Published by V&A Conservation
ISSN 096702273

V&A Conservation Journal

Autumn 2009/10 Number 58 £4.50 @ point of sale

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Front cover image: A detail of the new Medieval & Renaissance Galleries (Photography by Louise Egan)

Contents

V&A Conservation Journal No.58

Conservation Department

Staff Chart Autumn 2009/10

Head of Conservation
Sandra Smith

PA & Dept Secretary
Cherry Palmer

Sculpture, Metals, Ceramics & Glass (SMCG)	Furniture, Textiles & Frames (FTF)	Paper, Books & Paintings (PBP)	Science	Information Management & Administration
Victoria Oakley	**Marion Kite**	**Alan Derbyshire**	**Graham Martin**	**Fiona Campbell**
Sculpture Charlotte Hubbard Sofia Marques Victor Borges Brendan Catney (c) Johanna Puisto Lisa Wagner Jonathan Kemp (c) Sarah Healey-Dilkes Linda Temmink Phil James (s)	*Furniture* Shayne Rivers Tim Miller Nigel Bamforth Dana Melchar Carola Schueller Kerstin Wadewitz (c)	*Paper* Merryl Huxtable Victoria Button Michael Wheeler Susan Catcher Lisa Nash (RIBA) Pernille Jensen (c)	Boris Pretzel Brenda Keneghan Valerie Blyth Lucia Burgio Bhavesh Shah	Michelle Jensen Louise Egan Helen Nodding
Metals Diana Heath Joanna Whalley Sophy Wills Donna Stevens Catia Viegas Wesolowska Gates Sofer (c) Eva Annys (c)	*Gilded Furniture and Frames* Christine Powell Zoë Allen Tom Barrow (c)	*Preservation Conservators* Clair Battisson Simon Fleury Chris Gingell Eoin Kelly (c) Anne Greig (c)		
Ceramics & Glass Fi Jordan Juanita Navarro Hanneke Ramakers Amanda Barnes (c)	*Textiles* Albertina Cogram Frances Hartog Susana Fajardo-Hunter Elizabeth-Anne Haldane Lara Flecker Cynthea Dowling Joanne Hackett Roisin Morris Lynda Hillyer Keira Miller (c) Sam Gatley Sarah Glenn Sung Im Janine Spijker (c) Marilyn Leader (c) Jennifer Barsby (c) Constanze Zimmer (c)	*Books* Jane Rutherston Anne Bancroft		
Stained Glass Sherrie Eatman Ann Marsh (c)		*Paintings* Nicola Costaras Rachel Turnbull (c) Sophie Reddington (c)		

Visiting Researchers
Titika Malkogeorgou

Internships

Gilded Furniture and Frames
Léa Wegwitz

Paintings
Enrica Griseta

Ceramics & Glass
Stefka Bargazova (HLF/ICON)

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Harriet Standeven (V&A)

Key

Senior Management Team

(c) Contract Staff

(s) Secondment

RCA/V&A Conservation

Conservation of Metals and Surface Finishes
Sia Marshall, MA
(p/t with the National Maritime Museum)

Hans Holbein the Younger: An Investigation Into His Choice and Use of Materials & Techniques
Victoria Button, MPhil

Harming Works of Art: The Challenges of Contemporary Conceptions of the Artwork
Iris Kapelouzou, PhD

Still Adorned in Plastic? A Study of Plastics in Jewellery Making to Determine the Consequences for Preservation
Cordelia Rogerson, PhD

Other Students

Enabling Museum Professionals with New Collections Management Tools
Emma Richardson, University of Southampton/V&A Collaborative PhD

Analytical Chemistry
Carolyn McSharry, Imperial College/V&A Collaborative PhD

Mechanical Engineering Adel Elmahdy, Loughborough University/V&A Collaborative PhD
Xinyi Lui, Loughborough University/V&A Collaborative PhD
Judith Thei, Imperial College/ V&A Collaborative PhD

Conservation
Nanke Schellman
PhD Student, Dresden University of Fine Arts

I would like to thank the staff of the Conservation Department and Technical Services Section for their outstanding contribution to the delivery of the Medieval & Renaissance Galleries.

Through sensitive and skilled conservation the collections have been visually transformed and technical investigation has notably deepened our understanding of the materials, techniques and history of the collections.

The spectacular presentation of the collections within the galleries could not have been achieved without the expertise, skill and ingenuity of the technical team.

Mark Jones

Director

V&A Conservation Journal No.58

Editorial

Sandra Smith

Spanning the east wing of the Museum and covering an area of 4000m² on three levels, the 10 new Medieval & Renaissance Galleries, which opened in December 2009, are the culmination of over 45 conservator-years of work. The galleries include the first new-build public space at the Museum in over 100 years; it will improve circulation and create space to display large objects, such as the Oak Staircase from Brittany and Sir Paul Pindar's house (Schueller).

Co-ordinating and monitoring the work of 11 conservation studios – with some staff also assuring quality of the work of other external specialist studios – has been complex and challenging (Hubbard; Campbell). As Lead Conservator, Charlotte Hubbard combined admirable negotiation, team-working and communication skills with natural leadership to calmly guide the Department's M&R team and advise the Project Team on collection care issues. Throughout what, at times, has been an arduous work programme, practice, standards and approaches have been reviewed and refined to optimise the use of the resources available, prioritise work, develop new skills (Richmond) and safeguard staff health and welfare (Wagner and James). The preparation of objects dating from 300 – 1600, has prompted considerable discussion and ethical debate, raising such questions as 'How should the value of the medieval original be weighed against the value of a later restoration with its accumulated history?' (Costaras and Turnbull).

Conservation has transformed many of the pieces (Jordan), and in-depth examination and technical study (Marsh; Borges; Viegas and Seavers) has underlined the significance of object-based research in expanding our understanding of the V&A's collections (Motture).

Conservation staff's contribution to the Medieval and Renaissance: Past, Present and Future[1] blog, initially intended to herald the forthcoming galleries, has expanded, providing insights into how objects were made, used, worn, and repaired. This additional dimension complements the work of the curators and educators, and has been incorporated into the interpretative framework for the new galleries 'in ways that were never envisaged when the project began' (Frost).

The value of collaboration with the V&A's Technical Services Section as well as external conservation companies has been inestimable. By creating teams with complementary skills, new solutions have been found for the construction and mounting of the colossal architectural pieces. The unobtrusiveness of complex structural supports (Rose) allow even the most fragile pieces to appear to 'hang in space' effortlessly, above the visitor (Kidd and Nation).

The National Museums Directors' Conference *Guiding Principles* to reduce museums' carbon footprint[2] very much reflect the approach that the V&A has taken to the environment within the Medieval & Rennaisance Galleries. Passive methods of air exchange, using the ventilation systems within the structure of the building, together with natural and sustainable environmental controls, have been used, negating the need for air conditioning (Bingham and Walker). Intelligent and pragmatic assessment of the objects has pinpointed sensitive collections which require tailored environmental control. This is achieved through conditioned showcases (Pretzel).

On a scale unlike anything attempted by the V&A since the British Galleries opened in 2001, over two thousand objects have been conserved and re-displayed. Assessment and treatment began over five years ago, and, with a determination to maintain all the other 'public programme' events during this project, the dedicated and highly-skilled core staff complement has been supplemented with equally outstanding contract staff, interns, students and volunteers (see Acknowledgement and staff photo). Together, they have delivered work for numerous overlapping projects and deadlines. In 2009 alone, in addition to delivering the Medieval and Renaissance project, the Conservation Department has also completed work for; five other major galleries: Ceramics Phase 1; Theatre and Performance Gallery; The Robert H N Ho Family Foundation Gallery for Buddhist Sculpture in Asia; The Arts of Thailand and The Rosalinde and Arthur Gilbert Galleries;[3] eight exhibitions, including

Telling Tales, Hats: An Anthology by Stephen Jones, Baroque 1620 – 1800, and *Maharaja: The Splendour of India's Royal Courts;* 29 displays; 10 international touring exhibitions to sixteen venues; 11 UK touring exhibitions to twenty-four venues and over 100 loans. The achievement of this impressive programme is due to the unrelenting commitment, professionalism and enthusiasm of everyone involved. We are also indebted to the numerous colleagues in other museums and universities who have shared their expertise and provided access to their facilities to assist us with these projects (Burgio et al).

Confirmation that the RCA/V&A Conservation Postgraduate Programme has now closed to new students is poignant for the Department. In 1989, the Royal College of Art and the V&A, in association with Imperial College London, launched their unique partnership for the delivery of specialist, work-based learning in conservation, providing training, education, and research at MA level. The Programme set high standards for itself and its students, and during the past twenty years has seen 61 MAs, 15 MPhils, and eight PhDs through to graduation. All rose to that challenge, excelling in their understanding of highly specialist areas of conservation practice, some offered for the first time in the UK at Masters level, such as Photographic Materials, Historic Wallpapers, Upholstery, Musical Instruments, Stained Glass and Conservation Mounting of Textiles. The consistently high quality of the student work has been recognised in the national Conservation Awards, where the Programme has produced four winners and 6 short-listed students for the Student Conservator of the Year Award. The Programme itself received The Queen's Anniversary Prize for Higher and Further Education in 2000.

Both students and staff have been responsible for excellent and pertinent research (Button; Hartog).[4] *Conservation Principles, Dilemmas and Uncomfortable Truths* (Richmond and Bracker), and a forthcoming book on the history of twentieth-century household paints by Harriet Standeven, due to be published 2010, will become standard reference books for the future.

It is a tribute to everyone involved with the programme – the supervisors, examiners, visiting lecturers, but most notably the Programme staff (Alan Cummings, Jonathan Ashley-Smith, Helen Jones, William Lindsay, Alison Richmond and Harriet Standeven) – that the RCA/V&A Conservation programme will long be recognised as an excellent model for conservation education. It leaves behind an outstanding legacy of professional conservators and scientists who will continue to take formative roles, throughout the world, shaping the future of the profession.

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2. http://www.nationalmuseums.org.uk/what-we-do/contributing-sector/environmental-conditions/ (accessed November 2009)
3. http://www.vam.ac.uk/futureplan/projects/Gilbert%20Collection/index.html (accessed November 2009)
4. http://www.rca.ac.uk/Default.aspx?ContentID=504106&GroupID=159711&CategoryI D=36692&Contentwithinthissection&More=1 (accessed November 2009)

Benefactors acknowedgements

The V&A Conservation Department would like to thank the following for their generous support during the Medieval and Renaissance Galleries project:

The Mercers' Company – Coptic tunic (adult)

The Drapers' Company – Tristan and Isolde quilt

The American Friends of the V&A through the generosity of the Gladys Krieble Delmas Foundation – Venetian lantern

The Henry Moore Foundation – Objects in the Tuscan Sculptors display

The Founders Guild – Gloucester Candlestick

The 1851 Royal Commision – Gloucester Candlestick

V&A Conservation Journal No.58

Designs on the future: Developing the new Medieval & Renaissance Galleries

Peta Motture

Project Chief Curator

Figure 1. An early visualisation of new physical connections: The Palace and Home and the Courtyard and Garden displays (© MUMA)

The development of a major project of the scale of the V&A's new Medieval & Renaissance Galleries is an exercise in collaboration, co-operation and organisation. Since July 2002, when a small team was charged with the enviable task of establishing the concept for the new galleries,[1] to the opening in December 2009, a vast number of people with diverse expertise has brought the project to fruition. As the articles in this journal clearly demonstrate, the recasting has offered an exceptional opportunity for research and development on all fronts – conservation, curatorial, design, interpretative, scientific and technical. In order to set that research into context, this article will outline some of the key aspects of the development process.

The gallery project followed hard on the heels of the successful completion of the British Galleries, which opened to critical acclaim in November 2001 and won the European Museum of the Year award for its thematic approach to the displays. Our brief was to build on the success of the British Galleries by setting the Museum's outstanding collections within the broader context of European art and culture from 300 to 1600. These vary in scale from intricate jewellery to the high altar chapel from the Renaissance church of Santa Chiara in Florence. The displays incorporate a wide range of media, including sculpture and metalwork; ceramics and glass; books, prints, drawings and paintings; furniture and textiles. Each of the objects was assessed, photographed, catalogued and conserved. Not surprisingly, the logistics were challenging, involving extensive object movement and the reconstruction of complex and monumental works.

Our vision was to create stunning displays that showed the objects at their best, while providing visitors with the means to explore and learn at their own pace. Drawing on existing and specially commissioned research, our audiences were placed at the heart of our thinking, informing the interpretation and presentation of the material.[2] The narrative framework was based around the collections themselves, supplemented by a few strategic loans generously deposited by individuals and other institutions. Amongst these is a changing display of the British Library's early manuscripts, paintings from the National Gallery and the Courtauld Institute of Art, and artefacts from the British Museum and Royal Armouries.

A combination of large- and small-scale galleries was chosen so as to allow the full range of objects to be displayed together for the first time. In spring 2003, the London-based firm MUMA were appointed as architects and exhibition designers. They spotted the potential offered by the nature of the spaces, which comprised not just existing galleries, but also offices, stores and other back-of-house areas. An unused open-air space was transformed into an exciting new display area protected by a glass roof, employing innovative engineering technology. A circulation hub has also been created at the heart of the galleries, with a new lift and staircase, providing full access to this wing and across to the central core of the Museum. MUMA have also opened new connections and vistas that enhance the gallery narrative (Figure 1).

The scheme consists of 10 galleries, each with its own narrative and date range, such as Faiths and Empires 300-1250 (The William and Eileen Ruddock Gallery), and A World of Goods 1450-1600 (The Edwin and Susan Davies Gallery). Themed displays set the objects into context alongside individual highlights, selected as masterpieces or simply because they are extraordinarily engaging. One of our aims was to draw out the interconnections across period and geographical divides, as well as between the sacred and the secular, and indeed between art and artefact.

The design brief followed a 'less is more' approach, with a variety of pace and types of display that privileged the objects, while respecting the Grade I listed building – an object in its own right – in which the collections are set. This vision was shared by MUMA, whose sensitive and imaginative design allows the artefacts themselves to articulate the space, keeping architectural intervention to a minimum. One rare exception to this rule is the small room built to house the Scholar's Study display, the size of which was determined by that of Piero de' Medici's study (destroyed in 1659) in the Medici Palace, Florence. The ceiling vault is decorated with the original tin-glazed terracotta roundels from Piero's study by Luca della Robbia depicting the Labours of the Months (Figures 2 and 3), hinting at the original setting of these extraordinary survivals. The display includes a

(Photography by Sculpture Conservation)

Figure 2. Removal of one of the della Robbia roundels from the old display

(Photography by Christine Smith, V&A Photographic Studio)

Figure 3. April from the Labours of the Months by Luca della Robbia (7635-1861)

facsimile book and replica medal for visitors to handle. Elsewhere, original objects are available to touch. Carefully chosen in consultation with conservators and the RNIB, the UK charity supporting blind and partially sighted people, these artefacts and their Braille texts have also been tested with visually impaired visitors.[3]

(Photography by V&A Photographic Studio)

Figure 4. Vittore Crivelli *St Catherine* (765A-1865), before conservation

(Photography by V&A Photographic Studio)

Figure 5. Vittore Crivelli *St Catherine*, after conservation

Striking the balance between access and conservation is central to the creation of successful and meaningful displays. It often demands pragmatic decisions. For instance, it is particularly important to dispel the popular notion of the medieval 'dark ages' by creating spaces that feel light. This is no mean feat, given the constraints of combining materials requiring different light levels, notably sensitive objects such as textiles and drawings. To resolve this, some objects were chosen for rotation, others have been placed in drawers and cupboards, and occasionally, lights are activated by motion sensors. Only rarely did we decide to remove items from display or to leave them permanently on view in low light.[4]

Objects are often displayed to reflect their original setting, such as the liturgical dress mounted as though being worn in a display on Religious Processions, or the tympanum sculpture of the Misericordia (25:11-1882) by Bartolomeo Bon, set high as though above a doorway. Elsewhere, objects are set up for close viewing. In virtually every instance, the display context has informed the level of conservation treatment undertaken on individual objects, as has the desire to be honest about which areas are missing or restored. Cleaning alone has transformed some works (Figures 4 and 5), while in-depth examination and technical study has opened new avenues of enquiry. As ever, research has often raised more questions than it has answered, but this process does not end with the gallery opening, and several collaborative projects are underway.

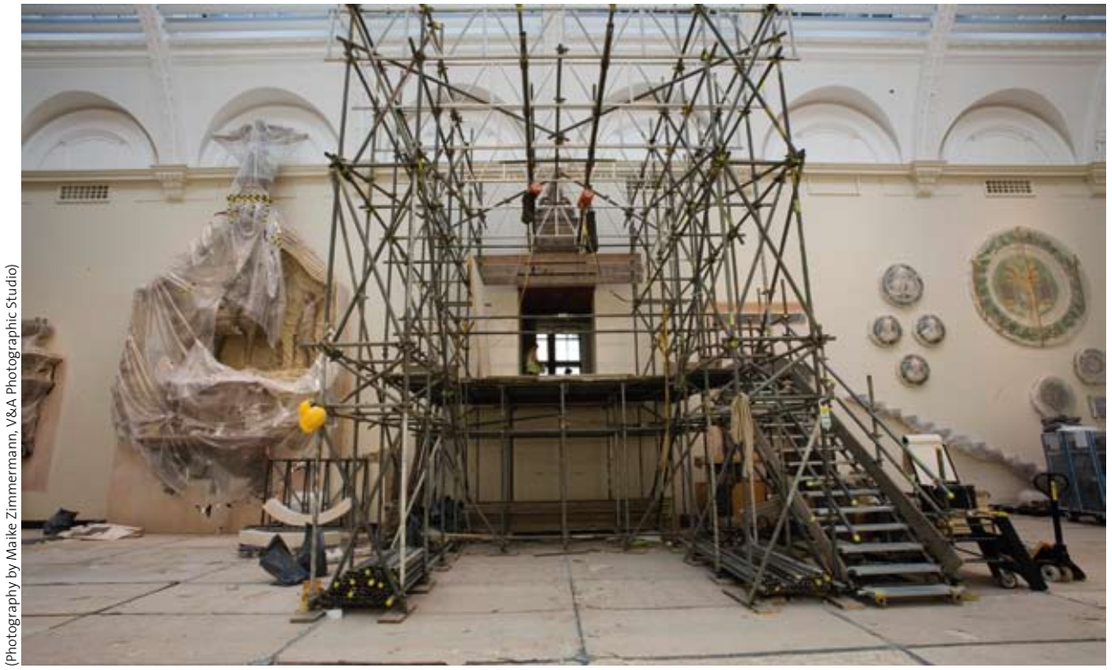
The focus of the project was to produce exciting displays that would set the objects at centre stage and inspire our audiences. In the process, new approaches to display have been developed in order to meet the varying needs of content, environment, design and accessibility. All of these must go hand in hand if we are to create successful displays. The repositioning of the Medieval & Renaissance Galleries offered a unique opportunity for this generation to explore the collections afresh. Through their practical work and in-depth research, conservators have made a fundamental contribution, emphasising once again the significance of object-based research and how it can expand our understanding of the artistic production and material culture of the past.

References

1. The team was led by Malcolm Baker until October 2003
2. See Frost, Stuart. 'Behind the scenes: Conservation and audience engagement', *V&A Conservation Journal* (Autumn 2009/10) pp.10-12
3. Two Discovery Areas and the Bonita Trust Study Area are also included
4. The light fall was carefully modelled by Arup, who worked on the day-lighting element of the galleries, in conjunction with DHA (responsible for artificial lighting) and MUMA

Aspects of the role of lead conservator

Charlotte Hubbard
Head Sculpture Conservator



(Photography by Maike Zimmermann, V&A Photographic Studio)

Figure 1. Ongoing works for the Medieval & Renaissance Galleries

The Medieval & Renaissance Galleries project is one of huge ambition, encompassing a large number of objects (over 2,000), a large number of galleries (10), the bringing of exterior space into internal use and the much-needed addition of circulation routes, as well as the redevelopment of staff facilities in the basement. The project is the culmination of Phase 1 of the Museum's FuturePlan, a series of redevelopment projects taking place throughout the site. FuturePlan Project teams are drawn from relevant departments within the Museum, and each member of the team has a specific role. The role of Lead Conservator is one that has been evolving throughout the progression of FuturePlan. Early on, the role took as its basis guidelines that already existed for temporary exhibitions, but the greater scope of gallery projects requires broader involvement with activities such as gallery decant and closure planning, membership of the Steering Group, or troubleshooting on practical object-related issues. Some of the responsibilities of the role are highlighted within this article.

As mentioned elsewhere in this journal (Motture, Frost), early stage planning began in 2002 to establish the intellectual rationale, and this included broad discussions between invited experts, curators, and educators around concepts and themes, as well as visits to external collections. The Project Team also conferred directly with individual conservation studios as part of the firming up of ideas. Content was developed into more concrete groupings until, in 2004, the Project Team had a clear enough idea of potential inclusions for conservators to begin their assessments for treatment. At this stage of a project, the Lead Conservator is working towards the creation of a conservation brief that reflects the proposed levels of treatment also taking into account the availability of resources, the nature of the objects, and the type of gallery. This includes trying to predict the need for analytical support for both treatment and research, and further input of the Science Section in areas such as environment and pest management.

V&A Conservation Journal No.58

In all, 4619 objects eventually made it onto the 'possible' list. Of those, 3200 were assessed, with 2032 finally chosen for display. It is a delicate balance to find the right point at which to start assessing objects – too early, and a lot of time is spent looking at objects that are dropped from the lists as ideas develop; too late, and pertinent information regarding display limitations or requirements is not to hand during decision-making processes. During the assessing stage, conservators from different specialisms log information that is then used to contribute to further development of gallery plans as well as the planning of conservators' work. The assessments take into account not only the recommended intervention, if any, and how long it might take, but also such things as the current mounting method, the environmental susceptibilities, and whether the object needed conservation before photography. One development during the evolution of this project is that, in addition to the treatment assessments, time required for thinking and discussion needs to be accounted for – this is now added in order to help the Lead Conservator to the full implication of resource allocation, and also to fully reflect the Department's input to a FuturePlan project.

Within a project of this size, where 73,000 hours of treatment time had been proposed for the chosen objects, it was important to be sure that resources were efficiently used. Those objects which apparently had a high number of treatment hours associated with them had different options for treatment proposed and discussed with curators. While some treatments remained as assessed, a variety of solutions were found for others: the proposed scope of some work was challenged and intervention scaled down; some work was undertaken by external conservation companies; short-term contracts were created; and in some cases, the objects chosen were exchanged for similar objects requiring less input. Generous benefactors also supported the treatment of several objects. During this period, the Lead Conservator needs to maintain an overview and aims to ensure a balance is met between the expectations of different parties.

The central logging by conservators of object-related information, particularly in a project that covers a wide range of specialisms, aids the Lead Conservator considerably in gaining a broad picture of requirements and conditions that can then inform further discussions and planning with the Project Team. With the medieval and Renaissance display, the Galleries will have a passive approach to the environment, wherein maintenance of relative humidity within required parameters will be achieved by combining the use of internal heating with external air conditions through strategic ventilation, rather than installing conventional air-conditioning (Bingham and Walker; Pretzel). This, coupled with the aspiration to have as many objects as possible on open display, meant that early recognition of which of the objects were the most vulnerable was paramount. The database aided the swift identification of those objects, as well as the definition of which type of display environment was necessary for them: allocation of cases could follow accordingly. The project has provided us with the opportunity to challenge our own perceptions, particularly when it came to environment and objects on open display: We have worked with predictions of expected outcomes, our climate monitoring system will provide us with more information for analysis of the working galleries (Pretzel). Conservators wrote generic statements regarding display principles for each type of object within the new galleries. These were given early on to the architects as well as curators, to ensure they had relevant background information when it came to design of display. The project was to tell the medieval and Renaissance story in a new way: Whereas previously displays had been arranged more according to object type or material, the ambitious collocation of objects of all types required an approach that took into account the mixed nature of each display. As part of the consideration of how we would display the objects, new environmental guidelines for FuturePlan projects were written. Further opportunities for conservator feedback on design ideas came at other key design stages, with comments being passed on to the Project Team for inclusion in the client's response to the design.

As well as gathering information from the Conservation Department, the Lead Conservator's role is also to provide progress reports (Campbell) from the project to the Department, and in part, to represent the project to the Department. This means that the Lead Conservator has to be aware of the overall levels of conservation resource allocation. He or she is there to aid the delivery of that particular project, but there may be many other projects underway at the same time – work for Medieval & Renaissance Galleries project could not be seen in isolation. During the entire period, work was also going on in more than fifty other gallery spaces. The impact of this has to be accommodated, while at the same time the Lead Conservator has to influence the teams to ensure focus remains balanced. Faced with high demands from a variety of directions, the need for flexibility became ever more apparent. Conservators had to deal with changes in resources, requiring decisions about treatments to be revisited and proposals modified. The reduction in scope has not, however, meant a reduction in quality of input, as articles in this issue and the objects on display will amply demonstrate. Stability of objects has been the over-riding concern.

This project started early on in the evolution of FuturePlan and the development of the role of Lead Conservator has been concurrent. Clearly, each project will have differing scope and requirements, but the early inclusion of the Lead Conservator in each project is an important factor for ensuring timely contribution from the Department. The fact that each new project team is comprised of a fresh group of people can mean that lessons learnt on one project might not necessarily be transferred to influence a subsequent one. However, the sheer number of projects that have now been, and will continue to be, undertaken as part of FuturePlan means that we have the opportunity to gather together valuable conclusions from each. The development of a number of guidelines relating to projects is one reflection of this; another is the involvement of the V&A's Training and Development Department, who are developing different ways of communicating and embedding the learning, with, for example, short video interviews to be made available for all staff.

The wide range of objects included in this project has provided the opportunity to deepen understanding of conservation specialisms other than my own. As Lead Conservator I have had the privilege of working with a wide range of interesting and inspiring people both from within and beyond the Museum, as well as opportunities to develop negotiating skills, to gain insight into and appreciation of broader issues beyond my own concerns as a conservator, and to exercise (and influence) the maintenance of balance and of flexibility. This has been a demanding and stimulating project.

Acknowledgements
My thanks to Fiona Jordan, Alison Richmond and Sandra Smith for their thoughts and comments during the writing of this article.

V&A Conservation Journal No.58

Behind the scenes: Conservation and audience engagement

Stuart Frost
Gallery Educator

It is clear that amongst the museum-going public there is a fascination for the work that goes on behind the scenes. Increasingly conservators in museums around the world are spending time working in public gallery spaces in view of visitors. At the Museum of London, conservators treating timbers destined for the Medieval London display worked in a prominent position near the main entrance. In the Museo del Bargello in Florence, the conservation of Donatello's *David* was recently completed in an open workshop. At the V&A, conservators have been working on objects for the new Medieval & Renaissance Galleries in the Italian Cast Court whilst it was closed to the public. Visitors were able to view the work in progress from an upstairs gallery (Figure 1).

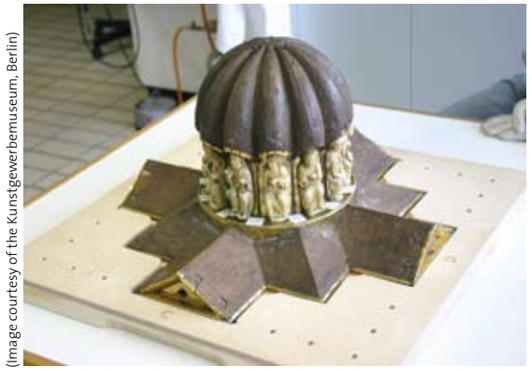
(Photography by Fi Jordan)

Figure 1. View into Gallery 46b where conservators worked on objects for the Medieval & Renaissance Galleries

Conservation for the galleries has been highlighted to the V&A's audiences in other ways. From the initial planning meetings for the new displays in June 2002, the project concept team were keen to provide the public with insights into the work that would take place in the conservation studios. We felt it was essential to provide the public with information on the long-term treatments and to highlight the difference that conservation makes to objects.

We considered developing some touch-screen interactives to stand alongside key objects in the galleries. We thought, for example, that digital animation could be used to help visitors understand how the appearance of a medieval painted sculpture of the Virgin and Child had changed over time, or that short films could be used to reveal the complex installation process for large architectural objects. After discussion, it was decided that the project's online presence offered a more immediate, appropriate and effective way of addressing this. Both conservators and curators across the V&A have supported this desire to use the web to highlight work that the public would otherwise not see.

A number of potential case studies, where the conservation was likely to transform either the object's appearance or our understanding of it, were identified at an early stage. The treatment of these objects was documented through photography, before, during and after treatment. Curators or conservators wrote short summaries of each project (Figure 2). Four case studies had been completed by the middle of 2008 and added to the V&A's website. A number of others case studies have been added subsequently.



(Image courtesy of the Kunstgewerbemuseum, Berlin)

Figure 2. The detailed examination of the Tabernacle from Cologne (7650-1861) was the focus of one online subject

In October 2006 a Medieval & Renaissance Galleries project blog was established on the V&A's website.[1] With fortnightly updates, the blog has allowed the Conservation Department to provide regular updates, photographs and summaries of their work to be posted almost immediately. The blog gives readers the opportunity to post comments and ask questions. Photographs of a large medieval quilt decorated with scenes from the legend of Tristan (1391-1904) were viewed over 700 times within twenty-four hours of posting on the website.

In addition to sharing their work online with the public, conservators have played an essential role in the development of many of the low- and high-tech activities that have been integrated with the gallery displays. For example, Elizabeth-Anne Haldane, Senior Textile Conservator, has embarked on a collaborative project to provide new insights into a tunic from Egypt made between 642-800 (291-1891) (Figure 3).[2] It has been the focus of two blog entries. Elizabeth-Anne and the project team were keen for visitors to have the opportunity to try on an accurate facsimile of the tunic. It is one thing to see a tunic hanging on a form behind glass, quite another to pull it over one's head and to experience moving around in a garment Figure 4). We were keen that the replica should be as authentic as possible and the results of the intensive study of this object have helped us achieve that. The cost of commissioning real applied tapestry decoration was beyond the available budget but Elizabeth-Anne sourced a digitally printed alternative, which clearly establishes the link with the original object. The facsimile fabric was produced by Zardi & Zardi, the company who also supplied the digitally printed in-fills for the treatment of the Spanish Carpet (784-1905) (Hartog).

Each of the 10 galleries will include one original object that visitors can touch. More specifically, and particularly for visually impaired visitors, we wanted to include objects that exemplified some of the key characteristics of the main period styles. This posed particular challenges for the earlier styles such as Romanesque and early Gothic where options within the collections were limited. Conservators, curators and educators worked in close collaboration to find suitable objects able to cope with the rigours of repeated touching whilst offering visually impaired visitors as rich and rewarding a tactile experience as possible.

(Photography by V&A Photographic Studio)

Figure 3. An Egyptian tunic, made between 642-800 (291-1891). Visitors will be able to wear a replica based on this tunic

Conservators have made valuable contributions elsewhere. They have participated in study days organised in conjunction with the Open University, sometimes sharing the results of research before publication. They have provided advice about techniques such as tapestry weaving for new touch-screen interactives and have commented on the scripts for new *How was it made?* gallery films. Some have helped source materials such as Caen stone, imperial porphyry and limewood, which visitors will be able to handle in a partially worked format.

(Photography by Elizabeth-Anne Haldane)

Figure 4. Author wearing replica tunic with original in background

Conservators have contributed to the development of the interpretative framework for the new galleries in ways that were never envisaged when the project began. The replica of the Egyptian tunic, for example, would not have been developed without the involvement of the Textile Conservation Studio. By highlighting a number of varied and particularly interesting case studies online, the project team hope that it will have helped to enhance the visitors' understanding of the vital role played by conservators in the development of the Medieval & Renaissance Galleries.

The following Medieval & Renaissance Conservation Case Studies can be found on the V&A's website:

- The Façade of Sir Paul Pindar's House
  www.vam.ac.uk/res_cons/conservation/Conservation%20Case%20Studies/pindar/index.html
- The Virgin and Child with Angels by Peregrinus
  www.vam.ac.uk/res_cons/conservation/Conservation%20Case%20Studies/peregrinus/index.html
- A Medieval Tabernacle from Cologne
  www.vam.ac.uk/res_cons/conservation/Conservation%20Case%20Studies/med_tab_col/index.html
- The War of Troy Tapestry
  www.vam.ac.uk/res_cons/conservation/Conservation%20Case%20Studies/war_of_troy_tapestry/index.html

Acknowledgements

Conservation of the tunic has been supported by The Mercers' Company.

With thanks to Elizabeth-Anne Haldane, Helen Persson and Elin Simonsson, and to Zardi & Zardi for supplying the digitally printed fabric.

Reference

1. To view the Medieval & Renaissance: Past, Present and Future Blog, go to www.vam.ac.uk/vastatic/microsites/1265_frost/ (all accessed November 2009)

2. Haldane, Elizabeth-Anne et al. 'Waking the Dead: Scientific Analysis of an Egyptian Tunic', *V&A Conservation Journal* 57 (Spring 2009), pp.22-23

Medieval & Renaissance Galleries: A passive approach to humidity control

Michael Bingham and Steve Walker
Arup

During the design stage of the new Medieval & Renaissance Galleries (the project) the decision was taken to adopt a passive approach to environmental control. This article describes the rationale, analysis and benefits of this approach. The passive approach developed, exploits the massive nature of the building and uses sophisticated control techniques to minimise variations in humidity in the galleries but uses neither refrigeration nor humidification machinery to achieve its performance.

This article is primarily intended to describe the design measures developed for the control of humidity and temperature. Other environmental factors which affect the preservation of objects, such as lighting and dust filtration are not treated in detail.

During the design phase of the project the revision of the V&A environmental guidelines for conservation of objects in the Museum opened the opportunity of moving away from the traditional approach for environmental control. The traditional approach to environmental control relies on mechanical systems of air-conditioning to closely maintain the internal environment within a specified range of conditions. Such systems are energy intensive in use and require substantial space for machinery and considerable capital investment. Furthermore, in the case of the Medieval & Renaissance Galleries, the installation of such a system of air-conditioning would have required expensive alterations to the fabric of the building.

A comprehensive review, carried out by the V&A, of the objects to be included in the galleries and their previous display conditions highlighted that many of the objects were acclimatised to and displayed in a dry museum environment. This informed the environmental control systems design: object conservation should be prioritised over occupant comfort; on a seasonal basis relative humidity (RH) could be allowed to vary through a wider range than originally anticipated, between a minimum of 35% and maximum of 55% (45% +/- 10%); short-term fluctuations in RH should be minimised as far as possible and kept to less than a 10% variation in any twenty-four hour period; objects of higher sensitivity should be installed in showcases to further buffer them from environmental variations.

In addition to the conservation guidelines, the V&A sustainability policy also called for minimising the energy use of all new projects.

Thus, the challenge to the design team was to develop a low energy system for environmental control that would provide the internal environment required for the long-term preservation of the collections. Such an approach was found and developed for the project and its strategy and performance are described below.

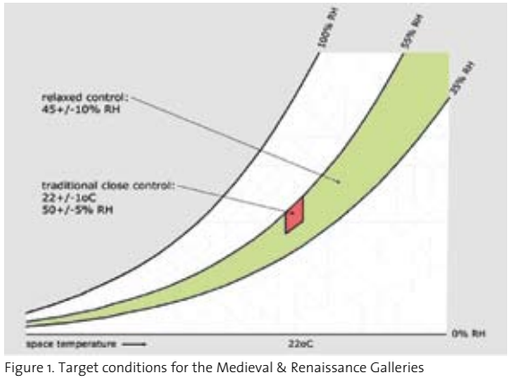


Figure 1. Target conditions for the Medieval & Renaissance Galleries

The target conditions (Figure 1) illustrates the range of thermodynamic conditions (shown on a psychrometric chart) permitted by the V&A environmental guidelines for conservation in the project and compares them with a more traditional mechanical air-conditioning system (with a control band of 22°C ±1°C and 50% ±5%RH). As can be seen, there is a far wider range of conditions permitted by the approach adopted for the project.

The internal environment of the galleries is subject to many constantly changing influences including, amongst others, internal loads generated by visitors, heat released by electric lighting, infiltration of outside air through the building fabric, and external temperature and humidity variations conducted and convected into the interior. The design strategy developed for stabilising the RH environment involves exploiting the external air condition together with the ventilation and heating of the interior. Examples are given below describing how this works in practice. Reference is made to Figure 2, which illustrates the environmental system behaviour depending on interior and exterior conditions (again using a psychrometric chart).

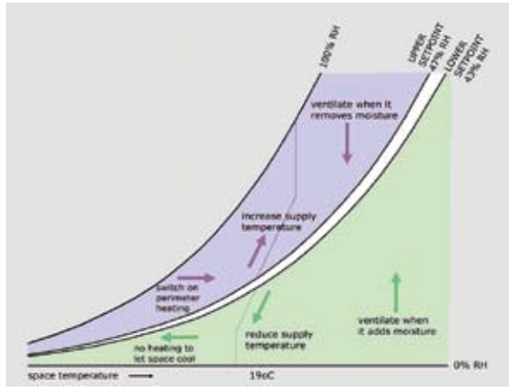


Figure 2. Control strategy to stabilise the RH environment

'Set points' are included here that govern the system behaviour: the upper and lower set points are tight control targets for the environmental control system that allow it to react before the upper and lower limits are reached.

Case 1: Internal RH above the upper RH set point. When the internal RH is above the upper set point (47%) the system aims to increase the temperature and lower the moisture content in order to bring the RH back to within the set points. Perimeter heating may be switched on to increase temperature and so lower RH. Air is supplied at a set point of 19°C initially with the set point increased as RH rises, note that, since there is no mechanical cooling of outside air, it will be supplied at whichever is greater of the set point or the outside air temperatures. To lower the moisture content the ventilation system is only switched on when the external moisture content is less than the internal moisture content.

Case 2: Internal RH above the upper RH set point. When the internal RH is below the lower set point (43%) the system operates in reverse and aims to reduce the temperature and increase the moisture content to bring the RH back to within the set points. Ventilation is only run when the external moisture content is higher than the internal moisture content. Perimeter heating is switched off and air is supplied at a set point of 19°C initially with the set point reduced as the RH falls.

To verify this control strategy, detailed analysis was carried out to assess the conditions that would occur in the galleries throughout the year and assess the degree of control that would be achieved. IES Virtual Environment dynamic thermal analysis software was used and in particular the Apache Simulation module. The program performs a detailed analysis of heat transfer and humidity processes and includes the effects of heat storage within the thermal mass of the building. The analysis used the CIBSE DSY weather data set for London which gives typical hourly values for temperature, moisture content and other climate factors corresponding with a hot summer.

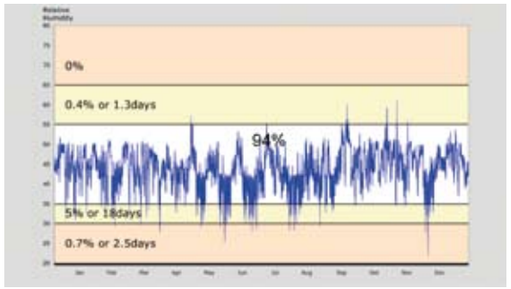


Figure 3. Annual RH level results for one year within the gallery spaces

The RH control was found to be very effective with the gallery spaces within the target band for more than 94% of the year (Figure 3). This performance is comparable with what would typically be achieved by a traditional close control mechanical air-conditioning system and, in terms of time spent outside of the desired control band, represents a very good level of control. Extremely low and high RH levels are almost completely avoided with only around 0.7% of the time below 30% RH and no periods above 65%.

In terms of occupant comfort the control strategy does lead to hot and cold periods which could be considered uncomfortable in a conventional space. However, for around 68% of the time, conditions are maintained at what would generally be considered comfortable temperature levels.

Tests carried out with an alternative weather file, the CIBSE Test Reference Year, achieved even better results with 97% of the time between 35% and 55% RH.

The analysis work performed also, crucially, allowed the stability of RH to be investigated in detail. Results from the analysis showed that there would be a significant number (around 29%) of twenty-four hour periods where the RH change is greater than 10%, however it also showed that periods with RH changes greater than 20% would be rare (around 1% of all twenty-four hour periods). This level of performance was accepted by the V&A. In fact, the performance in practice is expected to improve on this since moisture storage and exchanges with the building fabric, which were not part of the dynamic thermal modelling results (they were separately studied by other means), will act to moderate these variations.

Removing air-conditioning, particularly cooling and humidification systems, from the project gives a significant reduction in energy use (around 30%) when compared with a traditional close controlled mechanical air-conditioning system (Figure 4).

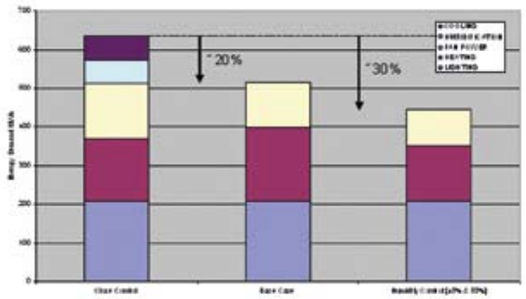


Figure 4. Energy savings achieved by passive approach to environment

In conclusion, the passive approach developed provides a level of control compatible with the conservation requirements of the project, it requires less capital investment in terms of mechanical equipment and leads to reductions in energy usage, running costs and carbon dioxide emissions of the galleries.

V&A Conservation Journal No.58

What's the difference? Climate comparisons for the Medieval & Renaissance Galleries

Boris Pretzel
Materials Scientist, Science Section

For a prestigious and ambitious development such as the Medieval & Renaissance Galleries, the final appearance of the objects on display is a major driver for the successful delivery of the project. However, the act of displaying artefacts inevitably impacts on their preservation. Understanding the interaction between collections and their environments is an essential element in determining display strategies that adequately balance the needs of current visitors (in terms of the ability to see, enjoy, and understand the exhibits) with long-term preservation issues for the artefacts. This article describes a new analytical approach developed at the V&A to allow gallery climates quantitatively to be assessed in terms of the hazards they pose to artefacts. The approach was developed in response to the changing environmental decisions being made during the M&R project and examples of the analysis on climate predictions for galleries within the scheme are presented here.

In keeping with current trends, one of the intentions for these galleries was to place as much of the collections as possible on open display. A double-height gallery in the centre of the development houses environmentally robust artefacts, compatible with daylight illumination and not requiring undue attention to the climate. More delicate objects, including works on parchment, manuscripts, tapestries, polychromed wood, textiles and carpets, are housed mainly in the surrounding perimeter galleries.

With increasing emphasis being placed on energy efficiency and pressure to reduce overall costs, the initial plan to air-condition the perimeter galleries was rejected and more sustainable approaches for providing suitable climates were sought (the scheme finally chosen is described in a separate article by Bingham and Walker in this journal).

Abandoning reliance on air-conditioning is not of itself a revolutionary concept. The past two decades have seen considerable developments in our understanding of the interactions of museum collections with their climates. Vague suggestions of how objects might be affected have been replaced by sophisticated mechanical models to determine their response. Previous spirals of specifying ever tighter ranges of temperature and humidity 'acceptable' for objects on display, based to large degree on the limits of what might (theoretically) be achieved (with ever more sophisticated and expensive control equipment) coupled with an uncertainty about the long-term effects of all but quite large fluctuations, have been shown to be of limited benefit to the majority of artefacts. The resilience of collections to moderate fluctuations, together with a realisation that very tight performance specifications are very difficult, if not impossible, to achieve,[1] has led to more relaxed and realistic specifications being accepted by many institutions. Indeed, the V&A's Environmental Policy, published in 1991, already contained quite pragmatic climate specifications, with relatively broad ranges for temperatures and humidity (18 to 25°C, 40 to 65%RH).

Although the move away from air-conditioning is not out of keeping with other galleries at the V&A, when combined with the emphasis for objects on open display it inevitably influences the climates to which these objects are subjected. This begs the question of how to predict the consequences of these decisions on artefacts, and, more broadly, how to predict the risks to artefacts posed by different climates.

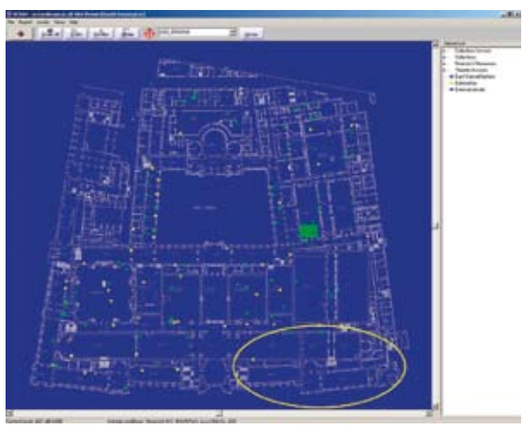


Figure 1. OCEAN: V&A South Kensington ground floor. Sensor positions are indicated by the coloured square icons (the colour representing current climate status). Medieval & Renaissance Galleries lie within the yellow ellipse

In 2003, the Museum embarked on a four year project to develop and deploy an estate-wide climate monitoring system (Object Centred Environmental Analysis Network – OCEAN).[2] The system (Figure 1) was first deployed in the south east quadrant of the V&A. By 2006, the time when decisions on the future of the air-conditioning for the Medieval & Renaissance perimeter galleries were being considered, three years of climate data already existed for these spaces. These data formed the starting point for developing a risk-based approach to the analysis of gallery climates in terms of artefact preservation.

Figure 2 shows data for one year in traditional time series plots for two galleries within the Medieval & Renaissance development. One of the galleries (G8) was air-conditioned, whereas the other (G62, one floor above) was not. Such plots allow simple determination of maximum and minimum values of the parameters, and, with practice, even allow estimation of the ranges within which the majority of the data lie. However, they are of little use for determining the relative merits of the climates in the two galleries. (In the figure, temperature is represented by the red line, plotted against the left axis, whilst RH is represented in blue, plotted against the right axis. The range of temperatures in the two galleries is approximately equal – 16 to 26 °C – but the RH spread is slightly larger in the air-conditioned space – 20 to 74%RH versus 21 to 65%RH.)

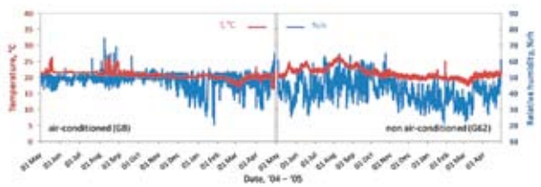


Figure 2. Traditional times series plots for one year for an air-conditioned (left) and a non air-conditioned gallery (right)

Figure 3 shows the same data, rearranged and plotted in the temperature – relative humidity (RH) plane, with the colours representing the proportion of the data at any given temperature and RH. The air-conditioned and the non air-conditioned spaces are now clearly distinguishable with the air-conditioned gallery climate occupying a significantly smaller area that the unconditioned gallery climate. Such graphs are well suited for representing climate distributions when considering relative thermodynamic permanence. For artefacts entirely insensitive to fluctuations, this determines the merit of different climates.[3] However, for most artefacts, the thermodynamic stability (i.e. the rate of deleterious reactions) is of only secondary importance as mechanical damage dominates their climate induced decay.

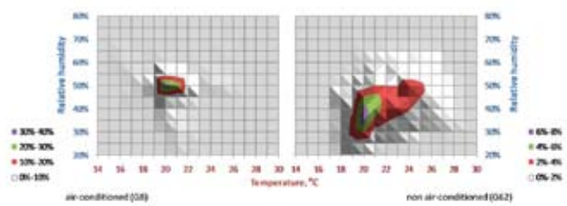


Figure 3. Climate footprint plots showing the same data as Figure 2

Stresses are induced in artefacts as a result of their expansion or contraction, relative to some constraint, as they respond to changes in climate. Generally, such dimensional changes will either be small or will be dominated by the response to changes in relative humidity. It is rare for mechanical damage to be due solely to moderate fluctuations in temperature. Therefore only fluctuations in RH need in general to be considered for predicting risk of damage.

It takes time for materials to regain respond when the local RH changes. An increase in RH, for instance, will cause wood to expand but thin layers of material (such as wood inlay or veneer) will equilibrate to the change in a matter perhaps of hours whilst a solid piece of wood might take many days or even weeks to respond fully. The response of artefacts to changes

in RH will therefore depend on both the magnitude and the duration of the changes. Even quite large fluctuations in RH will have only minimal impact if they occur over periods too short for a significant response. To take account of the many possible different rates of response, the full analysis considers fluctuation periods ranging from 24 hours to one month.

Figure 4 shows the output from this stress field analysis. In this chart, green areas represent the times for which induced stress fluctuations remain moderate and safe (very small risk of damage). Orange regions represent tolerable but not entirely safe stresses (small to moderate risk of damage in time) and red areas represent unsafe induced stresses (high risk of damage). Bars are overlaid with a red lozenge indicating the maximum value of each of the fluctuations (plotted against the secondary y-axis). The fluctuation periods are indicated on the abscissa. The chart also indicates incidences of excessively high RH (>75%, risking of mould and fungal growth). Using this analysis, climates can be distinguished in terms of the risks posed to collections merely by comparing the proportions of unsafe fluctuations. For well-defined collections, this comparison need consider results only for the fluctuation period closest to their response rate. For less well-defined collections or collections with different rates of response, the ratios for each of the fluctuation periods will need to be combined to give a single figure of merit.

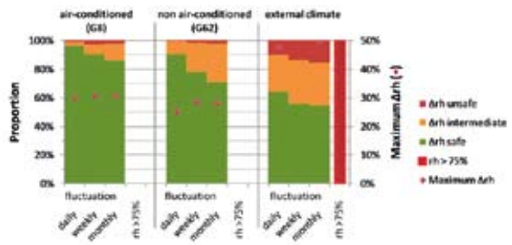


Figure 4. Climate traffic lights for assessing daily, weekly and monthly RH fluctuations for the data as in Figure 2, together with the external climate

As a next step in developing the analysis, extreme value theory approaches have been adapted and applied to fluctuation distributions precisely to quantify probabilities of exceeding critical fluctuation magnitudes. However, the mathematics used in this approach were developed to predict, amongst other things, risks in financial markets; given the recent worldwide economic turmoil, it would perhaps be prudent to verify more fully the appropriateness of this approach before disseminating it further...

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V&A Conservation Journal No.58

A method statement for the Medieval & Renaissance Galleries

Lisa Wagner, Sculpture Conservator
Phil James, Museum Technician

The installation of 12 wall-mounted, middle to large-scale monuments and architectural features made of stone, stucco, and terracotta in the two largest rooms of the new Medieval & Renaissance Galleries was, in its dimensions and timescale of 14 months for completion, a project unprecedented in the history of the V&A. Key to this was the close collaboration between Technical Services and Sculpture Conservation developed during the decant of the majority of these objects between 2005 and 2007.[1] The experiences gained in the de-installation highlighted areas that needed further analysis and fed into the production of a comprehensive risk assessment and method statement to support the planning and logistics of a controlled installation process as well as to structure and manage a safe work environment.

Under the Museum's Health & Safety (H&S) policy a risk assessment must be carried out prior to works commencing. This reflects legal obligations concerning safety of staff at work. In such a large project, involving similar, different and related activities taking place at the same time, it was vital to consider the wider context of the work and identify risks, which could arise. A workable method statement concerning work at this scale, however, has to respond to a number of additional requirements, which are also of relevance when considering H&S, and also cover important aspects of work and people coordination:

- Manpower
- Material and equipment needs
- Pace of work and rest periods
- Need for external contractors' work
- Installation requirements
- Conservation needs
- Training needs
- Installation process fitting in with other demands on staff and equipment elsewhere in the Museum

An underlying work approach is reflected in the method statement. Two teams, ideally comprising a maximum of two conservators and two technicians, each would work simultaneously in the gallery space building two monuments. Realistically it would sometimes be necessary to alter the team numbers as conditions changed. The two teams would carry out installation work while remaining conservators would prepare further objects for gallery installation in the conservation studio. Every two to four weeks, depending on the physical strain of the installation task, the teams would rotate, bringing the installation teams back to the studio allowing two new teams continue the installation.

The rotation system was designed as a key element in reducing physical strain, exhaustion and stress. At the same time it ensured that two installation projects could be carried out continuously, allowing free conservators and technicians to be employed to work elsewhere in the Museum or in the conservation studio. The method statement, a pre-agreed overall installation approach, as well as a logbook for each installed monument, ensured continuity of the installation method as they act as reference documents for changing teams.

A large tool cage was equipped for each of the two running installation projects with a carefully chosen set of tools. The set of equipment has to be re-filled and put in order before each hand-over to a new team to allow for an efficient work-flow. This standard set of equipment was set apart from special equipment needs, particularly fork lifts, gantry, hoists, and scaffold specifications, as these would require scheduling-in for availability, hiring and trained staff to operate.

Highlighting periods when external contractors were needed to erect or change steel scaffolds, to build fabric supports or to insert steel mounts, or, when rest phases needed to be factored in, to allow mortars to set before putting on more weight, are an important part of the method statement as it helped managers to arrange the installation schedule and link with contractors.

Overall, a comprehensive risk assessment and method statement should ensure thorough understanding of the work and the risks involved. It should also provide information which forms the basis for deciding necessary expenditure and, importantly, demonstrates to the Museum that its obligations are being met and that the installation will be managed responsibly. It is particularly important that the Museum's Health & Safety advisors are involved since those preparing the document may not be aware of all the health and safety issues relevant to the project. During the installation process constant monitoring of work should be performed by all persons involved to ensure that they conform to the appropriate health and safety procedures. Therefore, it is imperative to phrase and detail the method statement so that it can be understood by everyone.

Analysing all the requirements with regard to the situation in the Medieval & Renaissance Galleries, provided information which was developed by Sculpture Conservation into a risk assessment and method statement template for major built-in objects that could be produced for each object with little change. The major difference in each case was object-specific handling, material needs and resources. The risks to personnel performing the practical work, others, and risks to objects and Museum conditions, largely remained the same. This consistency in the template allowed the main focus of preparation to be directed at identifying and devising methods for each object installation.

Creating a clear document and applying it to works, raised awareness in people, showed where change was necessary, and brought risk and task analysis to the forefront leading to efficient and cost-effective preparation and work performance while allowing effective responses to changing needs and conditions. It has demonstrated that a good understanding of the work environment and conditions (such as the need for team rotation), the impact of time schedules of external contractors, the provision of accessible refreshment, the impact of dust creation, and learning about health and safety implications (such as hand-arm vibration from drills leading to far reduced exposure limits) cannot be underestimated. The development and application of the risk assessment and method statement has been a very useful tool in aiding the management of these different aspects in the installation of large-scale monuments for the Medieval & Renaissance Galleries.

It is hoped that the method statement will support the work of technicians and conservators involved in similar projects and is available for download in the on-line issue of this journal.[2] It should be noted that the template needs to be adjusted if it is applied to any task and after careful assessment of risks. Health & Safety regulations do change and are specific to each country. The V&A and its staff cannot be held responsible for the consequences of using or adapting the method statement template.

References

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Medieval & Renaissance Galleries conservation progress logs

Fiona Campbell
Information Systems Manager

One of the functions of the Conservation Administration Section is to generate statistical information for the Department. The Medieval & Renaissance Galleries is the largest project that the department has delivered since the British Galleries. For the past five years it has involved virtually all the conservators and scientist working in all eleven studios; over 70 members of staff. The Medieval and Renaissance Galleries Steering Group needed to be assured that progress on this flagship project was not compromised by the numerous other activities (exhibitions, loans etc) that were running concurrently. Mid-way through the project, a way of presenting this information in a readily understandable monthly Conservation progress report had to be devised. These were generated using hours recorded in Microsoft® Excel 2002 format. To try to give the reports a little flexibility and to set them up for possible use in future projects, we decided to also experiment with generating reports in Microsoft® Project Professional 2002.

The information for the reports was drawn from two existing sources of management information, the CSD Activity Logs and the conservation recording system Concise. Initially the M&R Progress Logs were devised to show progress over time by objects (from Concise) and hours (from the Activity Logs), against a completion date of October 2009. An arbitrary date of October 2006 was assigned for the commencement of the project, though some work had already begun before that date. The Progress Logs spreadsheets were then successfully used to generate charts with trend lines, however, the graphs did not show much variation monthly. This was investigated and highlighted limitations in the data available.

The object list for the Medieval & Renaissance Galleries has been repeatedly modified over the course of the project to reflect changes to the galleries' design. As a result, the conservation estimates were also revised as some objects were more complex to treat than originally anticipated. The original estimates were therefore inaccurate.

Activity Logs have been used in the Conservation Department since 2006 (Figure 1). The Activity Logs capture the Department's time spent on the full range of potential Museum activities by month. The spreadsheets are simple and many of the headings are generic, e.g. 'loans' or 'scholarship' which does not provide for much flexibility when completing them. The collated information is subsequently used to determine the accuracy of original project time-estimates and helps in the forecasting and allocation of staff resources to future projects. Practical conservation, recorded by project, is not separated in these logs from activities such as assessment, project meetings, advisory work and preventative conservation.

Treatment information is recorded on the bespoke conservation database, Concise, which includes both estimated and actual time for work on each object. However, there are limitations on the depth of information that can be drawn from this system. There are at least two possible fields in Concise used to record treatment time. A very complicated data-filter consequently needs to be applied to retrieve statistics. Using information from Concise to report on progress was found to be inaccurate, particularly for objects which required lengthy conservation time (e.g. the reconstruction of large architectural fragments involving several members of staff) as hours are not entered into Concise until the object is completed.

The next step was to determine if, by using an alternative system, more accurate feedback could be provided and more accurate data recording enabled. Assisted extensively by an agency staff member, Sean Clements, a project manager of considerable experience and with input from Charlotte Hubbard, Head Sculpture Conservator, the Admin section retrospectively converted the data in the Conservation Progress Logs to MS Project. This proved to be an ideal learning resource for the section, allowing us to develop our skills in a previously unfamiliar piece of software.

V&A Conservation Journal No.58

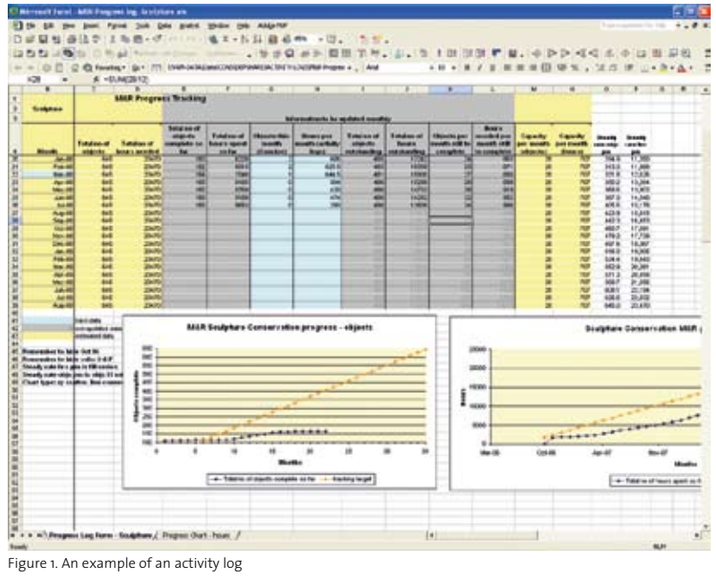


Figure 1. An example of an activity log

Whilst MS Project is ideally suited to resource/time forecasting before the start of a project, a great many parameter variations had to be tested to enable accurate conversion of data mid-project. The biggest hurdle was the fact that the version of MS Project being used did not seem to allow both retrospective 'Start Date' and task 'Duration' and this had to be entered manually after harvesting the data from Excel spreadsheets. Manual entry randomly affects the 'Completion Date', and, therefore both time-recording and cost-tracking reports. The 'tasks' (objects) could not be assigned in advance to 'resources' (people) as object lists continued to be modified and staff were allocated to them as the project progressed (not at the beginning). If tasks are not allocated the data does not generate 'predecessors', leaving progress estimates against milestones impossible to generate. Estimating treatment time in the MS Project template, using data initially recorded in Concise, proved impossible as inaccuracies caused the 'Finish Date' to be extended beyond October 2009.

A combination of these factors ultimately meant that Gantt charts and reports from MS Project were not very useful. The process of converting the data however, gave a very clear insight into potentially more accurate project planning across the V&A. It was impressive that MS Project was able to cope with retrospective data of this quality and it was satisfying to have been able to set up a template that could be adapted to smaller, self-contained projects, perhaps, for example, large loans. With finalised object lists supplied sufficiently far in advance to allow individual objects to be pre-assigned to individual conservators, MS Project may be possible to use for accurate conservation planning.

Acknowledgements
I would like to acknowledge the invaluable input of Sean Clements for his three weeks continuous work in converting the Concise and Excel data into a recognisable MS Project template and his authorship of a user manual for this purpose.

New mounts for the headless stone boy and his brother

Matthew Rose
Museum Technician, Design and Outsourcing

The re-installation of the sixteenth-century dormer window from Château de Montal (531-1905) (Figure 1), an imposing 8m tall and 3.5m wide exhibit, in the Paul and Jill Ruddock Gallery, The Renaissance City, required new mounts and fixing solutions. These were provided by the Museum's Technical Services, Design and Outsourcing mounts workshop.

Perched in a shallow niche atop the highest ledge of the Château window stands a headless stone figure just a metre tall (Figure 2). Under one arm he clutches a skull carried as nonchalantly as a football. Somehow he seems more curiously comical than macabre. Is that head he carries his own? The figure gestures close to his chest as much to answer, 'Oh, quite possibly'. His costume could almost be that of an ancient Roman with its skirt and puff sleeves. During the dismantling of the entire dormer window by the V&A Sculpture Conservation team in the summer of 2007, it became evident that the headless figure was separated from his feet. His dressy shin guards hid well the trauma of a clean break through his left ankle and the more shattered right shin and crumbled calf. The areas of loss had a concrete filler make-up. To prevent the figure toppling forward a simple 30cm bar bracket had been embedded in the lime mortar of the niche behind and fixed directly in a hole high between the shoulder blades. This was held with a pin through the hollow of the neck.

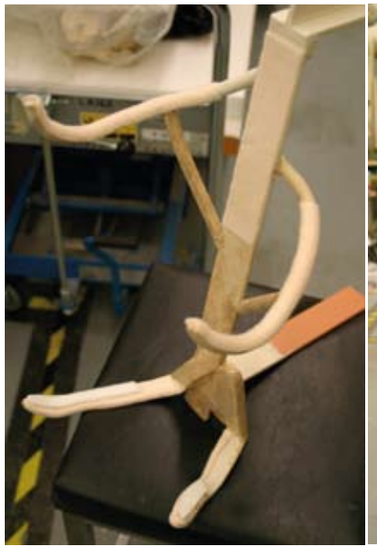
The size and condition of the existing hole did not offer a sufficiently strong point by which to secure the heavy statue; a new solution to support and secure this figure on his ledge was needed. In discussion with Lisa Wagner, Sculpture Conservator, it was established that the new mount should suspend the entire weight of the torso as the crumbled lower legs and the slanted nature of the break meant it was no longer appropriate for the feet to take any significant weight. To facilitate the process, it was suspended from a gantry in the Sculpture Conservation Studio and a design was devised for a substantial but discreet support harness that would suspend the weight of the torso from the back of his niche. The statue was transferred to the mounts workshops to better enable the fitting of the mount.

(Photography by Lisa Wagner)

Figure 1. Dormer window (531-1905), after treatment

(Photography by Matthew Rose)

Figure 2. Headless stone figure during installation



(Photography by John Dowling)

Figure 3. Detail of break across ankles and support offered by mount

Figure 4. Finished mount for headless figure

Figure 5. Trial run of mount for headless figure

The design consisted of four prongs welded to a back support that ran the length of his spine, with steel bars of 15mm diameter hooked through the underarms taking the weight and preventing the forward tilt (Figure 3). Additional load bearing and stability would be provided by 6mm thick flat bars fitting beneath the hem of his dress at either side.

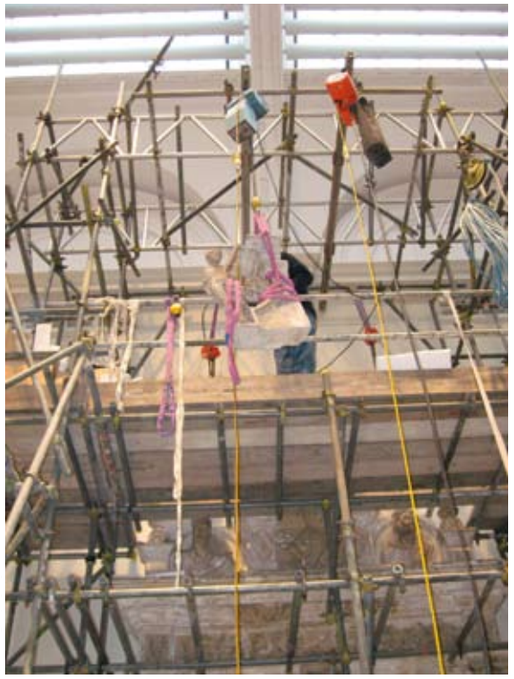
In total the mount consisted of 10 separate pieces of steel welded together. Each section of this mount was pre-cut, shaped, bent and fashioned to fit as much as possible prior to any welding taking place. From the outset, the most significant difficulty was to distribute the considerable weight equally on all four hooks of the harness and ensure the torso would balance suspended at the correct angle. The other difficulty was devising a way to anchor the harness securely into the niche. The solution was to weld two steel bars, at right angles, onto the back of the mount. These slot into the lime mortar joins between the blocks of stone. The distance between these bars corresponds exactly to the height of the principle block directly behind the figure. The flat bar at the bottom of the mount fitted between the two stones level with the hem of the dress. The top bar, a T-section, would rest on top of the stone, its tip against the wall. Onto that stone were placed two further blocks that sandwiched neatly either side of the T-section. As an additional safety measure, the tip of this bar was fitted with two long, threaded bolts to prevent the mount withdrawing itself from the cemented join.

The welding of so many separate pieces at such a precise alignment was to prove the real challenge. Here the skills of John Dowling, Museum Technician, were invaluable in the construction of this mount. On completion, a test run prior to installation was staged in the workshops with the mount clamped to a bench (Figures 4 and 5) to demonstrate the effectiveness of its design. Once successful, the mount was undercoated with rust prevention, painted to blend in with the stone and Plastazote® padding added to load bearing areas (see Figure 3).

A mounts solution was also required for another Dormer window character, a stone boy clinging precariously like a monkey onto the far right side of the edifice. Unlike his twin, this statue had old breakage and cracks in the arm, his ankles and the support column jutting from his side. Two stabilizing support armatures were devised; one hooked under his armpit and gripped from the collar bone, another held from under the stump of his left elbow and then under his side support column (Figure 6). This mount was designed in pieces that could be assembled and bolted together around the figure in situ rather than a single-welded armature.

(Photography by Matthew Rose)

Figure 6. Stone figure on right of window during installation



(Photography by Matthew Rose)

Figure 7. Installation of the dormer window, raising stone figure into position

In February 2009, the window was finally installed in the Paul and Jill Ruddock Gallery (Figure 7). The separate section of the headless figure's feet was initially placed unfixed at the bottom of the niche before the figure was lifted into his support harness as the angle of the break prevented the feet being fitted after the figure. The feet were then tilted up to match the snapped limbs and, after correct alignment, lime mortared into position. When viewed from below, the end result is that the headless boy's mount is a quite unobtrusive feature of the exhibit. The other figure's distance from the wall meant his armature is visible from some angles. However, both these mounts were effective solutions for difficult statues. They also afforded a great opportunity for the V&A Mounts Making team to develop its metalwork skills and demonstrate the versatility of its in-house mounts production.

Sir Paul Pindar's house on the move again

John Kidd, Senior Technical Project Manager, Momart
Matthew Nation, Director, Taylor Pearce Ltd

In early 2007, Momart and Taylor Pearce Ltd, art handlers and installers, were appointed to record, dismantle, pack and remove to storage the façade of Sir Paul Pindar's house (846-1890) from its position in Gallery 48 so that it could be re-instated in the Simon Sainsbury Gallery of the V&A's new Medieval & Renaissance Galleries.

The façade was installed in Gallery 48 (the old shop area) in 1909. It comprises of a two-storey, ornate timber façade with a projecting central bay. The overall size is approximately 9.5m high by 5.3m wide by 2.4m deep.

Scaffolding had been erected prior to our involvement to allow for a full survey of the structure to be carried out. CgMs Consulting, planning consultants for archaeology and historic buildings, were commissioned by the V&A to produce measured drawings and identify original and non-original parts of the house façade. These drawings, along with our own on-site drawings and digital photos, were used to form the basis for the recording of the façade during the dismantling.

The floor joists, floorboards and the two side projections are not original, along with the window glass and various parts of the external decorative mouldings. The support structure that fixed the façade to the Museum wall is also non-original timber. Metal ties, fixed between the timbers and rear brick wall were also added in 1909 to provide stability to the façade when it was erected in the Museum.

Basic parameters for the dismantling of the façade were set out by the Museum and were as follows:

- The timber façade was to be dismantled into the minimum number of sections that will allow for transport and packing
- Cutting of original materials was not permitted
- Each section, regardless of size, was to be given a unique reference number and annotated onto drawings
- Each element was to have a label securely attached
- The numerous parts were to be packed for transport and storage

(Photography by Matthew Nation)

Figure 1a. Roof boards after removal

The façade was generally dismantled in the following sequence: the false sides, plasterboard ceilings and wooden boards on top were removed to reveal the 1909 support structure beneath (Figure 1a); the surface mounted, non-structural elements (such as windows, cornice, internal panelling, carved timber panels) revealing the bare bones of the original structure and, finally, the structural elements were carefully dismantled piece by piece. As each piece was removed it was numbered, labelled, measured and its location noted on the drawings. The leaded windows had been mounted into the casements with 6mm square beading pinned into position and also wired onto horizontal metal bars screwed into the mullions. The windows were assessed individually for stability and, if considered necessary, low-tack masking tape was used across vulnerable panels to prevent them dropping out during handling. The tape was removed after the window had been lowered to ground level. The windows were placed in a plywood cradle with Plastazote® cushioning and straps, and lowered to the ground using a Genie lift. Once at ground level, the windows were packed vertically into purpose made plywood cases.

(Photography by Matthew Nation)

Figure 1b. Fixing method, reverse of panelling

The carved timber panels beneath each window had been fixed into location on the historic framework using bent over nails as clamps (Figure 1b). These needed to be carefully extracted, bent or cut to release the panels.

(Photography by Matthew Nation)

Figure 2a. Joints and fixings

(Photography by Matthew Nation)

Figure 2b. Bressummer beam removal

With both the windows and carved panels removed, along with all other non-structural coverings such as architraves, the main structure could be dismantled. In order to maintain stability during the dismantling process, temporary supports were needed on some of the structure; this was achieved by using the scaffold and bracing the timber between poles with Plastazote softening. Scaffolders were on-call throughout the dismantling to adapt the scaffolding as required.

The original mortice and tenon joints on the large structural timbers were still intact and most of them fitted together as they would have originally. New timber pegs had been employed in 1909 to secure the original mortice and tenon joints and, in addition, there were numerous screws, nails and surface-mounted metal brackets used to strengthen the joints (Figure 2a). The large timbers were lifted using block and tackles whilst the smaller elements were light enough to be lifted manually. Timbers were lowered to ground floor with an electric hoist, either by slinging the piece directly or placing smaller parts onto a pallet base. Working from the top down i.e. starting with the second floor, the framework was removed in the following sequence:

The metal ties were removed to free the structure from the gallery wall. The long bressummer beam, spanning the entire width at the rear of the frame was released by removing wooden pegs and all other fixings at the joints. It could then be lifted clear and lowered to ground level (Figure 2b). The outer vertical timbers could then be freed, and by carefully tilting them away from the framework at the top, the short horizontal elements could be carefully removed (Figure 3a). With this framework removed from either side, it left the central, three-windowed semicircular bay standing on its own, enabling this very large part of the structure to be removed as a complete unit due to it still retaining the original joints that had not been previously disturbed. In order to minimise any movement between the original timbers and to provide a structure for lifting the bay, a timber framework was constructed around the entire bay. This was then lifted clear and lowered to ground level (Figure 3b). With the second floor removed, the first floor could then be dismantled in the same manner until the whole façade had been removed from the Museum wall. The façade is re-constructed in a slightly different manner to the 1909 installation. The aim being to remove as much non-original material from the façade as possible. Contemporary steelwork was designed to give structural support but with as little interference of the original timbers as possible. The house front is suspended from a wall and 'hangs in space', giving a much greater sense of a fragmentary façade, and providing an exciting display of this magnificent timber structure.

(Photography by Matthew Nation)

Figure 3a. Vertical timber being removed

(Photography by Matthew Nation)

Figure 3b. Bay being lowered

Work in progress: The development of the Medieval & Renaissance Galleries

(Photography by Sculpture Conservation Studio)

(Photography by Mathew Nation)

(Photography by Anne Bancroft)

(Photography by V&A Photographic Studio)

(Photography by V&A Photographic Studio)

(Photography by Fi Jordan)

(Photography by Sculpture Conservation Studio)

(Photography by V&A Photographic Studio)


(Photography by V&A Photographic Studio)


(Photography by Zoe Ferguson)


(Photography by V&A Photographic Studio)


(Photography by Sculpture Conservation Studio)


(Photography by V&A Photographic Studio)


(Photography by Louise Egan)


(Photography by Rachel Turnbull)


(Photography by V&A Photographic Studio)


(Photography by V&A Photographic Studio)


(Photography by V&A Photographic Studio)


(Photography by V&A Photographic Studio)

Loss compensation at the first floor interior panelling: Sir Paul Pindar's house front

Carola Schueller
Furniture Conservator


(Photography by Carola Schueller)

Figure 1 (a & b). Front and back of interior panel No. 39 with losses at the lower horizontal rail and lower corner joints with the softwood repair screwed to back

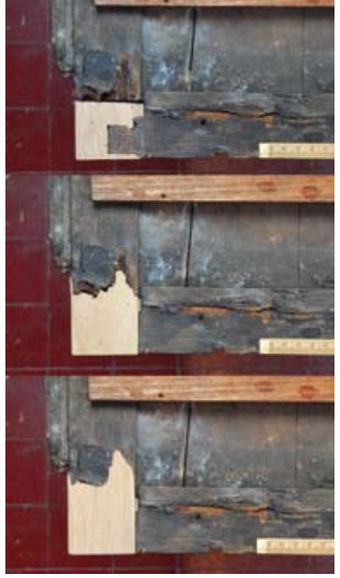
The façade of Sir Paul Pindar's house (846-1890) is a three-storey wooden house front built in 1600 and is one of the very few timber buildings to have survived the Great Fire of London in 1666. Originally located in Bishopsgate Without, it was dismantled and presented to the Museum in 1890 when Liverpool Street Station was enlarged. The façade was first reconstructed in what is now one of the V&A's Cast Courts prior to being moved, in 1909, to Gallery 48, the old shop area by the main entrance of the Museum. In early 2007, the front was dismantled and most components were brought to the Conservation Studios for examination and treatment.

The entire wooden structure is made of oak. Structural timbers at the outside employ mortise and tenon joints with big wooden pegs to secure the joints. The panels at the outside are nailed to the timber frames. The inside panelling is constructed as frames with mortise and tenon joints, the panels set in a groove with pegs to secure the joints. No evidence of original glue was found which enabled the house and the individual panels to be dismantled relatively easily by removing the pegs.

Once dismantled the individual panels and frames from the exterior and interior, together with cornices and mouldings, were examined and the damage was recorded. Major problems to be addressed during conservation were the structural degradation of the wood due to weathering, former woodworm infestation, mould and mildew. These factors combined had resulted in loose joints along with fractured and missing timber, so treatment was aimed at stabilizing each individual piece structurally to allow all components to be handled and reassembled safely. The unstable wood required consolidation and insertion of new material to compensate for losses of fragile areas. The display incorporates a supporting steel structure at each floor of the façade.

Examination revealed that the interior oak panelling at the first floor was unstable and required specific treatment due to losses at the joints caused by standing water (Figure 1a). Through the endgrain of upright frame members, water had reached far into the timber causing it to develop localized growth of mould and mildew, despite the oak's natural resistance to biological attack owing to the presence of tannins. Stress and strain on the degraded wood had subsequently resulted in cracks, fractures and the loss of original material. Attempts were previously made to resolve the structural problems either when the front was installed in 1890, or when moved in 1909. Supporting softwood was nailed to the frames and panels, the fragile joints were left exposed (Figure 1b). These losses made it possible to examine the mortise-and-tenon dimensions, tool marks of chisels and saws and manufacturing details (such as the chamfered edges of the tenon which helped the tenon to slide alongside the joint shoulders into the mortise during assembling) adding to our understanding of sixteenth and seventeenth-century woodworking techniques.

To regain structural stability and to protect the damaged original substrate adjacent to the area of losses, modern, wooden fills were needed. Two conservation principles were to be considered: no original material should be sacrificed, and, whatever material is added to the original has to be easily removable in the future. The options for replacement materials are wood, modern resinous putties or a mixture of both fitted to the shape of the loss and then adhered to the original.[1] Loss compensation



(Photography by Carola Schueller)

Figure 2. Layered loss compensation at the proper left lower frame joint at an interior panelling

(Photography by Carola Schueller)

Figure 3. Loss compensation consisting of the fitted oak replacement and Araldite epoxy resin

in this case would have disguised the original joint and obscured the early seventeenth-century mortise and tenon joint. Hence, it was agreed that loss compensation should be de-mountable.

The first step of the treatment involved consolidating fragile areas around the losses. The acrylic resin Paraloid® B72 was used at a 10% and 15% concentration (weight/volume) in a solvent mixture of acetone and ethanol (3:1). Fast evaporating solvents like acetone and ethanol do not support deep penetration into the wooden structure;2 since the deterioration was mainly superficial, the consolidant-solvent-mixture gave adequate strength for further treatment and handling. The choice of non-toxic solvents also allows for an application in the galleries for larger parts which could not be moved to the conservation studios. The liquid resin was partly injected into the cavities with syringes and partly brushed onto the wood. The 10% solution was used first and then the 15%, both procedures were repeated twice.

Oak was chosen to replace the lost frame members as it matched the original species, grain and figure. Thin and wide strips of oak were prefabricated (3mm, 4mm and 5mm thick with a width of 60mm) and then blocked in layers to the areas of loss. Some replacements were in two parts enclosing surviving tenons (Figure 2): the replacement face was screwed to the back part of the fill. To match the layers to the original, the outline of the loss was transcribed onto transparent tape that was then adhered to the oak strips. The wood was cut by hand with a jeweller's saw following this outline and the individual layers glued together with Canadian cold setting fish glue. For the inner areas of the loss, a tight fit was unnecessary for the protection of the original joint and for the stability of the frame. It was only necessary at the topmost surface layers, where in addition to the oak strips the two component epoxy resin Araldite®Av1253 was used.

The Araldite Av1253 epoxy putty was applied to the oak replacement and then brought close to the original wood with a sheet of transparent polyester film Melinex® in-between acting as a separation layer. Once hardened, the replacement was taken off, the polyester film was removed and the top layer glued to the lower layers (Figure 3). The infill fitted exactly into its location, all layers together slide as a whole into the mortise and fit in place. Fragile areas are now consolidated and strengthened with Paraloid B72, a non-intrusive and reversible approach which allows each part to be removed for future examination of the joints. All exposed edges and broken joints were protected and ready for safe reassembling in the Simon Sainsbury Gallery.

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V&A Conservation Journal No.58

Training through collaboration – conservation of the Camaldolese Gradual

Jane Rutherston

Senior Book Conservator

The illuminated musical manuscript (MSL. 5836-1868) was produced in Tuscany, probably Florence, around 1380 for the Camaldolese order (Figure 1). The manuscript measures 559 x 410 x 150mm and is made up of 21 quires, each of four parchment bifolia, sewn onto six alum-tawed bands that had been laced into the 18mm thick wooden boards. The binding is full leather decorated with metal bosses. There is evidence of four lost straps, two at the fore-edge and one at the head and tail. The manuscript had been rebound at least once as evidenced by the remains of secondary spine leather on the boards.

(Photography by V&A Photographic Studio)

Figure 1. Camaldolese Gradual (MSL.5836-1868) before conservation

The manuscript seems to have been intact on arrival at the South Kensington Museum in 1865 but had since deteriorated, probably due to the weight of the boards and a weak binding structure, requiring full conservation and re-binding. When it was identified for inclusion in the Medieval & Renaissance Galleries it immediately threw up the question of how best to conserve it and whether we had the expertise; the collection at the V&A contains few illuminated manuscripts on parchment, particularly of this size, and the book conservators have limited experience of working with such bindings.

Sound binding techniques would be vital in ensuring a structure strong enough to support the heavy boards to maximise the longevity of the proposed conservation. The choice of sewing, spine linings and endpapers would all be important in achieving optimum opening with good board attachment and leverage. The two options were to send it out to be conserved or to take a collaborative approach by seeking an experienced consultant to come and work alongside a conservator. It was agreed with the Head of Conservation that the latter would provide a unique training opportunity. Christopher Clarkson, independent conservator and Conservation Consultant to the Bodleian Library, Hereford Cathedral Mappa Mundi & Chained Library, The Wordsworth Trust and Dove Cottage, was approached as he had both the necessary skills and experience in teaching.

After a meeting with Chris and a day spent looking at the manuscript, a plan and schedule of work was drawn up comprising two phases. The first phase would be undertaken by the book conservator in preparation for phase two when Chris would come to the studio for a week to undertake the binding. As part of phase one various colleagues, from the V&A and outside, were consulted for their expertise. This included analysis of pigments by Lucia Burgio, Senior Object Analysis Scientist, and the removal of specific metal furniture on the boards by Sophia Wills, Senior Metals Conservator. The X-radiography of boards was undertaken by Janet Ambers and the identification of wood by Caroline Cartwright, both museum scientists in the Department of Conservation and Scientific Research, the British Museum. The pulling of the manuscript, lifting of board papers, cleaning of leaves, repairs to parchment, consolidation of pigments, digging out of filler in board channels, sourcing of leather and other materials, and documentation was undertaken by the book conservator.

(Photography by Jane Rutherston)

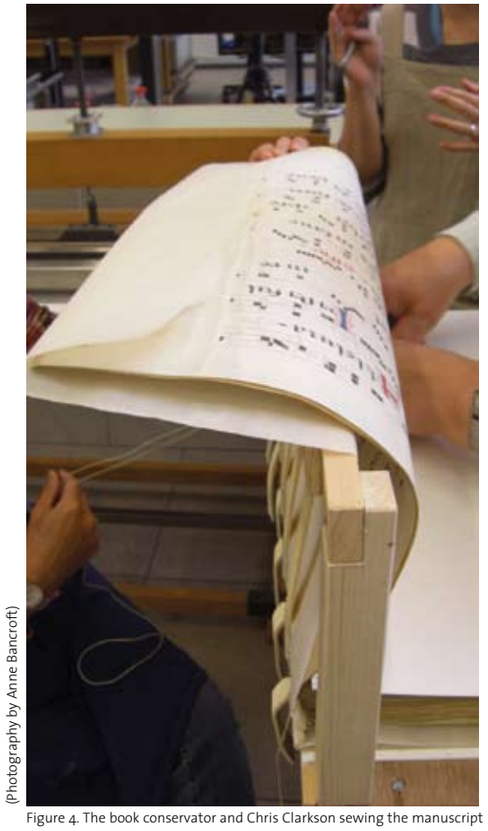
Figure 2. Securing the laced in bands

(Photography by Anne Bancroft)

Figure 3. Forming the concertina guard

Chris came to the studio towards the end of September 2008 to undertake the second phase. The tacks were removed to release original bands and headbands, the channels were cleaned of remaining filler, new endleaves were made up, the manuscript quires (incorporating a concertina guard) and the headbands sewn, the boards laced on and fixed (Figure 2), and the leather dyed. The book conservator was able to assist in many of the procedures (Figures 3 and 4). At all stages Chris would explain the rationale supporting the choice of procedure and explain the methodology to the conservators, allowing photographs and notes to be made as the work progressed. The lining of the spine, covering the spine with new leather and advise on laying down of the new board leaves was completed in February 2009. Throughout the project Rowan Watson, Senior Curator, Word & Image Department, was involved in all decision making processes regarding the re-binding.

This project offered a unique opportunity not only to discover more about the gradual but for the book conservator to broaden her skill base and benefit from Chris's technical expertise and historical knowledge of binding structures. It also illustrated the huge advantage working in the V&A where conservators are able to seek advice and learn new techniques and treatments from colleagues both within and outside the Museum. Even the ability to gain access to different tools and materials to aid their work is a privilege that should not be underestimated.



(Photography by Anne Bancroft)

Figure 4. The book conservator and Chris Clarkson sewing the manuscript

Acknowledgments

I would like to thank Christopher Clarkson, Janet Amber, Caroline Cartwright, Lucia Burgio, Sophia Wills, Rowan Watson and my colleague Anne Bancroft for their kind help on this project, as well as Peter Kelleher and Maike Zimmermann, V&A Photographic Studio, for their patience in videoing and photographing many of the stages of work.

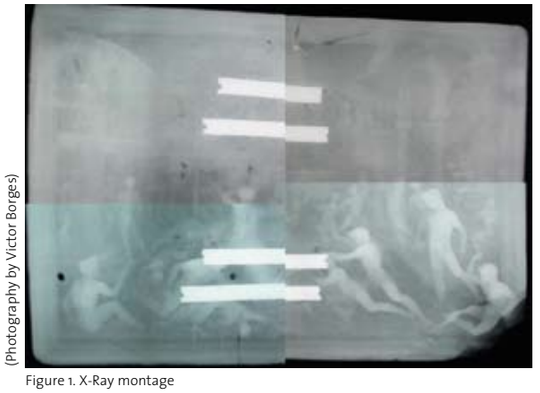
A stucco relief by Francesco di Giorgio Martini: Conservation and technical considerations

Víctor Hugo López Borges

Senior Sculpture Conservator

As part of the V&A's Medieval & Renaissance Galleries Project, a stucco panel (251-1876) by Francesco di Giorgio Martini was treated by Sculpture Conservation. This Sienese relief, dating from about 1474-80, depicts a scene of conflict (possibly Lycurgus and the Maenads), although it has long been described as an Allegory of Discord. The treatment was carried out before the relief was loaned to the National Gallery for the exhibition *Renaissance Siena: Art for a City* in 2007.

The surface and the structure of the panel were assessed under a binocular microscope; an X-ray mapping of the panel (Figure 1) was also carried out. The information collected, together with the historical documentation available, was vital for making a correct diagnosis of the panel's conservation needs. Moreover, it was possible to draw further conclusions regarding the material and technique of manufacture, which are fundamental for a better understanding of the object.



(Photography by Victor Borges)

Figure 1. X-Ray montage

The relief has suffered significant losses, and there are two major breaks that divide the panel into three fragments. These breaks were repaired with plaster of Paris and, in addition, the central break was reinforced from the back with two flat, metal dowels, providing extra structural support.

The first documented evidence of a cast of this relief is a photograph, dated from 1897, found in a *Catalogue of Plaster Casts* by Brucciani & Co. This cast shows the central break suggesting that these repairs were carried out prior to this date.

Before cleaning, the entire surface was obscured mainly by wax deposits, which appeared to have penetrated into the epidermis of the panel. There were also thick, dark deposits of wax located in the recesses and irregularities of the relief (Figure 2). These irregularities were caused by abrasion or by air bubbles formed during the original casting of the panel which now appear as tiny holes. The wax may have been applied to act as a releasing agent to facilitate the removal of the mould made to create the Brucciani casts. It would also have been used to hide imperfections and block voids to ensure a smooth casting. This application was probably carried out by Brucciani when the mould was produced.

After examination, the panel was assessed as structurally stable and therefore did not require any conservation treatment. However, the surface remained extremely dirty and required cleaning. Different techniques were used in order to recover, as much as possible, the original light tone of the stucco, as well as to emphasise the depth of the relief.

Initially the surface dirt was removed by dry cleaning with powdered rubber and rubber erasers of different grades (Figure 3). The wax makes the plaster surface stable and resilient to abrasions that could have otherwise occurred using this mechanical cleaning method.

The second step involved a chemical treatment to remove the thick, dark deposits of wax. White spirit, a non-polar solvent, was chosen in preference to a polar solvent, which would disrupt the gypsum in the stucco. The process, executed under a binocular microscope for more accuracy, involved softening the deposits with the solvent followed by its careful removal with a small scalpel blade. This operation had to be repeated several times and in rotation so the delicate stucco material under the wax would not be disturbed.

(Photography by Victor Borges)

Figure 2. Surfaces darkened by wax deposits

(Photography by Victor Borges)

Figure 3. Dry cleaning in progress

The areas underneath the removed thick deposits were much lighter than the surrounding areas. To even out the tonality of the panel, these areas were retouched with Gamblin Conservation Colours diluted in iso-propanol. These colours can be easily dissolved in low-polarity solvents and are very stable to light exposure.

Under magnification the stucco surface showed irregular particles of gypsum together with impurities, such as clay and soot, all typical characteristics of gypsum plasters produced in traditional kilns. What is more difficult to define is whether we are looking at a traditional stucco or just a traditional gypsum plaster. Further analyses would need to be carried out in the future in order to exclude the presence in the panel of key ingredients of traditional stucco mixtures (such as aggregates like fine sand or marble dust, and additives such as animal glue or resins).[1]

Tool marks and evidence of the texture of clay or wax can clearly be seen on the surface of the stucco, indicating that the very first model of the panel was probably made out of clay or wax.[2] The relief may not have been a direct reproduction of this first model but certainly still carries the impressions made by tools during the modelling process.

There were no evident layers of plaster in the panel and air bubbles were present in areas of high relief. The X-ray images do not reveal any indications that the high relief features, such as heads, were added post casting. All these observations support the conjecture that the whole panel was produced from one single batch of gypsum plaster or stucco without any subsequent work. Therefore it may have been produced with either a piece mould or a flexible mould. These types of moulds would have allowed the creation of the panel in one single batch without the need of adding the high relief elements after the casting. However, the earliest documented reference to flexible moulds made out of animal glue is in Biringuccio's treatise, *De La Pirotechnia*,[3] published in 1540, much later than the manufacture date of the panel.

Finally, the X-ray images indicate the inclusion of a multitude of small air bubbles throughout the panel, which could suggests a quick, slightly careless casting process. Fast mixing and pouring of the plaster increases the presence of air in the mass. As the plaster sets, some of these air bubbles migrate to the surface where they cannot be released due to the surrounding mould. The presence of such excess of bubbles disrupting the fine surface details, could suggest that the relief was perhaps not intended as a piece for display. This cast could then have been produced to remain in Martini's studio either as a reference for future works, as a training tool for the apprentices in his workshop, or for use by others. However, the lack of detailed finish does not rule out the possibility that it was displayed as a work of art in its own right, particularly as a related piece survives in the Chigi Saracini Collection in Siena,[4] and works in such modest materials were collected, even by the elite.

Acknowledgements
I am grateful to Peta Motture, Chief Curator on the Medieval & Renaissance Galleries Project, for her contribution towards this article.

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V&A Conservation Journal No.58

The Bourdichon Nativity: A masterpiece of light and colour

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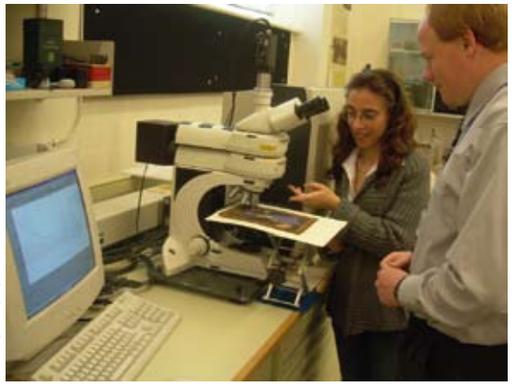
Robin J.H. Clark, Sir William Ramsay Professor, Chemistry Department, University College London
Richard R. Hark, Professor of Chemistry, Juniata College, Huntingdon, Pennsylvania, USA

In 2003, with the assistance of the National Heritage Memorial Fund, The Art Fund and the Friends of the V&A, the Museum acquired a late fifteenth-century illuminated miniature by Jean Bourdichon, an artist who worked at the French Court and served four kings (from Louis XI to Francis I) in his lifetime.[1] The V&A miniature (E.949-2003) is of the Nativity (Figure 1) from the *Book of Hours of Louis XII,* commissioned to celebrate his accession to the throne in 1499 at the age of thirty-six. The manuscript's troubled history saw it being brought into England, probably at some point in the sixteenth century, where it was eventually debound and its miniatures dispersed among various private collections. It was only in recent times that most of the original miniatures were tracked down again, and within the last thirty years that 11 full-page miniatures, four calendar leaves, and 53 text leaves from the manuscript have been identified; these were the subject of an exhibition at the J. Paul Getty Museum and the V&A in 2005/6.[2,3]

(Photography by V&A Photographic Studio)

Figure 1. The Nativity (E.949-2003)

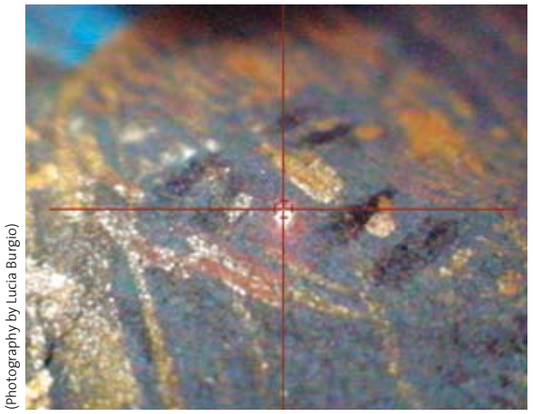


(Photography by Richard Hark)

Figure 2. Lucia Burgio and Richard Hark analysing The Nativity (E.949-2003) by Raman microscopy

In spring 2008, the Science Section borrowed, for four months, a Renishaw Raman spectrometer from the Chemistry Department, University College London, with the purpose of analysing as many pieces as possible from the extensive collection of V&A manuscript cuttings (around 2000 items) as well as a series of high-profile medieval and Renaissance manuscripts and miniatures, the Bourdichon Nativity being among the latter. The Nativity was subjected to extensive study by Raman microscopy (Figure 2) as well as X-ray fluorescence (XRF) analysis, the latter by use of an ARTAX micro-XRF spectrometer. Selected areas on the miniature were also examined under high magnification (100x to 800x) with a Leica Aristomet optical microscope. A more detailed description of the results was recently published.[4]

The results of the XRF investigation revealed that a significant amount of bismuth is present in most grey areas as well as in many brown and black areas, such as in the shepherds peering through the window in the background (Figure 3a&b), the donkey's head and some of the architectural details. The existence of bismuth-based pigments, including those found in other pages of the *Book of Hours of Louis XII*, has only recently been acknowledged and documented. [3, 5, 6, 7]



(Photography by Lucia Burgio)

Figure 3a. Detail of bismuth-rich area analysed on a shepherd's face

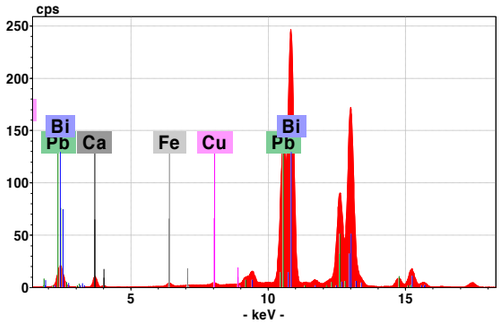
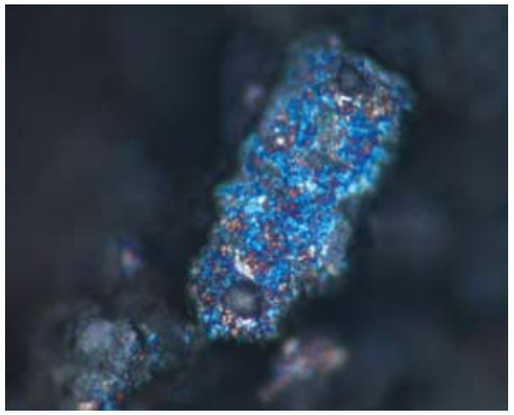


Figure 3b. XRF spectrum from the same area

The areas with high bismuth content were examined carefully under high magnification, and a large number of shiny, metallic-looking particles were observed, which were quite flat and very iridescent. The morphology and the appearance of the particles (Figure 4) suggested that they could be either metallic bismuth or bismuth(III) sulphide (bismuthinite, Bi2S3). The yellowish bismuth(III) oxide (bismite, Bi2O3), was excluded as a possibility on the basis of its colour. When the same particles were analysed by Raman microscopy, only a weak spectrum was observed. Reference samples of bismuthinite normally give a very distinctive Raman spectrum, whilst metallic bismuth either yields no Raman spectrum or gives rise to a very weak one, which matched those obtained from the bismuth-rich areas on the Nativity (Figure 5).



(Photography by Lucia Burgio)

Figure 4. A glittering, iridescent particle in a bismuth-rich area on a shepherd's face. Leica Aristomet microscope, magnification 640x

The Raman analysis of the various areas on the miniature revealed that Bourdichon used a palette which was rather typical of his time, as traditional pigments such as vermilion, red lead, azurite, indigo, lapis lazuli, lead-tin yellow type I, carbon black, lead white, gypsum, calcite, haematite and goethite were detected. However, these pigments were almost always applied in complex mixtures and it was not unusual to find four or five different compounds used together (see for example Figure 6, showing the colourful mixture used for the black wooden beam along the proper left border of the miniature). These mixtures also included unusual compounds, such as mosaic gold and pyrite, as well as finely divided, more traditional, shell gold. All the evidence collected so far highlights Bourdichon's special ability to utilize conventional and innovative pigments with consummate skill to achieve impressive light and colouration effects.

Acknowledgments
The authors thank Mark Evans, Merryl Huxtable, Bryony Bartlett-Rawlings and Claire Hart de Ruyter, Victoria and Albert Museum, for their continuous help and support; Mike Rumsey, Natural History Museum, for his advice in matters regarding the mineralogy of bismuth compounds; the EPSRC for a grant for the purchase of the Renishaw spectrometer/ laser system; and Renishaw plc for assistance.

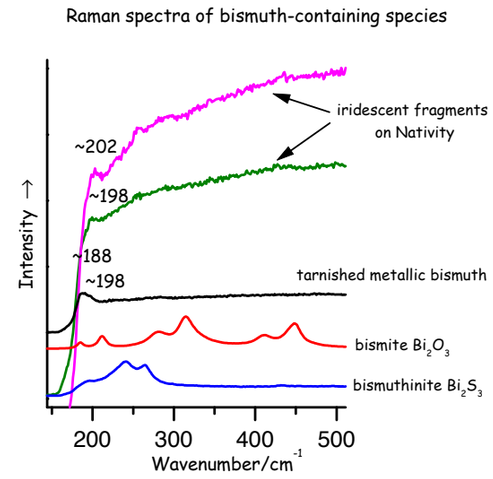
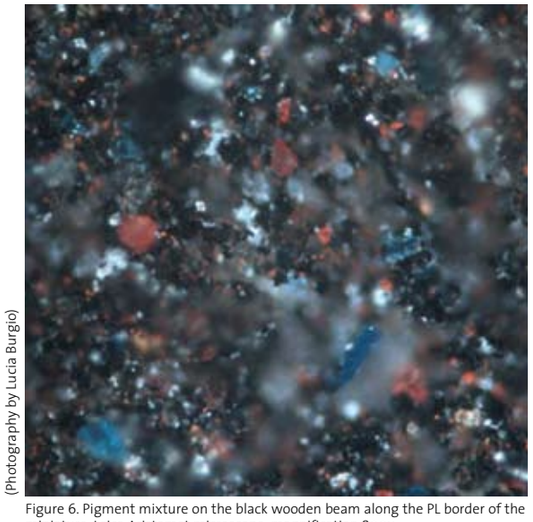


Figure 5. Raman spectra of pigments in the Nativity compared to those of reference specimens



(Photography by Lucia Burgio)

Figure 6. Pigment mixture on the black wooden beam along the PL border of the miniature. Leica Aristomet microscope, magnification 800x

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Deteriorated enamelled objects: Past and present treatments

Fi Jordan
Senior Ceramics Conservator

The re-display of a number of fourteenth- and fifteenth-century enamelled objects has given the Ceramics and Glass Conservation Studio the opportunity to assess a number of past treatment methods used on the degraded surface of enamels on metal.

An enamel on metal is made by applying layers of powdered coloured glass to a metal substrate where it is fused by heat. The stability of the enamel depends on its composition and the surrounding environment. An unstable glass formulation will allow soluble alkaline components in the glass to interact with moisture in the atmosphere causing chemical and physical changes to take place. Dissolved alkaline salts collect at the surface in the presence of moisture and grow as crystals when they dry out. These changes result in degradation ranging from a network of fine cracks (crizzling) to larger open cracks, a loss of translucency and areas where the enamel is no longer adhered to the substrate (flaking). This may be accompanied by corrosion on the metal substrate.

Deteriorated enamel surfaces were often coated with a barrier layer in the past; this appears to have been a common practice from the 1960s to the 1980s. The choice of coatings may differ but none have prevented further deterioration from occurring.

(Photography by V&A Photographic Studio)

Figure 1. (M.580-1910) Altar cross, Italy, 15th century

A silver-gilt altar cross (M.580-1910) ornamented with 22 translucent enamel plaques on a silver substrate (Figure 1) had been entirely coated with a thick plastic layer of polyurethane lacquer (Joy Glaze) in 1971. Not only did it obscure the surface quality of the enamel, but it also created a harmful microclimate promoting salt growth.

On arrival in the Studio in 2008, the coated enamels were in a poor condition. The enamel and underside of the coating were wet with deliquesced alkaline salts and the most severely degraded enamel resembled sugar granules. The unsightly coating was lifting from the surface pulling off flakes of deteriorated enamel with it (Figure 2). Although there is a risk of causing further disruption to the surface during the removal of a coating, in this case it was prompted by the immediate need to stem the active flaking and reveal the enamels.

(Photography by Fi Jordan)

Figure 2. (M.580-1910) Detail of the coating as it lifts from a baisse taille enamel plaque

(Photography by Fi Jordan)

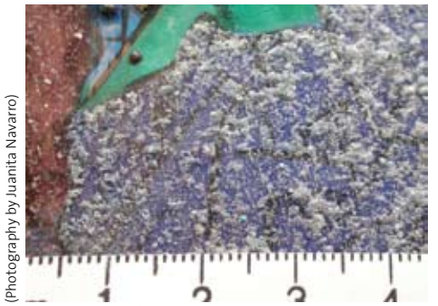
Figure 3. (M.580-1910) Detail of plaque, after treatment

(Photography by Fi Jordan)

Figure 4. (707-1884) Detail of powdery, fur-like salts pushing through a disrupted coating

(Photography by Fi Jordan)

Figure 5. (707-1884) Detail of plaque, after treatment



(Photography by Juanita Navarro)

Figure 6. (552-1877) Detail of central plaque, Louis XII triptych before treatment, 2008

Under magnification, it was possible to lift the coating from the surface with the aid of a shaped wooden swab stick. Loose corrosion products were removed by aspiration with a miniature vacuum tweezer unit. Surface cleaning was undertaken in an attempt to slow the deterioration process by removing the alkaline salts where possible. The method involved lifting the soluble salts from the surface with a sable artist's brush. Firstly, absorbent paper was wet with deionised water and the brush wet from the paper to ensure that it was only slightly dampened. The cleaning process was repeated using a dry or almost dry brush and blotting paper to help absorb moisture. Consolidation was kept to a minimum. Paraloid™ B72 (ethyl methacrylate/methyl acrylate copolymer), (approximate 2% solution in acetone) was applied, by brush, to the most severely deteriorated enamel and to reattach flakes that had lifted with the coating (Figure 3).

Past records and present monitoring provide information on the direct effect of treatments on unstable enamels. A fourteenth-century silver-gilt processional cross decorated with translucent enamels (707-1884) has documentation from 1984, 1993 and 1996. It details the recoating, cleaning or localised consolidation with Paraloid B-72 in acetone. Since 1996, flaking has occurred on coated and uncoated areas. There were also areas that had been consolidated in 1996 displaying no further signs of salt activity. Other plaques required the partial removal of the coating (Figures 4 and 5). In some areas the disrupted coating or dirt was all that held loose flakes of enamel in place. These were retained by re-dissolving the consolidant with a drop of solvent applied on a sable brush at the appropriate spot. This practice had been used in 1999 on the crizzled blue and mulberry coloured enamels on the Louis XII Triptych (552-1877), Limoges, around 1498-1514.[1] The painted enamels are known to have had at least two different coatings in the past.

Re-examination in 2008 revealed signs of further degradation, including new flakes of the mulberry enamel. Figure 6 shows a detail of the salt efflorescence, flakes of blue enamel and copper corrosion products held within the degraded surface coating. The re-treatment followed the concept of minimal intervention with localised cleaning, in an attempt to lift salts from the surface, and consolidation of loose flakes as described above.

Re-examination of the objects has highlighted the problems faced by the conservator. The most appropriate current approach to interventive treatments remains a cautious one based on the needs of each object. Treatment decisions can conflict with each other and it is always difficult to decide how far, or even if, to proceed. If the deterioration is not stopped, the enamel could eventually be lost. Research remains important to find solutions to the problems encountered in the conservation of chemically unstable enamel, including the improvement of environmental conditions and the use of current and new consolidation materials.

Acknowledgements
I would like to thank Juanita Navarro, Senior Ceramics Conservator, for valuable discussions and information.

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Stained and painted glass from the Chapel of the Holy Blood, Bruges

Ann Marsh
Stained Glass Conservator

The figurative and armorial stained glass panels from the Chapel of the Holy Blood, Bruges are a prominent feature of the new Medieval & Renaissance Galleries. Their original home is a double chapel, the ground floor of which is in the Romanesque style while the first floor, the Chapel of the Holy Blood, is of Gothic design. It is called the Holy Blood because of the relic it houses, a rock crystal vial said to contain cloth used by Joseph of Arimathea to wipe blood from the body of Christ. The stained glass was removed from Bruges in 1795 and sold to a local man, who then sold them to an English dealer in the early nineteenth century. Some of the panels were later installed in Kilburn Grange, a private house in north west London. The panels were acquired by the V&A in 1918.

Despite being extensively restored, the panels are of great interest for their depiction of the ruling class in the late fifteenth century. The four figurative panels depict Maximilian the first (later Holy Roman Emperor) as Archduke of Austria, and his wife Mary of Burgundy, their son Philip the Fair (Figure 1) and his wife Joanna of Aragon and Castile, daughter of Ferdinand and Isabella of Spain. She later became known as Joanna the Mad for refusing to bury her beloved husband after his death; she could not bear to be parted from him and carried his body wherever she went. These almost life-sized figures are even more interesting because they are not biblical. During the period when the panels were made it would have been much more usual to depict saints, prophets and other characters from the Old and New Testament, particularly when shown on this scale.

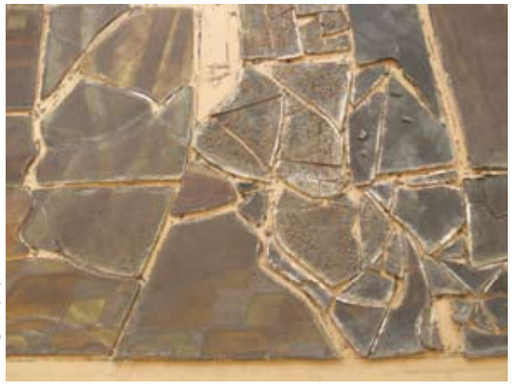
Prior to their arrival at the V&A the panels had been subject to extensive restoration, with repairs and additions being carried out at various times during their history. In the nineteenth century, the top of each figurative panel was replaced with identical architectural backgrounds which include leads deliberately added to look like repair leads. This work may have been carried out by, or at the request of, the dealer to make them easier to exhibit, more saleable or to enable them to be installed in another architectural setting. In each panel it is possible to identify different phases of restoration as the later additions of glass are of variable quality with different painting styles and paint colours. Some of the older glass is heavily corroded on the front and back, resulting in a thinning of the glass. The corrosion pits eventually connect resulting in weakening and breaking of the glass along these lines (Figure 2 and 3). Deep pits make the process of bonding and infilling difficult as it is undesirable for the pits to become filled with resin. It is therefore necessary to devise ways of protecting the glass to avoid the flooding of these pits while still achieving flat infills and bonds. In order to explore all the options for dealing with the deeply pitted glass, a visit was made to the York Glaziers Trust to study their newly-developed methods for bonding and filling highly corroded glass from York Minster. The visit enabled us to adapt our own methods to deal more effectively and efficiently with the Holy Blood panels.

(Photography by V&A Photographic Studio)

Figure 1. Panel (C.441-1918), c. 1496, showing Philip the Fair, before (left) and after (right) treatment, transmitted images

(Photography by Ann Marsh)

Figure 2. Before treatment, reflected image showing heavy corrosion patterns on glass surface



(Photography by Ann Marsh)

Figure 3. During treatment, reflected image showing multiple breaks in corroded glass

There are many considerations to be made before beginning conservation. These relate to saving, where possible, early or original leads, removing as many of the old repair leads as possible to make the panel more pleasing and easier to read, and repairing any glass breaks. The work must result in an improvement to the overall appearance of the panel while maintaining the ethics of minimal intervention. When such extensive work has already been carried out these can be difficult judgements, particularly in relation to the leading of panels. It is likely that panels of this period will have been re-leaded many times and the original glazier's intention will have been lost. Many people who work on stained glass see lead as being used merely to provide structure and strength. Therefore, they use mainly 6mm lead throughout to expose as much of the glass as possible. There is of course merit in this; however, the use of varying widths of lead can also add strength to the design as well as to the structure of panels. Many late nineteenth-and twentieth-century stained glass artists used lead as an integral part of their designs as well as to hold the glass together. One such person was the prolific post-war German stained glass artist, Johannes Schrieter, who liberated lead from a purely functional role to create what became known as 'wandering lines' of lead; these are decorative lead lines that do not have any structural function. The Holy Blood figures required more definition to enable them to stand out clearly from their backgrounds. During conservation the decision was taken, where possible, to vary the width of the internal leads, particularly around the figures so that they would be more defined and easier to read (see Figure 1).

The many replacement pieces of glass, with their varying quality, not only of production but also of interpretation of the design, have resulted in some strange and quirky visual qualities (note the wasp waist of Philip the Fair). Occasionally the removal of old repair leads can emphasise these misinterpretations, making them even more obvious and confusing to the viewer's eye. Some of the Holy Blood armorial panels suffer from this problem and as a consequence we took the decision not to remove all repair leads. The armorial panels also contain some much older leads and these too have been left alone where possible. Despite interference by well-meaning conservators and restorers over their lifetime, these panels remain intriguing, attractive and unusual examples of the art and craft of stained glass from the Renaissance period and deserve to have pride of place in the new galleries.

Acknowledgements
The display of stained glass panels from the Chapel of the Holy Blood, in the Medieval & Renaissance Galleries, has been generously supported by Sam Fogg.

'This burden of light is the work of virtue':[1] Research on the Gloucester Candlestick

Catia Viegas Wesolowska, Senior Metals Conservator
Stephanie Seavers, Metalwork Curator

(Photography by C. Viegas Wesolowska)

Figure 1. The Gloucester Candlestick (7649-1861)

The preparation for the Medieval & Renaissance Galleries has provided an opportunity to research a number of extraordinary objects in the Museum's collection. One such exceptional piece is the Gloucester Candlestick (7649-1861), a rare example of Romanesque metalwork (Figure 1). Engravings upon the stem show that it was given by Abbot Peter to the Benedictine Church of St. Peter in Gloucester (now Gloucester Cathedral), dating the piece between 1104 and 1113. The country of origin of its manufacture has been widely debated, though comparisons with manuscript illuminations from Cambridge and Durham suggest that the decorative style is English. Analysis of the candlestick has uncovered intriguing evidence regarding its construction, increasing our understanding of metalworking techniques at this period for which little metalwork survives.

Initial examination raised questions regarding the way in which the candlestick was made. Disassembly showed that it was cast in three parts, in the lost wax or *cire-perdue* method. This technique is described in detail by the contemporary craftsman and Benedictine monk Theophilus in his technical treatise *Schedula diversarum atrium*, dated between 1100 and 1120.

At present, the three sections of the candlestick; the drip pan, stem and base, are secured by an inner copper alloy tube through which an iron rod runs, threaded and tightened with a nut at the base. During examination and dismantling, possible evidence of an earlier method of assembly was found. On the inside of the joins there are marks, slots and protruding segments (now broken). On the outside, there are engraved crosses, approximately 3mm high, which indicate the positioning of the sections during assembly (Figure 2). Further studies are required to determine if the copper tubing is part of the original construction or a later addition.

(Photography by C. Viegas Wesolowska)

Figure 2. Detail of the cross, marking the position of the lower section, and broken inner segments

The Gloucester Candlestick has an unusual metal composition for a cast piece. Analysis in the 1980s identified it as a brass copper alloy with an unusually high percentage of silver and that each cast section had a different composition (Figure 3).[2] These results were corroborated by recent X-ray fluorescence spectroscopy (XRF) non-destructive analysis.[3] Why this unusual core alloy was chosen and why differing amounts of silver were used in each section was not immediately apparent. It is possible that the silver was added to change the colour of the metal, to add to its fluidity in casting or aid the finishing of the piece. To test these theories, metal samples based on the original compositions of each section of the object were prepared to determine the characteristics of the alloy in the casting and finishing processes. The samples would also be indicative of the original colour of the finished surface as they would show the metal surface prior to having been gilded.

	Cu	Ag	Zn	Sn	Pb	As	Sb	Fe	Ni
Drip pan	75.2	5.80	16.1	-0.04	2.50	0.04	-0.04	0.28	0.05
Stem	65.4	12.1	17.7	2.29	2.20	0.05	-0.04	0.29	0.04
Base	60.1	22.5	10.4	3.01	3.52	0.19	-0.04	0.21	0.04

Figure 3. Metal composition of each cast section (%/w)

Two samples of each composition were made, one left unfinished and the other scraped and polished, producing the final surface colour and revealing, through the finishing process, the qualities of the alloy (softness, etc.). A further two samples were made from a mould taken from the candlestick (Figure 4) to study the behaviour of the metal in a more complex mould.

(Photography by S. Seavers)

Figure 4. (From left) Wax cast, unfinished casting (centre), finished casting (right)

The results showed that silver in the alloy increased the fluidity in the pour of the casting (the higher the level of silver the better the fluidity). This resulted in sharper detail on the alloy cast into the mould. Lead is usually added to make the metal flow in the cast and improve the workability of the final surface. However, as mentioned in Theophilus' treatise, if the surface was to be gilded, the lead in the alloy would disturb the gilding. Hence, the desire to gild the cast metal may influence the substitution of lead with silver for this candlestick.

The differences in composition did not noticeable affect the pouring qualities of alloy and the colour on the three samples was almost identical. It is therefore unclear why there is a difference in the percentages of silver across the three sections, though perhaps whilst the need to have proportionally high levels of silver was recognised, this was added empirically rather than in exact measured amounts.

The outcomes of the tests give a strong base to which further historical research may be applied. The tests have uncovered valuable information regarding the construction and composition of the Gloucester Candlestick. Further comparative analysis would determine whether any of the construction methods were used elsewhere. It is hoped that further study of a pair of candlesticks made of electrum, around 1100, from the Benedictine order's Hildesheim workshops and a recently discovered candlestick from the Abbey of St. Denis will broaden our understanding of Romanesque metalwork made for Benedictine communities.

Acknowledgements
We are grateful to Marian Campbell for her support, Duncan Hook at the British Museum for taking time to analyse the metal alloy, The Crucible Foundry for casting the samples, Graham Martin and Lucia Burgio. We would also like to thank the Founders Guild and the 1851 Royal Commission for financial support.

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LUCIS ON(US) VIRTUTIS OPUS REFULGENS PREDICAT UT VICIO NON TENEBRETUR HOMO
This burden of light is the work of virtue, shining doctrine teaches that man be not shadowed by vice

2. Brownsword, R., Pitt, E.E.H. and Wilkin, J. 'A technical note on the Gloucester candlestick' *Journal of the British Archaeological Association,* 1985, pp.168-170

3. Analysis also confirmed that the gilded surfaces were composed of gold with traces of mercury, indicating that the whole of the candlestick was fire gilded. However, the colour of the gilded surface differs on each section

Digital in-fills for a carpet

Frances Hartog
Senior Textile Conservator

(Photography by Frances Hartog)

Figure 1. The Carpet after conservation with digitally printed in-fills

The carpet fragment (784-1905) shown in Figure 1, woven in Southern Spain in the sixteenth century, measures approximately 2m high by 1.25m wide. It is one of almost 95 textiles chosen for display in the Museum's new Medieval & Renaissance Galleries which opened in December 2009.

In the past, the carpet had been displayed in a glazed frame. To examine it, it was removed from its frame and the stitching holding it to its fabric-covered, wooden back board was unpicked. It became apparent the bottom right corner of the carpet was not sewn to the back board but nailed. On close inspection it was evident the corner was in fact missing and the area of loss had been in-filled using plaster, cleverly textured and painted to blend with the original textile. Further investigation showed that this interesting choice of in-fill had been employed in other smaller areas of loss in the bottom third of the carpet and there was also a larger plug in the top left quadrant (Figure 2).

Though visually these in-fills worked beautifully, they were not sympathetic to the characteristics of the original textile; they were inflexible, extremely brittle and heavy. The design requirements for the new galleries stipulated that the carpet be on open display, hanging vertically. If this were to be achieved safely the plaster plugs would need to be removed – but what should replace them?

The fragment is relatively small with a complex, busy, highly contrasting, geometric design. In the past textile conservation has been relatively conservative in its use of in-fills; with conservation solutions wishing to be distinct from those of restoration. Rather than reweaving areas of loss, typically, dyed fabric is used, several pieces can be sewn together to give an impression of the missing design. In this case though, there is no dominant colour and attempting to recreate the complexity of the design using blocks of dyed fabric would be clumsy and in danger of drawing attention to the losses, inhibiting the viewer's enjoyment of the original design.

A more precise rendition of the design was aesthetically desirable. Fabric patches could be hand-painted but ensuring a crisp, accurate fit of the missing geometric pattern would be both challenging and time consuming. A printed method would be more appropriate but an initial artwork would still be required from which to print.

At this time, Alice Cole, a final year RCA/V&A MA conservation student, had just completed her research project 'Digital Printing for Textile Conservation'[1] digital printing appeared to offer an ideal solution for this particular object. The missing areas of design could be accurately recreated and, very importantly, fitted by manipulating digital photographic images of the pattern repeat, using the existing skills of the Photographic Department in the person of Ian Thomas.

The idea of using digital printing had first to be agreed on by the curators, both those from the object's 'parent' department and those responsible for the gallery where the carpet is to be displayed. At first the proposal met with some opposition; it was suggested that using so accurate a recreation of the missing areas could be seen as 'hood-winking'

(Photography by Frances Hartog)

Figure 2. Bottom right corner with old painted plaster plug

(Printed by kind permission of The Tetley Workshop)

Figure 3. Reverse of bottom right corner, before conservation

(Printed by kind permission of The Tetley Workshop)

Figure 4. Reverse of bottom right corner after removal of plaster plug

the Public. Reassurances were offered; the design could be printed in a lighter shade than the original, fulfilling the six inch/six foot rule (the in-fill is clearly visible at a distance of six inches but blends at a distance of six foot). The use of stippling to in-fill areas of loss in wall paintings was cited as a similar conservation solution. It was also explained that the patches, which were to be stitched in place, would be separate to the planned overall stitched support and therefore could be removed. The assurances coalesced to result in an agreement.

The existing plaster plugs were removed mechanically. The paint which extended beyond the plugs was analysed and the binding medium was found to be linseed oil. Much of it had leached out into the carpet's lining, destabilising the paint, which eased its removal considerably (Figure 3). Two combinations of solvents applied on cotton wool swabs proved remarkably effective: industrial methylated spirit with Stoddard's solvent at a ratio of 1:3 and acetone with Stoddard's solvent at a ratio of 2:1 (Figure 4).

From Alice's research the choice was made to use pigment printing; wet fastness test results were good, pigment inks are more resilient to light fading than the dye-based reactive or acid inks and the printing process does not involve any wet or steam treatment, avoiding the risk of shrinkage of the printed fabric.

The printing was handled through Zardi & Zardi, a company familiar and sympathetic to the heritage sector. Several trials were necessary to achieve both the correct fit and a good colour match, the latter being complicated by the impossibility of the object travelling to the printers. A linen fabric from a range used regularly by the printer was chosen as the substrate, a length of which was sent to the Museum for scouring before printing to avoid the danger of shrinkage in the future, should the carpet ever become wet (Figure 5).

(Photography by Frances Hartog)

Figure 5. Digitally printed fabric laid over carpet to show size and colour match

The time lapse from ordering the print to receiving the final result was several months, with experience this can now be shortened. One important improvement would be to ensure the digital image supplied to the printers is of a sufficiently high resolution. Had a large format transparency been scanned at a very high resolution a quicker outcome would have been achieved.

The result of this initial use of digital printing has satisfied expectations with the six inch/six foot rule being fulfilled. The printing is lighter in shade than the original and the use of a plain weave fabric, with no pile, will avoid the in-fills ever being mistaken as part of the original carpet. Hopefully, the public will be able to appreciate the design of this carpet fragment without the areas of loss detracting from their experience.

Acknowledgements
The treatment methodology and digital printing co-ordination was carried out by V&A Textile Conservation Studio but the work was contracted out to The Tetley Workshop.

Reference

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Master Bertram's Apocalypse Triptych
To clean or not to clean

Nicola Costaras, Head Paintings Conservator
Rachel Turnbull, Senior Paintings Conservator

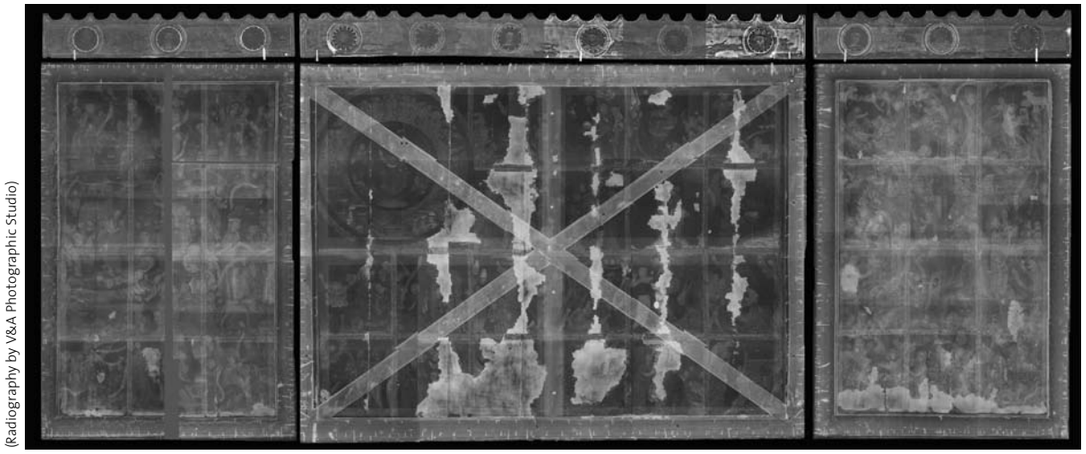
(Photography by V&A Photographic Studio)

Figure 1. Altarpiece before treatment (5940-1859)

Chosen for a prominent position in the planned Medieval & Renaissance Galleries which opened in December 2009, the late fourteenth-century north German Apocalypse triptych (5940-1859) was re-examined (Figure 1). The altarpiece consists of a central panel with double-sided wings, surmounted by *krönung*. The outer panels present scenes from the lives of St. John, the Virgin Mary, St. Giles and St. Mary Magdalene; with the wings open, 45 scenes of the Apocalypse are presented. The scallop-edged *krönung* panels are painted and gilded with foliage motifs and contain small roundels with painted heads. In the early twentieth century, Alfred Lichtwark, the first director of the Hamburger Kunsthalle, included the V&A altarpiece in the oeuvre of Master Bertram of Minden, but this attribution was brought into question in the late 1960s due to its perceived lesser quality. This article will examine the ethical, cultural and contextual considerations involved in the decision of whether or not to clean the altarpiece.

The altarpiece, which was bought in 1859, had undergone major conservation and restoration treatment prior to its acquisition, including the transfer of the paintings from their original panels onto canvas. The original engaged frame had been refitted around the canvases and repainted. Through technical examination it was possible to discover a great deal about the original construction and the present condition of the altarpiece. X-ray images of the panels indicated the position of paint losses (Figure 2). In the lower centre of the central panel there were several large areas of loss. Two campaigns of filling are discernible: the older show light, the later dark on the X-ray image. These losses had been retouched during the previous restoration; the layers of dirt and discoloured resin varnish on the paint surface gave it a generally brown appearance and made it difficult to distinguish between the original paint and the later reconstruction.

The results of the technical examination were discussed with the curators of paintings. Building on the information gathered in a technical report produced by Lara Wilson (Paintings Intern) in 2005, the discussion centred around the question of whether or not to remove the non-original varnish and retouching. How should the value of the medieval original be weighed against the value of the restoration with its accumulated history? It was apparent that in the event of our removing the later restoration comprising as much as 80% or 90% of



(Radiography by V&A Photographic Studio)

Figure 2. Composite X-ray image of whole altarpiece

certain scenes, that there would not be sufficient information to enable us to reconstruct them; it would be unethical. Due to the large areas of loss and previous reconstruction, taking the decision to clean the altarpiece was far from straightforward. In broad terms, both the value of the previous restoration and the more practical and visual implications of leaving or removing it had to be considered.

For us to place a value on the previous restoration, it was important to understand when, where and why it had been done. We felt that any treatment that had occurred while the altarpiece was still a devotional object in its original setting, and that had been done to maintain religious meaning, would have more, or at least a different value than that done by a restorer in the antiques trade to make it more saleable as a decorative object.

All the evidence points to the restoration having been carried out in the trade, probably in the mid-nineteenth century, not long before it was purchased by the Museum. Its provenance before this is not known. We also had to consider whether the restorer knew more than we do today about what was missing. The iconography is based on illustrations in a thirteenth-century manuscript,[1] it was possible that the same source had been used to inform the reconstruction. However, we can see from inaccuracies in the reconstruction, both pictorial and textual, that the restorer was not aware of the source of the text and compositions.

Having established that the reconstruction was likely to have occurred in a restoration studio rather than within the altarpiece's original context, we must still consider the value we place on it. Over its six hundred year history it has undergone several treatments. Each restoration was a product of the understanding and fashion of its own time and each superseded its predecessor. That the object has aged and will never be as it once was is a given, but by leaving the nineteenth-century restoration in place, we might preserve something of its story and acknowledge that all later interventions, being part of its history, have their own value. Nevertheless, we should be aware that whatever our decision is today, it becomes part of the same story, even if we should choose to do nothing. Undoubtedly, the notion of uncovering and presenting as much as possible of the medieval original without reconstructing missing passages is a product of the ideas of our own time.

(Photography by Rachel Turnbull)

Figure 3. A single scene before treatment and after cleaning and digital retouching

Ultimately the question is whether retaining this particular historical restoration outweighs the potential to regain more of the colour and quality of the surviving original paint. Although it is not possible to have both restoration and original in a physical sense, it would be possible to fully document the nineteenth-century intervention, and reveal what does survive by the hand of Master Bertram and his workshop.

It was felt that we needed a better understanding of the condition of the original paint surface. In order to get a sense of the potential gain, as well as loss, in carrying out any treatment it was decided to carry out a cleaning test. The result was startling, revealing the excellent condition of the surviving paint with intact, unfaded glazes and fascinating subtleties of colour and technique. It enabled close comparison with surviving altarpieces in Germany and confirmed the original attribution to Master Bertram. Removing the later restoration revealed substantial areas of original paint that had been covered by the filling and retouching and also showed that there had been many inaccuracies in the reconstruction. What we had lost in the process was the nineteenth-century interpretation of the medieval scene and an integrated whole; what we had gained was 90% of the original paint surface in astonishingly good condition, and a firm attribution (Figure 3).

It should be pointed out that only cleaning the original, leaving the nineteenth-century restoration intact, was not an option. The tonality of the reconstructed areas matched the colours distorted by discoloured varnish and dirt layers. The many inaccuracies in the reconstruction meant a partial approach would give a confusing result, in terms of both mismatched form and colour. If the altarpiece was cleaned it would change from being an integrated object, albeit discoloured, to one clean but incomplete.

After weighing up all of the considerations described above, the decision was taken to clean the altarpiece. In the context of the new Medieval & Renaissance Galleries the choice was made to privilege all that survived of the medieval altarpiece, around 90%, in preference to an antiquarian interest in the object as evidence in the history of taste.

Acknowledgements
The display of the triptych with scenes from the Apocalypse, in the Medieval & Renaissance Galleries, has been supported by the American Friends of the V&A through the generosity of Sir Thomas R. Moore, New York.

Reference

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Professional development in a project culture

Alison Richmond
Deputy Head, RCA/V&A Conservation Postgraduate Programme

A large part of the work of conservators and scientists in the V&A is now generated by major projects within FuturePlan. In 2008, 46% of the Conservation Department's work fell under the 'Major Project' heading and of this 39% came under 'Medieval & Renaissance Galleries Project'. There is a strong assumption in the V&A that professional development of staff is desirable for the Museum as well as for the career prospects of individuals, and a personal development plan is a part of Performance Management. Continual Professional Development (CPD) is also an essential requirement of the Institute of Conservation's (Icon) accreditation scheme (PACR). Sandra Smith, Head of Conservation, has reflected that, with increased demands on conservators resulting in proportionately less time on each object and a decline in the proportion of detailed investigative and interventive work, 'high level conservation skills... are currently under-utilised and under threat'.[1] Given that this is a reality not just for the V&A but also for many other museums, it seemed worthwhile to find out what kind of professional development is facilitated by the V&A's current major project.

Interviews with senior staff gave an indication of the range and spread of CPD and the personnel involved across the Department. Professional development tended to fall into two main categories of skills and knowledge: specialist and generic. The first includes those required for object-based work, e.g. documentary research, technical analysis, interpretation of evidence and interventive treatment. Generic refers to skills common to all professions, such as project-, resource- and people-management, communication, team-working, decision-making and risk assessment. Many of these skills cross over the two types; for example, decision-making is as much part of practical conservation as it is of project management. This overall picture fits neatly with the profile of the professional conservator in the twenty-first century drawn by Pye and Sully, who noted that in developing a range of professional skills – both specialist and generic – conservation is following the normal evolution of professions.[2]

Many interviewees noted that the best way of ensuring professional development of specialist skills and knowledge is to plan it into the project at the outset. When the conditions of the initial in-situ examination and assessment of an object are favourable (such as adequate light, magnification and complete access), and the conservator has enough relevant knowledge about its condition, materials and techniques, then staff development can be planned into the estimate of resources needed for conservation (Rutherston).

Collaborations lead to staff development because the process involves the exchange of specialist information in a new situation. Projects in the V&A offer a wealth of opportunities for collaboration, within and across departments, between museums, and with external individuals and organisations. Much of this happens on a pro bono basis. Expertise from outside the Museum was sought by metalwork conservators to help identify the components of the *Alton Towers Triptych* (4757-1858), thus enabling an increasingly rare opportunity to examine and discuss objects with fellow professionals. Working alongside conservators, Museum Technician Matthew Rose developed skills through innovation – designing and constructing a mount that would support a stone figure without putting any weight on vulnerable parts (Rose).

When in-house resources are not available, external funding has been sourced to enable work to go forward. Generously supported by The Mercers' Company, the Egyptian Tunic (291-1891) dating from 642-800, identified at the time of assessment as requiring substantial investigation and treatment, was allocated as a development opportunity to a member of staff who had not previously worked on an archaeological artefact. The project evolved into an externally funded, collaborative research initiative with the University of Bradford, which has proved to be a very successful project for all concerned and has built up new networks for the future.[3]

Externally funded internships and fellowships have been created to develop individuals from outside, who in return contribute to the research and conservation of the collections. In 2006/7, funding was generously provided by the Samuel H Kress Foundation for a Conservation Fellowship to provide for a paintings conservator to research and treat a number of Renaissance objects, in particular painted cassoni. Eowyn Kerr reported that 'the year has provided a deeply enriching experience, allowing for the development of a specialist expertise in the conservation of cassoni panels, whilst creating an opportunity to work in a cross-platform environment with the V&A staff and collections.'[4]

It is notoriously difficult to give accurate assessments of time when objects are examined in galleries or storage areas. It is sometimes not until the object arrives in the conservation studio that its condition and information potential become apparent. Research is often an intrinsic part of the process of examining and treating an object and can uncover previously hidden information that may lead to unforeseen research questions.

Master Bertram's Apocalypse Triptych (5940-1859) is a case study in reassessing the importance of an object – and the time required to conserve it – as more information becomes available during the conservation process. The 'Master Bertram' proved to have an ethical minefield hidden beneath its obscuring varnish requiring conservators to optimise their skills associated with reflective practice – in decision-making, liaison, networking and consultation, and to nurture these by consulting experts from within and outside of the Museum. In terms of adding value to the object, the research and treatment have resulted in a re-evaluation of the status of the altarpiece (Costaras and Turnbull).

The Medieval & Renaissance Galleries project involved the de-installation and re-installation of life-sized, freestanding and wall-mounted sculptures and monuments of a scale and quantity that had not been tackled in the Museum since the 1960s. Contract conservators with relevant expertise, employed to supplement the core team, were able to transfer their skills to permanent staff. This enhancement of knowledge allowed a greater understanding of these architectural pieces, access to skills associated with masonry and buildings, as well as conservation practice (Hubbard).

Everyone agreed that through involvement with the project all staff were learning – albeit in different ways – many generic skills common to all professions and crucial to the smooth running of projects, such as good communication, negotiating, resource management and decision-making. Senior staff learned how to deliver projects more efficiently and became fluent in writing tendering specifications and managing external contractors. The role of the lead conservator has both developed the post-holder's self-confidence and honed essential skills. However, my findings concur with those of Pye and Sully that conservators are generally apprehensive about what they see as an erosion of their specialist skills in favour of generic professional ones.[5]

There are many examples of professional development within the Medieval & Renaissance Galleries project; some were planned, others happened on an ad hoc basis. In the case of the Medieval & Renaissance Galleries, fabulous and complex objects offer unparalleled opportunities for conservators to develop their knowledge and skills through research into the materials and techniques of manufacture, the condition of the object and its history, conservation materials and techniques previously used, and the development of new treatments. Most projects have a lead-in time of several years and increasingly staff are being strategically 'skilled-up' in anticipation of the changes in emphasis. For example, in the foreseeable future, the emphasis will be on the display of the Furniture, Textiles and Fashion Collections; staff are being prepared accordingly. Nevertheless, a question remains about how strategic we are able to be within the project framework. The development of conservation staff depends on the availability of objects of complexity and time to research them. Conservation staff, through this and other large projects, have developed their generic skills, enabling conservation advice to be integrated throughout all stages of the project development. Yet, if the specialised skills and knowledge that help to unlock information from fragile objects, which have been repeatedly modified through restoration, are to be developed in a project-based culture, we need to raise awareness of the value that this information can add to the understanding and enjoyment of our cultural heritage.

Acknowledgements
I would like to thank Sandra Smith, Charlotte Hubbard, Victoria Oakley, Alan Derbyshire, Marion Kite, Graham Martin, Ann Bancroft, Sophia Wills, Nicola Costaras, Rachel Turnbull and Elizabeth-Anne Haldane for their contributions to this article.

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Work in progress: Holbein's drawing processes[1]

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When examining a drawing how do we describe what we see; what are the materials; how were they applied and, furthermore, how may these factors relate to the function of that drawing? This research investigates the function of the sixteenth-century German artist Hans Holbein the Younger's portrait drawings by reinstating the object at the centre of the research and investigating its means of production. This may seem an obvious approach but whilst Holbein's portrait drawings are by no means neglected, it is surprising how much technical information is unknown, approximated or has been passed down, sometimes inaccurately, through literature and never really questioned.

This research involves a systematic examination of Holbein's portrait drawings that relate to extant Holbein paintings and miniatures. Its aim is to clarify what information is held in the drawings and how that, in turn, informs the method of transfer to oil or miniature, and what these methods may have been. Does the function of the drawing help to dictate the processes and materials of production and how may they affect the appearance of his drawings?

My initial findings concern three aspects of the drawings: the rendering of the flesh tones; what appears to be Holbein's use of red chalk as the initial drawing media for facial features; and, finally, the as yet unresolved and most complex of the issues, the contouring, incorporating the method of transfer. In this article I will be focusing on the last of these, explored through two portrait drawings from The Royal Collection at Windsor: *Sir Richard Southwell,* 1536 (RL 12242, Figure 1) and *Elizabeth, Lady Audley* c.1538 (RL 12191, Figure 2) - which correspond respectively to an extant painting and a miniature by Holbein.

Contours are a prominent feature in Holbein's portrait drawings. They are strokes that define shape, and the function of such contouring in Holbein's portrait drawings, along with their link to the process of transfer, is often debated. Uncertainty in the literature relating to these contours is in part due to a lack of definition or clarification of what is being described but also is the result of difficulties in deciphering the sequence of media. The contours have been described as having been reinforced with metal point and, in other cases, in ink. In some drawings the authorship of these contours has been called into question.[2]

In an attempt to clarify this issue, it helps to consider the contouring in Holbein's portrait drawings in multiple ways. First, there is the contour itself and the shape it defines. Then there is the issue of the make-up of those contours and how they have been affected – for example, have they been affected by the means of transfer (i.e. indenting with a metal point or a stylus of some kind, or by pricking with a needle); or by the action of reinforcement, which may not have anything to do with transfer – or indeed a combination of these things. Investigating the materials and techniques and trying to decipher the sequencing of these contours is beginning to untangle these issues.

(The Royal Collection © 2009 Her Majesty Queen Elizabeth II)

Figure 1. *Sir Richard Southwell*, 1536, 370 x 281mm, RL 12242

(The Royal Collection © 2009 Her Majesty Queen Elizabeth II)

Figure 2. *Elizabeth, Lady Audley*, c.1538, 292 x 207mm, RL 12191

Since contours can include evidence of transfer, a definition of what that evidence may be is important. Obvious signs would be pin-pricks for pouncing; less obvious, though, are the indentations that trace over the contours – and distinguishing between the use of metal point as a means of transfer and solely as a means of drawing is problematic. There is little doubt that the contouring is significant. This research has confirmed that contours serve to work towards capturing likeness *and* are key in providing the salient lines of that likeness for the potential transfer of that drawing.

The contours that make up *Sir Richard Southwell* are complicated and hard to distinguish and describe. Perhaps out of the two drawings considered here, it best illustrates the complexity of the contour issue. Chalk, possibly charcoal, metal point and black aqueous media have been used. Southwell's chin line is an illustration of Holbein's contours rarely being a continuous, single line but rather a series of strokes and often made up of more than one type of media. In the fainter areas of his costume there is said to be metal point over black chalk or charcoal, but this could be the result of black lines resulting from the blind indentations being filled with the black friable media. Indentations following contour lines for transfer are present. Indentation implies pressure from an instrument that traces the salient contours, that in turn makes a mark onto the underlying substrates – often said to be a carbon paper on top of a panel.

Although *Lady Audley* survives in drawing and miniature portrait format, there is no known oil painting of her. Her outer facial contours on the drawing are somewhat easier to read and appear to be black chalk overlaid with black ink or watercolour. The wet media serves not only to emphasise the contour but also shows a commitment to that final line. The use of metal point alone appears to be used in the design for the necklace. There is no black chalk underdrawing in that area. There are no indentations on this drawing and this has been taken as an indication of no visible signs of transfer. This, in turn, may imply that there was never a panel painting of this subject and also calls into question the function of the drawing in relation to its use as the drawing for the miniature.

In conclusion, my initial findings illustrate a variety of Holbein's drawing materials and techniques. Further investigation will hopefully clarify Holbein's processes and use of the drawings. The next phase of my project will build on scientific analysis and ongoing examination of the drawings to inform reconstruction, which in turn, may provide further insight into the function of Holbein's captivating drawings.

Acknowledgements
I would like to thank Alan Derbyshire, Alan Donnithorne, Dr Susan Foister, and Dr Harriet Standeven.

Victoria Button is funded by the Arts & Humanities Research Council.

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1. This article is an adaptation of a presentation given during an academic workshop at the National Portrait Gallery, London, in December 2008. http://www.npg.org.uk/research/programmes/making-art-in-tudor-britain.php

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Conservation: Principles, Dilemmas, and Uncomfortable Truths – A summary[1]

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Alison Richmond, Deputy Head, RCA/V&A Conservation Postgraduate Programme

Conservation: Principles, Dilemmas, and Uncomfortable Truths, brings together critical thinking from a variety of areas of practice.[1] It embraces the diverse aspects within and outside conservation in order to provoke the cross-fertilisation of ideas from one sphere to another. Its contributors, who come from the fields of philosophy, sociology, history, art and design history, museology, conservation practice and theory, architecture, and planning and public policy, address a wide range of conservation theories, ethics and principles in ways that encourage the reader to compare and contrast across specialist areas. But while their contributions offer many opportunities for comparison, it is not a textbook, nor is it comprehensive. Instead, its chapters invoke and stand alongside the current body of knowledge, complement it, and aim to prompt further debate among conservation professionals, museum and heritage professionals, art and cultural historians, lecturers and students, and others invested in cultural heritage theories and practices.

Conservation is currently re-evaluating itself in relation to society and acknowledging both its role in assigning and perpetuating cultural value, and its need for greater dialogue outside of the profession. *Conservation: Principles, Dilemmas, and Uncomfortable Truths* captures thinking at a time when large fluctuations are happening within conservation theory, including the philosophical shift from scientific objective materials-based conservation to the recognition that conservation is a socially constructed activity with numerous public stakeholders. Its chapters offer snapshots of how conservation narratives and ethics are being reconsidered, reinterpreted, and reconfigured in this first decade of the twenty-first century through essays that evince how conservators and others concerned with the production and consumption of cultural heritage understand, internalise, and respond to the ways in which contemporary developments within and beyond the field of conservation are challenging traditional ethics and practice. Though the chapters are highly varied in their scope, focus, and methodology, they all expose the uncomfortable truth of the impossibility of singular and objective truths within cultural heritage care and management. By tracing the agencies and agendas that once drove, or drive today, the development of principles in conservation and its specialised disciplines (Jonathan Ashley-Smith; Nicholas Stanley-Price; Jukka Jokilehto), moments in history (Cathleen Hoeniger), countries and communities (Zuzana Bauerova; Catherine Smith and Marcelle Scott; Marion Kaminitz and Richard West), and new art media (Tina Fiske; Jill Sterrett; Glenn Wharton and Harvey Molotch); scrutinising conservation's aims and whether they can be reconciled with future developments (Chris Caple); unpacking the factors through which cultural value is ascribed at any given time (Helen Clifford; Isabelle Brajer; Miriam Clavir); identifying and interrogating the social constructs, processes, and needs with which conservation must engage (Simon Cane; Elizabeth Pye; Dinah Eastop; Erica Avrami); and critically analysing the very precepts of conservation ethics (Jonathan Kemp; Jonathan Rée; Salvador Muños Viñas), the authors wrestle with and offer ways of disentangling the ethical dilemmas confronting those who maintain and sustain cultural heritage for today and tomorrow.

(Photo reproduced with permission from Frank Oudeman)

Figures 1. Sarah Sze, *Things Fall Apart*, 2001, mixed media installation with vehicle. Collection SFMOMA, Accessions Committee Fund. © Sarah Sze. Contemporary art forms challenge traditional theories and practice of conservation. Jill Sterrett outlines the particular difficulties that the contemporary art museum encounters when dealing with an installation artwork that becomes part of the permanent collection.

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Thanks to:

External contracts
The Tetley Workshop
Protosheet
Zardi & Zardi
Cliveden Conservation
Taylor Pearce Ltd
IWF Ltd
Glazzard (Dudley) Ltd
SI Electrical
Plowden & Smith
Momart
John Kidd
Pest Express Ltd
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Glasbau Haan
Stone Productions Ltd
Christopher Clarkson
Phillippa Duffus
David Vallance
Brian Singer
Department of Conservation and Scientific Research at the British Museum
University of Bradford
Brass Foundry Castings Ltd
The Crucible Foundry Ltd

V&A contract staff
Albert Traby
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Constanze Zimmer
Tom Barrow
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Jonathan Kemp
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Sophie Reddington
Sally Marriott
Angelina Barros D'Sa
Ailke Schroeder
Lara Broecke
Laura Zukauskaite
Jane McCree
Jennifer Bullock
Mike Bowes
Xavier Aure Calvert
Tae Eun Kim

And all others who contributed to the Medieval & Renaissance Galleries.

(Photography by Maike Zimmermann, V&A Photographic Studio)

Figure 1. The Conservation Department 2009