INFORMATION TECHNOLOGY IN MUSEUMS

Introduction

The world is a rapidly changing place. It is not only in the realms of politics and economics that great changes are happening, Information Technology (IT) continues to develop making the world a faster, yet smaller place. Until recently progress has tended to be in storage, retrieval and display facilities, but by the end of the 1980s and beginning of the 1990s this had been extended to the area of telecommunications. These systems have enabled data to be passed from one end of the world to the other at ever increasing speed and in ever growing quantities. From reading the telecommunications press it becomes apparent that progress is often slow because of the national and international legislation that is needed to regulate the communications industry. However, the number of satellites in the sky and fibre optic cables in the ground will inevitably increase, with little regard to existing political or economic boundaries.

It is also true to say that museums continue to adapt and change their methods and techniques. In the last thirty years there has been an evolving emphasis from cataloguing to documentation to collections management with a growing concern for knowing what objects are where, in what condition and how a museum acquired them. IT has been a major influence in this as the potential of computer technology for handling such information has been explored and realised. Although entering data into a computer system can be as slow as compiling manual documentation systems, retrieval can be much quicker, giving the curator a better picture of the current state of the collections. In the public areas of museums the trend has been towards more visual and interactive displays, placing VDUs, keyboards and mice beside traditional cabinets and cases. Again, IT has been an overriding factor in this development.

The role of the museum

It is possible to suggest three main roles for a museum (Fig. 1). The first and perhaps most obvious is that of a store house and archive. The results of archaeological excavations, botanical and geological surveys, or the products of artists and sculptors, be they artefacts, documents, pictures or specimens, have to be put somewhere, and this is usually in a museum or gallery. However, with the role of store house go the functions of curation and conservation, ensuring objects are stored in suitable conditions, or damage is repaired. Since there are legal ramifications in establishing ownership complete acquisition documenta-

1. Archive/Storehouse
   "somewhere to put objects from past and present worlds"

   Users: curators
   conservators

2. Resource centre for research
   "somewhere to study objects to understand their purpose in past and present worlds"

   Users: postgraduate researchers
   post-doctoral researchers
   curators

3. Educational establishment
   "somewhere to learn about objects and what they tell us about past and present worlds"

   Users: undergraduate students
   school teachers
   school pupils
   general public

Fig. 1 — The roles of a museum and their audiences.

tion is essential, while the value of some objects may require high levels of security. In the event of an object being stolen, the more details known about it, the more likely it is to be recovered.

The second purpose, which follows on from the first, is that of a resource centre for research. Without objects museums would have no *raison d'être*. As a consequence, and despite the security implications mentioned above, museums need to be accessible, they are places where people can study objects and documents as they seek to understand the world, past and present. In order to fulfil both the roles of research and archive, the collections need to be satisfactorily documented so that at least it is known what there is and hopefully where it is. Naturally the physical organisation of artefacts and documents depends on a particular museum, but indexes and catalogues of classes and types of objects are to be expected with provision for updating in the light of further research and the addition of new material. Since the major portion of collections kept by museums are held "in reserve", it is also imperative that researchers at whatever level have the means to find out what is held "behind the scenes".

The third role similarly follows on from the second, in that museums are educational establishments. This is most obviously expressed in the form of university museums, such as the Ashmolean Museum, Oxford, where the col-

lections are used by students in their studies. However, school children frequently make use of museum displays as part of their school lessons, while it is important to remember that museums are one of the primary public faces for many subjects such as archaeology, history and geology. It is in museum displays that the public see what archaeologists, art historians and natural historians make of the world. It is in fact possible to identify four types of audience, each requiring a different level of detailed information. The university student needs specific documentation about objects and possibly access to them as well. Parties of school children need themes that illustrate aspects of their school curricula. Between these two are the school teachers who do not require the same amount of detail as students, but need enough information to evaluate the relevance of any display to the school curriculum.

The public will expect displays of material to give relevant and coherent pictures of current interpretations of the world. In this case, this may mean informative labels behind glass cabinets, but it is perhaps true to say, though with little hard evidence to back this up, that people tend not to read labels. The more visual the display and also the more 'interactive' it can be made, the greater its ability to communicate a message. We live in the age of the television and the games machine, when the small screen in the corner of the living room has an all pervasive influence. With the development of home-based multimedia and Photo-CD systems there will be a growing expectation of finding computer-based interactive displays in museums. Theme parks and entertainment centres, such as Euro-Disney outside Paris, will inevitably compete for the hearts and minds of the public, and this is something the museum world needs to address and in which IT can help.

The role of IT in the museum

Information Technology is only a tool to be used in the service of other disciplines, so basically IT is there to help. The official definition of IT in the UK in 1982 was stated as,

> « the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numeric information using a micro-electronics based combination of computing and telecommunication ».

With regard to the three museum roles given above we can see how IT can and has been used (Fig. 2). For archival purposes the computer has been used to hold descriptions of objects, mainly as text and numbers as an aid to collections management. Several museums have begun to build image-bases, for instance the National Museum of Denmark, Copenhagen, and in the future shelves of discs may replace the filing cabinets full of negatives. This will make the images more accessible to researchers and also allow objects stored in the

The archive
- data, text and images storage on computer-readable media
  - e.g. security copies
  - reserve collection inventory
- collections management system
  - e.g. accessions
  - loans
  - conservation

Research
- query systems
  - e.g. expert systems/identification systems
- cataloguing and indexes
- analysis programs
  - e.g. statistics
  - geographical information systems
- image processing

Education
- publication of catalogues and leaflets
  - e.g. traditional typesetting
  - CD-ROM
- gallery display labels
- interactive gallery displays
- multi-media presentations

Fig. 2 — The role of IT in museums.

reserve collections to be seen, at least in picture form, in the galleries. This is not to encourage the use of images instead of the objects themselves, but pictures of thin sections or particular parts of the decoration or different profiles give a more comprehensive description of an object. However, given the high cost of some of the objects that are found in the Art History market it may be preferable to use an image rather than handle a vase worth ten thousand pounds or be within touching distance of a multi-million pound painting.

It is in the help that IT gives to research that is perhaps the most exciting of ITs benefits. This is not just the use of analytical programs, Geographic Information Systems, or even expert systems. With image processing software it is possible to superimpose one profile over another allowing comparisons to be made more easily. One example is the use of die-casts of coins, to determine which coins may have been produced by a particular die. Similarly, enhancements can be made to poor quality negatives, photographs or X-rays once they have been scanned into a computer system. Further, it is possible to link several workstations by a Local Area Network, thus allowing the same data to be shared, across the museum, so a conservator can be examining the treatment

record of an object while a curator is considering the same object's place in an exhibition while a student examines the object's documentation for an essay.

Returning to the public face of museums, interactive gallery displays are growing in number. In an increasingly technological age, where the young are familiar with the intricacies of keyboards, touch screens and mice, it is likely that the computerised display will be *expected* in galleries. They are not there to replace the objects, but to complement them, giving background information in a more accessible form. Multi-media technology makes it possible to integrate into a single system all the elements that comprise an object's description — documentation, photography, analytical results, X-rays, etc.

With a look to the distant future there may be a growth in the number of speaking exhibits. In fact museums such as one in Hastings, on the south coast of Britain, have already used these in special exhibitions (as part of the Domesday Book celebrations). It is also possible to conceive of robot guides wandering our museums taking visitors around. However, quite when they will be able to cope with the myriad of arcane questions that can be fired at human guides is something that may postpone their arrival for some time.

There is a danger that IT, if taken to an extreme, will convert the sedate, intellectual atmosphere of a museum into that of the cacophonic amusement arcade. Although this is not to be encouraged, it is worth asking which of the two attracts more people and consequently more money.

The role of telecommunications in the museum

As we approach the year 2000 we can echo the Minister of State for Information Technology in the UK, who said in 1984,

> « we are entering an exciting era, we are now seeing the museum of the future and the excavation of the future emerge from the realms of science fiction and become reality » (Stewart 1984, 86).

In 1975 the British archaeologist Jim Doran (Doran, Hodson 1975) had described as alarming the desire to see a world-wide archaeological computer-based data bank which another, American archaeologist, Robert Chenhall, had described several years earlier as the struggle « towards what seems an impossible dream » (Chenhall 1971, 159). However, reality is catching up with fiction so that this is now an achievable goal and not just for archaeologists. The development of the ARCHIS system in the Netherlands, which links archaeological databases in universities with the State Service for Archaeological Investigations (Roorda, Wiemer 1992), demonstrates the feasibility of researchers having access to a huge distributed database of information held in museums, both nationally and internationally.

Once upon a time, if a scholar wanted to see an object, for instance a Greek

vase, he would have to visit the museum where it was kept. The main draw back was the need to travel around the world to see all such vases, which could be an expensive and time-consuming undertaking. One solution to this problem is to have all the vases in the same physical location, but while this may help research, it would not make such objects very accessible to the masses. Furthermore, museums are not isolated units and collections have been split for many different reasons, and this has been of benefit to mankind in making representative selections accessible to more people. Indeed, to have collections separated is beneficial from the security angle — if the collection is lost in one part of the world, through natural or man-made disaster, other parts of it will still exist elsewhere.

Another solution is to take the dedication of a scholar who compiles a large corpus of the information about such objects, including photographs, and who publishes his work, as was the case with Sir John Beazley's two volumes, *Athenian Black-figure Vase Painters* and *Athenian Red-figure Vase Painters*. This solution removes the need to visit many different places, although a serious researcher would still need to visit some museums. Further, this published information is organised and accessible, although the arrangement of the material which may suit one scholar, may well be a hindrance to another. The more serious disadvantage is that research continues and new vases are found making it necessary for new editions of such works to be published.

Given technological advances, instead of a published volume, this information can now be stored on a computer system and organised so that the desired information can be retrieved in numerous ways. Of course, the main draw back recalls the problem of the single museum collection in that the information is stored on one machine in one locality. This is a step backwards, as it is not as accessible as a published book, which may be on a scholar's shelf or in a library. However, the contents of the database can be published as a Compact Disc, which is more flexible and has a greater capacity than an ordinary book, but this type of medium has one drawback in common with ordinary paper publications. If a new edition is required, the CD has to be re-written and re-distributed. Telecommunication networks remove this disadvantage, having the benefit of allowing the information to be distributed among several institutions, but accessible from any location, as well as enabling the information to be kept up-to-date. It would seem that such networks could be a panacea for museums to making their collections available.

Hurdles, pitfalls and other considerations

Although there is a vast potential in what IT can do for the museum world, there are a number of problems that need to be overcome before this bears

Data entry
- slow
- verification

Data retrieval
- processing speed of computer
- speed and friendliness of operating systems and software
- data structures and indexes
- transmission speeds between computer and peripheral
- size of information files
- user interface
  - language
- standards
  - data structure
  - data content

Progress
- hardware and software upgrades
- incompatibility

Copyright
- ownership
- copying

Money
- NOT necessarily equipment
- running costs
- people

Fig. 3 — Considerations in implementing IT in museums.

fruit. These can be divided into several areas (Fig. 3).

A major hurdle faced by all museum computing projects is that of data entry. This is not really a case of the equipment and the programs to capture the data, the problem lies in the quantity of information to be stored. Even with a small army of "data-inputters" it may still take a number of years to feed into a computer all the relevant information. Furthermore, the smaller this army the longer it will take. People can only type so fast, photographing objects takes a certain amount of time and scanning documents can also be slow and time-consuming. What must also be taken into account is that data entry is really a two stage process, after the information has been stored on the computer it needs to be checked for accuracy. No matter how sophisticated a computer system may be, it will have no value if the information it contains is wrong.

Having put accurate information into a computer system, it will also have no value if it cannot be extracted again. A number of technical factors are involved in this which are to do with the hardware employed. The speed of computer processors has increased markedly in the past decade, and will undoubted-

ly continue to do so. The quality of operating systems and the software they employ is also improving as development continues so enabling faster access. The structure of databases on the other hand can be a crucial factor in getting at the information they hold. It is here that trade-offs between an ideal structure must be weighed against speed of retrieval. It is often the case that a fully normalised relational database is slow at extracting data compared to one that is organised to facilitate this process. Indexes may help, but these have to be correctly specified and are often dependent on the data management system. The speed and reliability of communications networks is another factor to be considered but again these are improving with time. The size of files is yet another consideration. The larger the file the longer it takes to transmit. This applies just as much to textual output sent line-by-line as to images. Brevity and minimal resolution have to be balanced against information content and sensibility.

Another aspect to information retrieval is language. Although continental-wide networks already exist, for the European continent there is still the problem of language to be overcome. If everyone spoke and read the same language then there would be no problem, or conversely if everyone could speak every other language then the inability to communicate would not exist. However, not everyone has a natural ability to speak languages other than their native one, nor do they often have the chance. The European Museum Network and the Dyabola bibliographic database possibly point the way to resolving this issue, with the option of choosing the language of the prompts and messages. In general, at the start of any session, the user should be prompted for their preferred language with the system then accessing the correct words and phrases.

The issue of computer standards is to a large extent outside the control of museums. However, the standards used by museums in their practice, documentation and management is one subject that has exercised many minds and about which much has been written and said. It is probably idealistic to assume that everyone will agree about what terminology should be used in what subject area and what attributes are described. The best option may be to advocate that agreement be reached on minimum standards of what should be stored, i.e. the data structure, and user interfaces. Beyond that, sufficient help should exist in a system to enable anyone to use it, and understand the contents, whatever the subject area and whatever the language. One thing that should be avoided is people spending more time discussing what to call a vase, rather than studying the vase itself.

Another major problem to be faced by all users of IT is constantly changing technology. This has advantages because better equipment means better serv-

ices and capabilities. However, the draw back may be that having taken the decision to use a certain set of equipment at some time, future developments may be such that a museum has gone up a technological blind-alley. It is to be hoped that this does not actually happen and it would not be in the interest of IT companies to allow it to. However, any changes that need to be made when transferring data and programs may well be time consuming. Furthermore, as has happened with the Beazley Archive, changes in software may mean restructuring a database and re-writing all the programs that made it work. For instance the relational model of databases replaced the network type, but may yet be superseded itself.

Copyright is an issue that has recently come to the fore as a major hurdle. Information Technology is extremely good at copying anything stored on computer readable media. This is not a problem for backing up or archiving vital information, but since copying and publishing have become a great deal easier, the possibility of using computer stored text and images, without permission, has brought the issue of ownership of computer files and intellectual property rights to a crucial stage. With traditional paper publication pictures need to be of a certain quality and so displaying images on computer screens below that quality means they are unlikely to be used. However, if the publication is a CD then as long as the screen display is satisfactory, which it would be, since it would be an exact copy of the original, then the way is open to malpractice. The issue is very complex and may well take some years to resolve, although museums are potential losers.

Finally there is the problem of resources. Museums are often poorly funded. Fortunately, with regard to IT, much of the technology they will require will be put in place by others, for commercial and business purposes. This means that valuable museum resources need not be spent on building and launching satellites or laying intercontinental fibre optic cables. Museums will have to budget for equipment, such as the computers, cables, modems and dishes, which makes it all work. There is also the cost of employing the people who can run and maintain it. Although some people specialise in museum-computing, more sophisticated systems may require much more highly trained individuals, rather than a volunteer from the existing staff who becomes the "resident expert".

An end note

Although political changes have been dramatic in the last few years we cannot expect to see the same rate of change in the museum world. Indeed, we should be looking towards the next century, and perhaps as far ahead as the year 2040, fifty years hence. The world of Sir John Beazley has long gone but

the legacy he left has been such that not only have people accepted his work, but it has been possible to incorporate it into computer systems. We should try to ensure that the work we endow to the future is a firm foundation on which future curators and museum professionals can build.

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BIBLIOGRAPHY

CHENHALL R.G. 1971, *The archaeological data bank, a progress report*, « Computers and the Humanities », 5(3), 159-169.

DORAN J.E., HODSON F.R. 1975, *Mathematics and Computers in Archaeology*, Edinburgh, Edinburgh University Press.

ROORDA I.M., WIEMER R. 1992, *Towards a new archaeological information system in the Netherlands*, in G. LOCK, J. MOFFETT (edd.), *Computer Applications and Quantitative Methods in Archaeology, 1991*, British Archaeological Reports (International Series) S577, Oxford, Tempus Reparatum, 85-88.

STEWART J.F. 1984, *Museums - 'cabinets of curiosities' or centres of information?*, in R. MARTLEW (ed.), *Information Systems in Archaeology*, Gloucester, Alan Sutton Publishing, 77-89.