

SCIENCE REVEALED: THE HIDDEN STORY OF OBJECTS

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ABSTRACT

National Museums Liverpool's Conservation Centre opened a new permanent exhibition in 2006 that shows how science unlocks the secrets of items in the museums' collections. The original concept for the display involved making connections between the visitor's own objects, and objects that end up in museums, and showing how science helps to understand more about these objects. The exhibition, entitled *Reveal – the hidden story of objects*, includes a working laboratory, which aims to make scientific analysis and examination accessible to a non-specialist audience. Facilities include digital X-radiography and both optical and scanning electron microscopy, linked to a large plasma screen so the visitor can view the work in progress. This paper describes how the original concepts were realized in the final exhibition, and, through visitor evaluation studies, discusses how successful the exhibition is in making the science of museum objects interesting and accessible.

INTRODUCTION

National Museums Liverpool's Conservation Centre opened to the public in 1996, with the aim of making museum conservation accessible to the visitor on a year-round basis. Access included live video links to the studios, regular public tours, hands-on activities, and a permanent exhibition *Caught in Time* which showed how conservators keep the ravages of time at bay for museum collections. In 2005, the exhibition was nearing the end of its projected ten-year lifetime, and the opportunity was taken to review the themes of the exhibition and to develop the audience of the Conservation Centre.

The Conservation Centre and *Caught in Time* display were ground-breaking at the time, given that this was the first permanent UK exhibition dedicated to explaining the work of conservators. The Conservation Centre won a number of prestigious awards including IIC's Keck award in 1998, and the European Museum of the Year Award in the same year. The main themes of the *Caught in Time* exhibition were the agents of deterioration, and the methods used by conservators working on different material and object types to combat them. The underlying view in the exhibition, of conservation as an activity that seeks to prevent change objectively (as the title *Caught in Time* suggests), is one that is now challenged by theorists [1–2]. As a drive to increase access to collections has become dominant in museum policy, the role of conservation has also changed, to reflect better its role in facilitating access alongside preventing deterioration. Another aim for the new display was to widen the appeal of the exhibition to a broader social group. Over 75% of *Caught in Time* visitors were from the professional and middle classes as defined by occupation according to the social grades developed by the National Readership Survey [3].

Plans for refurbishing the exhibition were drawn up, based on developing the theme of how conservation uses science to find out more about objects. The redevelopment was funded primarily by a successful application to the ReDiscover fund, which was a joint venture between the Millennium Commission, the Wolfson Foundation and the Wellcome Trust, to support science education and engagement with the public. The Getty Foundation provided additional support for the gallery fit-out and audio-visual elements.

In 2006, the Centre re-opened with a new permanent exhibition, *Reveal: the hidden story of objects*. It illustrates one of the main contributions of conservation to facilitating access — through unlocking the secrets of objects. Alongside this was a desire to enhance public enjoyment and understanding of science in an accessible way through museum collections, and by relating

these to the objects people might have in their own homes: dolls, a family bible, a wedding dress and even a motorbike. It then invites the visitor to study objects in detail, and use scientific methods to find out more about them. At the heart of the exhibition is a glass-walled laboratory, which contains the microscopy and X-ray facilities for the Conservation Centre, so visitors can see examination work being carried out.

The redevelopment approximately doubled the original exhibition space, by expanding the displays into the original reception area. It also created a separate new temporary exhibition space for changing displays, and a dedicated learning suite for group activities and school visits. The Conservation Centre was re-branded, with a more contemporary look and new signage designed to appeal to a broader audience.

EXHIBITION KEY MESSAGES AND OBJECT SELECTION

The exhibition content was initially developed according to the methods described by Serrell [4] and Rand [5]. The exhibition development was then taken forward by a content team made up of two museum learning staff, a conservator and two scientists. The team worked closely with other conservators and curators as well as the exhibition designers, Houghton Kneale Design Ltd.

The concept for the *Reveal* gallery contains three key messages. Broad and thematic in nature, these are the key ideas that every visitor should take away with them after visiting the gallery. Each key message has a set of components which run through every exhibit in the gallery and it is expected that these concepts will be absorbed by the large proportion, if not all, of visitors. These messages clearly informed the object selection and presentation; however selection was also influenced by the desire for each object to be a beautiful and interesting thing in its own right. In addition, the objects chosen have a 'hidden' side that can be revealed through science. In this way it was hoped to take the visitor through a process of science by osmosis; the visitor wants to know more about these intriguing objects, and that extra knowledge is provided by scientific investigation. Crucially, these scientific investigations, not just the information they reveal, are an integral part of the exhibition.

Key message 1: memories are carried in your things

- everything carries information about its own history
- what we find out about the things in museums can tell us more about your things.

Throughout *Reveal*, the visitor is meant to explore the types of information contained within an artefact. This involves examining the objects as carriers of memory, both social collective memories, as well as individual personal experience. Objects that are the focus of this key message are familiar to the visitor. Family bibles, wedding dresses or fashion items such as paper dresses and plastic mackintoshes are preserved in many homes, and are amongst the items on display. One of the first display cases a visitor might approach contains four Roman coins. These coins were in excellent condition until damaged in a fire during the Second World War. The damaged, misshapen coins are included in the exhibition, not only to demonstrate what happens to metal under extreme temperatures, but also that objects change over time. Moreover, that sometimes collections care decisions



Fig. 1 Introductory area of *Reveal*. The displays include familiar objects that have a story associated with them. © National Museums Liverpool.

cannot stop the effects of time or history, even within a museum collection. As well as 'traditional' museum exhibits — such as the Roman coins, eighteenth-century samplers and ethnographic artefacts (an Inuit fishing game and an Amazonian head dress and bracelet) — it is envisaged that visitors will be surprised by what they find in the display. The aim is to challenge expectations of what should be in museum collections and preserved for future generations. For example, a pull-out drawer reveals a selection of 'throwaway memories' in the form of personal, transient objects. These are souvenirs consisting of recent music festival flyers, magazines and carrier bags. By linking people's personal collections to the museum context we want to encourage a sense of ownership for the cultural heritage around visitors, on their streets, in their homes and in their museums, Fig. 1.

Key message 2: discovering how and why things are made

- how were things made?
- what are they are made of?
- why do we want to know this?

This key message focuses on the ways in which memories contained in an object can be revealed using science. Many forms of scientific analysis are explored in this way. The message applies to every object on display, as discovering how and why things are made is central to conservation. The inclusion of a working laboratory in the exhibition space aims to demystify scientific enquiry, Fig. 2.

The laboratory is at the heart of the exhibition. Separated from the gallery space by large full-length glass doors, and a demonstration bench with glass windows, staff are able to talk directly with the visitors. The laboratory houses optical microscopes linked to digital cameras, the centre's scanning electron microscope, and an X-ray cabinet and computed radiography (CR) unit for digital processing of X-radiographs. All are linked to a large plasma screen that can show work in progress. When there is no-one in the laboratory, a presentation about how each piece of equipment is used to study museum objects is shown. The facilities selected were those that make scientific analysis and examination accessible to a non-specialist audience. Microscopy and X-radiography both produce images that rely primarily on visual interpretation and are easier to explain than, for example, spectroscopic or chromatographic techniques. In particular, CR is a development that brings the X-radiography process into public view. Wet processing of conventional X-ray plates in a darkroom would be impractical in the public space, but the digital processing involved in CR makes it a rapid and dry technique that gives results within a few minutes.



Fig. 2 The *Reveal* laboratory, showing staff working at the microscopes, and the plasma screen with a link to the computed radiography display. © National Museums Liverpool.



Fig. 3 A display case illustrating the use of graphics to present information in a multi-layered magazine style format. © National Museums Liverpool.

Within the gallery, the objects on display are accompanied by text panels, images or interactive displays which discuss the relevant conservation and historical issues. The design of the display cases, interactive displays and text panels was created with a multi-layered approach to content display. The format is designed to break down the barriers between information and object. This creates a fun, exciting and entertaining way to discover and explore. Informative and educational; the design is heavily influenced by the use of montage and an imaginary lab-book page where ideas are scribbled down next to drawings and images. Features such as arrows and highlighting circles on the glass lead the visitors' eyes through the displays. Many of these devices were developed by examining current trends in magazine page design, Fig. 3.

Reveal demonstrates that the conservation and historical questions raised by interaction with an object can be answered using scientific analysis. The results of the analysis are on display with the object, often in an interactive format. This multi-faceted approach enables the exhibition to contextualize science in the real world. Examples of the analytical methods presented in this way include:

- *optical microscopy*
Cross-sections of a marble surface before and after laser cleaning are used in a discussion about laser cleaning of marble.

- *scanning electron microscopy*
is used to examine pests, fibres and the contents of compartments within an African *Nkisi* figure
- *X-ray analysis*
This is used in the analysis of a painting, where the visitor can explore an earlier, hidden composition. Using joysticks to fade between normal light and X-ray analysis, views of the work are shown on a screen mounted next to the original. The X-ray analysis reveals stylistic re-working by the artist, which is discussed alongside the exhibit.
- *ultraviolet(UV) and infrared(IR) light*
Analyses are shown in an interactive light-box. The UV, IR and X-ray views of a sixteenth-century Italian panel painting of the *Madonna and Child* are displayed. This exhibit is also used to explain the electromagnetic spectrum.

Techniques which the centre does not have in-house are also demonstrated, and include:

- *radiocarbon dating*
Demonstrated on a Neolithic plinth.
- *dendrochronology*
As used to analyse a panel painting.
- *computed tomography (CT) and X-ray in combination*
These are used to examine an intact, fully-wrapped mummy of Pedeamun, Fig. 4. The visitor can navigate through the scans and X-rays of the body interactively, on a screen in front of the original object. This has proved a very popular part of the exhibition, Fig. 5.

Key message 3: preserving the memory

- things change over time
- an object's environment affects how it changes.

This key message is concerned with the science of decay that can destroy artefacts in museums, at home and in our outdoor spaces. *Reveal* discusses what can be done to minimize damage to cultural heritage, and why, as an individual or as a society, this may be important. This key message also enables the visitor to examine some scientific concepts in greater detail, including:

- *laser cleaning*
Alongside a part-cleaned marble sculpture there is a description of the nature of laser light and how this energy



Fig. 4 The wrapped mummy Pedeamun and the computer interactive display for the X-ray scans. © National Museums Liverpool.



Fig. 5 A visitor looks at the X-ray scans of the mummy Pedeamun. © National Museums Liverpool.

can be used to remove sulphation crusts selectively from, in this case, outdoor public sculpture.

- *the chemistry of glass*
A range of glass objects is on display including a Roman glass beaker, the surface of which has become iridescent over time. It is a change to the object that its original creators would never have seen. The accompanying text provides a description of what glass is, some of its unique properties, and how the mineral content of glass affects its colour.
- *an explanation of DNA*
Mounted bird skins and an illustrated book of a collector's expedition are on display. These highlight recent advances in science that mean that the DNA contained in these specimens can now provide important new information.

Finally, the exhibition asks the visitor to consider the contemporary materials around them today and what conservation issues these may pose in the future. Materials such as Nomex, aluminized Kapton, and Teflon-coated silicon fibres used in the space suits of the 1960s, are described. These are now badly degraded. The implications of the physical deterioration of storage media such as CDs and hard disks, and associated impacts, are also discussed.

Should the visitor want to learn more about the artefacts on display or any of the scientific concepts touched upon, he/she can explore the *Reveal* database. This resource is available via the internet and on two consoles in the gallery. These computer points also have a 'frequently asked questions' section, and links to websites which contain sources of further information (such as Conservation Online and The Smithsonian Centre for Materials Research and Education). There is a full education programme sited in a learning base adjacent to *Reveal*, which can cater for classes of children or special interest groups. A pre-booked 'Opinion Service' is also offered by the centre's conservators to the general public, to help them look after their own objects.

THE LABORATORY IN PRACTICE

The working laboratory in public view within *Reveal* was a departure from the original approach to making conservation accessible when the Centre first opened in 1996. Initially, access was controlled through booked tours and scheduled live video links to conservation studios, and the 'goldfish bowl' approach was avoided. During the first 10 years, the studio tours were found to be much more popular than the live video links. Visitors seemed to prefer to see the real objects and to talk

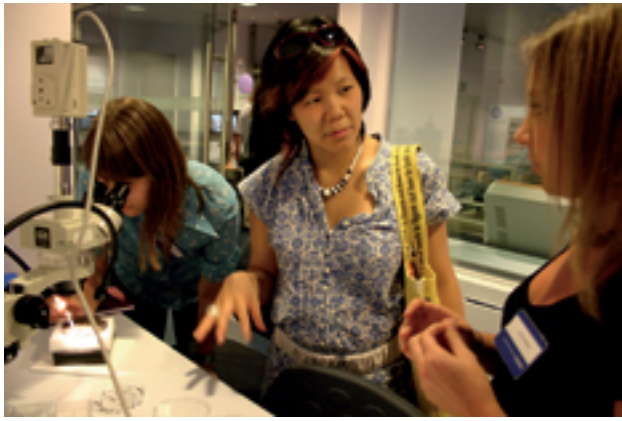


Fig. 6 Scientists talking to visitors in the *Reveal* laboratory. © National Museums Liverpool.

directly to conservators, rather than communicating through an interpreter and a video screen. Conservators would sometimes find themselves on a video link to a virtually empty room, so that it would have been easier to have brought two or three visitors up to the studio. Both studio tours and video links have now been discontinued.

Interpretation in the laboratory is carried out by those using the equipment, Fig. 6, rather than a dedicated demonstrator. Ensuring that the laboratory is staffed for a large proportion of the exhibition opening hours is a challenge, so when it is unstaffed an audio-visual interactive explains the use of the equipment. There is sometimes also a conflict between interpretation for the public and inviting visitors to ask questions, and spending productive time to use the equipment and get good analytical results. When the scanning electron microscope is in use in a dark corner of the laboratory, it does not invite visitors to interrupt — and it is easy for the operator to be absorbed in the work and become oblivious to visitors on the other side of the counter behind him/her. Researchers put together a brief summary explaining ‘work in progress’ that can be posted on nearby noticeboards, and make time to talk to visitors at the end of a session on the microscope.

The laboratory has become an ideal forum for presenting current work, and updating the information in the *Reveal* laboratory. For example, recent features have included the analysis of objects from the Egyptian collections in advance of the redevelopment of National Museums Liverpool’s Egyptian gallery. It provides an opportunity to demonstrate links to all parts of the collections and our other museums, and a focus for special interest groups — such as young archaeologists or metal detector enthusiasts. Events such as *X-ray your toy: see what’s inside* have brought in young visitors and an opportunity to interest them in conservation and science in general. The exhibition, and particularly the laboratory, has been successfully used as the focus for a trial session for the new GCSE in *Applied Science — science at work*.¹

AUDIENCE DEVELOPMENT AND VISITOR EVALUATION

Visitor profile studies were carried out in the year following the re-opening of the Conservation Centre and the new *Reveal* gallery. These categorized visitors by their social grade, according to the marketing standard developed by the National Readership Survey [3]. The social grades ABC1 include professional and middle classes, whereas C2DE grades include

¹ GCSE is a UK academic qualification undertaken by 15–16 year olds at the end of their compulsory education period.

clerical workers, skilled, semi-skilled, and unskilled manual workers and those with no income. Visitors from social grades C2DE have been traditionally under-represented in museums and the arts in general [6], and increasing the proportion of visitors from these grades has formed an important part of the funding agreement between national museums and the UK government in recent years [7]. One of the aims of the Conservation Centre redevelopment was to appeal to a broader audience, and attract more visitors from the C2DE social grades, and also to attract a higher proportion of younger visitors. In the year following the redevelopment, the proportion of visitors in socio-economic groups C2DE has increased from 25% to 34%, and visitor age profiles have changed, with the percentage of visitors under 24 increasing from 23% in 2004–2005 to 41% in 2006–2007.

The visitor profile research looks at casual visitors, but there have also been significant changes to the numbers and profile of people visiting the centre in pre-booked groups for specific activities. The number of visits from school classes of children aged 11 and under has nearly doubled, with the total number of children increasing from just below 2000 in 2004–2005 to over 3000 in 2006–2007. The most popular session for this age group in 2006–2007 was a science/art based session on the physical and chemical changes to public buildings and monuments caused by pollution.

The centre was particularly keen to evaluate whether the exhibition is successful in making the science of museum objects interesting and accessible to visitors. The content team created questionnaires to ask visitors what they think about science, and how much they know about conservation, both before and after they visit the *Reveal* exhibition. This work is still underway, but the initial results from a group of GCSE students suggest that the exhibition is having some positive impact in engaging visitors with science and conservation. The students were asked whether they liked or disliked science on a scale of 1 to 5. Before they visited *Reveal*, 20% said that they liked science, and this increased to 33% after their visit. Of the group, 13% had visited *Reveal* previously, and 41% had some idea of what conservation was. After they had visited, 79% had some understanding of conservation, and used descriptions such as ‘caring for’, ‘preserving’, ‘protecting’, ‘saving’, ‘looking after’, ‘keeping clean’ to describe what conservation is.

Other sources of information include the comments written in the visitors’ book. The vast majority of these are positive, and those which are negative usually contain some useful learning and development pointers. However, there is little that is specific about how much they enjoyed the scientific content. A recent assessment by the Visitor Attraction Quality Assurance Service stated: “The Centre is a real gem, with innovative displays and cutting edge interpretation”.

This visitor research will be continued over the next 12 months and beyond, and the questionnaires will be used for organised group visits and casual visitors, to get an insight into the objects and themes that people find interesting (or otherwise). An additional visitor counter has recently been installed at the entrance to the temporary exhibition area. These studies may help establish whether the changes in the profile of visitors to the centre are related to the *Reveal* gallery, or the consequence of the wider redevelopment, including the new temporary exhibition area and re-branding of the Conservation Centre.

CONCLUSIONS

The *Reveal* exhibition demonstrates how investigative conservation and scientific research contributes to knowledge of objects, history and collective memory. It aims to counter the negative view that conservation and access are mutually exclusive endeavours by actively demonstrating that by using science to examine

our cultural heritage we are able to improve access for all. This is the image of conservation that the centre would like to promote: one of conservation increasing access to cultural heritage. The potential of conservation and heritage science to enhance the accessibility and public understanding of science is becoming an increasingly important factor.

The UK House of Lords enquiry on *Science and Heritage* undertaken in 2005–2006 cited Liverpool's Conservation Centre as an example of the successful engagement of the public with heritage science [8]. As an exhibition that deals with science and conservation, *Reveal* has been exceedingly well received, and the response from those interested in the subject has been very positive. It is more difficult to gauge how successful it is in engaging those visitors who might otherwise not have been interested in heritage conservation. Ongoing visitor evaluation will enable assessment of how well the exhibition works as a way of engaging the public with science. Now that *Reveal* is up and running, the challenge is to develop a fascination with heritage science, and to ensure that conservation and scientific investigation of our heritage ceases to be a behind-the-scenes activity that no-one is aware of, but becomes a high-profile and valued part of the museum sector.

ACKNOWLEDGEMENTS

The authors would like to thank Ken Martin Architects, Houghton Kneale Design, Mezzo films, the project office, development team, audio visual and new media departments, and all conservators and curatorial staff of National Museums Liverpool. We would also like to thank Dr Stuart Wilks-Heeg, School of Sociology and Social Policy, University of Liverpool, for information on social grades. We are grateful to the following for their financial assistance: The National Lottery through the Millennium Commission, The Wolfson Foundation, Prof. Phil Redmond CBE and Mrs Alexis Redmond, The Wellcome Trust, The Getty Foundation, Mr Nicholas C.F. Barber CBE, Mrs Mary Yates.

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