieval.

There are a number of possible ways to overcome this problem. Frequently updated paper catalogues or micro-fiche printouts are possible solutions. However they fail to take advantage of the great flexibility of the computer. And if data is being changed or updated regularly the printouts will soon become out of date or will become inordinately expensive to reproduce. Other solutions depend on finance and include purchase of further micros, buying multiuser or network computer systems. Perhaps the most feasible method, given present financial restraints is the purchase of cheaper personal computers as data entry and word processing stations, while leaving the main micro as the data retrieval and printer station. This solution does depend upon providing communications between micros which requires a high level of expertise.

Although the costs of personal computers have fallen it should be remembered that a really effective system requires a disc drive of at least 64k of memory, a proper monitor and a printer. This increases the cost from 300-400 pounds up to about 1300; not much less than a 'business' machine. This would be more robust and have more applicable software (but is unlikely to have such good graphics as for example the BBC has).

Trade Unions, Job Losses and Working Conditions.

The lack of finance may cause computer services to be funded by a reduction in staff numbers. This would be a mistake as all archeological units are hard pressed and need more staff to help preserve and record the countries fast diminishing cultural heritage. Trade Unionists in Archaeology should be aware of these problems and fight any attempt to lose jobs to new technology. Indeed there is a strong case for increasing man-power in the short term. Firstly to provide the initial set up work and secondly to use the full power of the computer by computerising all of the backlog of sites and finds recorded. Only when this is done will the awesome power of the computerised database can be fully exploited. Archaeologists should therefore make sure they negotiate through their trade unions for no-manpower-loss

agreements on the introduction of new technology.

Consideration and money must also be provided for the proper wiring and installation of the computers to avoid danger to staff from trailing leads. Noise reduction covers should be provided for printers, especially if the printer is of the daisy wheel type. The ergonomic siting of VDU's can, with decent adjustable typing chairs, data sheet stands and good lighting, reduce many of the fatigue and boredom related problems associated with the use of VDU's. It is also necessary to seek advice on the maximum amount of time that should be spent in front of the VDU - perhaps only 2 hrs per session should be allowed if entering data as any longer can cause problems of backache, eyeache, and excessive boredom. These are not just problems of staff relations but also cause an increased incident of error.

Although many of the possible health hazards are due to ergonomic and work organisational problems and can, with forethought, be overcome, there are suggestions of a danger of radiation from VDU's. The radiation is of a very low level and health and safety reports suggest there is no long term hazard, although there are unsubstantiated American reports of possible dangers, to the unborn foetus.

The Human Interface.

Just as the industrial revolution worsened the working lives of those consigned to the factories and mines there is a danger that the computer will have adverse effect on many peoples' working lives. On the other hand they may take over in the form of industrial robots many of the boring production line and mining jobs. In the office there is a danger that the computing tail will wag the archaeological 'dog'. Staff are bound to resent changes imposed by the use of computers. To overcome these problems computing staff must do their utmost to alleviate problems connected with the inhumanity of what appears to outsiders to be a thinking machine. The computer system must be designed for ease of use by those it is intended for. A good way of achieving this is to model the computer system on the manual process. This ofcourse assumes that the manual method is logical. If so it helps users to be working in a familiar way to their previous approach.

It is important to get output requested by staff to them as quickly as possible and projects should be set up to give some early return. If the user can see the end result clearly they will be a lot more receptive to concentration on the essentially boring task of data collection. There are definite advantages getting all members of staff involved in the data collection process. Knowledge of the workings of the data collection system will help basic recording and recording.

Backlog

Many of the more impressive features of computers will not be exploited until there is the possibility of cross correlations between sites and finds assemblages. This means entering data from previous sites. It is a huge task and desperately needs central government funding. It is ideally suited to the introduction of new technology and is exactly what MSC schemes should be about. However it does require a longer term commitment than one year, and archaeologists must stress that for important cultural purposes such as this a new longer term MSC scheme is required.

Conclusions

Computers are not solutions but are tools. They can be used to good advantage to improve data analysis and the presentation of data. Computer systems require a large investment to set up and the initial data collection costs will be high. But once the majority of archaeological data is collected in a machine readable form it will make the task of the researcher in collecting information far easier. To achieve this as efficiently as possible coordination of the archaeological computing effort is necessary. The allocation of special funds to pay for the set-up costs is also necessary. A program of incorporation of information collected in the past should be begun. There will be many problems over the next few years but within five years computers will be seen to be indispensable for archaeology.