CONSERVATION DOCUMENTATION AND THE IMPLICATIONS OF DIGITISATION

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ABSTRACT

Conservation documentation can be defined as the textual and visual records collected during the care and treatment of an object. It can include records of the object's condition, any treatment done to the object, any observations or conclusions made by the conservator as well as details on the object's past and present environment. The form of documentation is not universally agreed upon nor has it always been considered an important aspect of the conservation profession. Good documentation tells the complete story of an object thus far and should provide as much information as possible for the future researcher, curator, or conservator.

The conservation profession will benefit from digitising its documentation using software such as databases and hardware like digital cameras and scanners. Digital technology will make conservation documentation more easily accessible, cost/time efficient, and will increase consistency and accuracy of the recorded data, and reduce physical storage space requirements. The major drawback to digitising conservation records is maintaining access to the information for the future; the notorious pace of technological change has serious implications for retrieving data from any machine-readable medium.

INTRODUCTION

As each new museum opens across the world, as each new television program on archaeology and history premiers, our interest in the past grows. People are fascinated by history but they might not consider how the information is gathered. Historians generally use written contemporary documents to reconstruct the past, but curators in museums and archaeologists rely more on objects to interpret how our ancestors lived.

The term 'object' can be defined as anything that is made by humans and therefore has an intended use, whether it is symbolic or functional; for the purposes of this discussion it does not include other cultural property such as furniture that might be considered objects. Curators and archaeologists seek to learn about the manufacture, use, and ultimately disposal of objects. The questions that can be asked of objects from our past are seemingly endless and the answers open up a world of information that was inaccessible without them.

What is not always recognised by the casual visitor to a museum, a cultural institution, or an archaeological site is that objects change over time from the moment they are made until their disposal; this change can be natural, such as metal corrosion which alters surface colour and texture, or the change can be stimulated by the past use of the object by humans, which yields either subtle wear marks or signs of major alterations. The ability to recognise changes and interpret them accurately is important for they themselves also contain information about our past. Moreover, once an object enters a study collection it might also undergo natural and/or deliberate changes. These deliberate changes may come from work done on the object to make it more recognisable for the observer, or more stable in its new environment, or to reveal additional information.

Conservators are trained to investigate objects using a variety of techniques that can answer many of the questions posed by the curator and/or archaeologist. Investigations are undertaken to ascertain if objects are stable and what might affect their future stability. It is also the conservator who is trained to be aware of changes to objects and rectify adverse changes where necessary. Any information collected through the course of this work should not, however, be left to someone's memory and therefore should be recorded at the time of discovery in a form that will be accessible for future research, consultation and comparison The dilemma that archaeologists and curators face is that detailed conservation information usually cannot be drawn from every object in a collection, as the resources available are often limited.

The process of documentation within our technology-driven world has changed dramatically due to the introduction of computers into the workplace over the last thirty to forty years. The record-keeping of conservation work can be positively changed if conservators fully embrace computers and digital technology. There are, nevertheless, many issues that must be taken into account before institutions and conservation departments adopt new hardware and software; the way in which conservation information is documented digitally should be carefully considered. In order to properly assess this issue, first the history of conservation documentation and the data and tasks

that are recorded will be explored, followed by the ethics that are involved in documentation; finally the technology that can be used by conservation professionals and the implications of its use will be addressed.

HISTORY OF CONSERVATION DOCUMENTATION

1.1. What is conservation documentation

Conservation documentation can be defined in a variety of ways. In terms of remedial conservation, it is the data collected during the entire course of treatment in the conservation laboratory; preventive conservation documentation includes the data collected during the course of investigating an object's or a collection's stability in its environment. Conservation documentation can include recording the object's condition, any treatment done to the object, any observations or conclusions of the conservator as well as any analytical work done. The data can be recorded in different ways such as written text and photographs. But the form of documentation is not universally agreed upon nor has it always been considered an important aspect of the profession. Good documentation should provide a complete story of what has happened to the object before it reached the institution, while inside the institution, and while inside the conservation laboratory; it should provide as much information as possible for the future researcher, curator, or conservator.

1. 1. 1. First mention of documentation?

It is difficult to determine when conservation documentation was first conducted but there are early descriptions of restoration conducted in the 16th century but these are written by observers, not the restorers themselves. The pioneers of modern conservation as we know it today, scientists like Rathgen, Scott and Plenderleith do not mention the concept of documentation in their work. In 1905 Rathgen was among the first to publish a paper detailing conservation work, *The Preservation of Antiquities*, but there is no mention of documentation within this paper. Similarly Scott's report to the trustees of the British Museum entitled *The Cleaning and Restoration of Museum Exhibits* (1926) does not note documentation. In Plenderleith's book published in 1934, coincidentally of the same title as Rathgen's, there is also an absence of this concept. The examples of specific objects' treatment in these books may be considered the earliest documentation although they were included merely to serve as illustrations. Another early source is the museum journal *Technical Studies*, which began in 1930 and it contains one of the earliest articles on documentation, "A Museum Record of the Condition of Paintings" (1935). This paper by George Stout refers solely to the documentation of painting conservation but he does refer to the fact that a committee will be convened shortly to investigate how to report on the conservation of objects (Stout 1935). A search of conservation literature has not turned up any such article. His paper, however, points to even earlier articles published in 1932 (La Conservation des Tableaux Contemporains, *Mouseion*, XX) and 1933 (Documents sur la Conservation des Peintures, *Les Dossiers de l'Office International des Musées*, No.2) which address the idea of how to report on the conservation of paintings.

1.1.2. Early published journals

By the mid-twentieth century, most museums had no standardised documentation procedures in their conservation departments nor any standing requirements for any reporting to be done. In fact very few museums have consistent conservation records before the 1970s. Prior to this period it seems that documentation was sporadically done and when it was, the reports were sparse in terms of the data recorded.

Perhaps the best chance that an object had to be completely documented was when the conservator planned to publish the work. In fact the editor of *Technical Studies* commented on the need for more consistent conservation documentation in 1934 at the beginning of a paper on the restoration of a specific painting. He stated that the author's working record was made only for the purposes of presenting it to his museum and for publication; and his second point was most striking for this early period, that "until such records are consistently made and kept, the care and treatment of paintings will have to be carried on with a severe and quite unnecessary handicap" (Ruhemann 1934).

Conservation work, therefore, in the early part of this century was published within journals catering to museum professionals. It was not until 1950 that the conservation profession had its own journal, *Studies in Conservation,* published by the International Institute for Conservation giving conservation professionals a specific forum for presenting their own work.

1.2. What is documented

The process of conservation, both passive and active, includes a wide variety of techniques, materials and treatments, all of which have changed and expanded as research into conservation continues. As documentation is aimed at recording information related to the object as well as the information revealed by the object, there is a multitude of important documentation categories. While documentation is generally recognised throughout the conservation profession, not all conservators know or agree on what should be recorded. It has been left to the individual conservator or institution to decide, or for professional bodies to provide guidelines which members are ethically required to follow. Each of the following categories can be documented in a variety of situations.

1.2.1. Existing condition

The most important step in the conservation process is to document the existing condition of the ob-

ject; this is also the most frequently documented situation. The term "condition" refers to the state of preservation of the object which is determined by instability, damage and disfigurement (Miles 1990). Analysing the physical appearance of the object is the key to what will happen while it is in the care of the conservator and therefore is crucial as a tool for decision-making (Rickerby 1993). The physical appearance of the object will dictate what should be done to its physical environment and/or what should be done to the object to stabilise it. It also indicates whether any changes, obvious or subtle, have happened to the object over time (Rose 1992); this presupposes that the conservator is aware of what the ideal original appearance of the object was and can therefore compare the object before them to it or, if they are fortunate, to a previous condition report (Miles 1990). The condition before treatment or change to its environment should also be documented for comparison purposes when the work has been completed.

The documentation of the pre-treatment condition should include any cracks, efflorescence or disfigurement to the object (Buttler 1994); any sign of damage or wear, additions and losses, previous restoration (Klim 1992); locations and extent of physical defects, chemical alteration and its products (IIC-AG 1968); dimensional changes, colour change, insect damage, biodeterioration (Garrett 1989); to what extent, if any, the original surface is still present (National Park Service 1990); and how the condition was determined i.e. what type of technique(s) were used, such as magnification (Miles 1987). The environment in which the object is housed normally should also be recorded in this report, including the temperature, relative humidity, light levels, pollution, location within the institution, and packaging materials, if any. If all of these criteria have been assessed then the conservator should be able to establish the cause of any deterioration to the object, that is, whether it is due to inherent instability of the object, the environment in which the object is kept, or to previous work done on the object including conservation or restoration.

1.2.2. Condition after treatment

When treatment is completed, the condition of the object should again be documented in order to compare to its pre-treatment condition; it is a form of checking whether the object has actually improved and most importantly whether it has now stabilised. Therefore the same categories of information that were addressed before treatment may once again be considered.

1.2.3. Material composition and technology

The analysis of the material composition of the object as well as the technology used in creating it are crucial to understanding the condition of the object. Any work done on the object might be harmful if the material and manufacture are not properly assessed and documented, including potential decorations in the form of fragile paint. This category, of course, is important to the archaeologist and/or curator who has brought the object to the conservation laboratory and a superficial identification may have already been made. It is up to the conservator to agree with the identification or to conduct more extensive tests in order to assess the exact material composition and manufacturing technique. Included under this category of data should be a description of material(s), structure and method of fabrication by physical, chemical and biological composition; and the type of analytical technique used to determine these data (IIC-AG 1968). The method of determination may be as simple as a magnifying glass or as sophisticated as a scanning electron microscope, but it should always be explicitly noted what type was used so there is no question as to how the identification was accomplished. Analytical techniques involving chemical analysis are essential to document as they might interfere with further analytical study of object including DNA sequencing or a dating method (Davis 1994); if a researcher wishes to conduct these types of investigations it is necessary to know what might interfere with their results.

1.2.4 Conservation methods used

Every type of conservation work that a professional does to an object involves a certain amount of risk of damage to the object; even proven methods may cause an unexpected reaction immediately or in the future. The method of treatment is essential to document as it will affect the way in which any cause of deterioration in the future is interpreted. Also, documenting methods of treatments allows the conservator to monitor and assess the effectiveness of the treatment in the future (Collins 1995). The remedial conservation techniques used in treating an object must be documented completely, and any change to the environment, whether in the store or on display, must also be acknowledged. Treatment techniques are a separate category of information from analytical techniques; the former includes methods of cleaning or stabilisation such as air abrasive cleaning or vacuum impregnation while the latter includes dating techniques and elemental analysis such as neutron activation analysis.

Conservation methods may also include the addition or removal of material (te Marvelde 1999). Materials that might be removed from an object, including corrosion products or past conservation/restoration treatments, can include information about past periods of use and care and therefore should be carefully documented and a sample kept of the material (te Marvelde 1999). Reconstruction or restoration work should also be completely documented (Buttler 1994). As mentioned in the previous section, all methods used in treatment should be documented.

1.2.5. Materials used during treatment

The types of materials that are used for conservation treatment should be documented. This record should not be limited to just the generic names of

those introduced into the object and that are intended to remain in the object such as adhesives and consolidants. There are other materials an object is in contact with that are not intended to remain with the object, such as electrolytic solutions and ultrasonic solutions, but these should also be documented. Any contact with foreign materials might harm an object. Preventive conservation materials in the form of mounts and packaging should also be documented.

An important aspect in documenting the materials used during conservation treatment is to avoid using terminology that is colloquial and not specific to the material used. Proper brand names and a chemical breakdown of the material and its properties should be given at least once during the course of documentation and while abbreviations may be used for the sake of space and time efficiency, it should be ensured that only standardised, universal abbreviations are used (Horie 1990). There is no advantage in recording a material if a future conservator or researcher cannot identify the material. It is also important to include the manufacturer and/or supplier of the material (American Institute for Conservation 1994) as each manufacturer may have a different chemical formula for a certain product which affects how that material performs and reacts to the object itself.

1.2.6. Administrative details

This category of data is essential to the identification of the object that is undergoing conservation work and also contains information relating to the conservation work. Administrative details that should be documented include: the date of when all the different parts of the conservation treatment took place and the name of the conservator(s) (Grant 1994); the accession number or other identifying numbers (Anon 1990); the amount of time that each part of the conservation process took; other dates such as when it came into the laboratory, deadlines and the date of completion of the conservation process (Corfield 1992); the owner and/or client for whom the work is being conducted; its normal location including room number and if necessary shelf number; and if, it is a known work of art, then its title or name, the artist who created it and the time period or exact date (Tonissen Mayberry 1988).

1.3. When should conservation documentation be collected

There are many opportunities for certain types of conservation documentation to be reported. The types of documentation listed in section 1.2 are chosen individually as appropriate to the situation that is presented to the conservator at the time. The only time that all types of documentation would appear in a report would be when the object is actually placed in a conservation laboratory for remedial treatment. It is the sign of a well-organised institution with a good management plan and diligent collections care that all of the following processes are implemented. The following reports would not necessarily be conducted in the sequence as presented below.

1.3.1. Pre-acquisition reports

Before an object is purchased or a donation accepted by an institution, a condition report should be drawn up as part of a pre-acquisition report. In this case attention will be paid to the description of the object in terms of its composition and fabrication in order to assess whether the object is authentic (Buck 1973). Also the institution should consider the condition of the object to examine whether it will need extensive and costly conservation treatment prior to being put into use. An institution might turn down an object if it is in such poor condition that it will be require costly conservation treatment.

1.3.2. Archaeological excavation

Documentation of the excavation of archaeological objects is vital in establishing their proper care and conservation at the outset of their new 'lives.' The type of soil and the environmental conditions of the objects *in situ* should be recorded along with the condition of the object as found. If this is done then any potential problems can be foreseen and prepared for before the object is excavated or before the object is packed for travel to the archaeological laboratory. Block-lifting procedures should be recorded along with any first-aid treatments that are applied during excavation or immediately afterwards.

1.3.3. Condition report before/after treatment

Documentation should be done for every object that has been brought into the conservation laboratory prior to having any treatment. At this time the existing condition of the object should be recorded and if it has not been done at some previous time or if gaps in knowledge seem to exist, the material composition and technology used to manufacture the object should be documented. Additional documentation on the condition of the object should take place after the completion of any conservation work. Observations and thoughts about any technological and art-historical information that is uncovered in the course of examination should also be documented (Dollery 1996). In this report the environmental and storage conditions in which the object is kept should also be recorded along with the recommended ideal conditions (Collins 1995).

1.3.4. Technical/analytical report

Any time an object is subjected to technical or analytical examination, the work should be documented (Garrett 1989). A description of the method should be recorded to illustrate how the technique interacted with the object. If a sample needs to be taken then the exact location, composition and size of the material to be removed must be documented. The sampling location should be limited to an obscure area if possible and the size is dictated by the choice of pro-

cedure. A description of the conclusions of the examination should be included in the report.

1.3.5. Treatment proposal

A proposal for conservation treatment should be drawn up after a condition report has been completed. It is based both on the condition report and on what the curator or archaeologist, acting as the client, desires for the object as expressed in the request for conservation. The proposal can detail the problems that the object has and how they might be corrected by specific conservation procedures; the expected results of the procedures should be noted as a justification of the chosen methods (Orlofsky 1992). The date and the name of the conservator who proposed the treatment should be recorded in the report; an estimate of the time needed to complete treatment and its cost can be given and the material resources that might be expended. The proposal is used to show the client the option(s) for treatment and what the result of the treatment will be (Maxson 1989); the curator or archaeologist must then agree to the proposed treatment or ask for changes based on what they have been presented.

1.3.6. Treatment report

Any type of conservation treatment that is done on an object should be recorded in a detailed manner. Materials used for fills, adhesives and consolidants should be documented in a complete way as detailed in section 1.2.5 as well as any materials used during conservation processes such as ultrasonic treatment and electrolysis. All conservation processes should be completely documented no matter how insignificant. The date and sequence of the treatment should also be noted. Any moulding or casting of the object should also be recorded in this report (Buttler 1994). Any mistakes or failures in a conservation treatment should also be noted in the treatment report as it will be easier to deal with the mistake if it is known rather than covered up (Dowman 1970), and may help explain future problems.

1.3.7. Loan reports

Whenever an object is to go on loan to another institution, whether for exhibition or for study, its condition should be documented prior to approval of the loan request (Marsh 1979). This condition check may indicate that the object is too fragile to travel without extensive stabilisation work or expensive packaging and suitable shipping procedures. If the object is considered to be stable for travel the report should go with the object for comparison purposes. One of the essential parts of the loan report is the recommended environmental conditions for the borrowing institution. Prior to the object being returned to the lending institution another condition report may be produced or the object may once again be compared to the original condition report sent with it, and any changes should be noted. Once the object returns to the lending institution another condition check should be conducted before it returns to its normal location on display or storage. Dates of departure and arrival at both institutions along with the appropriate names of personnel who were involved with the condition reports should be noted in the loan report.

1.3.8. Pre-movement check

An abbreviated condition check/report can be made before any object is to be moved to another location in the institution or to another institution. This condition report can highlight whether the object requires special handling procedures or whether precautions must be taken in exposing the object to a different environment (Buck 1951). Any fragility noted which would prevent it being moved safely must be recorded and a request for desired conservation work should be sent if the object still requires movement.

1.3.9. Condition survey

For collections management purposes a condition survey is used to assess the condition of an entire collection rather than an individual object (Keene 1994). An abbreviated condition report should be designed by the conservation department and used to record the condition of the collection. The survey is not to be considered a detailed study of the condition of the objects but rather a superficial look at: how a collection is reacting to the environmental conditions that it is either stored or displayed in; if the packaging affects the objects; whether individual objects need some form of conservation treatment; and what priority they should have in terms of attention from the conservation department. At the time of determining a priority level for the objects it is useful to compare their present condition to any reports on their past condition to assess whether they have been subjected to a slow deteriorating process or some other factor.

1.3.10. Insurance policies

For insurance purposes, a condition report that can be used to estimate the value of the object (Orna 1982) and an up-to-date condition report should be submitted whenever there is a change to the condition of the object that might affect its monetary value. Many professional conservators might balk at contributing to something which assigns a financial price to cultural property but it is an essential part of collections management. If objects are damaged by fire or flood, etc. the insurance can pay for the costs of conservation treatment to repair them.

1.3.11. Security

Conservation documentation is essential for the protection of objects on archaeological sites or within institutions. Objects that have been stolen from an institution or looted from an archaeological site are rarely recovered if there is no documentation in place to identify them categorically from other similar objects (Thornes 1997). A condition report is ideal to

identify an object that may have been stolen or looted as it describes exactly the object's appearance and its material composition. Distinguishing features will have been noted in the condition report along with unique signs of damage, defects or disfigurement (Schmitt 1997).

1.4. Documentation Methods

There are as many ways to document conservation work as there are situations when data should be documented. There is no universal agreement amongst conservators on what form is best suited for documentation. There have been some attempts at standardisation of documentation, most notably by The Museum Documentation Association in Britain, but it seems that conservators and institutions have chosen to personalise the way in which they document their own work. There are two methods to document conservation work, textual and visual documentation, both of which can be in multiple formats and are usually used in conjunction. The choice of methods in which work is documented is up to the discretion of the conservator based on the object that they are working on.

1.4.1. Textual documentation

There are two forms that written documentation can take when recording conservation work: a free-text, essay style of reporting or an abbreviated check-list style. Both have their own advantages and disadvantages and may be used in combination or alone.

A free-text, essay style form records the conservation work in either a sentence structure or a point form structure on an open page; the documentation reads as a narrative of how the object has been cared for. This style is flexible as it allows the decision of recording information to be left to the conservator but it is also time-consuming and labour-intensive (Wentz 1995) as there can be a lot of repetitive actions in some treatments. The conservator must write out everything about the object by hand in a structure that is understandable yet concise; one necessity for useful and accessible documentation is for the handwriting to be legible. Free-text style documentation seems to be easier to add subsequent treatments and investigations as it is organised by date; however, it is difficult to search for a specific item of information. Free-style forms allow for much more detailed evaluation of the work being done to the object or its environment and allows for the observations, explanations and conclusions of the conservator to be recorded. This type of form is described as "the ideal recording medium" for describing the object and its conservation "as graphically and as easily as possible" (MDA Conservation Working Party 1977).

The check-list style of documentation form has become more popular in use for several reasons. It is simple to read as the form is pre-printed in type set and the conservator needs only to check off the information that applies to the object; it is a quicker way of documenting information and ensures that the information and terminology are standardised (Collins 1995). The check-list style form is very structured and user friendly for two reasons: it is simple to retrieve information from it; and the pre-printed lists are separated into different category boxes on the page which prompts the user to record certain information. This style, however, is not very flexible to any changes in routine work; the form also has to be extremely detailed in order for all possibilities of deterioration and damage, for example, to be covered (Perry 1983). Each speciality within conservation, such as paintings, paper or objects, documents unique types of damage. A multitude of forms would also need to be drawn up to cover the different situations in which conservation documentation should be recorded.

A combination of the two styles seems to be the best compromise but due to the ever changing nature of conservation with new treatments and new ideas entering the profession, designing an ideal form is an ongoing process (Marsh 1979).

1.4.2. Visual documentation

Another way of documenting the condition of an object or its treatment is visually, and photography is one of the most effective methods. There are many different ways in which to photograph an object; the first step is to consider why the photograph is being taken. Photographs can be black-and-white, colour or they can be processed as slides; they can encompass their entire object or they can show details. Different kinds of photography, such as raking light, infra-red, reflected or ultraviolet light, can be used to convey or reveal information invisible to the naked eye (National Park Service 1990). The intention of a photograph can be: to illustrate the extent and location of damage and/or deterioration; to show details of new or old information contained in the object; to indicate the size of the entire object or the normal location of the object; to portray how it is being treated during conservation work; to show the colouring of certain parts of the object or the entire object; and, amongst many others, to illustrate analytical or technical work or results.

Consideration must be given to lighting whenever comparative photographs are taken as lighting will have a great effect on the results; the position of the light, the light source, filter, film and magnification should all remain constant (Newton 1989). A colour scale and metric scale should always accompany a photograph. If quick-processing film such as Polaroid is being used to document the condition and treatment of an object, notes can be made directly onto the photograph.

Another type of visual documentation is an illustration which is usually drawn in pencil alongside the written description of the object's condition, given a scale, title, date and signed by the conservator. Illustrations can be used alone or to supplement photography but are generally used to clarify information such as location and extent of damage detailed in the

condition or treatment report (Karsten 1995). Details such as where, exactly, a type of chemical was applied to the object or where and how long a given crack is, can be shown accurately using an illustration which will usually record scaled measurements. The illustration might show the entire object or a section of it and can be paired with general and detailed photographs. Illustrations are usually considered to be useful for showing the pre-treatment condition of an object rather than an after treatment condition mainly because of the length of time that can be devoted to an illustration; and many conservators will use a photograph to document after-treatment condition rather than an illustration. Illustrations, done properly, will take time but the effort will be appreciated.

A third type of visual documentation is X-radiography which can be used to illustrate the internal structure/condition of a complex object or to investigate concretions. X-radiographs are able to 'see through' the surface of certain types of materials and show what cannot be seen by the naked eye. A film that is similar to photographic film is generally used to record the image (Cronyn 1990) but digital X-radiography has now become commercially available. X-radiographs should be labelled in the same format as photographs and illustrations, but in addition the choice of voltage used and its source, the length of exposure to the X-rays along with the type of film used should be documented (Cronyn 1990).

1.5. Retrieval Of Information

Using traditional paper records, the main methods of retrieving specific information from the documentation is by instituting a card index or a punch card system. Each of these systems involve the conservation information being listed in point-form on small paper cards which are searched manually. Card index systems are compiled by first choosing the field of information that the index will be sorted by; main fields such as conservation laboratory numbers and materials are the most common, but others such as date of examination and client may be used. This system means that duplicates of each object conservation card will have to be made for the number of indices that object is related to. Punch card systems only maintain one object card but that card is punched at the top so that a hole is immediately apparent to the searcher. The location of the hole along the top of the card relates to the type of information that has been chosen to be searchable.

There are many advantages and drawbacks to these manual retrieval systems which can be mainly solved by the installation of a computer database. While a card system is always available for searching, the person must be in the same room as the cards and it can be time-consuming to search through the card file by hand. A searcher can only benefit from a manual system if the required information is one of the fields set up for retrieval. Lastly the conservation information can be written on archival-quality card stock and permanent, fade-proof ink. The greatest criticism of a manual retrieval system is that it is too time-consuming to be feasible. With some laboratories treating up to several thousand objects a year, a card index soon becomes overwhelmingly large; the job of transferring information to the different subject card indexes can also be overwhelming and the administrator of it may be prone to mistakes or omissions.

1.6. Conclusions

Conservation documentation emerged before the beginning of modern scientific conservation and has evolved from a sporadic activity done generally for publication or as a report for an institution. Recording conservation related investigations is a time-consuming undertaking given the amount of information that needs to be documented. In order for conservation documentation to have any purpose it must be done diligently and by a trained professional. There are many decisions to be made about what type of report and information is appropriate to collect for a specific situation and in what form the data should be recorded. The conservator must decide how information such as condition and treatment procedures are going to be visually and textually documented.

ETHICS

2.1. Who documents conservation work

Documentation of the conservation process is expected to be done by every professional, and it is dependent neither on what type of object is being treated nor on who is doing the treatment. Conservators can be superficially divided into two groups which might affect how documentation is viewed; they can be either a private conservator who works for or runs a private business or they can be a public conservator, one who works for a public institution.

2.1.1. Private conservators

It was not until the 20th century that conservation became a true profession. It was first taught as a subject in fine art and archaeology university courses by the 1930s. The advent of modern professional conservation can be dated generally to the mid-twentieth century and to the formation in 1950 of first major international group of conservators, the International Institution for Conservation (IIC). Prior to the 20th century, conservation was conducted by private individuals who were artists who specialised in the restoration of the art form in which they were trained; this practice dates back to at least the Renaissance. Public institutions such as the British Museum and National Gallery did not exist before the eighteenth century therefore any artist who performed restoration work was commissioned, typically, by the wealthy owner of the work of art. Private conservators are still at work today; more often they are commissioned by private collectors or public institutions that have need of more specialised expertise.

The dilemma of the private conservator is that often they are paid only when conducting work on the

commissioned object. Sometimes clients do not desire details of the conservation work or will not pay for the time it takes to complete the documentation. Not every client, however, sees conservation documentation as needless and extraneous to the conservation work. This is an issue not normally discussed with respect to conservation documentation. One private conservator, however, has stated that many of his early clients were seen to toss the detailed documentation into the garbage on their way out of the lab and so now he includes in his contracts a space for the client to indicate if they require a report (Thompson 1998). He has now decided to charge for this report so that his time and resources are not wasted. He further states that not one institution or dealer has ever requested a report and very few private clients ever have.

The main reason why private clients, including dealers, might not want to keep conservation documentation relates solely to the financial value of their art work. If the dealer or client wishes to sell the art work then they may believe that its value will decrease if it is known that evidence of the object's authenticity or integrity might be compromised. Therefore a private collector or auction house would not want any conservation work to become public and might decline to have any proof of the alterations documented. A quick search of the Christie's and Sotheby's Web sites finds few objects that have the terms "conservation," "restoration," or "reconstruction" mentioned amongst their descriptions.

The decisions of the client should not stop the private conservator from keeping their own work book of conservation treatment and observations during the course of their work. It is normal for a conservator to keep a note book of their work in the laboratory and this tradition may be continued whether a complete report is to be drawn up for the client or not. While this workbook may be seen to fulfil the requirements of the profession, it does not take away from the fact that the documentation might not be kept with the object so that it may be consulted at any point in the future. There is less of an onus on the private conservator to keep all the documentation of an object for the foreseeable future when the object is no longer in their care or if a certain number of years have passed.

2.1.2. Public conservators

Conservators who work in a public institution are bound by the legal mandate of that institution which has implications on the conduct of their work. Public institutions are often supported financially by some level of the government, which in turn receives its revenue from the tax payers; therefore public institutions are responsible to its citizens. The professionals working in the institution have a legal obligation to take care of the collections to the best of their abilities as well as having an onus to fulfil the requirements of their profession.

Public institutions are more than ever in the public eye as the public has developed a greater awareness of the available resources at museums, archaeological sites and other institutions. In the past it was only the curator and a few researchers who might come into contact with the objects but now there is an increased demand from the public to use the collections (Chenhall 1978). This means that the institutional professionals, including conservators, have become increasingly aware of their responsibilities in collections care. Institutions have had to raise their level of care and management as their collections receive more attention from those who pay for them. The main difference therefore between private and public conservators is their obligation to the public and its ramifications.

2.1.3. Non-conservation professionals

Not all conservation activities are conducted by trained conservators within an institution, public or private. There are many other museum professionals and non-professionals who can be found doing some of the activities involved in conservation such as conservation surveys and even treatments. Volunteers, students, collections managers, registrars and curators can be found doing work that conservators are trained to do. Often as part of other museum training programs conservation is part of the curriculum, usually in the form of preventive conservation although the students in the program may be trained to document damage and deterioration as well as the causes behind it. Volunteers and students should have been trained in basic procedures and their level of skills should dictate which conservation activities they can participate in.

2.2. Underlying principles

It is one thing to read the code of ethics and abide by the guidelines for proper conservation practice but in order for a conservator to conduct themselves ethically at all times he/she must understand why the ethics were put in place. Why must conservators document all of their work? We know that objects contain information about our past, that any work done to an object can change it and therefore the work might change how the information appears to the researcher. Information might disappear or be hidden by the changes to the object and it is this integrity of the object that conservators are attempting to protect by documenting conservation activities.

2.2.1. Integrity

For the purposes of this discussion integrity can described as the nature of an object in the sense of its physical remains, its function or use during its lifetime and the meaning(s) that these convey. If an object is changed so that it incorrectly represents what the object should have originally looked like, then its integrity is compromised. Hence the information it conveys is equally compromised. This often happens with incorrect restorations and reconstructions. It seems that all codes of ethics agree that the integrity of the object should not be compromised and so they

recognise the basic premise that if the object's integrity is protected then so should the information about the past. Conservators are therefore instructed to respect the integrity of the object they are treating and consider whether their work will interfere with it.

2.2.2. Maintaining context of documentation

In order to maintain the integrity of an object which undergoes conservation treatment, the documentation created with it should be kept with the object. If one is separated from the other, the significance of both has disappeared. Researchers wishing to study a certain object will almost certainly want to view the documentation of the object's care as it might be pertinent to their investigations. For a researcher to form a complete picture of the object all of the documentation should be studied and it therefore has to be accessible. There is no point to keeping data which will not be consulted; if documentation is not accessible then it might as well have not been written. Once an object has left a conservation laboratory, if the object documentation does not go with it, the connection between the object and the record is lost.

2.2.3. Long-term preservation of documentation

Following on from the previous section, if a researcher needs to view the documentation about an object then the record should be in a form that is readable as well as being accessible (Webster 1990). There are important long-term preservation issues that underlie the ethics of documentation and the codes of ethics and guidelines for practice agree that the materials chosen for the documentation of conservation activities should be archivally stable. All the different forms of documentation, especially photography, must be chosen for their durability and ability to be preserved because it must be able to survive as long as the corresponding object. Archivally processed black and white prints will last longer than colour slides (National Park Services 1990) and Kodachrome film is more stable than Ektachrome; the film should be printed on fiber-based paper rather than resin-coated paper (Sloan 1987). Hand-written textual descriptions must use pens that will not fade nor run if touched by water (Palacios 1990) and the paper must be acid-free. The documentation should be kept in an environment that is favourable to its long-term preservation and monitored to safeguard its data.

2.3. Codes of ethics and guidelines for practice

Notwithstanding the practical reasons why we document conservation work there are also ethical reasons. Ethics can be defined as the moral principles and values that are established to guide our behaviour. Since activities within the boundaries of conservation and museum work are not covered by laws, ethics are needed to guide the work of conservation professionals. These ethics are put forward by national and international bodies who concern themselves with maintaining integrity and standards within the conservation profession. Conservation documentation is one of the main ethical principles stated in the guidelines of these bodies.

2.3.1. International Council of Museums (ICOM)

This organisation is one that crosses national borders and as such it is to the Council's code of ethics that conservators can turn if their nation does not have its own professional code. The International Council of Museums, however, is dedicated to the entire workings within a museum; for this reason its code must encompass a wide variety of activities therefore it does not contribute a large amount of guidance to conservation documentation. Under the section entitled "Conservation and Restoration of Collections," conservation professionals are advised to be familiar with the ethical issues expressed in the codes of professional conservation bodies; in the next section, "Documentation of Collections," it is stated that proper recording and documentation should be done in accordance with the "internal rules and conventions of the museum" (ICOM 1986). The code of ethics does not explicitly addresses a standard for conservation documentation but rather leaves that for the conservation professional bodies and the museums in which they work.

2.3.2. American Institute for Conservation of Historic and Artistic Works (AIC)

This national conservation body has provided explicit guidelines on how conservation documentation should be conducted starting with its first code of practice, *The Murray Pease Report*, written in 1963. The code of ethics states that the conservation professional is obligated to "produce and maintain accurate, complete, and permanent records of examination, sampling, scientific investigation, and treatment" (AIC 1994). The code of practice states that appropriate records should be made before any intervention, that a treatment plan should be prepared, and that dated documentation during treatment should be recorded (AIC 1994).

2.3.3. Australian Institute for the Conservation of Cultural Material (AICCM)

This national organisation states in its code of ethics that the conservator should "strive to attain the highest standards in all aspects of conservation, including…documentation" (AICCM 1986). Its guidance for practice states that appropriate records should be made: after a thorough examination of the object and before any conservation treatment is done; when a sample needs to be taken; for a treatment proposal; prior to the removal of material; and when a restoration or reconstruction is to be made (AICCM 1986).

2.3.4. United Kingdom Institute for Conservation (UKIC)

This national body is divided into different sections which govern each speciality within the conservation profession in the United Kingdom. Most of

the sections such as furniture, ceramics and glass, and metal are governed by a general code of ethics and guidance for practice while the archaeology section has its own code. In the archaeology section's guidance for practice, documentation is required to record: an object's condition and history; the methods and materials used; and all restorations (UKIC Archaeology Section 1990).

2.3.5. Canadian Association for Conservation (CAC)

It is from Canada's codes that the Australian Institute for Conservation borrowed many of its ideas for writing its own code of practice (AICCM 1986). Canada's national code of ethics states that "the conservator shall strive to attain the highest standards in all aspects of conservation including…documentation" (CAC 2000). In Canada's separate guidance for practice it is stated that the conservator is obligated to document all details of a cultural property's conservation including: initial examination; the creation of a treatment proposal; treatment; removal of material; and restoration and reconstruction (CAC 2000).

2.4. Uses of conservation documentation

There are many uses for documentation collected during conservation work beyond the obvious preservation of the information contained in an object. Documentation is also a memory aid for the conservator to remind him/her what has been done to the object and the ambient environmental conditions in which it is housed. More non-professionals and members of the public have begun to look at this collection of data and so future unforeseen uses must be considered. Therefore the conservator must not discard information because it is not useful today, in the event that it is needed in the future. The potential uses of documentation can be divided into two main categories: management or administrative use; and scientific or research use.

2.4.1. Management or administrative uses

Documentation can help assess the significance of the collection and help formulate policy on future conservation planning by establishing priorities for objects to be treated (Cunliffe 1994). Having a complete record of the care of an object in an institution is necessary, especially in a public institution, to demonstrate "accountability and compliance with legislation and conventions" (Davis 1994). Documentation on the object's environment can be used to plan future attempts at limiting continuing deterioration (Hill Stoner 1990) or to determine the suitability of the routine of maintenance and care (Garrett 1989). The reports are used to determine whether any damage has been done to an object while on loan or on display by illustrating the condition of the object prior to going on loan or on display.

Documentation is used to manage the object by keeping track of its location in and around the conservation department, by assigning conservators to work on them, determining the resources needed for the future and determining the resources already expended during conservation (Miles 1988). Private conservators and institutions can use their documentation to illustrate their skills and abilities in conservation; it can also justify the professional fees which are charged, thereby permitting the client to see the work involved in treating the object (Sloan 1987). Documentation, especially the visual aspects, are useful to illustrate that work has been done to the object when no difference is apparent to the client; it will also be useful for insurance purposes if a client claims that the object has been damaged as a result of the treatment. Most of these misunderstandings grow out of the fact that the client may not be as intimately familiar with the object as the conservator comes to be.

Documentation can be used to decide if an object should go on loan; if it is stable enough even to transport to a different area of the institution; if the institution should acquire an object; or if it is a treatment priority as indicated by the recommendations of a condition survey. It can also be used to claim ownership in case of theft. Examples of good documentation can also help institutions secure funding under schemes which require it as part of their application (Museum Documentation Association 1999).

2.4.2. Scientific or research uses

Documentation is essential to developing new methods for treatment and new materials to use in treatment (te Marvelde 1999); conservators must know what has been done to objects and what has been used and their success before they can develop new treatments and apply new materials. The records can be used to monitor and assess the effectiveness of past treatments and materials (Collins 1995) by periodic checks on the collection and comparison of the condition reported after treatment to the object's existing condition. It is also therefore used to monitor deterioration to evaluate the object's environment. Documentation is used to record the technical, historical and scientific information that was uncovered by examination of the object and can therefore be used by a researcher rather than studying the object itself. It can be used to indicate when the last time the object received attention by a conservation professional and to determine if its condition dictates more care.

Education specialists in museums as well as teachers use the collections to bring history to life for school children as well as university students (Hoffmann 1992). In order for these professionals to find useful objects to illustrate what they would like to discuss, conservation documentation should be used. Objects should not be exposed to excess handling that a search to find just the right object would entail. Complete documentation can aid the conservator in future conservation work by choosing treatments that will not interfere with or be interfered by

previous treatments (Sloan 1987). Documentation can be used to extract historical information about the conservation profession by studying when certain materials or certain methods were used and on what materials. Conservators can use the information recorded on previous occasions to indicate which path the next course of treatment should take (French 1988).

2.5. Conclusions

It is agreed by all national and international governing bodies involved in conservation that documentation of all activities is a practical duty and an ethical obligation. No professional practising conservator is exempt from this whether they work privately or in a public institution. The conservator is obligated to keep permanent documentation of all conservation procedures in order to protect the integrity of the object and must strive to ensure that the documentation stays with the object. Documentation should be made in a form that is archivally stable so that it will be accessible to researchers indefinitely. The multitude of uses of documentation for management, administrative, scientific or research uses ensures that documentation will remain a necessary component of conservation practice and will become more important as more uses emerge.

DIGITISATION OF CONSERVATION DOCUMENTATION

3.1. Technology used in conservation documentation

Digitisation, the process of converting data into a digital format, is being embraced by the conservation world. Information is in a digital format when it is recorded, processed, and stored by computer-related media in binary code (as 0s and 1s). The two principle methods of conservation documentation, textual and visual, are perfectly transferable to computers and computer-related software and hardware. Computers make it much easier to write and edit reports as well as manage information contained in databases (Sayre 1986); image capture, storage and manipulation are now possible as well. The three main technological tools which are currently being used are databases, digital cameras and scanners.

3.1.1. Databases

A database is a collection of organised, related information; paper card systems that are used to manipulate, organise and retrieve information are databases. The type of database that we are more familiar with is the form that can be accessed and manipulated by computer software where the information is in a digital format.

There are two principle types of database, flat file and relational, that can be used for conservation documentation. All the data in a flat file database is kept in one file in a single table (Keene 1996) while a relational database keeps its information in separate tables which are 'related' to each other by a common shared field (Quigley 1998). Relational databases are the preferred choice for storing and managing information as flat file database will not distinguish between treatments conducted on two different occasions (Keene 1996). Relational databases, while being more complex with the number of different tables, are more flexible and efficient; for example one table can be used to document information about conservators in the department, when one conservator's name is filled in for a new object the rest of the information about the conservator can be called up immediately without typing it in again (Keene 1996). A flat file database, however is easy to set up, understand and maintain.

Conservators have been using database management systems to document information since the late 1960s in the United Kingdom when the British Museum instituted BMUSE on a small computer in the Research Laboratory for the storage and retrieval of information. The next prominent software database that was created was SELGEM at the Smithsonian Institute in the late 1970s. Many institutions are now considering, if not having already created, their own database management systems to use for conservation documentation. Museums have embraced databases for collections management but conservation documentation is more complicated due to the number of situations and forms that it can take.

3.1.2. Digital cameras

This new technology is proving to be very popular as it is easy to use and allows more flexibility with the end-product. Digital cameras do not use film but rather a memory chip or floppy disk which stores the image in a digital format to be later downloaded onto a computer. Digital images can be viewed on the camera before they are saved and therefore the conservator can decide if the image actually shows what they intended it to show. Once transferred to computer, with imaging software, such as Adobe *Photoshop*, the image can be manipulated. Digital cameras allow the user to take black-and-white as well as colour pictures but the imaging software allows the user to convert colour images into black-and-white. Enlargements can be made of the images with commensurate loss of image resolution (Agfa 2000). Images can be cropped to take out the background or to show one specific area. The possibility of instant pictures for condition reports and treatment reports, whether stored on computer or printed is practical. A photographic paper printer can also be purchased for use in the conservation laboratory therefore making it possible to have immediate pictures that can be photocopied and written on or directly labelled. While the initial costs can be high (between US$400-US$1000 for a reasonable higher quality camera and Adobe *Photo-shop*, for example, can cost up to US$600), the costs will be recovered as there is no more developing costs or film costs, lost photographs or poor shots.

3.1.3. Scanners

Scanners are used to transfer an existing paper image or document into a digital format after which the scan be manipulated using an imaging software program. A conservation department can use a scanner if they want to transfer their existing photographic archive onto the computer as well to continue to keep their manual camera in use. The initial outlay of money for a scanner ranges from US$100 to over US$2000, although they are usually bundled with an image manipulation software program. It is up to the conservation department to decide which features are needed for the department and that will determine costs; additional features might include a 35mm slide scanner (Wingard 1996).

3.2. Permanence of information

As much as paper and photographic documentation must be maintained for future research and consultation, so too must any documentation stored digitally. Any data kept in a digital format is machine-readable only. It is not the digital information that will deteriorate over time but rather the material on which the information is stored. Presently, there are two principle formats for storage: magnetic media and optical media.

3.2.1. Magnetic media

Magnetic media stores information in ferromagnetic fields on a polyethylene film (Smith 1991). The fields magnetise tiny particles of the surface of the film to represent 0s and 1s, the basic binary code used in computers to represent letters, numbers, pictures and sounds. Every 0 is represented by a magnet pointing in a certain direction while every 1 is represented by a magnet pointing in the opposite direction. To obtain information from the magnetic film, the computer uses a device to translate the magnetic fields of the tiny magnets back into code.

Floppy disks, hard disks, and zip disks are all magnetic media. There is a substrate layer and a thin binder layer; it is in the binder layer where the magnetic particles are found while the substrate layer is the base that provides support for the fragile binder layer (Riss 1996). The base layer for floppy disks is polyester while the binder layer is "a complex mixture of plastic, resin, magnetic particles, solvents, wetting agents, plasticisers, anti-oxidants, lubricants, mineral powders, fungicides and sometimes conductive particles" (Riss 1996). Many of these ingredients are there for reasons other than storing information. The fungicides are present to prevent mould growth, the plasticisers are added to maintain flexibility of the tape while others are there to prevent or reduce friction, abrasion and static charge build-up (Riss 1996).

3.2.2. Optical media

The CD-ROM (Compact Disk – Read Only Memory) is the principle type of optical media used in computers and recently writable compact disks have become increasingly commonplace; they both have similar properties. A compact disk is composed of a thin hard plate usually made from polycarbonate which is a very stable thermoplastic (Bansa 1991). One side of the compact disk is used for storing information in the form of pits or holes in the polycarbonate; the pits form an extremely long spiral starting at the inner part of the plate and continuing to the outer edge. The pits alternate with spaces and it is in these pits where the information is contained. The pits, although only 0.1µm in depth, are read by a laser beam and cause reflection when the laser beam hits them; there is no reflection when the laser beam hits the flat spaces (Bansa 1991). It is the difference of energy between the reflection and non-reflection that forms the binary code representing letters, pictures and sounds (Bansa 1991). The side of the polycarbonate disk containing the information is covered by a layer of metal, usually aluminium, which aids in forming a reflective surface; on top of this metal is a clear layer of acrylic lacquer for protection from scratches and dust (Kodak 2000).

3.2.3. Storage capacity and longevity

Long-term storage of magnetic tapes, whether in the form of floppy disks, zip disks or hard disks, is generally thought to be between fifty and one hundred years as long as the proper storage conditions are used. As well as wear and tear, other factors such as keeping the tapes away from magnets and related machinery and reducing pollutants, food, moisture in the area where magnetic tapes are held or used (Stielow 1992) will ensure that the data can be read in the future. Floppy disks are small portable disks and have a capacity of 1.44 megabytes (MB: one million bytes) of information; zip disks are similar in size to floppy disks but slightly thicker and can store up to 250MB of data. Hard disks are the internal storage mechanisms that are contained inside computers; they can hold up to 60 gigabytes (GB: one billion bytes).

Optical media, in the form of compact disks, have been given the same longevity range as the magnetic media. Compact disks that are writeable and rewriteable are now extremely popular as they offer a relatively tough and resistant medium that can be repeatedly written over with no loss of resolution or data (Stielow 1992) and the rewriteable ability allows for changes and additions to the data. Compact disks are subject to scratches and so careful handling is important. Their environment should be kept free of food, drink, and pollutants. Storage capacity of the compact disk is around 600MB which is equivalent to 200,000 pages of text or 15,000 compressed images at low resolution (Mackenzie 1993).

3.3. Hardware And Software Obsolescence

With the ability to re-copy digital information without loss of data, and as long as the medium is stored in proper conditions, the only preservation issue involved is the speed of change in technology.

Digital information can only be read through some type of machine and access to it is therefore dependent on the preservation of the machine and functioning software. The quick turn-over of technology and software and hardware obsolescence, however, means that it will be more difficult to maintain the machine and software to read the information. As new and better technologies emerge, computer experts will embrace them and generally abandon the older software programs and hardware; the manufacturers will inevitably cease to make replacement parts for older hardware and soon knowledge of the older software programs will diminish. Maintaining an archive of obsolete software and hardware has been dismissed by experts to be too expensive and not feasible (Hedstrom n.d.). The current standard period of technological obsolescence is in between two to five years which means that maintaining access to the data will be an ongoing responsibility (Garrett 1996).

The simple answer to preserving information on computer-related media would be to simply 'print it out' but there is a "loss of functionality" for some kinds of information. The printed versions will no longer have active hypertext links or the ability to search a document by keyword (Kuny 1998); paper cannot represent a database or GIS (geographic information system) or replicate the non-linear movement through a web page (Bennett 1997). So a different solution must be found. Professionals have agreed that preservation of digital information depends on copying it rather than attempting to preserve the medium. There are two main ways of copying the information: harvesting and migration.

3.3.1. Migration

Migrating is defined as the transfer of information intact to another medium (Ditzler 1994). Migration is the chosen method for copying information at the moment because its purpose is to preserve the integrity of the document/file/program by making an exact copy of it in the new generation of technology. This means that not only is the data copied to a new medium but the structure of the information and the way in which it is related, features such as retrieval abilities and report making, will also be transferred intact. But this can be a very difficult method as there is limited experience in predicting when migration will be necessary and the search for the perfect new medium to transfer the format of the information can be difficult (Hedstrom n.d.).

3.3.2. Harvesting

The other way to copy digital information involves reformatting the information for use on a different medium (Ditzler 1994). Harvesting is done by reformatting the information to a simple standard format. This can result, however, in the loss of the structure of the document and relationships in databases, computation capabilities, and graphic displays, which is what migration attempts to prevent; removing the structure and relationships limits analytical potential of research documents (Hedstrom n.d.). But this way of preserving digital information is easier than migration as there is less of an onus on finding properly formatted new software; harvesting should only be the method of choice if it is only the raw information and not the structure and software capabilities that is important to be preserved.

3.4. Choosing and designing a database

There are certain decisions to be made by a conservator or an institution prior to choosing the form of the database system. The first step is to examine the current documentation practices by surveying the forms that are used for the various conservation activities and deciding, in consultation with the users of the forms, whether the forms fulfil current and future needs (Abt 1986). If the users request changes to the forms then modifications should be made before the software and hardware of the database are chosen. It should also be decided if the users will input their observations and work directly into the database or first take notes and then transfer the information to the computer because this will affect how the system is designed (Abt 1986). In a related point, it must be decided if the computerised system will completely replace the paper documentation or continue alongside. If paper documentation is continued, the designers must decide if it should be modified to make it easier to digitise in the future (Keene 1996).

An important question to resolve is how the object information will be kept in the database. Will all object information be stored digitally in one file or will images and analytical work be kept separately on paper or digitally in another file? With the increasing use of computers in analytical work it is easy to transfer the information from computer to computer and import it into the database.

The next decision to make prior to choosing or designing a software program is how the fields of information will be filled out within the computerised report forms. Will the conservator be able to place an unlimited amount of information within a field such as dimensions or treatment materials or will there be limits on what can be filled in? There are many options to consider such as: limiting the fields to a certain amount of letters; using a coding system to save time in data entry and save space in the database; selecting from drop down lists of controlled vocabulary that the conservator should use for each field; or allowing numbers to be used exclusively in certain fields.

Decisions on storage will have to be considered before a system is designed. Will the institution choose to save the information on the hard disk of a main computer (hard disks are now capable of storing up to 40 gigabytes of information for around US$1000), or will compact disks be chosen to store everything so that the information is portable? Back-up methods and security systems must be considered especially if the database system will be used on a network or if it

is decided to allow the database to be searchable over the internet or by external users; passwords might have to be instituted. The retrieval requirements of the user will also have to be determined: will the user be able to update or edit records at a later time; will there be restrictions on the type of records that can be retrieved; what fields will be used to search; and what will be the process of searching, through a specified report or a simple key word (Hopkins 1986)?

There are many management questions which must be answered as well. The format of printed reports must be designed to incorporate desired information fields and layout (Abt 1986). If there is already a computerised collections database in the institution a decision should be made as to whether the databases will be connected in some way so that all the institutions staff can access all available documentation on a given object (Corfield 1992). The future of conservation activities for the next five, ten and twenty years must be estimated so that the type of hardware chosen to run the software will be able to expand as the amount of conservation documentation grows (Abt 1984). Another management issue is to consider how the accuracy of the information will be maintained: will there be an appointed administrator of the database? (Keene 1996). The present computer capabilities should be considered and a decision reached as to whether the new database will be designed with those specifications in mind or to plan it around an ideal computer system which will be purchased in the future (Quigley 1998).

One last decision is to choose who will construct the database to the desired specifications. It could be designed in-house if there is a computer specialist in the institution; a commercial database package, such as Microsoft *Access*, could be purchased and adapted; or a computer programmer could be consulted.

3.5. Education of users

While computers are becoming more user-friendly, this phrase is usually reserved for more simple programs. A database is not always the easiest type of program to use and so there must be some time taken out to educate those who will be using it. This means that the actual and potential users of the database must be considered when scheduling a training session and making a user manual.

3.5.1. Computer training

The best way to make users comfortable with the database is to have them involved from the beginning. Whether the database is going to be bought as a commercial package and manipulated to fit the requirements of the documentation or whether it will be specially designed, the users should at the least be kept advised of the plans. In the ideal situation, the users will be involved with the designing of the database which will allow them to be familiar and comfortable with it by the time it is ready to be used. Sometimes this is not possible due to scheduling constraints and so training sessions should be set up that take the users through the database slowly and completely and this time should be used to have trial-runs. The practical outcome of these training sessions would be to allow changes to be made to the database if problems arise during training.

3.5.2. Terminology control

This is an issue that the conservation profession has been discussing since at least the early 1980s and the control of terminology is even more important when the discussion turns to computerised conservation documentation. The diversity of conservation treatments, the materials involved with the objects and their treatments is equalled by the terms used to describe them. Digitisation encourages the control of terminology within the context of documentation; it can ensure consistency in the description of condition and treatments which then makes it easier to search and retrieve the required information in the database (Wentz 1995). If different terminology is used to describe the same condition it makes searching for all the objects that have that certain condition impossible unless the searcher takes the time to think through every kind of description for that condition or consult every conservator to find what they are using to describe that condition. It is much easier to have a standardised terminology list that will be used by all and to have that list on hand for consultation complete with a definition for each term. An ideal situation would be for there to be a national/international standardised terminology which would make exchanging information and searching other institutions' documentation more efficient (Corfield 1983).

3.6. Practical use

Theoretically, digitisation of conservation documentation is an attractive proposition to an institution. The practicality of computers and its related digital technology also encourages its adaptation.

3.6.1. Accessibility

One of the greatest benefits from digitisation will be the potential for the information to be more accessible. Archaeologists, who will be primarily interested in the physical information that is uncovered during conservation, can have instant digital access to the information by having the record e-mailed to them or if they can search the database over the internet or on a networked computer. The greatest complaint by non-conservation professionals about documentation is that the information is too detailed and specific to be of any use to them (Dollery 1996). Having transferred the documentation forms into a searchable format combined with the obviously different fields of data, should make it much easier for archaeologists, collection managers and education specialists to extract the specific information in which they are interested. If it is decided to archive the visual and the textual documentation together (that is, in the same file/record) then complete access

to an objects conservation information is possible. Future researchers and conservators will only have to "visit" one place, whether it is remotely via the internet or travelling to one computer station in one building.

3.6.2. Efficient use of time

Although the first few weeks will have users hesitant and slower in their use of the database system and the new tools for documentation, in time practical use will increase the speed of documentation. Information collected during conservation activities can be inputted directly into a portable computer that can travel to all parts of the institution. As long as the database system is not too large then the start-up of the program and recall of information should be quick and easy. A digital camera will be more efficient to use as the saved images can be previewed prior to the act of saving; traditional methods would have the conservator waiting for the photographs to be processed to see if all the results were acceptable. Time will be saved in searching the archive to process enquiries; rather than hunting through the paper archive to find specific information from a certain record only to discover that the information is in a different laboratory or office. If all the data are digitised then it can be recalled within a few minutes on the computer.

3.6.3. Cost-effective

The cost of hardware and software needed to implement a new documentation system must not be allowed to solely influence decisions. Some of the prices quoted in section 3.1. only reflect the cost of the technology at the time of writing and it is well-known that prices decrease at a rapid pace. At a point in the future it will become more cost-effective to use the computerised system when all aspects of expenses are taken into account. The cost of paper for the forms, film for the camera, film developing and duplication can be added to working costs in time expended filling out the forms and data retrieval. By using computer and digital technology unless the forms are printed out, costs will be reduced; unless the digital images are printed out costs will be reduced, the cost of film developing and duplication will disappear; working costs will be greatly reduced using a computerised database for the input of data and its retrieval.

3.6.4. Storage space

Another factor in determining efficiency, both in terms of time and cost, is the amount of storage space that will be used after digitisation is implemented. The space needed to store paper documentation, photographic and analytical records is enormous; filing cabinets full of documentation are to be found in every conservation laboratory, registrar's office and analytical section. The paper trail that can be created during all of the activities involved in conservation is huge and once the space is full in the laboratory, older records will need to be moved and stored elsewhere to make room for the more recent records. Some spaces can be found in other areas of the institution and sometimes in other buildings. This action changes the accessibility of the information as well as affecting the potential preservation of it and the following questions arise: what type of space are the records in; is the storage climate controlled and pest-free; and who is going to monitor the records if they are stored in another building.

Digitisation means that text and visual files (which can be many megabytes in size) can be compressed into a format that is readily saved to a single compact disk. Some images in an uncompressed format can be over a gigabyte in size but in a compressed format they can be as little as 15 kilobytes (a thousand bytes). There are other impacts of compression such as loss of information which need to be considered before it is implemented. The physical storage space involved with digitisation is tiny compared with paper documentation but the problem with storage of machine-readable data is that the researcher cannot tell what is stored on it unless it is labelled. A specific, permanent method of labelling is important; the actual compact disk or the floppy disk must be labelled with its contents. Labels such as those used on audio compact disks are acceptable as is etching into the plastic cases of floppy and zip disks. A catalogue should also be drawn up that indicates where the records are stored and then it should be stored permanently and monitored so that it may be consulted; a digital catalogue may be kept on computer.

3.6.5. Consistency and accuracy of data

Spell-checkers, terminology control and an administrator can be part of a system to maintain consistency in the way the records are filled out and check the accuracy of the data. Consistency in the fields that are used in each form can be controlled so that the users do not skip data fields or forget to fill them in. The user should be prompted in some way to fill in all the required fields. Spelling can be corrected automatically as the words as entered and the dictionary can have any technical and scientific words added to it. Terminology can be controlled by a list located in the thesaurus or in another table in the database.

3.6. Conclusions

The decision to digitise conservation documentation is an important one for an institution to make but it must be considered carefully. The technology that can be exploited for documentation, mainly database software, digital cameras and scanners, is constantly changing which causes problems of its own. The conservator must still consider preservation issues as a computer is not the answer in itself; while the information in a digital format is reproducible without deterioration of that data, the medium on which the data is stored is not indestructible. There are two main methods for transferring the information contained on magnetic or optical media onto new

media; harvesting and migration seem to be the only logical answers that computer professionals have to preserve the information. The difference between the two methods is that migration preserves the structure of the file and its information while harvesting merely copies the information.

There are a multitude of questions about the design of a database that need to be answered before software and hardware can be purchased. Management issues should be considered such as who the users currently are and who potential future users will be and documentation issues must also be considered including terminology control. Digitisation of conservation documentation has the potential to revolutionise the way in which conservation activities are reported, accessed, stored and maintained. It is cost and time efficient, storage space will diminish, and accuracy and consistency will be improved.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

Comprehensive conservation documentation is a detailed activity and as such requires training in conservation and the understanding of technology, history and administration to make it all work. Documentation is ultimately a management issue, however, as the information must be maintained if it is to be of use in the future. The multitude of tasks within an institution or private business and the amount of information that should be recorded is potentially enormous; it can only be properly done if a management plan is in place to ensure that conservation professionals have the opportunity during their working time to complete documentation. The conservator is ethically bound by codes of ethics and standards for practice established by international and national professional bodies to document conservation work to the best of their abilities. The institution, whether a private or a public one, must give the conservator the time to do this as it is also bound by international museum guidelines to follow conservation ethics.

Ultimately it is the information contained in the object and the information about the object that is to be preserved through documentation. Keeping records of observations has evolved over the decades to become extremely detailed and therefore time-consuming and it also leaves a huge paper trail. Conservation professionals have become more aware that the work they do on objects have a great effect on them, in terms of future treatments and stability as well as research potential; with the increasingly complexity of conservation more information must be documented. When computers came into popular use, conservators realised the potential that the speed and efficiency as well as smaller storage requirements would have on documentation. Early work in the late 1960s in the United Kingdom started the profession's interest in computer applications and many institutions across the world now embrace the technology that can make their work more effective.

Databases are information management systems in the form of software programs on computers, and are the technology most used by the conservation profession. Databases allow conservation treatment forms, condition report forms and others to be set up on the screen to allow the normal required data to be filled in directly into the computer. Each object can have its own file in which all of the information collected during conservation activities can be kept; alternately the institution or conservation professional can decide to have each action, for example, as a separate file. It does not matter how the information is kept if a relational database is chosen because it connects each record to each other by a common field. Databases allow documentation to be stored in a form that will never degrade but it is the medium on which it is kept that will be of concern for future accessibility. Computer professionals have suggested two methods of maintaining access to the information contained on a computer or computer-related technology such as compact disks. Migration and harvesting are the two main ways of transferring the information stored in a digital format but migration is perhaps the more appealing method for conservation professionals as it attempts to maintain the structure of the data. Searching abilities and queries for reports will not be lost if migration is properly applied.

Other technological advances such as digital cameras and scanners, storage devices such as compact disks and large capacity hard drives, are increasingly used. It is the benefits that these software and hardware devices have over traditional paper documentation, photography and filing cabinets that encourages such use. The ability to reproduce photographs on demand from the computer or to transfer the documentation archive into a digital format are some of the benefits of using the new technology. The advantages of digitisation should be embraced by conservators and the initial costs of purchasing the equipment should not sway the decision.

Computer databases will be more efficient in terms of time, money and space if designed and used properly. They will ensure easier searching and retrieval for the non-professional and professional alike, but the users of the documentation must be trained so that they are comfortable with the system or problems will occur. Misconceptions on what information fields should be filled in or how the fields should be filled in, inconsistent terminology and simple mistakes can happen when there are multiple users of the hardware and software. There must be a system in place to prevent these problems from occurring whether it is in the form of an administrator or occasional re-training sessions.

The first area of future research should focus on terminology standardisation in the documentation of conservation. This is necessary to further modernise the profession and to allow the adoption of digitisation. Energy should be expended in investigating the compilation of a national or even an international dictionary of multi-lingual conservation terms. This

would make it easier for colleagues to understand each other when multinational projects are undertaken or when specific research is undertaken at other institutions. The standardisation of documentation forms should also be researched, if only for certain conservation activities such as loan reports. Another area of future research should be on the type of database management system that is used by institutions throughout a nation or the world; if they are compatible transfer of information will be easier.

With regard to the digitisation of textual and visual images, the type of file should be investigated, whether it is a JPEG, GIF, TIF, etc. The merits of each type of file format should be examined in terms of its longevity or ability to compress with least amount of data loss. A decision on a standard format for these files should be researched. A related area is to investigate how conservation documentation can be transferred to a new format when the technology has become obsolete. New technologies which can further benefit conservation documentation, such as voice recognition software, should be monitored.

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