

**AIC**

AMERICAN  
INSTITUTE FOR  
CONSERVATION  
OF HISTORIC AND  
ARTISTIC WORKS

**AIC PAINTINGS  
SPECIALTY GROUP  
POSTPRINTS**

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**Volume 18  
2006**

**The American Institute for Conservation of Historic & Artistic Works**



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INSTITUTE FOR  
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# AIC PAINTINGS SPECIALTY GROUP POSTPRINTS

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Papers Presented at the Thirty-third Annual Meeting  
of the American Institute for Conservation of Historic & Artistic Works  
Minneapolis, Minnesota  
June 8-13, 2005

Compiled by Helen Mar Parkin  
Volume 18  
2006

This publication entitled 2006 AIC Paintings Specialty Group Postprints is produced by the Paintings Specialty Group of the American Institute for Conservation of Historic & Artistic Works (AIC).  
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Publication of this serial began in 1988. Except for Volume 3 (1990) all issues until Volume 16 are unnumbered.  
ISSN 1548-7814

The papers presented in publication have been edited for clarity and content but have not undergone a formal process of peer review. This publication is primarily intended for the members of the Paintings Specialty Group of the American Institute for Conservation of Historic & Artistic Works. The Paintings Specialty Group is an approved division of the American Institute for Conservation of Historic & Artistic Works, but does not necessarily represent AIC policies or opinions. Opinions expressed in this publication are those of the contributors and not official statements of either the Paintings Specialty Group or the American Institute for Conservation of Historic & Artistic Works. Responsibility for the materials/methods described herein rests solely with the contributors. Additional copies of this publication are available for purchase by contacting the Publications Manager at the American Institute for Conservation of Historic and Artistic Works.

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The American Institute for Conservation of Historic & Artistic Works, 1717 K Street, NW, Suite 200, Washington, D.C. 20036-5346 <http://aic.stanford.edu>  
Thomson-Shore Book Manufacturer, Dexter, Michigan; Prepress by Chris Stavroudis; Judy Mahan, Consultant

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## TABLE OF CONTENTS

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### ***Paintings Sessions:***

<i>Digital Images in Conservation Documentation: Quality, Accuracy and Potential</i> David Saunders	1
<i>The ImageArchiver: Image Annotation and Metatag Manipulation Software for Conservation</i> Oliver Stahlmann	16
<i>Your Paintings Exposed: Negatives in the Kress Collection Archive at the National Gallery of Art</i> Joanna Dunn and Elizabeth Walmsley	23
<i>A Translation of the Byzantine into the Northern Renaissance: Hayne de Bruxelles' Madonna and Child, 1455</i> Scott A. Heffley	29
<i>François Clouet and the French Renaissance: Investigating A Lady in Her Bath</i> Pamela Betts	35
<i>Variants of Titian's Virgin and Child in a Landscape, A Comparative Study</i> Adelaide Izat	43
<i>Painting with Wax in Britain and America during the Eighteenth and Early Nineteenth Centuries</i> Lance Mayer and Gay Myers	53
<i>Seurat and the Making of <u>La Grande Jatte</u></i> Allison Langley and Frank Zuccari	67
<i>A Rubens Portrait Re-examined: How Contemporary Copies and Historical Documentation Aided in Interpretating a Reworked Portrait</i> Linnaea E. Saunders	76
<i>Contemporary Encaustic Techniques – Johns, Marden, Thek</i> <i>Michael Duffy</i>	84
<b><i>Selected Paper from General Session:</i></b>	
<i>The History of Conservation Documentation at Worcester Art Museum</i> Morwenna Blewett	94

---

**5 slides/3 minutes: Artists' Idiosyncrasies and Treatment Peculiarities**

<i>Where's the Beef? A Study of Extensive Overpaint to a Nineteenth Century Painting</i> Stephanie Grant	108
<i>A Note on a Discolored Oil Coating on a Nineteenth-Century German Painting</i> Elise Effmann	111
<i>Kees van Dongen's Reclining Nude: Preliminary Notes on the Artist's Varnish and an Unrelated Surface Phenomenon</i> Morwenna Blewett and Philip Klausmeyer	113
<i>Paintings without Grounds</i> Mark Lewis	116
<i>The Use of a New Product to Treat Canvas Irregularities: Tight-n-Up, Its Effects on One Painting and the Treatment of Those Effects</i> Niccolo Caldararo	117

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# DIGITAL IMAGES IN CONSERVATION DOCUMENTATION: QUALITY, ACCURACY AND POTENTIAL

David Saunders

**ABSTRACT** – The paper defines the attributes of quality and accuracy for digital images and assesses the need for these in conservation documentation. A survey of digital imaging technologies for examining and recording paintings is illustrated with examples of infrared, X-ray, visible and raking light imaging drawn largely from developments and practice at the National Gallery, London. The advantages of digital techniques over the analogue techniques they often replace are examined, and the new possibilities opened by the manipulation and interactive presentation of images are discussed.

## 1. INTRODUCTION

Twenty years ago, a handful of conservators were using computers and no-one outside the science departments of the largest museums and galleries was using digital imaging techniques. These two decades have, therefore, seen an immense change in this pattern of use; for better or worse, computers and digital cameras have become as much a part of the conservation studio as easels and pigments. This is an interesting point at which to survey the advances in the field, as something of a watershed has been reached with relatively inexpensive amateur digital cameras – these are now capable of recording as much detail as the best 35 mm slide films used routinely to document treatments in the past. This does not mean that no further improvements are possible; far from it, as the purpose of this review is to assess the requirements for conservation documentation, look at how far current techniques fulfil these needs, and what future developments might be desirable to meet conservators' expectations. The examples draw heavily from the author's experience at the National Gallery, London, but many have parallels in other museums and galleries worldwide. However, before detailing the practical application of imaging techniques, it is worth looking at the issues of quality and accuracy in images that are relevant to these discussions.

## 2. QUALITY AND ACCURACY

The suitability of the digital images recorded in museums to fulfil the variety of different purposes they are intended to serve, for example as permanent documents in a conservation archive or to assist in the technical examination of paintings, depends on both their quality and accuracy.

The quality of digital images is often quantified by their resolution and their bit-depth. The former gives an indication of the level of detail that can be resolved in the image and the latter can point to the ability of the image to represent the range of colours present in the image (or levels of grey in the case of monochrome images). The example offered in Fig. 1 shows the effect of image resolution. Both images cover the same area of a painting (*A Young Girl* by Jan Gossaert; National Gallery, London, No. 2211). The image to the left is extracted from an image that has a resolution of approximately 20 pixels per millimetre on the painting surface; that is, each square centimetre of the surface of the paintings is divided in to  $200 \times 200$ , or 40000 individual points. The fine detail, including the craquelure, is clearly visible. In contrast, in the right image, which has a resolution of 2 pixels per millimetre, this information is lost.

Another factor that contributes to the quality of an image is the bit depth. The number of bits or bytes needed to represent the colour of a pixel was a crucial factor in the early days of digital imaging, as memory and storage capacity were limited and standard computer monitors were unable to display images with high bit depths. At some stage, the 16 million colour image started to become prevalent, the figure of 16 million arising from the common method of coding colour in a red, blue and green channels, each of which has 256 levels;  $256 \times 256 \times 256$  gives over 16 million colours. With advances in imaging, most images now have at least 16 million colours, so the image format and bit depth are rarely issues.

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Fig.1. Detail from *A Young Girl* by Jan Gossaert (National Gallery, London, No. 2211). The image to the left has a resolution of 20 pixels per millimetre on the painting surface, that to the right a resolution of 2 pixels per millimetre

The second criterion to be considered is accuracy and, again, how accurate an image needs to be depends on purpose. Taking the example of the low-resolution image intended as an aide memoir on a web site, accuracy is not critical, as the object represented merely needs to be recognisable from the image. At the other extreme, an image intended to serve as permanent record of the state of preservation of an object, against which future records will be evaluated, needs to be detailed (high quality) and accurate, so that comparisons can be made in the future.

In some respects the boundary between quality and accuracy is poorly defined. A more meaningful division might be made between those attributes of an image that are largely subjective, and those that can be assessed against a particular standard, usually with respect to the object which has been imaged.

Attributes of image resolution, geometry and sharpness can be measured, but are normally assessed subjectively: is the image of sufficient resolution to see fine detail that is considered interesting or important; is the image distorted in one direction or 'curved' at the edges; is the image in focus? However, the factor that is most often assessed against an external standard is the colour quality of an image and here a more objective numerical comparison between the object colour and the colour in the image is possible as a complement to the subjective judgement of whether a colour 'looks' right. Naturally this only applies to visible images, as technical images are mostly monochrome and, if coloured, the colour is notional rather than representational.

### 3. POTENTIAL

Given images of appropriate quality and accuracy, what use can Museums make of the information they offer? There are three areas worth exploring. The first use of the images is to provide a route to store, and give access to,

visual representations of objects. This is the digital equivalent of the slide or photographic library, or the image inserted in an acquisition or conservation record. The potential advantages of the digital route include the flexibility of access that allows images to be shared between users and viewed remotely through the internet. An additional advantage is, of course, that digital images are not degraded through use in the same way as photographs.

For the conservator, many of the uses of images are similar to those made by other professionals concerned with works of art; curators, historians, art historians, exhibition organisers and registrars, for example, all need flexible and rapid access to visual records of objects. A new dimension for the conservator is offered by the possibility of recording, accessing, comparing and visualising technical images of works of art – those made using radiation outside the visible region or by employing particular imaging techniques, such as raking light or 3D imagers.

The second possible use is for comparative purposes. This comparison might be of images of different objects, for example to investigate similarities or test theories of method of creation; or of images of the same object made using different technologies, for example using a visible image to locate regions which appear changed in an X-radiograph; or finally, of images of the same object made at different times, to study changes in the state of the work of art. Comparisons have long been possible using photographs, but these comparisons have been hampered by the difficulties in assuring identical conditions for taking and processing the photographs and, in the case of colour photographs, film stock. Generally, the comparison can be made only through viewing photographs side-by-side, unless complex processing is undertaken in the dark room. As digital images can be viewed and manipulated on a computer, additional possibilities are opened, such as image superposition and mathematical comparison of images.

This leads to the third potential advantage of digital images, the possibility of interactively visualising and animating images to provide greater information on demand. This can range from a simple fade from one image to another, perhaps from an X-ray to a visible image so that the details of a previous version can be located in the context of the final paintings more easily, to manipulating 3D models of works of art on screen so that all parts can be seen and the object rendered as if lit from different positions and with different types of light.

#### 4. IMAGE TYPES FOR CONSERVATION DOCUMENTATION

In considering the use of digital images, it is worth first surveying the types of image that have been used in conservation, before looking at how digital analogues for these (or replacement technologies) have been developed. Seven types of images come to mind, of which only the first four will be considered here:

- Infrared images
- X-ray images
- Visible images (including macro-photographs)
- Raking light images
- Ultraviolet fluorescence images
- False colour infrared images
- Images of cross sections

##### 4.1 INFRARED IMAGES

Infrared photography, using film sensitive to radiation just beyond the red end of the visible spectrum (in the range of *c.* 700–900 nm), has been used to examine works of art, particularly paintings, since the second quarter of the twentieth century (Rawlins 1943). Because many materials that reflect light in the visible region transmit infrared radiation, the underlying paint or drawing materials may become visible when paintings are examined with infrared radiation. In addition, materials which match in the visible region – and therefore match to the eye – may have different reflectivities in the near infrared, so that alterations, overpaints or restorations are sometimes rendered visible in infrared images.

In the 1960s van Asperen de Boer developed infrared reflectography, which relies on producing an image using radiation slightly further into the infrared region (*c.* 1000–2000 nm). This radiation gives greater penetration through surface paint layers than infrared photography, as more materials are rendered transparent or semi transparent in the

image, revealing greater sub-surface detail, particularly in the underdrawing (Van Asperen de Boer 1969). During the last forty years infrared reflectography has become an essential tool for recording the underdrawing and most major museums have access to such equipment.

Infrared photographs generally have good resolution and reasonable sharpness. There is an issue of focus for infrared images, as the focus is usually determined by eye in the visible region and no compensation made for the longer infrared wavelengths. However, infrared photography uses wavelengths close to the visible, so the effect is relatively small. In contrast, although the images produced by early reflectographic systems had reasonable focus, as this could be adjusted while viewing the image from the infrared camera on a TV monitor, the sensors had very low resolution, so that in order to see detail in the underdrawing only small portions of the painting could be imaged. To produce an image of the whole painting many images had to be made and 'stitched' together, either by photographing the TV monitor or, as technology improved, by digitising the signal from the camera and assembling a mosaic image from the stored images. Both procedures have their drawbacks, and the quest to improve the quality of infrared reflectograms through improved equipment or improved image processing after image capture has been well documented elsewhere (Billinge et al. 1993; Burmester and Bayerer 1993; Saunders et al. 2000).

Two of the principle drawbacks of infrared tube cameras are that the geometry of the image (its 'squareness') is poor and that the lightness and contrast of the images changes as the camera warms up during an imaging session. Although attempts have been made to address these problems (Burmester and Bayerer 1993), another solution that has been available for some years is to use a solid-state digital camera sensitive to infrared radiation. The sensors in these cameras contain an array of cooled photosensors, and are therefore immune to the major defects of the tube cameras (Walmsley et al. 1992). Some museums have purchased such cameras, based on either platinum silicide (PtSi), or indium gallium arsenide (InGaAs) sensors.

This does not overcome the problem that in order to obtain an image of the whole painting it is necessary to assemble a mosaic from a grid of sub-images using image processing software. One solution has been to make infrared reflectogram images by scanning an infrared-sensitive point detector over the surface of a painting, or part of a painting (Bertani et al. 1990; Bertani 2001; Pezzati et al. 2004).

Although the quality of images available from solid-state array or point-scanning infrared systems is now very high, there remains the disadvantage that until recently the equipment has been too bulky and the process of image capture very slow. A recent project at the National Gallery, London has aimed to address these issues by developing a new infrared camera, based on an InGaAs array sensor, that scans across the focal plane of a large format lens to create an image of *c.* 5000 × 5000 pixels. The technical challenges of developing this camera, SIRIS (Scanning InfraRed Imaging System), have been described in detail elsewhere (Saunders et al. 2005; Saunders et al. 2006), but arose chiefly from the need to design and build a new lens, to control the movement of the sensor across the focal plane and to acquire and assemble the sub-images. The results, however, are extremely promising, as an image of a large painting (up to 2 × 2 m) can be made in around 20 minutes. The speed of operation makes the camera ideally suited for preliminary investigations *in situ* (Fig. 2), where it is often necessary to examine the entire surface of a large number of paintings to determine whether any underdrawing is present and highlight those areas worthy of in-depth investigation.

The camera can then be used in a higher-resolution mode to make these more detailed studies, either *in situ*, or in the studio. A demonstration of the improvements in the quality of infrared reflectograms over the last few decades is offered by Fig. 3, which presents three versions of the reflectogram of a *Pietà* by the Workshop of Rogier van der Weyden (National Gallery, London, No. 6265). Figs 3a and 3b are made with a vidicon camera, with Fig. 3a assembled from photographs taken from the TV monitor, and Fig. 3b by digitising the images and computer-assembling the mosaic. Fig. 3c is the image from the SIRIS camera, which as well as fewer imbalances in the lightness, shows much greater sharpness.

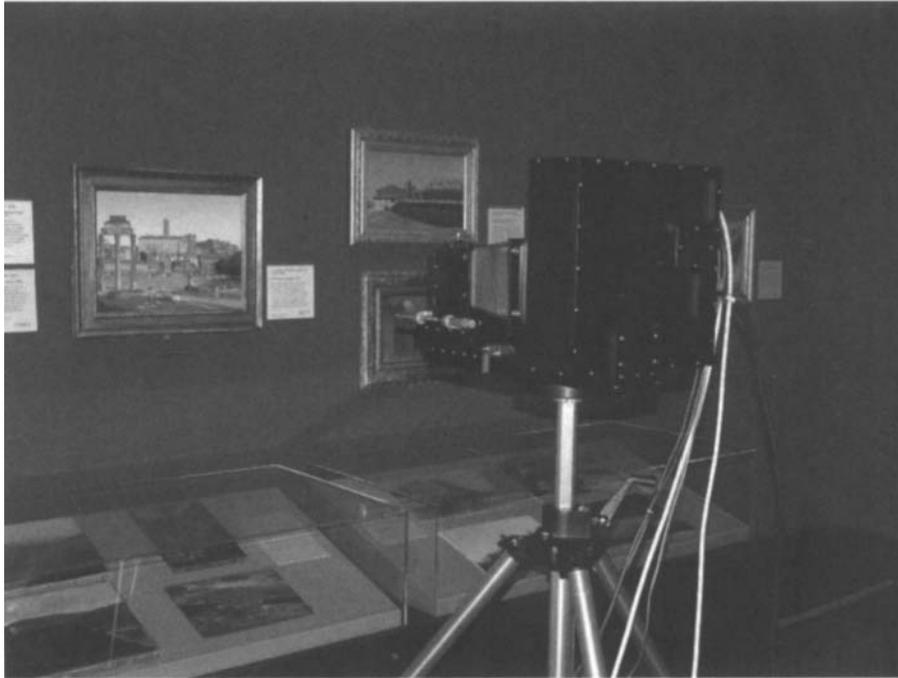


Fig. 2. The new SIRIS infrared camera in use at the National Gallery, London to image a painting *in situ*



Fig. 3a. Reflectogram of *Pietà* by the Workshop of Rogier van der Weyden (National Gallery, London, No. 6265): made with a vidicon camera and hand-assembled from photographic prints



Fig. 3b. Reflectogram of *Pietà* by the Workshop of Rogier van der Weyden (National Gallery, London, No. 6265) made with a vidicon camera, digitised and computer-assembled



Fig. 3c. Reflectogram of *Pietà* by the Workshop of Rogier van der Weyden (National Gallery, London, No. 6265) made with the SIRIS camera

## 4.2 X-RAY IMAGES

The use of X-ray images in the examination of paintings has an even longer history than that of infrared photography; it was applied to the examination of paintings soon after the discovery of X-rays by Wilhelm Röntgen in 1895. The technique was further developed in Europe and North America in the first quarter of the twentieth century as medical X-ray equipment became available for museum use. In the early 1930s an informal network of scientists and art historians using X-radiography had been formed to maintain contact and exchange information, the group met to discuss progress in the area in Rome in 1930 (Steneberg 1933). By 1938, Alan Burroughs, from the Fogg Museum of Art in Cambridge, Massachusetts was able to draw on X-radiographs from over a dozen American and European museums for his book, *Art Criticism from a Laboratory* (Burroughs 1938). In London, the National Gallery had set up an X-ray laboratory soon after the appointment of Ian Rawlins as Scientific Adviser in 1934 and by 1940 had published a series of X-radiographs of the Collection (Rawlins 1935, 1940).

The development of X-radiography gave conservators and art historians access to information related not just to the surface but to the three-dimensional structure of an object, including the structure of wooden supports, canvas weave, areas of paint loss and changes to the composition. The last of these has proved particularly interesting, allowing different artists' hands to be distinguished in different stages of a painting, the discovery of previous compositions beneath the surface of the painting and, in a few cases, the detection of 'fakes' (Pouncey 1937; Wehlte 1932).

In many respects, the equipment used to X-radiograph paintings has changed little over the years. Direct digital X-radiography, which is used increasingly in the medical field, has not become common in museums and galleries, probably for a combination of high cost and low resolution. Rather, digital X-radiographs are often the result of digitising the original plates or films using a high-resolution scanner.

The digitised images can be stored in image databases or archives in the same way as other images, but the great advantage of the digitisation process for X-radiography is that it allows further manipulation of the images, including mosaic assembly of the sub-images made for larger objects, changes to the dynamic range to highlight particular features in an image, and processing the image to remove the 'shadows' of elements of the three-dimensional structure. A more detailed description of the development and application of these processes is given elsewhere (Padfield et al. 2002); here the two procedures of most interest for the examination of easel paintings are summarised.

First, the 'joining' of the digitised images of the individual X-radiographs, which is achieved using the same software (VIPS) that had been developed at the National Gallery to create improved reflectogram mosaics from individual frames from an infrared camera (Cupitt and Martinez 1996). The image processing tools in the VIPS package were adapted to deal with the more difficult task of assembling X-ray mosaics; these arise because of the procedure for acquiring X-ray images and because the X-radiographs contain information about the three-dimensional structure of the painting. As a result, the individual images may have to be rotated and scaled to make an acceptable mosaic, more complex procedures than the simple translation required to make infrared reflectogram mosaics before the new SIRIS camera was developed. The issue of three-dimensionality necessitates using only surface features, such as brush marks and craquelure as guides for joining images, as parallax problems become apparent if features further from the X-ray film, such as nails or staples, are used to align the images. Comparing images made by joining digitized images with those made by traditional printing and hand-assembly shows that the joins are less visible and the geometric accuracy in the assembly is improved in the former. In addition, features that run across joins between sub-images are clearer.

The second procedure that is possible once a digitized image is available is the removal of visually distracting features. The information about the three-dimensional structure of a painting that is presented by an X-radiograph can often prove difficult to interpret. In particular, the information about the paint layers is sometimes obscured by the 'shadows' of the stretcher bars or a cradle applied to the back of a panel painting. Mechanical (Pease 1946) and processing (Loose 1964) techniques have been used in the past to try to remove these features, with mixed success.

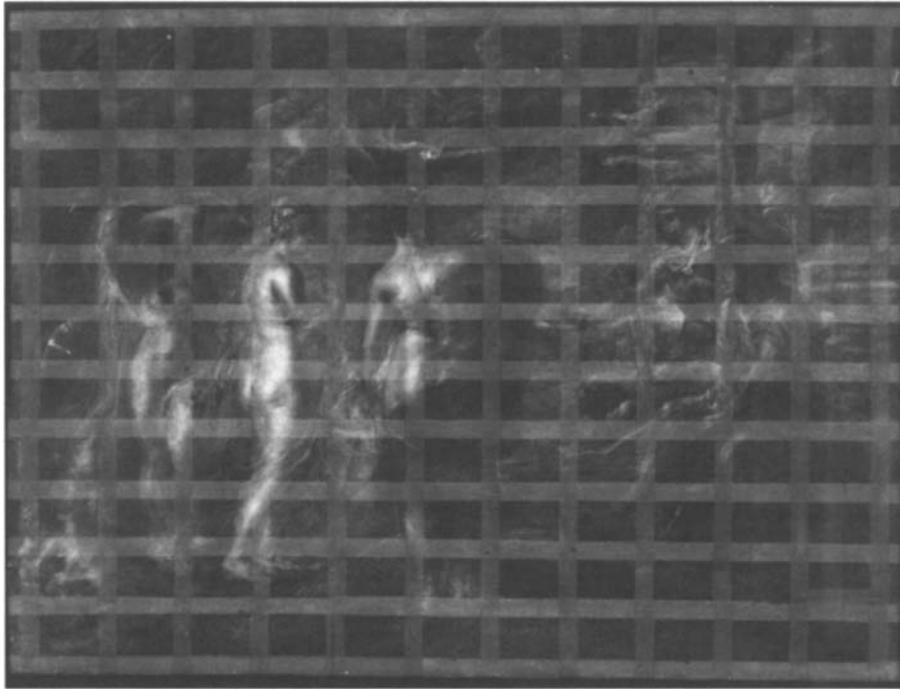


Fig. 4a. *The Judgement of Paris* by Rubens (National Gallery, London, No. 194): computer assembled X-radiograph



Fig. 4b. *The Judgement of Paris* by Rubens (National Gallery, London, No. 194): histogram matched radiograph

A simple image processing method has been developed at the National Gallery to suppress the effect of cradles and stretcher bars in X-rays. The mosaic image is first divided into a number of regions, according to the thickness of the secondary support (cradle or stretcher) in these areas; for example in Fig. 4a (*The Judgement of Paris* by Rubens; National Gallery, London, No. 194), four masks would be created, corresponding to regions where there is

no cradle, where only vertical or horizontal cradle members affect the X-ray image, or finally where both horizontal and vertical cradle members absorb part of the X-radiation. The mask defining the area with no cradle is then used as a control area to which the tonal ranges of the remaining areas are matched ('histogram-matching'). The procedure works well even for larger paintings; the X-ray mosaic of the Rubens was produced from 42 individual plates. The histogram-matched radiograph for this painting (Fig. 4b) provides greater readability of the features in the paint film, without the disruption caused by the complex cradle structure.

### 4.3 VISIBLE IMAGES

The principal function of visible imaging in a conservation context is to make visual records of paintings; to track the condition of paintings qualitatively over the years or to follow the progress of a treatment. This function has been fulfilled by traditional photography, museums and galleries having been quick to take up new developments in photography. The last two decades have seen digital imaging alternatives move from the laboratory to the photographic studio and into the amateur market, to the extent that film-based photography will probably become the province of the enthusiast.

In the case of the National Gallery, however, the impetus for digital imaging came not from the photographic department, but from the use of digital imaging techniques as a scientific method of making quantitative records of the change in paintings with time. This interest in digital imaging began in the late 1970s as an alternative to a spectrometer-based system that had been used to measure colour in discrete areas of paintings; digital imaging systems offered a non-contact means of making colour measurements across the whole surface of the painting. The development of these imaging system at the National Gallery has been described in considerable detail (Thomson and Staniforth 1982; Saunders 1989; Saunders and Cupitt 1993; Saunders et al. 2000), but has culminated in the system developed as part of the European Community-supported CRISATEL project (Liang et al. 2005). The aim of this research has been to make accurate measurements of colour to monitor change; in each system a monochrome camera has been used with a set of filters to generate colour data. Initially these data were converted to a colorimetric notation, usually CIE Lab data (Commission Internationale de l'Eclairage 1978), and comparisons made between colours using a standard colour difference equation. More recently, the increased number of filters in the CRISATEL system has allowed a reconstruction of the spectrum of regions on the surface of the painting. Colour comparison can thus be made using a spectral comparison, but other, new, possibilities are opened by the availability of the spectra, such as rendering the image of a painting as it might appear under a particular illuminant in the museum or, with additional research, pigment recognition.

However, this 'scientific imaging' is a stage further than most museums want, or need, to go; their requirement is for a means of making images of sufficiently high quality and accuracy for documentation purposes. As mentioned in the introduction, digital cameras are now producing images of comparable quality to high-quality film, but this was not the case in the early 1990s when the National Gallery was looking to extend the work on scientific imaging to the development of a high-resolution large format camera. The aim was to make images of the entire collection at a resolution that would be sufficient for general documentation purposes and that would also provide a bank of images for publication purposes, both for traditional printed publications and the rapidly expanding electronic publishing field.

The result was a European Community-supported collaborative project with other museums, universities and commercial companies: the MARC, Methodology for Art Reproduction in Colour project (Cupitt et al. 1996). One of the project partners, CCD Videometrie, constructed a prototype camera capable of making images of up to 20000 × 20000 pixels (Lenz et al. 1994), that was then deployed at both the National Gallery and the Alte Pinakothek in Munich. At the latter, 56 paintings were imaged with the camera and resultant data were used to produce the colour plates in a book on Flemish Baroque art – the first all-digital art catalogue (Burmester et al. 1996).

Experience with the prototype led to the development of an improved version of the camera – termed the MARC II camera. As with the prototype, an extremely important feature of the camera and associated software was the ability to calibrate the colour before each acquisition, using a set of colour standards. However, this camera represented an improvement on the prototype in a number of ways. Although the resolution was rather lower, the mechanics in the camera were designed for continual heavy use, the sensor had an extremely low dark current, allowing longer exposures, and improved electronics delivered a high-quality 12-bit linear signal to the controlling computer through

a fibre-optic link. Also, the time taken to image an entire painting was reduced by a factor of 20, so that a campaign of digitising all c. 2500 paintings in the National Gallery collection could at last be contemplated. The camera and the logistics of the digitisation process have been described in the *National Gallery Technical Bulletin* (Saunders et al. 2002). Such an undertaking, even for a collection of relatively modest size, relies not only on the imaging and associated computer technology. A significant investment was made at the National Gallery in extra art handling staff to cope with the increased movements of paintings from the wall to the studio and their removal from their frames prior to imaging.

This set of images, each around 400 Mbytes, has lived up to most of the expectations of the Gallery. The highest resolution images (c. 10000 × 10000 pixels) act a parent copy from which lower resolution versions have been generated for quick reference on the web site and for leaflets and information sheets. The web-site also contains higher resolution images, accessible through the ‘zoomable pictures’ feature (see <http://www.nationalgallery.org.uk/cgi-bin/WebObjects.dll/CollectionPublisher.woa/wa/collection?collectionName=Zoomable+Pictures>).

It had been intended from the outset to use the high resolution images in printed catalogues and monographs – ‘top-end’ publications featuring images of paintings from the collection. However, as the digitisation project developed, a parallel study to colour calibrate large format inkjet printers (capable of printing on media up to two metres wide) was under way in the Scientific Department. With the bank of images and the methodology to produce colour-accurate prints from these images, the Gallery was able to launch a pilot commercial venture in the shop, offering visitors the opportunity to purchase colour-accurate prints of almost every painting in the collection, Fig. 5.



Fig. 5. The print-on-demand kiosk in the National Gallery shop

In common with many of the other imaging projects at the Gallery, the project to calibrate large format printers mentioned above had begun as a piece of speculative research, investigating whether an emerging technology might have a place in the museum and in conservation documentation. The use of the large format printer, to provide life-size infrared, X-ray and colour images has become a part of the Gallery’s activity and has generated some unforeseen applications. For example, life-size colour prints were used by the conservator to assist in the reconstruction of a lost area of *The Dead Christ supported by Two Angels* by Carlo Crivelli (National Gallery, London, No. 602). Full size prints showing the painting before the old, discoloured retouching was removed sat alongside the painting during conservation and a print provided a surrogate on which the reconstruction of lost areas could be practised, Fig. 6.



Fig. 6. Conservator Jill Dunkerton practising the reconstruction of a lost area on a full size print of *The Dead Christ supported by Two Angels* by Carlo Crivelli (National Gallery, London, No. 602).

#### 4.4 RAKING LIGHT IMAGES

As will be clear from the previous sections, many photographic methods used to document paintings during conservation treatment have improved digital analogues. In contrast, raking light photography, in which light is cast across the surface of a painting at a very low angle to highlight surface texture or irregularity, has received relatively little attention. In essence, traditional raking light images can be considered simply as visible images taken under particular light conditions, but as has been seen for other types of imaging, digitisation can open new possibilities. In particular, image processing can offer the opportunity to combine raking light images made with the lights in different positions. The technique employed at the National Gallery to this end is termed polynomial texture mapping (PTM). Polynomial texture maps are made by taking a set of images using a static camera and object, while changing the position of the light source between acquisitions. The resulting images are processed by the PTM software to provide a rendering of the object on the computer screen (Malzbender et al. 2001). The viewer can manipulate the rendering to visualise how the object might appear under illumination from any direction, including positions that are intermediate between those under which the original images were recorded. A painting can be seen under 'normal' illumination, but can also be viewed as if lit by a raking light that can be moved through 360°. The PTM technique is much less expensive and computationally intensive than structured light or laser-based scanning techniques.

To make PTMs of paintings, a prototype system was constructed at the National Gallery. The system, seen in Fig. 7, comprises a lightweight dome that supports a camera at its apex and 24 lamps in three tiers. Twenty-four images are made, using light from each of the lamps in turn; the procedure and its application to small paintings and test samples have been described in detail elsewhere (Padfield et al. 2005).

The 'dome' has been used to make images of small paintings from the National Gallery and Tate collections, recording surface features including craquelure, planar distortion, wood grain (Fig. 8), canvas weave and *pentimenti*. By making images before and after physical change, the PTM technique can monitor and map change to the surface texture and shape of paintings (Padfield et al. 2005). In the future, a larger apparatus is planned, to allow bigger paintings to be imaged.

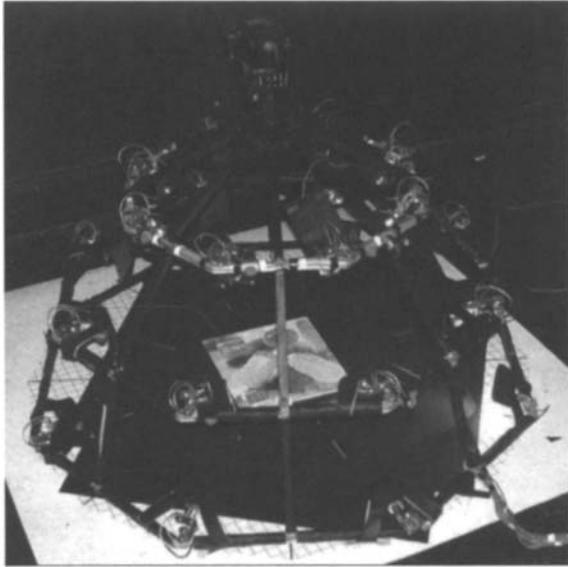


Fig. 7. The prototype 'dome' constructed at the National Gallery to make PTMs of small paintings



Fig. 8. Rendering of the *Portrait of Jean de la Chambre at the Age of 33* by Frans Hals (National Gallery, London, No. 6411) from the PTM, showing the painting lit as though by raking light from the left.

## 5. COMPARISON AND VISUALISATION

Side by side comparison of images has long been a method of identifying change or matching features that appear in an image recorded under one set of circumstances with an image recorded under a second condition. The comparison can be rendered difficult if the images are not on the same scale or are taken from a slightly different angles. More direct comparisons have been attempted by using double exposure developing to superimpose images, but this is not a straightforward exercise. Once images are in the digital domain, resizing, geometrical transformation and superposition become relatively simple, so that changes can be mapped and features from one image seen on a second image, or a composite image produced that juxtaposes information from different spectral bands, Fig. 9.

Two examples of the use of these techniques, are the detection of colour change described earlier, where images made at different times can be aligned and processed to create a map showing the areas in which change has occurred (Saunders et al. 2000), and the superposition of visible and infrared images to highlight the relationship between the surface paint and the preliminary design beneath (Saunders and Cupitt 1995).

In writing of some developments a problem is encountered. The output from the PTM software is a dynamic, interactive visualisation of the appearance of the painting under changing lighting conditions and is ill suited to a verbal description or static illustration on a printed page. In preparing the description of the use of PTM to study physical changes to the structure of paintings (Padfield et al. 2005), the authors prepared a web-site that allowed viewers to manipulate the PTMs and thus explore the surface structure of the paintings interactively (see <http://cima.ng-london.org.uk/ptm/>). Others have developed web-sites that allow the viewer to blend visible and infrared, or visible and X-ray images of paintings to explore the relationship between the surface and the underlying design or structure (see for example <http://www.visualarts.qld.gov.au/graphics/mof/default.htm>).

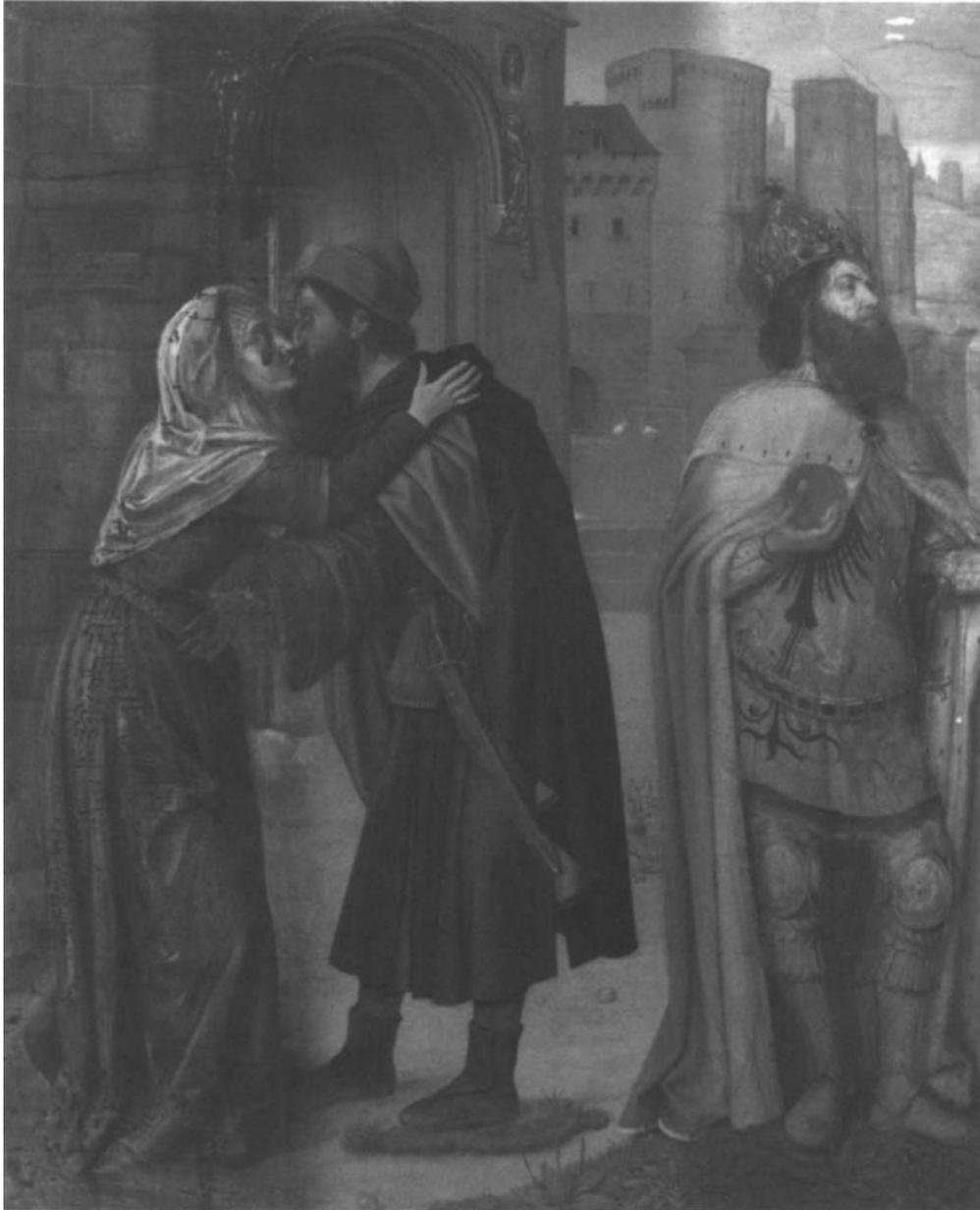


Fig. 9. An image of *Charlemagne and the Meeting at the Golden Gate* by the Master of Moulins (National Gallery, London, No. 4092) showing the blending of (from left to right) X-radiograph, visible image and infrared reflectogram.

## 6. CONCLUSIONS

The means now exist to make digital versions of all the major image-based forms of documentation used in paintings documentation. In some cases the digital techniques offer better quality and accuracy than the method they replace, while other still lag a little. In a few cases the digital technology offers previously unexplored possibilities, while all the digital methods offer a greater flexibility and the potential for post-acquisition processing. Advances in the way in which images are acquired and stored has continued to outstrip developments in the way they can be viewed and visualised, and it is in this area that most advances remain to be made. These will result partly from new technology but also from a change in perspective – in the way in which conservators expect to receive, and are comfortable using, images.

## ACKNOWLEDGEMENTS

The author would like to thank the many colleagues who worked with him over the years at the National Gallery, London, but in particular, John Cupitt, Joe Padfield and Haida Liang; much of the research described here is their work. The projects described here have been partly funded by the European Commission and by Hewlett Packard.

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# The ImageArchiver

## IMAGE ANNOTATION AND METATAG MANIPULATION SOFTWARE FOR CONSERVATION

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**ABSTRACT** – The ‘ImageArchiver’ is a software application developed by the Cologne Institute of Conservation Sciences. It was designed to manage, describe, classify and copyright digital still images especially for conservation purposes. Assembled information is stored as EXIF and IPTC information in the metatag header of the digital still image file. ‘ImageArchiver’ is a Microsoft Windows .net application with a free EULA Software license agreement.

### Introduction

Field projects at the Cologne Institute of Conservation Sciences - CICS are of major importance during the course of education for our students. One prominent project is an international conservation workshop on the island of Lopud near Dubrovnik on the Croatian coast (<http://www.lohud.echn.net>). For two weeks in September some 25 students from Cologne, Antwerp, Brussels and Split are working on the church inventory on the island, at present two large altarpieces from the 17th century in the Church of “Maria Sunj”.

On site documentation created a number of round about 100 digital still images (DSC) in the course of one day. Within two weeks around 1200 image files, taken by 25 students had to be catalogued and annotated. Handling such a large number of digital information and assigning all the detail-, before-, during- or after treatment shots soon became a matter of relative importance. Especially after returning to the schools in Germany, Belgium and Croatia, the documentation supervisors had to select expressive images for the final documentation report.

### Developing the software solution

A first approach was to create a small application to read the digital image files from the photo-card and to save them to a designated folder while renaming the images.

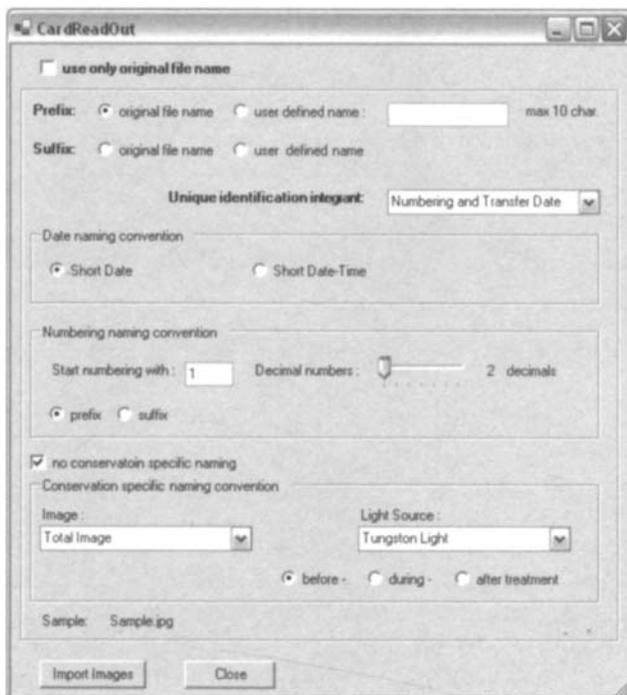


Fig. 1:  
Dialogue to import images from the card or from another folder to a designated folder. Various naming conventions can be predefined and processed through in batch mode. A copy is made of any image that is imported into the folders so the original files are never modified or deleted.

This rather simple tool worked quite successful. All cryptic file names were removed and replaced by more detailed and helpful names for retrieval.

Encouraged by this success to simplify our efforts of documentation we started to develop a desktop application which desirably would perform the listed tasks:

- manage images on our local system in different folders and subfolders,
- batch processing of large amounts of images by renaming them and moving them to their appropriate folders,
- create a thumbnail preview by resizing smaller preview images for fast navigation through the folders and application,
- copyright the images,
- immediately display all the technical information about the digital image file, such as camera make, model, ISO-type, shutter speed,
- annotate the images with important information specifically for conservation and documentation purposes,
- create a searchable database with the image information to search images based on their content,
- and create a mapping grid to place the detail images on a total image as a visual aid for data retrieval.

### Desktop Application Overview

As we decided to develop a desktop application to fulfill our project needs we also were aware that there are numerous solutions of large scale- to small shareware programs available. We thereby found an application called 'FotoVision' from Vertigo Software, Inc.. (<http://msdn.microsoft.com/smartclient/codesamples/fotovision>, (accessed 12/12/05))

This program is a desktop application that works with 'Microsoft Windows' Operating System and the additional '.NET' framework environment.

Available open source code to this program through the 'Microsoft .Net Development Center' and a 'EULA' (end user license agreement including distribution of derivative works) allowed us to use the core of the application and to make 'conservational' adjustments for our needs.

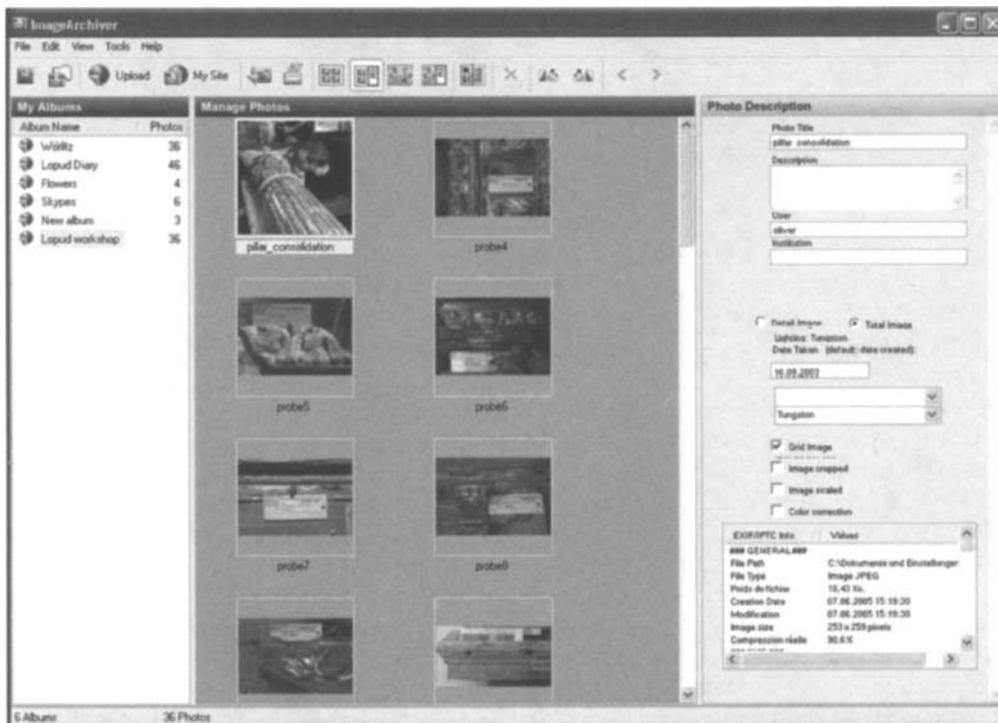


Fig. 2: The application as shown above contains three different panes: the left pane manages catalogues and folders, the middle pane displays the images in resized thumbnails, and the right pane contains the image specific details, conservation specific annotations and EXIF/IPTC information.

Navigation through the application is designed to work from left to right. The left pane holds a list view of all folders available. A click on a folder in the left pane reveals all the images contained in this folders as thumbnail preview while retrieving additional information about the folder in the right pane. As these folders work as containers for image files concerning certain steps in the conservation process, the additional folder information turned out to be quite helpful.

Clicking on a thumbnail in the middle pane of the application once again changes the right pane and reveals detailed information about the digital image file.

The screenshot shows a 'Photo Details' window with a thumbnail of a 'Wooden embossment' image. The window has three tabs: 'Photo Information', 'Exit Information', and 'File Information'. The 'Photo Information' tab is active, displaying the following fields and options:

- Title: Wooden embossment
- Author: Oliver Stahlmann
- Date: 30.06.2004
- Image selection:  total Image,  detail Image of
- Treatment:  before -,  during -,  after treatment
- Light Source: Daylight (dropdown menu)
- Description: (empty text area)
- Reference Image:  Reference Image, Reference Image Name: (empty field)
- Digital Manipulated Image:  Digital Manipulated Image, indicate original image file: (empty field)
- Publication:  Image suitable for Publication,  Image Used in Publication

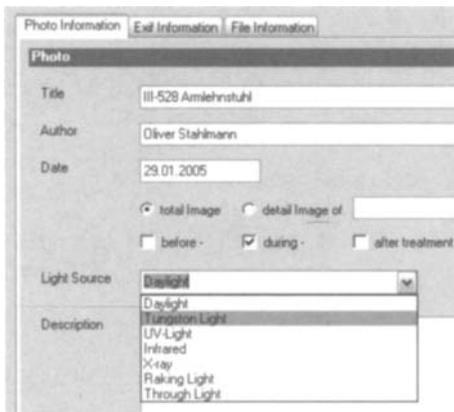
Fig 3: Detail pane after clicking on a preview thumbnail. Image annotation is specifically designed for conservation purposes and stored in a database of the application as well as in the metatag section of the image file.

The information revealed in the details pane of the image files consists of three main components:

### 1. Image Annotation

Image Annotation fields are free form fields of the desktop application which need to be filled out individually. The fields hold default values for conservation purposes such as lighting, before-, during-, and after treatment information and many more (see Fig. 4).

The annotations are thereby stored in two different ways. The application uses the file system and XML files as a simple database to retrieve information on the image files during search routines. Concurrently the desktop application uses a file system called IPTC metatags to store the annotations in the metatag section of your image.



The 'IPTC' metadata tags were originally designed to store content-based information in an image. 'IPTC' the International Press and Telecommunications Council is a consortium of the world's major news agencies. It develops and maintains technical standards for information exchange.

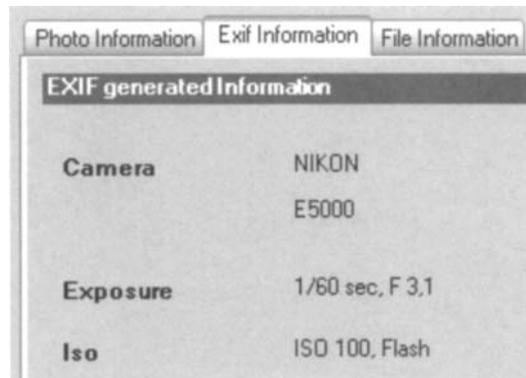
The 'IPTC' defined a set of metadata for news objects in its "Information Interchange Model" (IIM) standard which was released for the first time in 1991. This 'Image Resource Block' (IRB) can be inserted into popular image file formats (.tiff or .jpeg) and is commonly called "IPTC metatag" or "IPTC header" (IPTC Core documentation, <http://www.iptc.org/IPTC4XMP/> (accessed 12/12/05)).

Where 'EXIF' (see below) information is gathered by the camera itself, 'IPTC' information is supplemental and content driven information on the object or situation that is depicted. 'IPTC' tags are empty and need to be filled by an individual user.

## 2. Image embedded data retrieval

'EXIF' information however is created by your digitalization device. 'EXIF' is the acronym for exchangeable image file format and is a specification for the image file format used by digital cameras. It was written by the Japan Electronic Industry Development Association (JEIDA). The specification uses existing file formats such as JPEG, TIFF with the addition of specific metadata tags.

(<http://en.wikipedia.org/wiki/Exif> (accessed 12/12/05))



The metadata tags defined in the EXIF standard cover a broad spectrum (see Fig. above and table on next page) including:

- Date and time information. Digital cameras will record the current date and time and save this in the metadata.
- Camera settings. This includes static information such as the camera model and make, and information that varies with each image such as orientation, aperture, shutter speed, focal length, metering mode, and film speed information.
- Location information, which could come from a GPS receiver connected to the camera.
- Descriptions and copyright information. Again this is something which is most often done when post-processing the images (see IPTC above), as only high-end camera models let the user choose a text for these fields.

Tag	Value
Manufacturer	CASIO
Model	QV-4000
Orientation	top - left
Software	Ver1.01
Date and Time	2003:08:11 16:45:32
YCbCr Positioning	centered
Compression	JPEG compression
x-Resolution	72.00
y-Resolution	72.00
Resolution Unit	Inch
Exposure Time	1/659 sec.
FNumber	f/4.0
ExposureProgram	Normal program
Exif Version	Exif Version 2.1
Date and Time (original)	2003:08:11 16:45:32
Date and Time (digitized)	2003:08:11 16:45:32
ComponentsConfiguration	Y Cb Cr -
Compressed Bits per Pixel	4.01
Exposure Bias	0.0
MaxApertureValue	2.00
Metering Mode	Pattern
Flash	Flash did not fire.
Focal Length	20.1 mm
Maker Note	432 bytes unknown data
FlashPixVersion	FlashPix Version 1.0
Color Space	sRGB
PixelXDimension	2240
PixelYDimension	1680
File Source	DSC
InteroperabilityIndex	R98
InteroperabilityVersion	(null)

Table 1: EXIF Metadata Information created by a digital device and stored in the digital image file. (<http://en.wikipedia.org/wiki/Exif> (accessed 12/12/05))

The 'ImageArchiver' Application is recognizing these metatags and will maintain this information during image manipulation.

### 3. File System Information

The third component of the detail pane is retrieving information from the file system manager and displays information about your file type, file size, the date when the file was created and the date whenever the file gets modified.

### Mapping grid as visual aid for data retrieval

Another key component of the 'ImageArchiver' is the possibility to define a master or grid image for placing detail images on a grid or map.

After defining the image in the catalogue, the mapping functions and menu can be activated (see Fig. 6). A full screen image of your master image is provided accompanied by a list view of all files in your current catalogue. Once a specific file is selected in the list view it then can be placed on the map by double clicking on the selected area of your mapping image. It will be indicated with a red square (see Fig. 7) The "mouse over" function is invoking the detail images from the master image. Moving the mouse over the red squares it will reveal the detail image and additional information on the image in the upper left corner of the window (see Fig. 8).

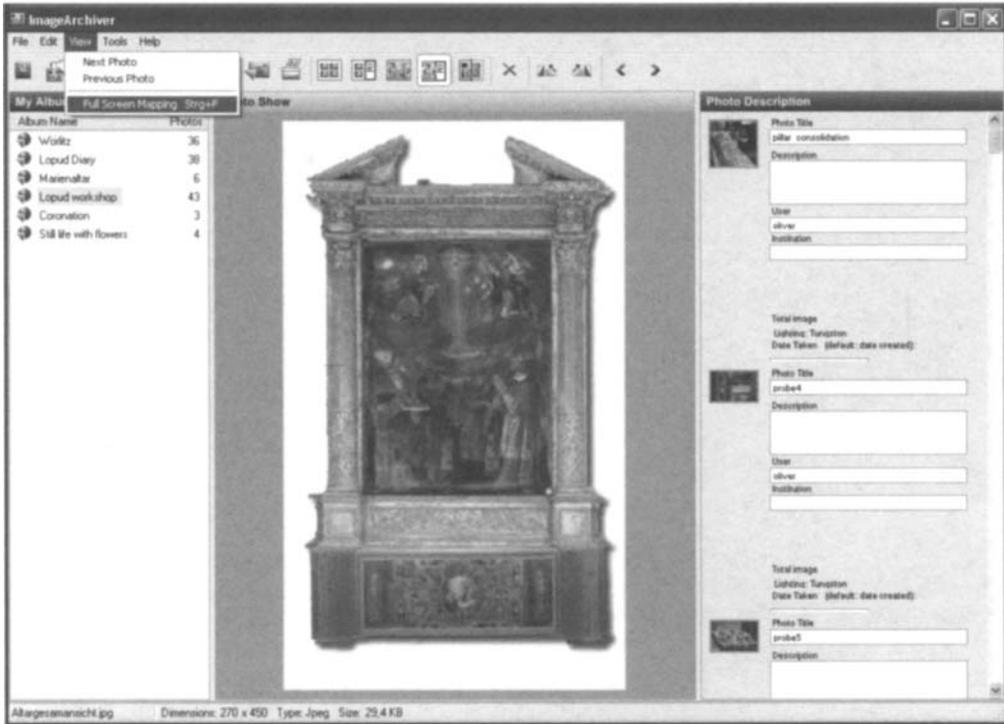


Fig. 6



Fig. 7: The master image is pulled up for mapping in full screen mode. The right pane changes and displays a scrollable list view of all the images that are in the current catalogue. Placing a detail image on the master image is indicated with a red square.



Fig. 8: The “mouse-over” function on the master image reveals the appropriate detail image in the upper left corner whenever the mouse is moved over a red square.

## Conclusions

We found that the ‘ImageArchiver’ desktop Application turned out to be a small and effective tool to catalogue image data in field project as well as during conservation work in our studios. With fast and easy access to multiple image files it made our life easier to annotate images with conservation specific information. Especially with projects that stretch over a longer time and with multiple hands working on it the ‘ImageArchiver’ helped us recollecting the data on our image files quite effectively.

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**YOUR PAINTINGS EXPOSED:  
NEGATIVES IN THE KRESS COLLECTION ARCHIVE  
AT THE NATIONAL GALLERY OF ART**

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ABSTRACT-The Kress Collection Archive in the Department of Image Collections at the National Gallery of Art, Washington (NGA), contains film and glass plate negatives, prints, and color transparencies dating from the 1920s-60s. The Archive documents paintings, sculptures and decorative objects owned by the Samuel H. Kress Foundation before they were donated to regional American museums. It was donated to the NGA in 1977 and is being catalogued. It includes photodocumentation of painting conservation treatments by Stephen Pichetto and Mario Modestini, framed/unframed views, infra-red, and ultra-violet photographs. Photographers include Brumer, Bullaty-Lomeo, Colten, Foto Reali, Peter Juley, Murray Keyes, Paul Kiehart, and Motal.

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In 1977, the Samuel H. Kress Foundation donated a collection of approximately 5,000 photographic negatives and prints to the Department of Image Collections (familarly known as the Photo Archives) at the National Gallery of Art in Washington, DC (NGA). The images are of the Kress Collection paintings, sculptures, decorative objects, and graphics before they were placed on deposit in regional American museums.[1] The collection includes glass plate and film negatives dating from the 1920s to the 1960s (National Gallery of Art 2005).

Many of the negatives document the conservation treatments of Kress paintings by the conservators of the Kress Collection, Stephen Pichetto, and his successor, Mario Modestini (Hoenigswald et al. 2001, Hoenigswald 2006, Modestini 2006). Most of the treatments were documented with overall and detail photographs. The backs of many paintings were photographed. Some of the photographs are "actual state," showing the paintings before retouching. Many of the paintings were photographed both framed and unframed, potentially providing a historical document of frames no longer associated with certain paintings. The collection was a working file, and it includes, for example, copy negatives of drawings in books that are related to the Kress paintings.

Samuel H. Kress used the fortune he earned from his chain of five and dime stores to amass a dazzling art collection during the first half of the twentieth century. He began by collecting Italian art, trying to accumulate at least one work by each major Italian artist, and he eventually established a foundation to provide for the purchase of works of art and to oversee their disposal at museums. Later, after illness incapacitated Samuel Kress, his brother, Rush Kress, assumed responsibility for the Samuel H. Kress Foundation, and the collection expanded to include northern masters. Samuel Kress originally intended to create a museum in New York City, but he was persuaded eventually to divide his collection among various museums around the country so it could be enjoyed by the entire population of the United States. He chose the museums based on the locations of his stores. He gave the largest portion of his collection to the National Gallery of Art, which had just been established with a gift from Andrew Mellon. At the Gallery's inauguration in 1941, Kress donated 386 paintings and 24 sculptures, and the Kress Foundation continued to augment this gift over the next several decades.

The Kress Foundation also provided the funding to establish the Department of Image Collections at the National Gallery of Art in 1970. The seeds of the Photo Archives had been planted in 1943 when Solomon R. Guggenheim donated the Richter Archive of Illustrations on Art, which consisted of 60,000 photographs and clippings from books and catalogues. The Foundation also provided funding for the first curator of the Archives, Sandrino Contini-Bonacossi, who was the nephew of one of Kress's primary dealers, Alessandro Contini-Bonacossi. Therefore, it seems fitting that the Foundation chose to give this collection of photographic negatives to the National Gallery of Art. The Photo Archives at the National Gallery of Art now contains over nine million images, of which this collection is a part (Lemke 2002).

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A set of photographic prints of the Kress Collection were given to the National Gallery of Art at about the same time as the negatives. The Photo Archives assumed that there was a print corresponding to each negative, but in actuality, this was not true. In some cases, there are prints that no longer have corresponding negatives. For others, there are negatives that were either never printed or, more probably, whose prints were lost. In still other cases, the phrase “no negative” was written on the print, but a negative actually exists.

The Kress negatives were accompanied by a hand-written list cataloguing the inventory. We do not know who compiled the 153-page list. There is an entry for each negative, ordered by the Kress accession number. Each entry includes the painting’s location (e.g museum or city), date taken, photographer, view (e.g before, after), and sometimes the type of negative as well. There are nine photographers on the list. Some of these were professional art photography firms, such as Peter Juley and Bullaty-Lomeo; others can be paired to dealers. For example, Murray Keyes worked for Duveen, and the Reali brothers ran Foto Reali, a photography firm in Florence, Italy, that did work for Contini-Bonacossi. Still other names on the inventory list were not professional photographers at all. We know that one of them, Paul Kiehart [2] was a restorer who worked for Stephen Pichetto and later for Mario Modestini.

A spot check showed that the inventory list did not actually correspond to the negative collection. For example, the *Madonna and Child with Angels* (K1311; NGA 1943.4.47), attributed to Botticelli, now at the National Gallery of Art, is a typical example. There were supposed to have been: a 1948 “before treatment” photograph by A. Martin, 1953 “after cleaning” (overall and detail) photographs by Paul Kiehart, and several 1954 “final” (after restoration) photographs, including an overall and an ultra-violet, as well as a 4x5 color transparency taken by Colten. What was actually found was: a 1943 overall photograph taken when the painting was acquired, two color transparencies and a black-and-white negative taken during the 1954 varnish removal, and two 4x5 “after treatment” negatives. No ultra-violet photograph was found. The discrepancies probably occurred because the inventory list was made between November 1975 and February 1976 and, although the National Gallery of Art agreed to take the collection in 1977, the National Gallery of Art did not physically take possession of the negatives until 1982. Therefore, the inventory list was probably an inventory of all the negatives that the Kress Foundation was considering giving to the National Gallery of Art, but not actually what was given.

To rectify this situation, the authors began to catalogue the negatives over the past year, and to enter the information into a computer database. The hand-written inventory list had been entered into a FileMaker Pro® database by Renée Lorion, a volunteer in the Painting Conservation Department in 2000. This was linked to a list of Kress paintings at the National Gallery of Art prepared by Deborah King of the Gallery Archives in 1992. Next, a relational database was made to catalogue the actual negatives, including type of negative, date, view, photographer, and inscriptions. This database includes artworks that went to the regional museums.

This task fell to the Painting Conservation Department because so many of the negatives were “during treatment” views, as well as ultra-violet and infra-red photographs, which conservators are used to looking at and interpreting. Many of the negatives were photographs documenting conservation treatments by Stephen Pichetto and Mario Modestini. At first, we were surprised to find treatment photographs dating to the 1920s and 30s; these seemed to be quite early. However, Anthony Hamber has found that “From the middle of the 1850s photography was being used by museum officials such as Sir Charles Eastlake [the first Director of the National Gallery, London] ...to record the physical state of paintings. Similarly scholars such as Giovanni Morelli were having photographs specifically taken to record the state of paintings both before and after cleaning and restoration” (Hamber 1995). Bernard Berenson, one of Morelli’s disciples, advised Samuel Kress about which Italian paintings to buy. Perhaps it was Berenson’s own vast photo archive that inspired Kress to collect photographs of paintings (Brown 1979). Similarly, participants of the 1930 International Conference on the Examination and Conservation of Works of Art, held in Rome, passed a resolution that a full record, both in photographs and in writing, be kept when a painting was cleaned or restored. Based on the papers delivered at the conference, a full record would have included magnified details, x-radiographs, infrared, and ultra-violet photographs.

Stephen Pichetto may have been following these recommendations for photographs. The negatives often have annotations by Pichetto written on the masked areas. Many were dated, and some noted the treatment stage, such as the negative of Pietro di Domenico da Montepulciano’s *Coronation of the Virgin* (K59), now in the collection of Howard University Art Gallery, which says “F. O.” for “final, overall” in the top right corner. The artist’s name was

written on a few negatives, including this one, which reads “by Montepulciano.” Some negatives were numbered with Pichetto’s numbering system, which was often crossed off and replaced by the Kress accession number.

The negatives are interesting examples for the history of photography, as well as conservation photodocumentation. The type of negatives ranged from glass plates (8x10) to Kodak Safety film in a variety of sizes (8x10, 4x5, 2x2). The earliest negatives we found were glass plates that date from 1928. In addition to finding different types of negatives, we also found negatives that were treated in a variety of different ways. Some have black paper masking, others have black tape, others have red plastic tape, and still others have red masking paint (Figure 1).



**Figure 1.** Nicolo da Foligno, *The Crucifixion* Pomona College, Claremont, California, Gift of the Samuel H. Kress Foundation, 1961, shown with 4 different masking schemes



**Figure 2.** Detail of a negative including a hat that probably belonged to Paul Kiehart,

Missy Lemke, Archivist of Italian Art, NGA Library Image Collections, has been identifying the photographers, based on the treatment of the negatives, the hand-written list, and the date of the negative. For example, she has observed that Paul Kiehart rarely doctored the negatives at all. Kiehart was responsible for taking treatment photographs of Kress paintings from 1953-1956. Therefore, negatives with no masking from these years can be attributed to him. A hat is in many of the negatives taken by Kiehart as well (Figure 2), so this might be another, amusing way to identify his work. Murray Keyes frequently retouched his negatives (Beville 1990). His work can often be identified by marks on the corresponding black-and-white print. Keyes’ prints were stamped with his name, the Kress accession number, and the painting’s dimensions (Figure 3). These prints were sent to scholars, such as Berenson and Roberto Longhi, etc. On the back of the prints, the scholars signed hand-written notes regarding the attribution of the art objects.



**Figure 3.** Verso of print showing Murray Keyes stamps

These negatives are especially valuable for documenting treatment histories. Often, only a short line of text is on the Kress Condition and Restoration Record forms, so the photographs (of which some were logged on the verso of the forms) provide an added context for these treatment histories. Some examples are described here [3].

Occasionally, it was not a single negative that was interesting, but rather a series, such as the “before” and “after treatment” negatives of a *Venetian Landscape* (K51) circa 1780/1800 by an anonymous painter, which is now at the Allen Memorial Art Museum at Oberlin College. The “before treatment” photograph (Figures 4) contains two figures, which have disappeared the “after treatment” photograph (Figure 5). The pendant, (K50) now part of the Kress Collection at the Mead Art Museum, Amherst College, Massachusetts also showed figures in the “before treatment” photograph, which are missing in the “after treatment” photograph. There is also a “during treatment” negative of this painting which shows the figure in the foreground beginning to disappear. Apparently, while the paintings were being treated, it was determined that the figures were not original and, consequently, they were removed. The paintings were once thought to be by Francesco Guardi, whose landscapes often included small figures. It is possible that at some point in the history of these paintings, a dealer added the figures in an effort to make the paintings look more typical of Guardi.



**Figure 4.** Anonymous *Venetian Landscape* Allen Memorial Art Museum at Oberlin College Before Treatment



**Figure 4.** Anonymous *Venetian Landscape* Allen Memorial Art Museum at Oberlin College After Treatment



**Detail of Figure 4.** Anonymous *Venetian Landscape* Before Treatment, figures are present



**Detail of Figure 5.** Anonymous *Venetian Landscape* After Treatment, figures have been removed

Negatives of Orcagna’s *Madonna and Child* (K1363; NGA 1952.5.18), now at the National Gallery of Art, revealed that it was treated twice. Stephen Pichetto often performed minor treatments of paintings to make them look a bit better. After Pichetto’s death in 1949, when Mario Modestini became Kress’s conservator, he often chose to give these paintings the full treatments he thought they required and deserved.

A dramatic treatment of Simone Martini’s *Annunciation* (K405; NGA 1939.1.216), now at the National Gallery of Art, is documented in the Kress negatives. The inventory list and the Kress Restoration Record indicate that there should be a “before treatment” negative from 1936, taken by Murray Keyes, and two “after treatment” negatives, one taken by Colten in 1955 and one taken at some point during the 1960s. The files indicated there were also three “during treatment” photographs, two details and one overall, taken by Paul Kiehart in 1955, but that there were no negatives for these photographs. We found five negatives; one “before treatment,” only one “after treatment,” and the three “during treatment” negatives that were not on the inventory list. The collection also contained prints of the “lost” negatives. Interestingly, when the painting was purchased in 1938, Stephen Pichetto listed it as in good condition, but in need of a cleaning, which he subsequently performed. In 1955, Modestini decided to clean the

painting again because “it was apparent that more overpainting had been done in the 16th Century, especially on the figure of the Angel” [4]. The series of negatives records the removal of the extensive overpaint.

Finally, a series of treatment photographs document El Greco’s *Laocöon*, now at the National Gallery of Art (K1413; NGA 1946.18.1). John Walker, the second director of the National Gallery of Art, explained how the painting became part of the Kress Collection: [In 1941,] when it seemed as though England might be seriously bombed Prince Paul [of Yugoslavia] moved the picture from the National Gallery in London where it had been on loan and shipped it to Washington. The Gallery was still in the process of construction, and I arranged for the painting to be stored at the Freer Gallery. When our building was finished it was brought to our storage rooms and remained there until the end of the war. ...David [Finley] and I persuaded Mr. Kress that it would be an important acquisition for his collection. This was not an easy task as Mr. Kress disliked very much the distortions of El Greco. Eventually, however, he accepted our word as to the importance of the canvas and finally it was purchased for the Gallery [in 1946].” (Finley 1945, Walker 1953). Once the painting was purchased, it was examined by Stephen Pichetto and photographed, probably by A. Martin in March 1946 [5]. The Kress inventory list includes 87 negatives taken by Martin, dating from 1939 to 1948. Generally the paintings were treated by Pichetto at the time of purchase. However, in this case, the painting was not treated until 1955, when it was cleaned by Modestini (Berger 1990, figs. 2a, 2b). The treatment of the celebrated painting was described in newspapers and popular magazines. Modestini described the heavy surface coating as comprising some twelve layers of varnish and overpaint (Walker 1956, 644). In addition to the varnish removal, Modestini removed overpainted loincloths (he was quoted as saying it took four months of work with a scalpel to carefully scrape away the overpaint) (Gieske 1956) and uncovered a third figure at the far right of the scene. The “during treatment” photographs, including close-up details showing the difference in craquelure between the original paint and overpaint, were taken by Paul Kiehart, the restorer who had worked for both Pichetto and Modestini.

The photographs of the *Laocöon* is just one example of many where the negatives and prints have been dispersed to various departments within the National Gallery of Art. For example, the records also mention 4x5 color transparencies taken during the treatment, and characterized them as poor, but no transparencies were found in the files. In the Department of Curatorial Records, there are black-and-white prints of only some of the negatives. Also, the painting was x-rayed in 1954 and 1955, and the x-ray films are now housed in the Conservation Department.

The Kress Negative Collection includes early examples of technical photographs, probably growing out of Kress’ interest in scientific examination methods. In 1956, it was reported that Kress had equipped the conservation studio “at a cost of nearly half a million dollars with x-rays, fluoroscope, ultra-violet and infra-red equipment, and an array of powerful microscopes” (Gieske 1956). The earliest ultra-violet photograph in the collection is represented by a 1938 glass plate negative taken by Murray Keyes of the Master of Santo Spirito’s *Portrait of a Youth*, now given to Agnolo di Domenico del Mazziere or Donnino di Domenico del Mazziere and in the collection of the National Gallery of Art (K514; NGA 1939.1.294). The earliest infra-red photograph is a 1936 glass plate negative of Giovanni Bellini’s *St. Jerome Reading*, now in the collection of the National Gallery of Art (K406; NGA 1939.1.217), also taken by Murray Keyes.

The conservation field is indebted to Stephen Pichetto and Mario Modestini for having the foresight to document their treatments with photography and to the Kress Foundation for preserving the negatives of these photographs. The Kress Foundation’s support of conservation is shown by the attention to the subject in the catalogues of the painting collection by Fern Rusk Shapley and Colin Eisler. The entry on each painting includes a description of its conservation history compiled by Mario Modestini. Moreover, at the back of each catalogue are black-and-white plates of each painting, made, one must assume, from the negatives in the Kress Collection Archive.

After the initial donation of paintings and sculpture to the National Gallery of Art, the Kress Foundation began to disperse the remainder of its collection. As a result, many of the paintings documented in these photographs are now located in museums across the United States. Since these historic photographs are valuable documents of the paintings before and during previous treatments, it is hoped that conservators from other institutions will consult the Kress Collection Archive to aid in future treatments.

## Acknowledgements

We would like to thank Misy Lemke, Gregory P.J. Most, Ruth Philbrick, Ann Hoenigswald, Anne Ritchie, Mario and Dianne Modestini, Lisa Ackerman and the Kress Foundation.

## Notes

- [1] For Samuel H. Kress, the Kress Foundation, and the deposit of artworks in regional American museums, see National Gallery of Art 1966, Perry 1991, Bowron 1994, Perry 1994.
- [2] Photographs of Paul Kiehart and Mario Modestini are in a [National Geographic Magazine](#) article (Walker 1956).
- [3] For another example of Kress negatives that document a treatment by Mario Modestini, see Rupprecht and Shaneyfelt 2006.
- [4] The Kress Foundation/ National Gallery of Art Kress Condition and Restoration Record discusses the 1955 treatment. Conservation Department, National Gallery of Art.
- [5] The painting went to a “Photographer” on 3/26/46, 1/13/50 and 11/44/55; see Registration card, NGA Curatorial Records Department.

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**A TRANSLATION OF THE BYZANTINE INTO THE NORTHERN RENAISSANCE:  
HAYNE DE BRUXELLES' *MADONNA AND CHILD*, 1455**

Scott A. Heffley, Conservator of Paintings

The world's collective memory fades with time. Art historical understanding of long ago is often pieced together from the physical evidence provided by an artwork, contemporary and later written and photographic documentation, and from spin-off works of art that might occur because of popularity. The story of Hayne de Bruxelles' *Madonna and Child* painted in 1455 pulls from evidence in many directions and in some ways acts as a Rosetta Stone in the translation of the Byzantine into the Northern Renaissance.



Hayne de Bruxelles, *Madonna and Child*,  
The Nelson-Atkins Museum of Art



*Cambrai Madonna*, Cambrai Cathedral,  
Cambrai, France

Hayne de Bruxelles was commissioned in 1455 to paint twelve copies of the highly cherished *Cambrai Madonna*, a circa 1340 Italo-Byzantine icon. A document in the archives of the Cathedral of Cambrai, France, records this commission, further stating that 'the images of Our Lady be in oil colors and well crafted.' A document also in the Cathedral of Cambrai, but from a year earlier, commissioned Petrus Christus to paint three copies of the *Cambrai Madonna*. Petrus Christus was paid about seven times as much for his three copies as Hayne was for his twelve, providing a measure for the relative status of each artist. The *Cambrai Madonna* was brought from Rome to Cambrai Cathedral in 1450 and was believed to have been painted by Saint Luke himself. Because of the highly

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esteemed Saint Luke attribution (patron saint of medicine and painters), a pilgrimage to the *Cambrai Madonna* was believed to heal the sick and copies of the painting were considered to have similar power and could be used for political or financial advantage. Since Constantinople fell to the Ottoman Turks in 1453, it is theorized that these copies were intended to help raise support for a Christian Crusade to rescue the fallen capital of the Eastern Christian Church.

The Nelson-Atkins Museum's *Madonna and Child* is clearly related to the *Cambrai Madonna* but executed in a completely Northern style, contemporary to the mid-15<sup>th</sup> century. Could this picture be by Petrus Christus, Hayne de Bruxelles or some other rendition? Dendrochronological examination verifies the wooden panel's mid-15<sup>th</sup> century origin. Stylistic evaluation aligns the painting more with a Rogier van der Weyden influence than that of Petrus Christus. The mother and child in the Nelson-Atkins picture show a tenderness and gentle naturalism that would be foreign to the harder, more isolated, character that Petrus Christus generally imparted to his subjects. Hayne de Bruxelles has been documented (again in the Cambrai Cathedral archive) as having painted part of a background wall for a Rogier van der Weyden altarpiece in that church. This association, plus the fact that Hayne worked in Brussels where van der Weyden was the lead painter, further suggests a relationship.



Detail, Hayne de Bruxelles, *Madonna and Child*



Rogier van der Weyden, *Virgin and Child*, Houston Museum of Fine Arts

Close examination of the Nelson-Atkins Museum's *Madonna and Child* shows numerous minor artist changes in the development of the painting. Artist changes include the lowering of the proper left eye of the Madonna by nearly 1/8"; adjusting the contours of the Child's proper left arm and chin line; and narrowing the Madonna's proper right hand. These kinds of changes would be expected from an artist that might be copying a work but continually refining it as he executed it through his own interpretation.

All of this evidence suggests that the Nelson-Atkins painting is one of the original copies that Hayne de Bruxelles made of the *Cambrai Madonna* in 1455.

Of the fifteen copies documented as having been commissioned of Hayne de Bruxelles and Petrus Christus, this is the only one that has been identified. A copy similar to the Nelson-Atkins' *Madonna and Child* is known from a Cologne auction catalogue of 1956. This painting's current location has not been determined and the piece not

recently examined. Evaluation of the photograph, however, strongly suggests that is a copy of the Nelson-Atkins' *Madonna and Child*. The Cologne piece is about two-thirds the size of the Nelson-Atkins piece and every detail of the costume and composition of the Cologne example matches the Nelson-Atkins' even down to the details of irregularity in the gold embroidery of the Madonna's proper right sleeve. The character of the faces in the Cologne piece, however, is vacant and simplified compared to the Nelson-Atkins painting which shows a sincere tenderness.

#### Hayne de Bruxelles' and Cambrai's *Madonna and Child* Compared

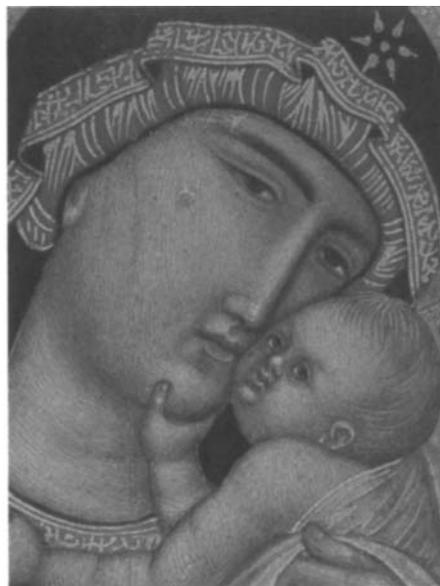
The compositions of the two works are identical. The Madonna's tilt of head; the holding of the Child up to her cheek; the location of Madonna's and Child's hands; the number and locations of drapery folds in the Madonna's robe; and many other compositional features correspond directly between the two works. Both have a gilt background which is typical for the Italo-Byzantine Cambrai piece, but is unusual for a 15<sup>th</sup> century Northern interpretation. The halo has been punched in the Cambrai painting and painted in the Hayne work. All of these similarities verify that the Hayne de Bruxelles is a copy of the earlier *Cambrai Madonna*.

The interpretation of the same composition in each painting, however, is significantly different. The Hayne de Bruxelles is very much in a contemporary Northern Renaissance style influenced by Rogier van der Weyden. The *Cambrai Madonna* adheres to the Eastern Byzantine style. The Hayne is done with oil paints and the forms are modeled in a soft, three-dimensional style. The Cambrai piece was painted with egg tempera and the very accomplished individual color strokes are evident throughout. The general tone of the Hayne shows a naturalistic tender relationship between mother and child. The mother is humbly looking down as the child softly gazes at his mother. The child here gently touches his mother's chin and lightly holds his mother's mantle. In the Cambrai piece, both mother and child stare at the viewer firmly and the child seems to grab his mother's chin and mantle tightly in a certain display of power and strength. The Cambrai's Byzantine interest in stylized repeated pattern is evident in the layering of the elongated fingers of the Madonna's hands, the drapery wrapped around the Child and the gilt depiction of the folds on the Madonna's sleeves and headdress. With the Hayne, as a Northern example, everything is more naturalistic. The Madonna's hands are stylized in direct relationship to hands done by Rogier van der Weyden.

The gold embroidery of the inner garments of the Hayne Madonna is in a contemporary Northern style. And the Child's blanket shows the Northern influence of sharp, irregular folds rather than repeated folds of the Byzantine example. The embroidered braid hemming the Madonna's mantle in both paintings depicts pseudo-Arabian writing. The Cambrai version provides a much more convincing approximation, however.



Detail, Hayne de Bruxelles,  
*Madonna and Child*



Detail, *Cambrai Madonna*

Restoration History of Hayne de Bruxelles' *Madonna and Child*

Three major restorations of Hayne de Bruxelles' *Madonna and Child* have taken place in the last hundred years. One prior to the 1932 acquisition of the painting by the Nelson-Atkins Museum (possibly in the early 1920's), one documented in 1941, and the recent restoration in 2003. A photograph of Hayne de Bruxelles' *Madonna and Child* from an Exposition of French Primitives in 1904 provides the earliest known image of the work. The early photo shows active tented cleavage in the upper right corner of the painting. A similar problem had to be addressed in the recent restoration. The painted halo, although clearly abraded, was in better condition than prior to the recent restoration. The rooster in the lower left corner is fully intact in 1904, whereas in the early 1920's restoration the back two-thirds had been repainted.

In 1923, the Kansas City collector A.R. Jones acquired the painting. It is likely that it had been fully restored prior to its arrival in Kansas City because it is not known who could have restored the painting in Kansas City after his purchase. This early 1920's restoration was remarkably over-zealous. The entire background had been re-gilt; the halos and background abbreviations had been fully repainted; areas of the faces and hands were reinforced and strengthened; and the hair of the Child had been fully repainted with much more active curls. This detailed information about the early 1920's restoration comes from Jim Roth's conservation report and photographs of 1941.



Hayne de Bruxelles, before 1941 restoration



Hayne de Bruxelles, after 2003 restoration

The restoration of 1941 by Nelson-Atkins conservator Jim Roth was much more careful. His examination report documented the over-restored state of the painting from the early 1920's restoration. Roth's extensive photo-documentation records the process of removing the earlier restoration. He rebuilt the appearance of the painting using mastic varnish and inpainting in vinylite medium. His approach was very modern in attitude, especially for 1941.

## Recent Restorations

By 2003, the 1941 restoration had dulled and changed so that the painting was no longer presented at its best. Also, the Metropolitan Museum of Art had requested to borrow the painting for its exhibition entitled 'Byzantium - Faith and Power (1261-1557)'. Under these circumstances another complete restoration was recommended in 2003. The Metropolitan Museum's exhibition hung Hayne de Bruxelles' *Madonna and Child* next to the *Cambrai Madonna* which provided a wonderful opportunity for direct comparison.

The removal of the 1941 restoration proceeded easily. Rebuilding of the appearance, however, required a variety of subtle approaches so that the final appearance of the painting could appropriately respect the period in which it was painted and address various states of material deterioration across the surface. The process of cleaning the picture yielded information that helped formulate the goals for the final appearance. For instance, when the painting was wet with solvent and therefore fully saturated, every area of the painting was over-saturated. The flesh is very thinly painted and full saturation caused the paint to gain too much transparency allowing the yellow-beige ground to optically blend with the cooler flesh tones which deadened them considerably. Saturation of the badly damaged gold leaf background darkened and enhanced the brown-green color beneath the gold and caused the remaining gold to lose much of its metallic character. The dark blue areas in the lower right of the figure became very dark and out of key with the rest of the blue garment tones.

It was clear that the painting needed a varnish application that would vary considerably across the surface. Mastic varnish in triple distilled turpentine with a 3% addition of Tinuvin 292 UV inhibitor was selected as the varnish. Mastic can be manipulated in various thicknesses providing controlled levels of saturation even with very thin applications. A 4% solution of mastic varnish was applied thinly to the entire surface of the painting and brushed out considerably overall. Wet varnish was immediately removed from the flesh areas and the gold background with a dry cloth. Small amounts of additional varnish were brushed into the dark blue garment in the lower right area of the figure because the varnish tended to sink in there. After the mastic varnish had more fully dried, in a couple of weeks, areas of the dark blue that remained matte were saturated to match surrounding areas with PVA-AYAC varnish in ethanol. This application was local and rubbed in with the finger to even the saturation and gloss in those areas. By applying the varnish and removing it in the flesh areas and gold leaf background, a small amount of varnish would be left behind. This was especially important in the gold leaf background which had become somewhat hazy from all of the previous restorations. The minute amount of mastic varnish left on the gold background eliminated the haziness and imparted a healthy unvarnished appearance in those areas.

Damages were inpainted with pigments in a PVA-AYAC medium. It is interesting to note that the representation of gold braid on the proper right sleeve and mantle hem of the Madonna had been nearly completely abraded away (the 1904 photograph of the painting showed that those areas were largely intact at that time). Microscopic examination showed that Hayne had executed those two areas of gold braid with fine lines of gold leaf and all other gold braid had been executed with yellow paint. Evidently the gold leaf lines were susceptible to cleaning materials and the yellow paint was not. It also seems to indicate that Hayne had begun the gold braid in gold leaf but switched to gold paint for the rest of the piece. The lost gold braid was recreated with inpainting as part of this restoration. The lost two-thirds of the rooster in the lower left corner of the panel was recreated based on evidence from the 1904 photograph of the work.

## Framing

The 1904 photograph showed the painting in a simple gold and painted frame. This frame is not contemporary to 1455, but it approximates the appropriate feeling. Sometime between 1904 and 1932 when the painting entered the Nelson-Atkins' collection an elaborately carved pseudo-French Gothic frame was added to the work. It is possible that this took place in the early 1920's when the painting suffered the over-zealous restoration. In the 1920's the dominant home decorating style was Gothic and this heavily restored painting with its elaborate Gothic frame would have aligned exactly with that aesthetic.

This elaborate frame, however, over-powered the sweet and intimate nature of the painting. Also, the rubbed red quality of the gold on the frame soured the rubbed brown-green quality of the gold background of the painting. After curatorial consultation it was decided to change the frame to a simple gold leaf profile. This new frame had a blue-grey bole with rub and toning that was more complementary of the panel's existing gold background.

## Conclusion

When we visit museums and look at a painting, we can learn from its appearance and labels. Usually, however, this is only the tip of the iceberg. Unraveling the art historical evidence and the physical evidence offered by the painting tells a much fuller story. When all of this is combined, a much more informed conservation treatment can be allowed to take place.



Hayne de Bruxelles, c. 1920's framing



Hayne de Bruxelles, 2003 framing

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## ACKNOWLEDGEMENTS

The author would like to acknowledge the invaluable help provided by The Metropolitan Museum's Maryan Ainsworth, Curator of European Paintings; The Nelson-Atkins Museum's Burton Dunbar, Adjunct Curator of European Painting; Hal Prestwood, Conservation Assistant; and Dinah Henderson, Administrative Assistant.

# FRANÇOIS CLOUET AND THE FRENCH RENAISSANCE: INVESTIGATING *A LADY IN HER BATH*

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**Abstract:** The National Gallery of Art's *A Lady in Her Bath* by François Clouet is an outstanding painting of the French Renaissance by an influential artist of the court exposed to French, Netherlandish and Italian art throughout his career. By using this painting as the focal point to an investigation of materials and techniques, it is hoped that a better understanding of the evolution of painting technique in 16<sup>th</sup> c. France, through the cross influences of Italy and the North, can be gained. Findings will be compared to the results of a survey of several other 16<sup>th</sup> c. French paintings as well as to published studies of 16<sup>th</sup> c. Netherlandish and Italian paintings.

## INTRODUCTION

The National Gallery of Art's *A Lady in Her Bath* (fig. 1) has been called one of the most striking examples of painting of the French Renaissance. It was painted by François Clouet who was active before 1540 to 1572. As did his father and teacher Jean Clouet (active 1516–1540), François held the title *Painter to the King*, and portrayed members of the French Royal families in drawn and painted form. An execution date of 1570, given in the early 20<sup>th</sup> century by the historian Louis Dimier based on the fashion of the bather's hair bonnet, is frequently cited. Numerous period versions attest to the popularity of the image, and today, ongoing and disparate theories as to the identity of the bather and the meaning of the painting attest to its persistent allusiveness.



Figure 1. Clouet, *A Lady in Her Bath*, c. 1570  
3.3 x 81.4 cm. National Gallery of Art, Washington, DC

The bather “reveals” the artist’s signature on the woven tub in which she sits. This is one of only two signed paintings by François Clouet.<sup>1</sup> The signed Clouet in the Musée du Louvre is a portrait of the artist’s friend, the apothecary Pierre Quthe. There is a small group of unsigned paintings attributed to Clouet as well as around fifty chalk drawings. Many copies of his paintings and drawings exist and the term “Clouet” has been used in the past as a general reference to French 16<sup>th</sup> c. formulaic portraits. Notably, Clouet’s oeuvre included the two major types of French easel painting produced at the time: conventional portraiture and the mannered Fontainebleau style.

Many historians observe that the painting *A Lady in Her Bath* shows a merging of Northern and Italian stylistic qualities. Northern influences can be seen especially in the features of the wet nurse and details of the still life. Italian

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influences can be seen in the loose brushwork of the curtain and in the pose of the bather, which is thought to be taken from a lost painting by Leonardo, the design best preserved in a cartoon by an anonymous artist in the Musée Condé in Chantilly. The merging of Northern and Italian stylistic qualities is demonstrated in much of the French artwork of this period. This can be explained by France's central geographic location as well as by events leading up to and extending into the period. At the end of the Hundred Years War with England in 1453<sup>2</sup>, artists from the North settled in France and brought with them the painting style developed by such artists as Van Eyck, and Van der Weyden. Italian influence was also seen early in France, above all in the works of the artist Jean Fouquet (c. 1420-1480) who had worked in Rome before returning to the French court around 1450. However, Italian influence would become much more evident in the 16<sup>th</sup> c. with the arrival of Italian artists at the French court at Fontainebleau.<sup>3</sup>

A great increase in artistic activity, incongruously mixed with extensive political and religious turbulence, occurred in France during the period that would come to be known as the French Renaissance. With the end of the Hundred Year's War, growing prosperity and sense of national unity enabled the French Kingdom to assimilate various French Duchies who had fought for their sovereignty with their respective English, Spanish, Italian and German alliances. Seeking still greater power and wealth, Francis I (reigned 1515-1547) continued a tradition of campaigns into Italy to seize lands claimed by his ancestry. Although—after some initial victories—these campaigns ultimately failed, Francis I took back to France his impressions of the Italian Renaissance, and, with the hopes of emulating its grandeur, assembled artists from France, the Netherlands and Italy at his palatial retreat at Fontainebleau. Throughout Francis I's reign, and continuing intermittently, due to religious and civil wars, through the reign of Henry IV, there was a great intensification of the arts of architecture, literature, sculpture, painting and printmaking.<sup>4</sup> The artists at Fontainebleau, with their diverse backgrounds and influences, developed a unique style of art, later coined the School of Fontainebleau.<sup>5</sup>

François Clouet was a highly influential artist of the court, exposed to French, Netherlandish, and Italian art throughout his career. Little is known about the methods and materials used by the Clouets or other French artists in this period, and contemporary French literature on art technique, comparable to texts by Vasari, Alberti, and Van Mander, is not known to exist.<sup>6</sup> By using the painting *A Lady in Her Bath* as the focal point of an investigation into materials and techniques, it is hoped that a better understanding of the evolution of painting technique in 16<sup>th</sup> c. France through the cross influences of Italy and the North can be gained. The technical study may, one day, aid in confirming attributions of other French 16<sup>th</sup> c. paintings and it may also one day elucidate the order of the creation of this painting in the context of its other versions. This technical study included X-radiography, infrared reflectography, and pigment and paint layer analysis. Findings are compared to those resulting from the study of several other 16<sup>th</sup> c. French paintings as well as to published studies of Northern and Italian 16<sup>th</sup> c. paintings.

## MEANING

A frequent interpretation of the painting is that it depicts a mistress of the French Court soon after giving birth. The designs of the bather's matching bracelets are consistent with those made by the jewelers of the Valois court.<sup>7</sup> The identity of the bather remains unresolved, although Diane de Poitiers, the mistress of Henry II (r. 1547-1559), is generally cited. Mary Stuart (Queen to Francis II, r. 1559-1560) and Marie Touchet (mistress of Charles IX, r. 1561-1574) have also been suggested as possibilities. For various reasons, attempts to identify the sitter so far have proved unsatisfactory.<sup>8</sup> A more expanded meaning is a mystery; for instance, what does the unicorn (fig. 2), often employed by artists as a symbol of virginity, mean in such a setting? If the painting represents a moral allegory the meaning is lost to us today.



Figure 2. Detail of Unicorn.

The Washington panel, one of multiple versions of this painting, is often thought to be the original. A dissertation on the subject listed sixteen versions—some repeating the entire composition and some only part.<sup>9</sup> The paintings seem to be by various artists and the bather's particularized features indicate that they portray different sitters. It is uncertain why different women were portrayed in the same setting with the same supporting figures, but perhaps the image was famous enough that other patrons desired a similar painting with the sitter of their choice in the 'setting of the elegant mistress'. The popularity of the bathing images spawned a series of easel paintings depicting both single and double bathers as well as related images of a lady at her dressing table (figs. 3, 4 and 5). The paintings are closely related and borrowed props and poses from the images of the single bather and the lady at her dressing table can be seen in some of the images of double bathers. In total, there are about 30-40 period paintings from these versions, and it is thought that more have been lost or destroyed in centuries subsequent to their creation.



Figure 3. *Woman at Her Toilette*, oil on canvas French artist, about 1550-1570. Worcester Art Museum, Worcester, MA.



Figure 4. *Gabrielle d'Estrées au bain*, oil on canvas. French artist, late 16<sup>th</sup> c. Musée Condé, Chantilly.



Figure 5. *Double Bathers*, French artist, late 16<sup>th</sup> or early 17<sup>th</sup> c. Private Collection

## TECHNICAL STUDY OF *A LADY IN HER BATH*

The painting was executed on an oak support measuring 92.3 cm x 81.4 cm. The panel is comprised of six vertically oriented, quarter-sawn, butt-joined boards. Dendrochronology carried out by Dr. Peter Klein determined an earliest plausible creation date of 1551. He concluded that two pairs of boards were each from a (separate) single tree and that all the oak originated from the French region. The panel was prepared with a chalk and glue ground that extends to the edges of the support. Cross-sections show the ground was applied in numerous thin layers, the total thickness measuring 265µm.<sup>10</sup>

Over the chalk ground, the artist applied two grey priming layers. The light-to-mid-grey lower layer is composed of lead white, relatively large carbon black particles, and a small percentage of chalk. The artist applied a second, paler and slightly thinner, priming layer comprised of large and dense aggregates of white lead, and a low percentage of small, well distributed black particles and traces of chalk.<sup>11</sup>

Clouet used a squaring method to transfer the pictorial composition to the prepared panel. Examination with infrared reflectography (IRR) revealed ruled lines, crisp and even, around the edges of the support: 2.0 cm in from the side edges, 2.5 cm in from the bottom edge and 3.5 cm in from the top edge. Along these lines are small equidistantly placed tick marks (approximately 0.5 cm long and 9.8 cm apart). No similar marks or lines were found within the body of the image. If a grid was drawn out over the entire panel, it must have been with a material that could be easily brushed away like loose charcoal, or with a material that is invisible in IRR. It is also possible that Clouet made a grid with string.

The artist's use of a grid strongly suggests that an underdrawing of some nature might exist. However, only a few lines of underdrawing, limited to contour areas, were detected. Two samples have indicated that the marks for squaring as well as underdrawing lie between the two priming layers. Although infrared imagery did not clearly show an overall drawing, when complemented by X-radiography, it did show several changes and shifts in composition. Small changes to the bather's pose were made, most notably along her proper left shoulder and elbow, her wrists, and the shape of the bunched sheet in her left hand. All the other figures show slight shifts primarily in their facial features. The boy's nose and lips were shifted slightly to the right and were slightly raised. The features of the maid in the background were lowered and her pitcher was widened. The outer right contours of the heads and the eyes of the wet nurse and the infant were shifted slightly to the right. Other changes include the almost complete repainting of the herbs and flowers lying on the tub's table after a slight shift in position to the right, as well as the revisions to the mirror, and the window lights.

Clouet built up the composition using relatively thin layers of oil<sup>12</sup> paint (generally 2-4 layers) applied with distinct boundaries between compositional elements. Infrared and visible light examinations reveal that the artist painted the background and garments before areas of flesh were finished. Flesh tones were underpainted with a mid-tone brown layer modulated for darks and lights. The artist then further modeled the flesh with a thin scumble of lead white and vermilion for illuminated areas and a glaze consisting of more brown and black pigments for shadowed areas. He added some azurite to the whites of the eyes of the bather and the boy as well as to the bather's body, enhancing the brilliance of her skin.<sup>13</sup> Clouet sometimes modeled forms with small hatching brushstrokes, often working wet into wet paint. Such areas can be seen on the wet nurse's fingers, the bather's white drapery, the fabric of the baby's bundle, and the bather's eyes. He also used feathery brushstrokes for blending, as seen in the curtain. This contrasts with the smoothly modeled and enamel-like areas of flesh. Observation with a stereomicroscope reveals the transparent layer of red lake on the illuminated areas of the curtain was brush applied and further textured in places by blotting with a finger or a piece of fabric. Clouet used a typical 16<sup>th</sup> c. palette including smalt<sup>14</sup>, azurite, vermilion, red lake, lead white, iron earths, lead tin yellow, umbers, ochres, and copper greens.

## DISCUSSION

The use of oak for panel-making is consistent with 15<sup>th</sup> and 16<sup>th</sup> c. artists from northern France, the Netherlands, and northern Germany.<sup>15</sup> The method of employing butt-joints in panel manufacture is also consistent with the majority of panels made in the Northern countries. The dendrochronological analysis of the oak of Clouet's panel yielded results consistent with those of an oak panel from a painting in the Friedsam Collection at the Metropolitan Museum attributed as "Style of François Clouet". The painting is a small portrait of Charles IX and believed to be painted shortly after 1561. Dendrochronology expert Peter Klein noted that the similar ring structure and ring spacing of the boards from the two panels indicate the trees most likely grew during concurrent years and in close proximity. Comparison with the wood origin of other French panels cannot presently be made as they have not been systematically studied.<sup>16</sup>

For panel preparation, the use of chalk is also consistent with Northern artists including northern French artists of this time.<sup>17</sup> Indicating the availability of materials, the Italian painter Rosso Fiorentino adapted to the use of chalk as a ground while working at Fontainebleau.<sup>18</sup> Chalk has been identified as a preparation layer on other French 16<sup>th</sup> c. panels examined in this survey, as well as on two period versions of *A Lady in Her Bath* on canvas.<sup>19</sup>

A small but growing body of analysis so far indicates that light-to-mid grey priming layers, as found on Clouet's painting in Washington, were used increasingly in France during the 16<sup>th</sup> c. The French treatise *Academie de la Peinture*, published by De La Fontaine in 1679, recommends for the preparation of panels three layers of a fine chalk ground with either another layer of glue on top or a grey oil layer.<sup>20</sup> Since the tradition of using panels had been steadily declining, due to the preference for canvas, for some time by La Fontaine's publication, the suggestion was most likely an older one and probably in use during the preceding century. An estimated starting date for the use or preference of grey primings in France is not yet known.

Priming layers were used widely throughout Europe in the 16<sup>th</sup> c. to prevent the oil of the successive paint layers from absorbing into the porous chalk or gesso ground. Analysis of Northern paintings in the collection of the National Gallery London, reveals that many Northern artists, especially those working from 1500 onwards, often toned their primings with lead white and small amounts of red and black pigments to give a pinkish-beige to warm grey tint, similar to what Karel van Mander described in his 1604 *Schilder-Boeck*.<sup>21</sup> A few light-to-mid grey primings have been found on paintings of such Northern artists as van Heemskerck<sup>22</sup>, Holbein<sup>23</sup>, and Van Orley<sup>24</sup> as well as slightly earlier on some paintings in the Master of Flemale group.<sup>25</sup> In general, Northern primings tended to be translucent and pale, but became more strongly toned by the end of the 16<sup>th</sup> c. Analysis of 16<sup>th</sup> c. Italian paintings suggests a more extensive and varied use of toned primings ranging from light to dark and in a range of colors. A study of the Italian paintings in the collection of the National Gallery London has shown that most of the 16<sup>th</sup> c. paintings with light-to-mid toned primings (as opposed to white or mid-to-dark toned primings) are from areas north of the Apennines.<sup>26</sup> The colors of the primings vary, and although pale cool greys are found, the most common seems to be a warm, slightly brownish grey that corresponds to recommendations in Italian treatises of Vasari, Borghini, and Armeneni. Of the three most prominent Italian artists who worked at the Château Fontainebleau, Rosso Fiorentino was often known to use dark primings, several of Niccolò dell'Abate's paintings have light-to-mid grey primings,<sup>27</sup> and Francesco Primaticcio's preference of primings is unknown as surviving easel paintings by him are rare.

With known exceptions, analysis indicates underdrawings in Northern paintings were often executed on the ground layer before the application of a translucent priming layer.<sup>28</sup> In contrast, underdrawings in Italian paintings are often found (also with known exceptions) to be executed on top of a priming layer.<sup>29</sup> This difference is perhaps directly related to the degree of translucency and darkness of priming layers preferred by artists of the North versus those in Italy. Limited findings from this study indicate that the underdrawing of 16<sup>th</sup> c. French paintings frequently lies on top of a priming layer;<sup>30</sup> however, more analysis is required to determine a French preference if any. The purpose of Clouet's technique of sandwiching his drawing media between the two toned priming layers in *A Lady in Her Bath* is not completely understood and comparative instances have not been noted by this author. Perhaps Clouet was purposefully altering the optical tone of the preparatory surface with the second paler priming layer, or was simply sealing his drawing with the second priming layer. It is tempting to conjecture that the artist was perhaps using a combination of methods by simultaneously drawing *on top* of a darker imprimatura layer as might be an Italian preference, and drawing *underneath* a paler, thinner priming layer as might be a Northern preference.

Grids were the easiest method to enlarge or reduce a prepared design and their use increased in the early 16<sup>th</sup> c. across Europe.<sup>31</sup> Other French paintings examined with IRR in this study did not seem to have grids or indications of grid use (i.e., lines along edges). Grids were most likely being used in France before the execution of Clouet's *A Lady in Her Bath* as art historian Etienne Jollet notes an allusion to squaring made by the early French artist Jean Perréal (1455-1530), although it is not known how extensive was their use.<sup>32</sup> Later, a canvas prepared with a grid is illustrated in a 1676 French treatise by Felibien.<sup>33</sup> Literature indicates that there was an earlier and more extensive use of grids in Italy<sup>34</sup>; however, more grids have been found with IRR examination on Northern paintings. This seeming imbalance could be due to various reasons such as the type and range of paintings examined with IRR to date, the increasing use of darker priming layers and grounds especially in Italy, which could potentially obscure the lines of a grid in IRR, a possible tendency to dust away the lines or apply them in a material invisible in IRR, or simply a preference for other transfer techniques.

Underdrawings observed with IRR in the French paintings in this study exhibited a range of styles, including a free gestural-type drawing, a simplified contour drawing—sometimes more loosely drawn and sometimes with a more mechanical or traced appearance—and in some cases the use of hatching was employed to develop areas of shadow. A study of 16<sup>th</sup> c. French paintings undertaken by Patrick Le Chanu at the *Laboratoire du Centre de Recherche et de*

*Restauration des Musées de France* (C2RMF) indicates that, generally, the French artists who came from or were trained in Northern Europe used a densely hatched underdrawing, and, in contrast, French artists who trained and worked at Fontainebleau often limited their underdrawing to contours of the design, possibly because of Italian influence.<sup>35</sup> Results of IRR examinations to date do suggest that 16<sup>th</sup> c. Italian artists, with the exception of several Venetian artists, often restricted their underdrawing to contours of designs<sup>36</sup> as opposed to executing elaborate underdrawings often developed with hatching for modeling as many Northern artists continued to do for a longer period of time.

The technique of painting forms with defined boundaries was typical of 16<sup>th</sup> c. French paintings examined in this survey. This technique is seen in the works by artists of both the North as well as parts of Italy in the 16<sup>th</sup> c., but it generally persisted longer in the North. Blue pigments, most likely azurite, were found in the flesh and whites of the eyes of several French paintings examined in this survey and have been noted often in the flesh of Northern paintings.<sup>37</sup> Modeling of form with small hatching strokes of paint was seen on several other French paintings in this survey and is similar to what is seen in Northern examples such as Memling. The pigment smalt was found on the painting *Woman at Her Toilette* in the Worcester Art Museum<sup>38</sup> and a version of *A Lady in Her Bath* in Paris<sup>39</sup>; the approximate identification of smalt by visual means on several other French paintings in this survey suggests its use was fairly common. Further analysis is needed to show if the French artists were working with smalt more widely than most Northern artists by mid century.<sup>40</sup>

## CONCLUSIONS

The National Gallery of Art's Clouet painting *A Lady in Her Bath* was executed at a time of greatly increased artistic activity in France. At court, François Clouet would have worked with artists of diverse influences and would have seen the royal collection of Italian and Northern paintings, one of the finest collections in Europe and the start of what is now the collection of the Musée du Louvre. Historian Henri Zerner states, "Even artists who arrived (at Fontainebleau) as fully trained professionals altered their manner when in contact with Rosso or Primaticcio."<sup>41</sup> This study has begun to show that this is possibly true of some working practices of French 16<sup>th</sup> c. artists.

The technical findings from *A Lady in Her Bath* suggest that Clouet perhaps employed some preparatory methods influenced by Italian artists; however, most of his execution of design paint layers remained closer to a Northern approach. The same could be said, perhaps with somewhat fewer Italian inspired features, for most of the other 16<sup>th</sup> c. French paintings examined in this study. Some materials such as the oak support and chalk ground, speak of materials readily available rather than particular artist's choices. On Clouet's *A Lady in Her Bath*, the use of the darker priming layer as well as the limited use of contour underdrawing may have been associated with the introduction of Italian artists at Fontainebleau, while the use of the paler and slightly thinner priming layer, applied over the underdrawing, may be associated with more of a Northern artist's technique. The use of grey priming layers stands out as a lasting French preference, considering the continuation of the use of grey as a preparation top layer (or 'grey eye') over a red layer on canvases in the next centuries. The techniques of painting forms with confined boundaries, incorporating blue pigments in flesh tones, as well as using small paint strokes to model form are all reminiscent of techniques used primarily by Northern artists. However, the brushy and expressive character of paint application on the red curtain is more influenced by Italian painting technique. It is possible that the seemingly widespread use of smalt in 16<sup>th</sup> c. French paintings may have also been an Italian influence.

To this author's knowledge, grids have so far not been found on other 16<sup>th</sup> c. French paintings examined with IRR. Although grids may have been in use France at an earlier date, it is notable that many surviving drawings by the artists of the School of Fontainebleau have been squared for transfer, and this may indicate a preferred method at least here. Grids were more likely to be used for more complicated compositions, and not expected on small portraits.

Painting conservator Jill Dunkerton observes that during the 16<sup>th</sup> c., there was a gradual standardization of technique between Italian and Northern artists.<sup>42</sup> France, as a probable stop-over—as times of peace allowed—for artists from the North traveling to and from Italy, may have been a large contributor to this phenomenon. This study has begun an exploration of the methods and materials of paintings in France in the 16<sup>th</sup> c. Hopefully it will provide a useful reference as more 16<sup>th</sup> c. French paintings are analyzed in regard to their materials and techniques.

## ACKNOWLEDGMENTS

The author would like to thank the Samuel H. Kress Foundation as well as those conservators at institutions in the United States and Europe that have been extremely gracious and generous during the course of this project. A special thank you to the conservation staff of the National Gallery of Art, the Worcester Art Museum, the Museo de Art Thyssen-Bornemisza, and the Royal Collection at Windsor Castle.

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<sup>1</sup> The authenticity of the signature on a third painting in Vienna is doubted by most art historians.

<sup>2</sup> The war ends in 1453 but a formal treaty is not signed until 1475.

<sup>3</sup> Perhaps three of the most influential Italian artists at Fontainebleau were Rosso Fiorentino, Francesco Primaticcio, and Niccolò Dell'Abate.

<sup>4</sup> Although there is a noticeable scarcity of French paintings in comparison to Netherlandish and Italian 16<sup>th</sup> c. paintings, what was produced in France at this time represents an explosion when compared to the early and later years of the 16<sup>th</sup> c. and the beginning years of the 17<sup>th</sup> c. when painting in France was nearly at a stand still. Throughout the period it is fair to say that other areas of the arts were cultivated more strongly than was painting.

<sup>5</sup> First used by Adam von Bartsch in his catalogue of prints *Le Peintre-Graveur* (21 vol., 1803-21) referring to a group of etchings and engravings. In Anne Plogsterth's doctoral dissertation on the subject, *The Institution of the Royal Mistress and the Iconography of Nude Portraiture in 16<sup>th</sup> C. France*, (Columbia University, 1991, p. 34), she notes that the term refers to a style developed at the Chateau de Fontainebleau but not restricted to art actually produced there or artists who worked there.

<sup>6</sup> The first French treatises that included information on painting technique would be written in the next century, and before this, generic *Books of Secrets* from old sources were popular.

<sup>7</sup> Clare Vincent, Associate Conservator of European Sculpture and Decorative Arts, Metropolitan Museum of Art. Private correspondence, August 31, 2004.

<sup>8</sup> For thorough studies on this subject refer to: Ann Plogsterth, *op. cit.* (see fn #5); Herni Zerner, *Renaissance Art in France: The Invention of Classicism* (1996, 2004); Gail Parson Zlatnik, *Myth Vision and the Harem in French Painting from Fontainebleau through the 19<sup>th</sup> C.* (PhD University of Iowa, 1998); Rebecca Elizabeth Zorach, *The Figuring of Excess in French Renaissance Art* (PhD University of Chicago, 1999).

<sup>9</sup> Plogsterth, *op. cit.* The author notes that the whereabouts of some are unknown and the list could include duplicate listings.

<sup>10</sup> Measurement was taken from a cross-section that appeared to have a complete ground layer (R1327).

<sup>11</sup> The lower darker priming layer ranged from 10-20  $\mu\text{m}$  and the upper lighter priming layer ranged from 8-15  $\mu\text{m}$ .

<sup>12</sup> Oil is estimated visually and by staining with amido black (AB2), which did not detect the presence of protein.

<sup>13</sup> No samples were taken. Azurite was identified *in situ* with stereo microscopy.

<sup>14</sup> Energy Dispersive Spectroscopy (EDS) analysis revealed components: Si, (Fe), (K), (Ca), (Co), (As).

<sup>15</sup> Jørgen Wadum. "Historical Overview of Panel-Making Techniques in the Northern Countries" in *The Structural Conservation of Panel Painting*, ed. Kathleen Dardes and Andrea Rothe, (Los Angeles: Getty Conservation Institute, 1998), 149-177. Wadum notes that although most French panels of this period were made of oak, some of walnut and poplar have been found.

<sup>16</sup> Dr. Peter Klein, Hamburg University. Private correspondence.

<sup>17</sup> Philip Hendy and AS Lucas, "The Ground in Pictures" *Museum* vol. XXI no. 4, (1968), 261 fn #8 and fn. #8a. Also, Ségolène Bergeon, "Painting Technique: Priming, Colored Paint Film and Varnish (Chapter II) *PACT #13, Scientific Examination of Easel Paintings* (1986), 36.

<sup>18</sup> Scailliérez, Cecile, E. Ravaud, J.P. Rioux, *et al.*, "La Pietà de Rosso Restaurée" *Revue du Louvre* (1999), 63-81. See section "Couleurs, pigments et technique" by Rioux, p.78.

<sup>19</sup> Chalk grounds were found on versions of this painting in Chantilly (Musée Condé) and Paris (Musée des Arts Décoratifs).

<sup>20</sup> See Ann Massing, "French Painting Technique in the Seventeenth and early Eighteenth Centuries and De La Fontaine's *Académie de la Peinture* (Paris 1679)" in *Looking Through Paintings*, ed. Erma Hermens (Uitgeverij de Prom and Archetype Publications, 1998), 352, 383-384.

<sup>21</sup> Campbell, Lorne, Susan Foister, Roy Ashok, eds. "The Methods and Materials of Northern European Painting 1400-1550", *National Gallery Technical Bulletin*, vol 18, (1997), 6-55 (see section on "Preparation of Panels for Painting"). See also: K. van Mander, *Het Schilder-Boeck waer in Voor eerst de leerlustighe lueght den grondt der Edel Vry Schilderconst in verscheyden deelen Wrot Voorghedraghen...*, Harlem 1604.

<sup>22</sup> *St. Luke Painting the Madonna* (1532). See: J.R.J van Asperen de Boer, M. Faries and J.P. Filedt Kok, "Painting Techniques and Workshop Practice in Northern Netherlandish Art of the 16th C." in *Kunst voor de beeldenstorm* (Rijksmuseum, Amsterdam, 1986), 108.

<sup>23</sup> *The Ambassadors* (1533). See: Martin Wyld, "The Restoration History of Holbein's *Ambassadors*" *National Gallery Technical Bulletin*, vol. 19 (1998), 4.

<sup>24</sup> *Retable de la Passion* (c. 1525). See: Hélène Verougstraete-Marcq, «L'Imprimatura et la maniere strice. Quelques exemples dans la peinture Flamande du 15e au 17e siecle Louvain le Neuve » *Le Dessin Sous-Jacent dans la Peinture* (Louvain-La-Neuve, 1987), 22-23.

- <sup>25</sup> *Saint Veronica*. See: J.R.J van Asperen de Boer, “On the Painting Technique of the Master of Flémalle Panels at Frankfurt”. Also, a grey underlayer was locally applied in *The Virgin and Child Before a Firescreen*. See: David Bombard *et. al*, “The Virgin and Child Before a Firescreen: History, Examination and Treatment”. Both articles are from *Robert Campin; New Directions in Scholarship*, Susan Foister and Susie Nash, eds., (Belgium: Brepols, 1996) 21-25; 37-54.
- <sup>26</sup> Jill Dunkerton and Marika Spring “Development of Painting on Coloured Surfaces in Sixteenth-Century Italy” *Painting Techniques; History Materials and Studio Practice, Contributions to the Dublin Congress of the International Institute for Conservation, 7-11 September 1998*, (London, 1998).
- <sup>27</sup> *Ibid.*, 128. *The Death of Eurydice*. Also, this author’s observation through a stereo microscope indicates that dell’Abate used a similar priming color on the painting *Eros and Psyche* (c. 1560) in the Detroit Institute of Arts.
- <sup>28</sup> Campbell, Lorne, Susan Foister, Roy Ashok, eds., *op cit.*, 25.
- <sup>29</sup> David Bomford, ed., *Art in the Making: Underdrawings in Renaissance Paintings*, p. 69; and, Wadum, *op cit.*, p. 166.
- <sup>30</sup> In some cases, on paintings with a confirmed or suspected (with X-ray or IRR analysis) priming layer, the drawing can be seen in visible light laying directly under the thinly applied paint layer of the design.
- <sup>31</sup> Molly Faries, “Underdrawings in the Workshop Production of Jan Van Scorel— A Study with Infrared Reflectography”, in *Scientific Examination of Early Netherlandish Painting: Applications in Art History; Nederlands Kunsthistorisch Jaarboek*, vol. 26 (Bussum, 1976), 103.
- <sup>32</sup> Regarding the tomb of Philibert le Beau in Brou, French artist Jean Perréal (1455-1530) comments, « Tellement que les ouvriers qui besogneront après seront tenus de l’ensuivre à toute rigueur, en réduissant le petit pié au grand. » See: Etienne Jollet, *Jean and François Clouet*, (Paris, 1997), footnote 263 (part I).
- <sup>33</sup> Felibien, André Sieur des Aiaux, *Entretiens sur les vies et sur les ouvrages des plus excellens peintres anciens and modernes, I-V*. See : Livre Troisième, Chapter VI. (Paris, 1666), 301-302.
- <sup>34</sup> J.R.J van Asperen de Boer, M. Faries and J.P. Filedt Kok, *op. cit. fn #22*, p. 111. Also Carmen Bambach, *Drawing and Painting in the Italian Renaissance Workshop: Theory and practice 1300-1600* (Cambridge, 1999), 51-52; 127-131.
- <sup>35</sup> Patrick Le Chanu, « La place du dessin sous-jacent dans l’élaboration des peintures de chevalet : Réflexion à partir de quelques exemples tirés de l’art français du XVIe siècle » *Le Dessin Sous-Jacent dans la Peinture* (Louvain-La-Neuve, 2001), 169-178.
- <sup>36</sup> Bomford, ed., *op cit.* (fn# 29), 75-76.
- <sup>37</sup> Jill Dunkerton, Susan Foister, Nicholas Penny, *Dürer to Veronese; Sixteenth-Century Painting in the National Gallery* (New Haven and London, 1999), 240.
- <sup>38</sup> Philip Klausmeyer, Andrew W. Mellon Conservator in Paintings and Conservation Science at the Worcester Art Museum, visually identified smalt pigments in a cross-section of a sample taken from along the edge of the painting.
- <sup>39</sup> In a technical study at the *Institut de Formation des Restaurateurs d’Oeuvres d’Art* (IFROA), of the Musée des arts Décoratifs’ *Portrait de dame au bain*, painting conservator Christian Châtellier identified smalt in a cross-section analyzed with SEM-EDS.
- <sup>40</sup> Numerous accounts of smalt have been noted on Italian paintings throughout the 16<sup>th</sup> c., while fewer have been noted on Northern paintings.
- <sup>41</sup> Henri Zerner “Fontainebleau School; First Fontainebleau School; Dispersion of artists from Fontainebleau” Grove Art Online. Oxford University Press, (Date accessed: 6/5/05), <http://www.groveart.com/>.
- <sup>42</sup> Jill Dunkerton, “North and South: Painting Techniques in Venice”, *Renaissance Venice and the North, Crosscurrents in the Time of Bellini, Durer, and Titian*, exh. cat. Bernard Aikema and Beverly Louise Brown, eds, (New York: Rizzoli, 2000), pp. 93-103.

## VARIANTS OF TITIAN'S VIRGIN AND CHILD IN A LANDSCAPE, A COMPARATIVE STUDY

Adelaide Izat, Conservator of Paintings

**ABSTRACT** - In the course of treating the Royal Collection's painting attributed to Titian and Workshop, *Madonna and Child in a Landscape with Tobias and the Angel*, some analysis of its materials and painting technique was possible. This prompted comparison with three other variants of the theme, held at the National Gallery London, the Palazzo Pitti, Florence, and the Kimbell Art Museum, Fort Worth. The painting at the National Gallery London is held to be the prime version, although none of the others are exact copies and all exhibit distinct revisions that can be attributed to Titian. As far as was possible, technical examinations were undertaken on all four paintings, with emphasis on the transfer of the composition. The comparison revealed both similarities and distinct differences in style, materials and techniques. Overall, the technical examination helped consolidate an understanding of this group of paintings in the context of the dynamic between Titian's own stylistic explorations, the commercial aspect of his practise and the degree of studio assistance.

There does not appear to be a straightforward sequence to the development of the theme, each painting appearing to take the National Gallery, London version, *The Virgin and Child with the Infant Saint John and a Female Saint or Donor* as its reference point, rather than being built one from the other.<sup>1</sup> The London painting is dated to around 1532 and seems always to have been attributed to Titian. It is possibly the first of Titian's compositions to be explored in several variants.<sup>2</sup> The Pitti version *Madonna and Child with Saints Catherine and John the Baptist* was recorded by 1624 in the Medici Collection, and transferred to the Palazzo Pitti in 1693. Its current attribution is described as coming from Titian's bottega<sup>3</sup>. The first certain notice of the painting now at the Kimbell Art Gallery in Fort Worth, *The Madonna and Child with a Female Saint and the Infant Saint John the Baptist*, was in 1952 at Christie's, London, and is dated to the 1530's. Whilst being attributed to Titian, it is generally agreed that an assistant might have been involved in laying in the three central figures.<sup>4</sup> The painting in the Royal Collection of the *Madonna and Child in a Landscape with Tobias and the Angel* is attributed to Titian and Workshop, dated to c. 1535, and possibly originally belonged to the Dalla Torre, an important Venetian family known to Titian<sup>5</sup>. It was subsequently acquired by Jan Reynst in Venice, and from his brother Gerard's collection by the States of Holland and West Friesland, who gave it to Charles II in 1660. John Shearman attributed the Virgin and the Child to Titian and the landscape and subsidiary figures to workshop assistants.<sup>6</sup> This has been informally disputed to the extent that it is now generally agreed that the Virgin is also largely of workshop origin.<sup>7</sup>

In terms of compositional changes, the National Gallery version was largely unaltered during execution except for the colour of the female saint or donor's dress, which was originally pink but subsequently altered to yellow. The Virgin's dress also extended lower but later was tucked back and the foot added.<sup>8</sup> The Kimbell and Pitti variants may be said to involve some compositional improvements.<sup>9</sup> In the Pitti variant, the Infant Baptist is transferred to the right foreground where he kneels with a lamb behind him. The kneeling woman is now fully identified as Saint Catherine by the wheel behind her. The Virgin's arm stays where it is in the London painting, but now picks a flower from the bank and the Infant holds an apple. However, recent x-radiography of the Pitti version reveals that St. John was originally placed to the left of the Virgin, as in the National Gallery version. Unlike in the latter, however, two hares touching noses were fully worked up in the right of the foreground corner of the painting to balance the composition<sup>10</sup> (see Fig. 5). These were covered over by the kneeling St. John. The left side of the composition was painted over with plants and trees, like the Kimbell and the Royal Collection versions.<sup>11</sup>

X-radiography of the Kimbell version revealed an alteration to the Infant's head during painting to face the kneeling woman, his proper right arm was originally painted in the same pose as that found in the National Gallery version before being altered to its final position resting on his head and his proper left arm was pulled in. At the left side, what appears to be an angel was freely laid in, visible in the x-radiograph, but subsequently painted over with landscape and a finch.<sup>12</sup> Instead, St. John advances in from the right with a lamb, and as in the Pitti painting, the Virgin plucks a flower from a bush.<sup>13</sup>

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Fig. 1, Titian, *The Virgin and Child with the Infant Saint John and a Female Saint or Donor*, ©The National Gallery, London, oil on canvas, 102.4 x 143.7cm



Fig. 2, Titian, *The Madonna and Child with a Female Saint and the Infant Saint John the Baptist*, The Kimbell Art Museum, oil on panel, 105.4 x 148.3cm, copyright © 2006 by Kimbell Art Museum, Fort Worth, Texas



Fig. 3, Titian's bottega, *Madonna and Child with Saints Catherine and John the Baptist*, Palazzo Pitti, ©Ministero dei Beni e le Attività Culturali, oil on canvas, 93 x 130.2



Fig. 4, Titian and Workshop, *Madonna and Child in a Landscape with Tobias and the Angel*, The Royal Collection © 2006 Her Majesty Queen Elizabeth II, oil on panel, 85.7 x 120.2cm, before treatment

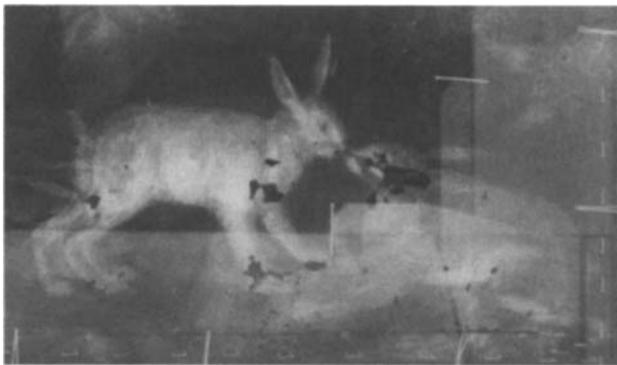


Fig. 5, Titian's bottega, *Madonna and Child with Saints Catherine and John the Baptist*, Palazzo Pitti, ©Ministero dei Beni e le Attività Culturali, x-radiograph detail

Compositionally, The Royal Collection version clearly stands apart. The female saint has been removed completely, the space filled instead with a twisting Infant who holds a rose up to the Virgin. The angel, Tobias and his dog fill the right middle ground. The Virgin plucks a campanula from the bank of flowers in front of a rose bush.

Both the National Gallery and the Pitti versions are on canvas, their original stretchers now lost and both are lined. The National Gallery painting has a probably non-original strip attached along the left edge. The London canvas is of a medium-fine twill weave with 19 threads to the centimetre vertically and 18 horizontally. The Pitti canvas is

plain woven and slightly coarser, having approximately 16 vertical threads to the centimetre and 14 horizontally.

The Kimbell<sup>14</sup> and Royal Collection variants are notable for their structural similarities. Both poplar panel supports are comprised of three horizontal grain planks, and both are inset twice at each joint with dovetailed cleats, with their grain perpendicular to that of the panel. The Royal Collection verso is largely unaltered except for a subsequent lead-based coating across the whole surface (which interferes with interpretation of x-radiographs). The Kimbell version exhibits an elaborate cradle that partially obscures the verso, seemingly of Italian origin. The Kimbell's dovetailed cleats are, like the rest of the panel, larger than those on the Royal Collection panel. However, only the Kimbell possesses inset plugs associated with faults in the wood.

Thin gesso grounds on 16<sup>th</sup> century Venetian canvas paintings are common, and the majority of Titian's canvases examined are no exception.<sup>15</sup> Indeed, samples taken from the National Gallery painting indicate a thin gypsum ground bound in glue.<sup>16</sup> The Pitti painting appears to have an even thinner ground layer, just filling the interstices of its canvas. The Royal Collection panel has an unusually thick gypsum layer with both calcium sulphate anhydrate and dihydrate identified with PLM, also in a proteinaceous binding medium.<sup>17</sup> It also exhibits large particles of charcoal in the gesso layer. The same phenomenon was found in some samples showing the gesso ground in Titian's early painting of *Jacopo Pesaro being Presented by Pope Alexander VI to Saint Peter*, in Antwerp, of 1506-11.<sup>18</sup> They could be unintentional impurities or possibly part of the workshop practice. It is not at this stage possible to say whether or not they were added intentionally.

Both the National Gallery and the Royal Collection versions exhibit light grey imprimature consisting of lead white and carbon black bound in drying oil<sup>19</sup>, conforming in composition to earlier paintings such as the *Holy Family with a Shepherd*, or *Sacred and Profane Love* and the Antwerp painting mentioned above. The imprimatura layer would have acted to modify the surface of the gesso, rendering it less absorbent to paint medium. Also, however, the gesso could still absorb some of the excess oil from the paint of the underlayers, improving the rate at which they could dry for the successful application of glaze layers.<sup>20</sup> This conformity to techniques dating from up to two decades earlier reveals a surprising level of continuity to his technical practice.<sup>21</sup> The Kimbell and the Pitti paintings seem to dispense with this imprimatura but possibly both have unpigmented oil layers throughout to seal the ground, followed by a locally applied build up of the colour fields, another well-documented and characteristic approach.

The rounded forms and drapery of the earlier part of Titian's career are reflected in a fluid underdrawing style with curved broad lines.<sup>22</sup> Later, his drawing can be characterised by rougher dynamic strokes made with a brush of what is probably dilute black paint, and by the omission of the extremities, such as hands and feet. Only approximate, broad shapes of key drapery and figures tend to be sketched in. The importance Titian attached to the direction of a figure's gaze is emphasised at the underdrawing stage with characteristic filled-in irises.<sup>23</sup>

There is little evidence for carbon-based underdrawing in the National Gallery version, except for brushy liquid marks, possibly around female saint's face and short placing marks around the baby's hand. The relationship between the figures is visibly loose and rough, as seen from the working-out of the drapery folds with an approximate reserve left for the Infant. Infrared reveals then, that Titian was working the image out as he went along, indicating the absence of a rigid process. It is suggested though, that there *must* have been a drawing on paper, as what little underdrawing there is would be an insufficient guide to painting.<sup>24</sup> Of the few surviving drawings on paper firmly attributed to Titian, several include squaring grids, offering the possibility that this method, if any, was used to proportionally enlarge the figures.

The Kimbell painting also reveals little carbon-based underdrawing, exhibiting similar faint brushy lines around the figure grouping although this is clearly based on a pre-existing model. The Virgin's eyes also show the characteristic dark irises.

By contrast, infrared reflectography of the Royal Collection painting revealed a variety of styles, indicating different hands, some traced and some free in appearance, all executed with a wet material, with the point of a brush, at times heavy and elsewhere achieving fine lines. As predicted, the Virgin's head and torso exhibit the stilted, laborious drawing style associated with a traced line (see Fig. 8). Specifically, it is characteristic of the 'schematic, somewhat jagged outlines' of the labour-saving calco method of transfer.<sup>25</sup> However, in the blue drapery, the lines are loose, abrupt and certainly not traced in appearance. The Virgin's chest is delineated with two rough concentric markings and the Infant's position is also roughly marked out with loose concentric and swift lines (see Fig. 6).



Fig. 6, Titian and Workshop, *Madonna and Child in a Landscape with Tobias and the Angel*, The Royal Collection © 2006 Her Majesty Queen Elizabeth II, IR-R detail of the Infant's torso and legs

These bear striking similarity to the underdrawing of the Infant in Titian's *Holy Family with a Shepherd*, at the National Gallery, London,<sup>26</sup> reflecting the more fluid style of the earlier part of Titian's career, typified by broad curved lines.

Another insight into this varying working process comes with analysis of the broad marking-in of the RC Virgin's foot. The artist (if not Titian then certainly someone carrying out his instructions) transferred by the calco method no more than the outline of the Virgin's upper half and the position of her foot, before another hand, presumably Titian's, then marked in the rough details of the Virgin's chest, lower blue drapery and the Child. Therefore, even prior to transfer onto the panel, the artist had conceived or discussed the new composition, unlike in the Pitti and Kimbell versions. It has been a predominant perception that Titian only intervened in workshop pieces to 'add the finishing touches' or a 'few masterly strokes', to transform them into paintings that could pass as being by Titian. This stems from documentary evidence such as Ridolfi's observation that Titian allowed his assistants to make copies of his great paintings and then he kept them. He also claimed that Titian often retouched them, sometimes to the extent that they became substantially his own work.<sup>27</sup> Here however, infrared reflectography presents strong new evidence of Titian's collaborative intervention at the earliest as well as the final stages of the compositional process.

However, a completely different starting point was found with recent infrared reflectography of the Pitti painting. It reveals a totally faithful tracing of a previous composition, almost certainly that of the National Gallery painting. Every detail is carefully reproduced, from the figure of St. John on the left side, to the background elements of the cattle, herdsmen and the landscape lines. An even, careful line predominates, with some subsequent adjustments made with a thicker brush. The Virgin, St. Catherine and notably the final St. John all exhibit the directional placement of the irises. The Pitti lines share a few strikingly characteristic details with those in the Royal Collection version (see Figs 7 and 8) but largely the latter is not as exhaustively traced.<sup>28</sup>



Fig. 7, Titian's bottega, *Madonna and Child with Saints Catherine and John the Baptist*, Palazzo Pitti, © Ministero dei Beni e le Attività Culturali, IR-R detail of Virgin's head



Fig. 8, Titian and Workshop, *Madonna and Child in a Landscape with Tobias and the Angel*, The Royal Collection © 2006 Her Majesty Queen Elizabeth II, IR-R detail of Virgin's head

Tracings were taken of all four paintings and it was found that the dimensional changes in the Kimbell and Royal Collection versions were made not exponentially but in a piecemeal fashion. All the principle component parts are largely the same size in all the paintings. For instance, the outlines of all the Virgin's head and hands are more than coincidentally similar, yet the scale difference between the head and hands differ in each painting. So the component parts have been carefully traced to construct a broadly similar shape within the appropriate space, rather than being enlarged or shrunk wholesale.

This confirms that a tracing technique must have been used for all three variants of the National Gallery painting, whether or not a squared grid was also employed. For the London painting, the quality of the transfer depended entirely on the artist's visual judgement. At their best, proportional squaring grids could not allow as precise a translation of contours that are found here, as either full-scale spolvero, calco or tracing with translucent paper.<sup>29</sup> Another example of the transfer of specific component parts is found from tracings of two versions of St. John, now in Venice and the Escorial, executed with a thirty-year gap between them. The legs were found to be almost the same, proving that some kind of drawing or cartoon must have been made and kept to allow the later resumption and development of the theme.<sup>30</sup>

However, as already indicated by the underdrawing, the strongest evidence for the wholesale use of a cartoon is the detailed precision with which the Pitti tracing fits over the NG composition. The lower half of the composition is consistently out by about 10mm, suggesting that the cartoon slipped during transfer.

A pentiment shared between the Kimbell, Royal Collection and Pitti variants lies in the Virgin's drapery profile along her proper left lower leg. In all three paintings a formerly more rounded shape is visible. In all three, the profile was straightened at a later stage in the painting process. The National Gallery version also shows the final straighter profile yet infrared indicates that the ultramarine drapery probably started with the more rounded shape. This is not apparent from an examination of the surface in visible light, as the landscape/drapery boundary is fully integrated in its final form. The tracing must have been taken before this final revision of the Virgin's drapery (but *after* her foot was included). This does not prove that all the paintings were executed simultaneously although there was clearly a colour reference in the workshop for the repetition of the yellow dress and crimson sash for the Pitti Saint Catherine.

As with other earlier works by Titian,<sup>31</sup> the painting stage of the National Gallery, the Kimbell and the Royal Collection paintings seems to have been begun by blocking in the lower layers of the landscape and background using the underdrawing as a rough guide before beginning the figures. Some overlapping of boundaries is found to a greater or lesser degree in all the paintings. However, the Pitti version is anomalous in that the lower, dark, warm grey layer of the landscape appears to run under most of the figure grouping as well, showing dark through the craquelure of the flesh tones. This remains unexplained by infrared and x-radiography.

Comparative examination of the x-radiographs highlights the lively and integral quality of the brushwork across the whole surface of the paint film in the National Gallery painting, whereas the other three variants are notably more formulaic in the drapery as a result of the transfer process. The Royal Collection painting exemplifies this contrast, in the dynamic brushwork of the Infant and the lower half of the Virgin, as compared to her torso.

The Kimbell and Pitti versions appear to have a more opaque build up of the flesh tones than the other two versions. In the Kimbell's female saint figure, this is in part explained by some reworking of her head and eyes to accommodate changes to the Infant, echoing again that notable feature of the value Titian attached to the direction of the eyes.

A well-documented characteristic of Titian's compositional reassessment or rough marking-out of contours is the short, broad marks of x-ray opaque paint. It is found in the National Gallery version as a long stroke that runs diagonally to the right of the Virgin into the foreground, and as a kind of placing mark between St. John's chin and his elbow (see Fig. 12).<sup>32</sup> Similar marks have not been observed in the other variants, despite their various compositional changes.

Pentimenti revealed by the x-radiographs include those made in the Kimbell painting, such as the angel being freely laid in at an early stage, possibly using red lake, probably mixed with lead white<sup>33</sup>, before being concealed by a thin white layer and painted over with landscape. The same method of concealment was used in the National Gallery painting when changing the colour of the female saint or donor's dress from pink to yellow. Indeed, in both versions, these areas share a similar degree of opacity to x-rays. However, this is not a consistent practice across the variants as the Pitti painting's first St. John and rabbits were covered with a dark grey film.



Fig. 8, Titian, *The Virgin and Child with the Infant Saint John and a Female Saint or Donor*, ©The National Gallery, London, x-radiograph

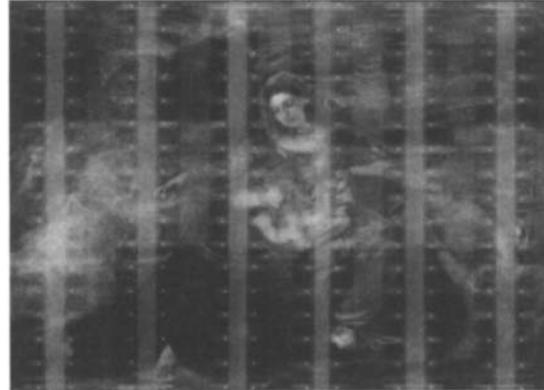


Fig. 9, Titian, *The Madonna and Child with a Female Saint and the Infant Saint John the Baptist*, The Kimbell Art Museum, x-radiograph, copyright ©2006 by Kimbell Art Museum, Fort Worth Texas



Fig. 10, Titian's bottega, *Madonna and Child with Saints Catherine and John the Baptist*, Palazzo Pitti, ©Ministero dei Beni e le Attività Culturali, x-radiograph



Fig. 11, Titian and Workshop, *Madonna and Child in a Landscape with Tobias and the Angel*, The Royal Collection © 2006 Her Majesty Queen Elizabeth II, x-radiograph



Fig. 12, Titian, *The Virgin and Child with the Infant Saint John and a Female Saint or Donor*, ©The National Gallery, London, x-radiograph detail of St. John, see white arrow

The only sample available from an area of flesh paint in any of the versions examined was from the shadow of the child's shoulder in the National Gallery version. A darker grey green layer is visible underneath, with a little carbon black, and what is described as a lighter pink lower layer, with a top layer containing surprising quantities of vermilion.<sup>34</sup> The Royal Collection painting's flesh tones were applied directly over the pale grey imprimatura, relatively thinly compared to the thicker, more opaque modelling evident in the Kimbell's flesh tones. The Pitti figures are strongly coloured by the dark purplish grey lower layer, and the surface tonalities are abraded.

The red drapery of the Royal Collection<sup>35</sup> and the Kimbell are of similar construction, with opaque lower layers followed by red lake glazes, and shadow areas comprised of thicker and darker glazes containing particles of black rather than using grey or other coloured lower layers, as found in other paintings by Titian. Despite this, the Kimbell painting shares stylistic similarities with the Pitti painting, and both have thicker, deeper red glazes, containing more black. Yet the reds in the Pitti are achieved over the aforementioned dark layer rather than the Kimbell's whitish lower layers.

The blue drapery in the National Gallery, the Pitti and the Royal Collection paintings is all composed of ultramarine. The sky and mountainous areas of both the National Gallery and the Royal Collection versions were also executed with ultramarine. The Kimbell painting alone is composed of azurite. The Royal Collection's blue drapery structure uses the imprimatura as a reflective pale base, followed by a thin middle layer of what is almost certainly indigo beneath an upper layer of medium-quality ultramarine.<sup>36</sup> It bears close structural resemblance to that of the Virgin's blues in the earlier *Holy Family with a Shepherd*, at the National Gallery, London which also exhibits the whitish lower layer, the indigo layer and an upper layer of similarly distributed mid-quality ultramarine. This is as compared to the National Gallery variant, which is densely encrusted with good quality ultramarine, where the blues run over a dark red lower layer in the shadows and over orange-brown in the lighter areas. One cannot distinguish between a master from his assistants at the microscopic level, as they were all trained in his methods and materials, but to an extent, it can certainly reflect the quality that a patron could expect by rank or had paid for. The use of azurite in the Kimbell painting is anomalous therefore, and may appear as a specific colour choice in its own right, if not simply for its economic benefits.<sup>37</sup> It shares with the Royal Collection version the use of a whitish reflective lower layer.

The four variants all appear to start with a translucent brown layer under the landscape. The Pitti painting is alone in following this with the dark purplish grey lower layer, over a large area. Subsequently, all the variants apply a standard sixteenth century limited green palette, containing relatively opaque pigment combinations of lead white, lead tin yellow, copper-based green and yellow earth, followed by translucent copper green glazes and in highlights, lead-tin yellow type one. Red lake has also been noted in the Royal Collection and Kimbell versions, perhaps added to enhance the intensity of the green and add depth. This has been found elsewhere on paintings not only by Titian, but also Cima, Raphael, Garofalo, and Palma Vecchio.<sup>38</sup> Translucent glazes of softwood pitch or tar bound in heat-bodied linseed oil (as for all other glaze pigments) are also probable on all the variants. However, this is an area for future investigation.<sup>39</sup> There is no evidence for Titian's well-documented practice of oiling out between layers from any samples examined.

In conclusion, a comparative examination reveals a complex and variable process where well-understood technical procedures were inextricably linked to and led by Titian's fluid and ever-changing artistic exploration. This group of variants are among the first products of a practice that became increasingly common in Titian's workshop, using methods of design transfer and enlargement that facilitated the process of refinement, variation and exact reproduction.<sup>40</sup> As Tietze aptly wrote, Titian, loved to sow on once-broken soil, and it is characteristic of his artistic economy that no idea was allowed to get lost, even over a matter of decades.<sup>41</sup>

It is arguable then, that the National Gallery version was taken from a small-scale drawing, transferred either by eye or using a squared grid as an enlargement that subsequently a full-scale cartoon was used for transfer onto the variants, probably using the calco technique rather than any form of squaring and possibly at a particular point before the first variant was finished. Transfer was undertaken wholesale for the Pitti painting and proportionally in a piecemeal fashion for the Kimbell and the Royal Collection versions. Infrared reflectography shows that, contrary to the conventional view, Titian was practically involved, even at the early stages, in the critical revisions of a theme over several versions, with arguably greater or lesser assistance from his workshop.

An attempt to rationalise systematically the findings of this survey only serves to highlight the precise *lack* of rigidity and a non-linear flexibility of attitude that identifies Titian in relation to his workshop procedures. From an examination of these variants at least, it becomes evident that the commercial and workshop aspects, including all the technical minutiae are *all* in the service of Titian's art, where change is the only constant.

#### Acknowledgments

This technical study has relied wholly on the goodwill, time and resources of the curators and conservators of the institutions involved. The author wishes to thank the following for their assistance and advice: The National Gallery,

London, Carol Plazzotta, Jill Dunkerton, Marika Spring, Rachel Billinge; The Kimbell Art Museum, Claire Barry, Elise Effmann, Na' Cole Trujillo; Galleria Palatina, Serena Padovani; Ministero dei Beni e le Attività Culturali, Prof. Antonio Paolucci, Opificio delle Pietre Dure e Laboratori di Restauro, Cristina Acidini, Cecilia Frosinini, Roberto Bellucci, Ottavio Ciappi, and The Royal Collection Trust, Lucy Whitaker, Rupert Featherstone, Nicola Swash; and for the generous support of the Samuel H. Kress Foundation.

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<sup>1</sup> Christiansen, K. 1987. 'Titianus (per) fecit', *Apollo*, CXXV, p. 194

<sup>2</sup> Penny, N. 2003. *Titian*, exhib. cat., ed. Jaffé, D., The National Gallery, London, p. 120

<sup>3</sup> 1978-79. *Tiziano nelle gallerie fiorentine*, exhibition catalogue, Palazzo Pitti, no. 11, pp. 70-72

<sup>4</sup> For Keith Christiansen, *op. cit.*, the Kimbell painting is a more developed variation of the London painting by Titian, although a studio assistant could have laid in the three central figures. The Kimbell painting is given to Titian by Pillsbury, E. et al. 1987. *In pursuit of quality*, Fort Worth, pp. 177-178, but has studio assistance for Penny, N. 2003. *Titian*, exhib. cat., ed. Jaffé, D., The National Gallery, London, p. 120. Certain pigment changes have occurred, some discolouration of the verdigris glazes is possible, the azurite of the blue sky and the Virgin's robe has darkened and the brilliant orange realgar glazes used for the female saint's drapery have also darkened. In general, its present autumnal appearance is unlikely to have been the artist's original intention.

<sup>5</sup> The Della Torre arms of a tower with crossed swords are just discernible beneath later different arms painted directly on top.

<sup>6</sup> Shearman, J. 1983. *The early Italian pictures in the collection of Her Majesty the Queen*, CUP, pp. 256 - 258

<sup>7</sup> The Virgin has suffered from considerable abrasion and repainting around her features. Caution must also be exercised in interpreting the right-hand area of sky and parts of the mid-ground as these are largely lost.

<sup>8</sup> See Penny, N. 1999. 'Two paintings by Titian in the National Gallery, London, notes on technique, condition and provenance', *Tiziano: técnicas y restauraciones*, Museo Nacional Del Prado, Madrid, 3, 4 y 5 de junio, p. 109

<sup>9</sup> *Ibid.*, pp. 109-111

<sup>10</sup> This appears to derive from Giovanni Bellini's *The Virgin and Child*, 1509, at the Detroit Institute of Arts, Detroit. Chorley, C. 2005. Personal communication.

<sup>11</sup> I am grateful to Serena Padovani at the Galleria Palatina and Cristina Acidini and Cecilia Frosinini, at the Opificio delle Pietre Dure e Laboratori di Restauro for enabling this examination.

<sup>12</sup> The x-radiograph is published in K. Christiansen. 1987. 'Titianus (Per) Fecit', *Apollo*, CXXV, pp. 190-196

<sup>13</sup> The iconographic implications of such changes are beyond the scope of this paper; see Rosand, D. 1992. 'Pastoral topoi: on the construction of meaning in landscape', *Studies in the History of Art*, 36, ed. John Dixon Hunt, National Gallery of Art, Washington, pp. 161-177

<sup>14</sup> I am grateful to the Kimbell Art Museum Conservation Department for undertaking technical examinations.

<sup>15</sup> Bull, D. and J. Plesters. 1990. The feast of the gods, conservation, examination and interpretation. In *Studies in the history of art*, 40, National Gallery of Art, Washington, p. 59

<sup>16</sup> I am grateful to Marika Spring for permission to examine the NG samples and for her help and advice.

<sup>17</sup> The National Gallery gesso layer appears browner than the Royal Collection gesso layer, probably as a result of impregnation with glue from lining.

<sup>18</sup> Dubois, H. and A. Wallert. 2003. Titian's painting technique in *Jacopo Pesaro being presented by Pope Alexander VI to Saint Peter*. In Cambell, C., *Titian, Jacopo Pesaro being Presented by Pope Alexander VI to Saint Peter*, Koninklijk Museum voor Schone Kunsten, Antwerp, Restoration, Vol. 3, No. 1, p. 23

<sup>19</sup> Although, in one NG sample, a conglomeration of manganese black was found in the grey layer.

<sup>20</sup> Dunkerton, J. 1994. Developments in colour and texture in Venetian painting of the early 16<sup>th</sup> century. In *New Interpretations of Venetian Renaissance Painting*, ed. Ames-Lewis, F., Birkbeck College, University of London, p. 70-1

<sup>21</sup> Dunkerton, J. & M. Spring. 2003. The technique and materials of Titian's early paintings in the National Gallery, London. In Cambell, C. 2003. *Titian, Jacopo Pesaro being Presented by Pope Alexander VI to Saint Peter*, Koninklijk Museum voor Schone Kunsten, Antwerp, Restoration, Vol. 3, No. 1, p. 19

<sup>22</sup> Dunkerton, J. 1994, *op.cit.*, p. 70

<sup>23</sup> Dunkerton, J. & M. Spring. 2003. p. 13

<sup>24</sup> Dunkerton, J. 2005. Personal communication.

<sup>25</sup> Bambach, C.C. 1999. *Drawing and painting in the Italian renaissance workshop; theory and practice, 1300-1600*, CUP, p. 12

- <sup>26</sup> See Dunkerton, J. 2003. Titian's painting technique. In *Titian*, exhib. cat., ed. Jaffé, D., The National Gallery, London, p. 49
- <sup>27</sup> Pignatti, T. 1993. Abbozzi and ricordi: new observations on Titan's technique. In *Titian 500*, National Gallery of Art, Washington, p. 73
- <sup>28</sup> For instance, both have precisely the same characteristic marks delineating the Virgin's jaw and neckline.
- <sup>29</sup> Bambach C.C. 1999. *Op.cit.*, p. 19
- <sup>30</sup> Dunkerton, J. 2005. Personal communication. The earlier *St. John the Baptist*, circa 1531-2, is now in the Gallerie dell'Accademia di Belle Arti, Venice and the later version, probably late 1560's is at the Monasterio de San Lorenzo de El Escorial, Patrimonio Nacional, San Lorenzo.
- <sup>31</sup> Dubois, H. and A. Wallert. 2003. Titian's painting technique in *Jacopo Pesaro being presented by Pope Alexander VI to Saint Peter*. In Cambell, C., 2003. *Titian, Jacopo Pesaro being presented by Pope Alexander VI to Saint Peter*, Koninklijk Museum voor Schone Kunsten, Antwerp, Restoration, Vol. 3, No. 1, p. 26
- <sup>32</sup> Dunkerton, J. 2005. Personal communication
- <sup>33</sup> As is the angel at the right edge of the Royal Collection version, also containing red lake and lead white.
- <sup>34</sup> Spring, M. 2005 Personal communication
- <sup>35</sup> A sample was taken from the Royal Collection painting from the fragmented edge of a damage in shadow of the Virgin's red drapery. It shows three opaque layers above the imprimatura, which contain lead white, red lake and small quantities of black, followed by at least two, probably three thick, red glaze layers, likely to be of insect dye origin. Similar pink shades of red lake are found in the National Gallery of London's *Venus and Adonis* and again, especially in the *Holy Family with a Shepherd*. The upper glaze layer contains quantities of black particles, visible under UV. Examination by dispersion also revealed the presence of small particles of glass; perhaps acting functionally as a siccatif for the poorly drying lake pigments. Glass particles were also found in a sample from the red lake of Adonis's shirt in Titan's *Venus and Adonis*, at the Getty; see Birkmaier et al. 1995. Technical examinations of Titian's *Venus and Adonis*: a note on early Italian oil painting technique. In *Historical painting techniques, materials and studio practice*, Preprints, Univ. of Leiden, 26<sup>th</sup>–29<sup>th</sup> June, The Getty Conservation Institute, p.123
- <sup>36</sup> Although this would be hard to positively identify even with FTIR due to the thinness of the layer. Spring, M. 2005. Personal communication.
- <sup>37</sup> It appears to be much darkened and disrupted. Several causes are possible, including if Titian had developed habitual proportions of pigment to medium in relation to the porosity of the canvas ground, as has been found on the Louvre's *Crowning with Thorns*, also painted on panel and also unable to absorb the excess medium. The latter was also painted with walnut oil, not as efficient a dryer as linseed, another possible cause of the disruption seen here. See Dunkerton, J. 1994, *Op.cit.*, p 71
- <sup>38</sup> Dunkerton, J. 1994. *Op.cit.*, p. 68; see also Dunkerton et al., 2002. The technique of Garofalo's paintings at the National Gallery, *National Gallery technical bulletin*, Vol. 23, pp. 20-41
- <sup>39</sup> For instance, a Royal Collection sample from an area of landscape shows a clean, golden brown layer above the lead-tin yellow highlight, which appears to be an intentional glaze layer. Further analysis may determine whether it is discoloured verdigris or pitch.
- <sup>40</sup> Bambach, C.C. 1999. *Op. cit.*, p. 296
- <sup>41</sup> Tietze, H. 1954. An early version of Titian's *Danae*, an analysis of Titian's replicas', *Arte Veneta*, VIII, p. 200

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## PAINTING WITH WAX IN BRITAIN AND AMERICA DURING THE EIGHTEENTH AND EARLY NINETEENTH CENTURIES

Lance Mayer and Gay Myers

**ABSTRACT** - The presence of wax in paintings is of great interest to conservators, since the ready solubility and heat-sensitivity of wax can make a painting liable to damage during conservation treatment. A study of manuscript and printed sources makes it clear that wax was used --- at least on an experimental basis --- by many painters in Europe and America during the eighteenth and early nineteenth centuries. Wax was sometimes mixed with oil paint, sometimes combined with resins (without any oil), and sometimes melted into a design that had been applied previously with water-based media. Beginning in the nineteenth century, wax was also sometimes applied to the back of a completed painting in order to preserve it or to correct problems of cracking.

A painting by George Stubbs (1724-1806) examined by the authors at the Yale Center for British Art --- *Phaeton with a Pair of Cream Ponies and Stable-Lad* (1780-85) (fig. 1) --- has a number of interesting characteristics. It is painted on an oak panel, it has no ground to speak of, it is flaking (and has flaked in the past), it is very heat-sensitive, and the paint is soluble in virtually any solvent --- in fact the paint is much more easily soluble than a natural resin varnish that was applied in 1960.



Fig. 1. George Stubbs, *Phaeton with a Pair of Cream Ponies and Stable-Lad*, ca. 1780-85, wax and resin on oak panel, 35 1/4 x 53 1/2 in. (89.5 x 136 cm), Yale Center for British Art, New Haven. Paul Mellon Collection

Scientists at the National Gallery in London have described three distinct phases in Stubbs's painting method. In his earlier paintings, Stubbs used a straightforward oil-painting technique. Then, during the 1770s and the first part of the 1780s --- the period when *Phaeton with a Pair of Cream Ponies and Stable-Lad* was painted --- he used wax and resin (with no oil at all), which is what makes this and other paintings from these years extremely sensitive to heat and solvents. In his third and final phase, Stubbs used oil paint plus wax and resin, which makes his later paintings somewhat soluble and heat-sensitive, but less so than ones from his middle phase (Mills and White 1985; Shepherd 1984; White et al. 1980).

We eventually wrote a chapter for the catalogue of the exhibition *Stubbs and the Horse* organized by the Kimbell Art Museum (Mayer and Myers 2004a). In that essay we tried to put Stubbs's technical innovations into a larger

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context, and found that there were many points of connection with our ongoing research into American painters' techniques. Some of the American painters who traveled to London in the eighteenth century wrote accounts that give us insights into the world of British painters that we cannot get from any other source, while some Americans brought ideas about wax back from London and passed those ideas on to other American painters.

In the present article we will concentrate on aspects of our research that we did not discuss in depth in our article in the Stubbs exhibition catalogue. These include technical details that are of interest mainly to conservators, and a discussion of the various ways in which ideas about wax played out in America during the nineteenth century. We have been looking at written documents rather than analyzing samples from paintings, but we hope that this kind of documentary study can help conservators be aware of which kinds of paintings are likely to contain wax, and which ones might have the potential to be as troublesome as some paintings by Stubbs.

Stubbs's career coincided roughly with the second half of the eighteenth century, which was also probably the period of greatest change and innovation in painting techniques since the Renaissance. This was the period of neoclassicism, and wax painting was in a sense the perfect pursuit for the neoclassical period. Pliny, the Roman author, had written about how ancient Greek painters had used wax, but Pliny's account was so vague that there was plenty of room for experimentation, a favorite eighteenth century activity. Wealthy, upper-class amateurs could feel useful too --- they could use their knowledge of Greek and Latin languages and literature to interpret ancient texts and encourage artists to adopt the techniques of the ancient world. The other side of this coin is that they sometimes became impatient when artists did not adopt these methods fast enough.

The most important early publication on wax painting was *Memoire sur la peinture à l'encaustique et sur la peinture à la cire*, written by the famous French antiquarian Count Caylus in collaboration with a physician named Majault (Caylus and Majault 1755/1972). Caylus proposed a great variety of different techniques for working in wax, which to a cynical modern observer might imply that none of them worked very well. Caylus made a distinction between encaustic --- which involves heat and which he considered the more authentic ancient Greek technique --- and what he calls *peinture à la cire*, which involved mixing wax with resin to make a cold solution that could be applied more or less like oil paint. Caylus himself supplied indirect evidence that the hot processes were difficult to do when he reported that all of the artists he had consulted preferred the (less authentic) cold processes.



Fig. 2. Title page to J. H. Müntz, *Encaustic, or Count Caylus's Method of Painting in the Manner of the Ancients*, London, 1760 (detail)

By 1758, the Swiss-born artist Johann Heinrich Müntz (1727-1798) was carrying out experiments with wax in England under the patronage of the wealthy author and tastemaker Horace Walpole. Müntz published a book summarizing these experiments in 1760; his book was supposedly an improvement on Caylus's work, but Müntz really only discussed one of Caylus's methods. Müntz's improvement (fig. 2) involved rubbing wax into the

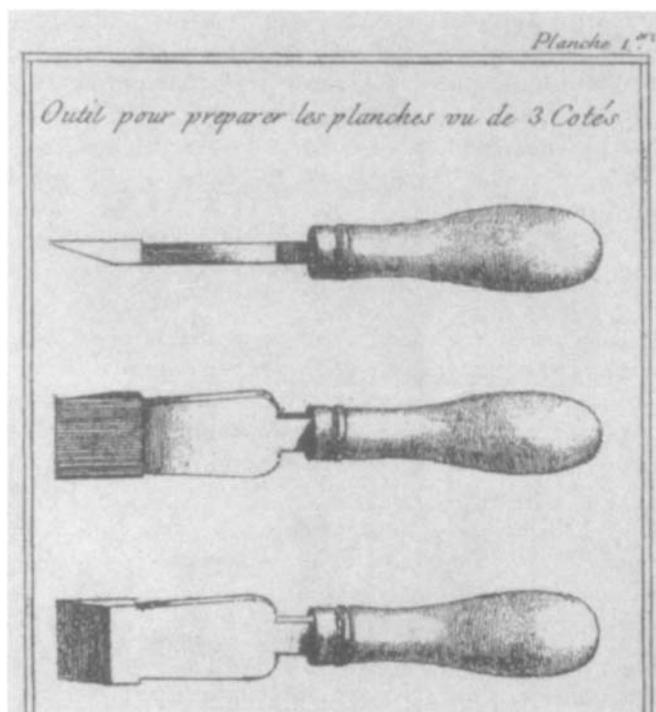
back of a canvas, then applying a design to the canvas with pigments ground in water, and then heating the canvas so that the wax would melt into the design. After Müntz's book came out there was a very noticeable growth of interest in wax on the part of British painters throughout the 1760s. For instance, the 1764, second edition of *The Handmaid to the Arts* by Robert Dossie quoted at length from Müntz, although the first edition, which was published in 1758, did not even mention wax painting. Dossie's second edition treated painting in encaustic --- and painting in enamel

as well, a medium that Stubbs also tried --- as if they were equal, alternative media that an artist might use, like oil or watercolor. It was a new thing to think about the arts so systematically, and in fact *Handmaid to the Arts* was only one of the many systematic compendia of practical knowledge that began to appear all over Europe at about this time, of which Diderot's encyclopedia is only the most famous.

A book like Dossie's must have encouraged artists to experiment with different media. In fact, Charles Willson Peale (1741-1827), who owned a copy of the second edition of Dossie's *Handmaid to the Arts* that he had bought in Philadelphia, even felt compelled to explain that during his stay in London between 1767 and 1769 he "was not contented with knowing how to paint in one way, but engaged in the whole circle of arts, except at painting in enamel," as if it were normal for an artist to want to try them all (C. W. Peale 1983-, 5:34).

It was also in the 1760s that Joshua Reynolds (1723-1792) began to describe experiments with wax in his ledger books (Cormack 1968-70; Talley 1986; Dubois 2000). Reynolds's accounts of his experiments are sometimes cryptic, and it is clear that he used wax in a variety of different ways. A painting by Reynolds from 1785 at Tate Britain was analyzed and found to contain mainly wax and resin --- with practically no oil --- which is very similar to the way that Stubbs was using wax at about this same time (Jones 1999).

Paintings executed primarily with wax and resin can be shockingly soluble. *Phaeton with a Pair of Cream Ponies and Stable-Lad*, described above, is easily soluble in polar solvents, but is also soluble in toluene and even slightly sensitive to benzine. Helmut Ruhemann noted in his book *The Cleaning of Paintings* that the only old painting he had ever encountered that was soluble in solvents as mild as turpentine was a painting of 1780 by Stubbs, which is from exactly the period when Stubbs was painting with wax and resin only (Ruhemann 1968, 87).



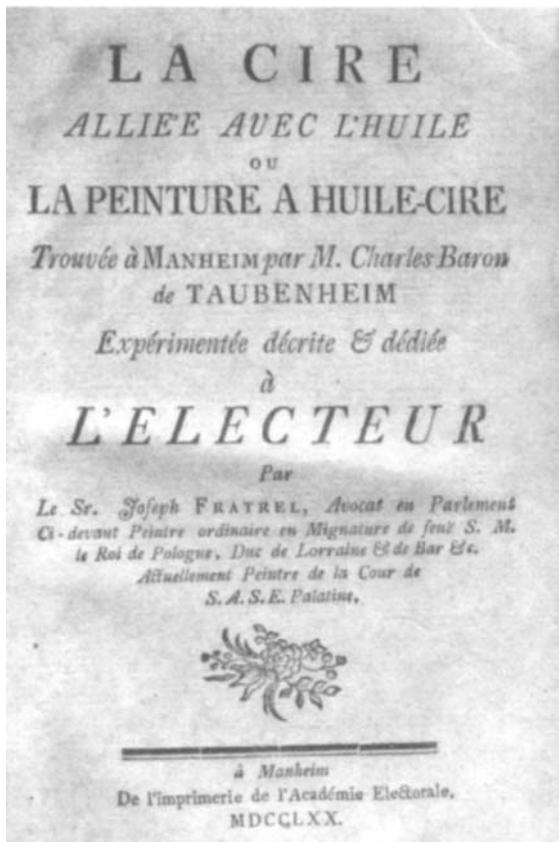
Many of Stubbs's wax paintings are painted on wood panels. The use of wood as a support is fairly unusual in Britain at this time, and earlier researchers have sometimes supposed that Stubbs might have used wood because a hard wooden panel was similar to the ceramic supports that Stubbs was using at this time for his experiments in enameling. But wood panels had been specifically associated with wax painting since the time of Caylus in the 1750s. A famous *Minerva*, painted in 1754 by Joseph-Marie Vien (1716-1809) under the guidance of Caylus and described in his book, was painted on wood (Gaetgens and Lugand 1988, 151-52). Caylus's book even included an illustration of a special tool for scribing a series of parallel lines into wood panels to imitate the texture of a twill fabric, and also to make the paint stick better (fig. 3).

Fig. 3. Plate 1 from Count de Caylus and M. Majault, *Memoire sur la peinture à l'encaustique et sur la peinture à la cire*, Geneva, 1755 (detail), tool for scoring wood panels

(Americans have sometimes thought that Gilbert Stuart [1755-1828] invented this technique --- in fact, it could have been rediscovered independently in America forty years later, or, alternatively, Stuart could have seen or heard about the technique during his time in Britain.) Caylus also designed a special apparatus for heating up a thin wooden panel to make it easier to apply encaustic paint. Caylus's device was essentially a tank that could be filled with boiling water, made from tinned sheet-iron with a copper face on which the panel was placed. Caylus recommended fir as a support when using his heating apparatus because it warps less when heated, and even suggested making a laminated board out of three thin layers of fir to avoid warping altogether (Caylus and Majault 1755/1972, 36-38, 46-47).

Conservators on the lookout for wax paintings should therefore remember that wood supports were often associated with wax in the eighteenth century. Eighteenth-century wax paintings on wood panels sometimes have little or no ground layer, but rather a very thin layer of wax-resin. This is true of both the Stubbs painting *Phaeton with a Pair of Cream Ponies and Stable-Lad* and the Reynolds portrait, described above, that was analyzed at Tate Britain.

In terms of the rationale for wax painters using wood as a support, Caylus wrote that the ancient Greeks “preferred wood for their paintings to all other materials, and if a similar practice [that is, wax painting] is established among us, I believe one would do well to imitate the ancients on this point” (Caylus and Majault 1755/1972, 19). Archeological correctness may therefore have been one motive for neoclassical artists who believed that they were recreating the methods of ancient Greece. But there is evidence that some artists also believed that wood would last longer than canvas --- Caylus wrote that when wax painting was executed on wood it could even surpass fresco in durability (Caylus and Majault 1755/1972, 18). (In America, Gilbert Stuart believed that the superior durability of wood was particularly true in the American climate [Evans 1999, 82, 147n].) A modern observer might disagree with this, and in fact the painting *Phaeton with a Pair of Cream Ponies and Stable-Lad* by Stubbs, which is on a panel made from four pieces of oak about 3/8” in thickness, has had persistent problems with the wood moving along the joints.



During the 1780s Stubbs began to mix wax and resin with oil paint. In doing this he forecast the future of wax painting, even into the nineteenth century. In Britain at least, the more complicated methods that involved heat generally fell out of favor and were replaced with methods that involved adding wax to oil paint. We do not know exactly why Stubbs made this change, but simply knowing the title of a book that Joshua Reynolds owned in 1771 --- *La Cire alliée avec l'huile, ou la peinture à huile-cire* (fig. 4) --- might have given an artist the idea to mix wax with oil. The appearance of this book in England --- it was written by Joseph Fratrel, a Frenchman, and promotes a proprietary wax mixture invented by a German nobleman, Baron von Taubenheim --- is also a wonderful symbol of the easy passage of ideas across national boundaries at this time (Reynolds’s ownership is mentioned in Rice 1979, 114, 248n, and 286n).

Among other things, Fratrel’s book suggested that an oil-wax mixture could be used as a varnish, and perhaps could be called the “king of varnishes” (Fratrel 1770, 172). During the 1770s, after this book’s publication, we see British painters like Alexander Cozens (c. 1717-1786) using a varnish that

Fig. 4. Title page to J. Fratrel, *La cire alliée avec l'huile, ou la peinture à huile-cire; trouvée à Manheim par M. Charles Baron de Taubenheim*, Manheim, 1770

contained wax (Rice 1979, 99), and in 1775 Benjamin West (1738-1820), who always did things a little differently, was said to have used a retouching varnish that contained spermaceti, which is a waxy material from sperm whales (Copley and Pelham 1970, 336-37). This is the earliest reference that we have found to spermaceti being used by painters, although spermaceti reappeared later in the eighteenth century as an ingredient in commercially-produced paints in Britain (*Trans. Soc. Arts* 1794, 12: 271-79).

By the 1780s, the decade in which Stubbs changed his wax-painting procedure from wax/resin to wax/resin/oil, there were many other publications and many more variations on wax painting. Some involved treating wax with an alkaline reagent to make it soluble in water; a book by Vincenzo Requeno, a Spanish monk working in Italy, proposed mixing gum Arabic with mastic resin and wax, and then fusing the design with heat after it had been applied (Requeno 1784 and 1787). Just as some of Caylus’s ideas were translated and interpreted for an

English-speaking audience by Müntz, Requeno's ideas were brought to Britain by Emma Jane Greenland, who first published them in English in the 1780s, then tinkered with the recipes and published different versions over the next twenty years, so a generation of British and American painters would be familiar with what came to be called "Miss Greenland's process" (*Trans. Soc. Arts* 1787, 5:103-10; 1792, 10:168-73; and 1807, 25:43; see also R. Peale [n. d.]). Eventually wax-painting was carried out all over Europe; the techniques by this time were so varied and the "new and improved" versions so frequent that one begins to suspect that none of them was very easy to do.

This is corroborated by Charles Willson Peale, who gives perhaps the only disinterested firsthand account of an eighteenth-century artist trying out one of these processes. Peale bought a copy of Müntz's book when he arrived in London in 1767 and wrote that he was at first was "much pleas'd with it," but eventually found that fixing the colors with wax "darken'd the coulours too much" (C. W. Peale 1983-, 1:118). In Müntz's process, the design was applied to a canvas with pigments ground in water, and then saturated with wax in front of a fireplace (see fig. 2). But what Peale found was that the wax darkened the pigments to such a degree that it was simply too difficult for a painter to predict or control the outcome. Müntz anticipated this problem, for he included in his book instructions for an artist to paint out a trial canvas of all of his or her colors, cut the canvas in half, melt wax into one half, and keep the two halves of the trial canvas as a guide to how much the colors will change upon heating (fig. 5). This might have worked well in theory, but one can imagine an artist having difficulty making the visual leap between the trial canvases and water-based paint that became matte while the artist was painting the design.



It is interesting to contrast Charles Willson Peale's testimony about the difficulty of Müntz's method with an outburst from Horace Walpole, who at one point criticized British painters for failing to adopt Müntz's hot wax process, saying that it was "not from any defect or difficulty in the practice, but from the stupidity and obstinacy and John-trot-plodding-in-the-same-wayness of the professors [meaning not teachers but "professed" or professional artists]" Walpole 1937-83, 28:301). Upper-class amateurs like Walpole --- and Count Caylus and Baron von Taubenheim as well --- played a very important role in initiating, encouraging, and disseminating the innovations of this time. But they had trouble understanding that the essential conservatism of painters (which Walpole read as obstinacy) comes from the very steep learning curve of a craft that takes years to master.

Fig. 5. J. H. Müntz, *Encaustic, or Count Caylus's method of painting in the manner of the ancients*, London, 1760, diagram of a plan to make a test canvas to compare different colors unsaturated and saturated with wax

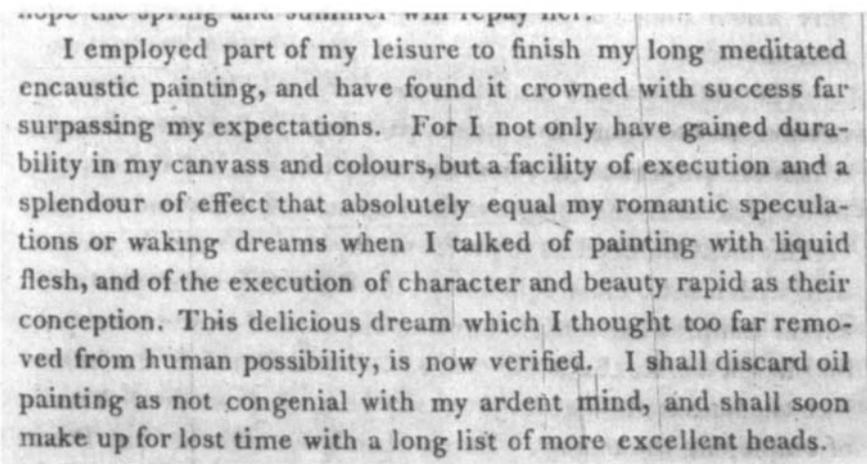
Ease of execution must have been one of the reasons that artists like Stubbs moved toward mixing wax with oil paint. Stubbs's painting of the horse Hambletonian, from about 1800, was analyzed and found to have a relatively small proportion of wax and resin compared to oil, and it could be safely cleaned by conservators at the Hamilton Kerr Institute (McClure and Featherstone 1984). This technique of mixing a little wax and resin with oil paint eventually became fairly common among British painters. For instance, when the American Thomas Sully (1783-1872) visited London in 1809 and 1810, he noted that a number of British painters melted beeswax into mastic varnish, then incorporated a lump of this wax-resin mixture into the pile of white oil paint on their palettes (Sully 1809-71, fr. 79). Since at least a little white went into most parts of a painting, the beeswax-and-mastic mixture would be incorporated into the other colors in that way. This would have been much closer to the way that painters were accustomed to work than applying powdery paint and then infusing it with hot wax --- and possibly being unpleasantly surprised with the results.

An interesting aspect of the British practice as described by Sully is that the lightest colors could (in theory) have *more* of the wax-resin mixture in them and therefore be more soluble than darker colors. On the other hand, in a number of nineteenth-century recipes wax was particularly recommended as an additive to the pigment asphaltum,

which could make for increased solubility in dark shadows and dark glazes as well (Sully 1809-71, fr. 137; Osborn 1845, 89; Ridner 1850, 99-100).

Meanwhile, in America, Charles Willson Peale never lost his interest in wax, in spite of his disappointment with Müntz's method. He seems to have painted mostly in oil, but a memorandum book that he kept beginning in 1794 shows that he was carrying out experiments in order to improve upon Müntz's method --- sometimes mixing pigments with sugar water, and sometimes with wax and turpentine before applying them and then melting them with heat. One senses that the experiments did not always go smoothly --- at one point Peale wrote that one of his experiments was an improvement upon Müntz's method, but then he decisively crossed out this comment (C. W. Peale 1794-, 32, 41-46).

In some of Charles Willson Peale's experiments in this notebook, it is clear that he was working with his son,



I employed part of my leisure to finish my long meditated encaustic painting, and have found it crowned with success far surpassing my expectations. For I not only have gained durability in my canvass and colours, but a facility of execution and a splendour of effect that absolutely equal my romantic speculations or waking dreams when I talked of painting with liquid flesh, and of the execution of character and beauty rapid as their conception. This delicious dream which I thought too far removed from human possibility, is now verified. I shall discard oil painting as not congenial with my ardent mind, and shall soon make up for lost time with a long list of more excellent heads.

Rembrandt Peale (1778-1860). And it was Rembrandt Peale who, during a visit to France in 1810, made one of the most dramatic announcements in the history of American painting techniques. In

Fig. 6. Rembrandt Peale, Original letters from Paris. *The Port Folio*, 4 (1810) (3): 275-9 (detail)

letters to his family (fig. 6), which were immediately published in America, (thanks to his father, who tended to stage-manage his son's career) Rembrandt Peale said that he had invented a new process of encaustic painting. He wrote that he had gained: "a facility of execution and a splendour of effect that absolutely equal my romantic speculations or waking dreams ..." going on and on in a similar vein and finally concluding with: "I now paint entirely in encaustic --- oil painting appears to me too dirty, too sticky, and too stinking" (R. Peale 1810, 275-79). In Paris, Rembrandt Peale painted a number of encaustic portraits of some of the famous Frenchmen of the day, including the painter Jacques Louis David.

Although Rembrandt Peale claimed that he had invented his encaustic process himself around 1810 after nine years of experimentation, the true story may be slightly more complex. At exactly this time, the French painter and author Jacques-Nicolas Paillot de Montabert (1771-1849) was promoting a new encaustic technique in Paris (Rice 1979, 170-174). It is difficult to believe Peale was not at least influenced by Paillot de Montabert, but we do not know exactly what Rembrandt Peale's process was. Most likely, he deliberately kept his recipe a secret, because he hinted that he would not reveal the recipe unless he was financially compensated (R. Peale 1811, 15). We do know, from something his father let slip, that Rembrandt Peale's process involved a chafing dish or stove for melting in the colors after they were applied (C. W. Peale 1983-, 3: 101, 103 n). (Paillot de Montabert's method consisted of applying paint made with copal, gum elemi, and wax dissolved in oil of lavender, which could be melted in after the paint was applied.)

But this episode, which began with such fanfare, ended with something of a mystery. After Rembrandt Peale's initial announcement in 1810, and indications during the next year that Charles Willson Peale had tried out his son's process --- and bragged about it in a letter to Thomas Jefferson (C. W. Peale 1983-, 3: 101-103; 3: 114) --- we hear absolutely nothing more about encaustic in the Peale family's correspondence. The only other clue that we have found to the fate of Rembrandt Peale's great plans of 1810 came much later, when he tried to sell John Neagle (1796-1865) a secret recipe for a sum of money, and Neagle rejected his offer, saying "I reminded him of the failure of his wax painting" (Neagle 1826-, [n. p., entry made Sept. 1832]). It is interesting to speculate about why Peale's encaustic would have been considered a failure, although the most likely explanation lies in the fact that many

eighteenth- and early nineteenth-century wax paintings have suffered from flaking (see discussion of this below).

Another mystery is that even after Rembrandt Peale's apparently brief infatuation with encaustic, some of his oil paintings remain unusually sensitive to solvents. This is definitely true of his largest and most famous painting, *The Court of Death* (1820, Detroit Institute of Arts), which the authors treated in 1994-95. We found that many areas of paint, even some of the light-colored, opaque body colors, were extremely soluble. Correspondence between Charles Willson Peale and Rembrandt Peale hints that father and son had become interested in wax again at this time --- not a hot encaustic technique, but adding wax to oil paint. (C. W. Peale 1983-, 3:633, 795). We thought that this might help explain the solubility of *The Court of Death*, but analysis at that time did not yield positive results for wax (Mayer and Myers 1996).

The Peales seem to have passed on their interest in wax to Thomas Sully. As early as 1808 Sully wrote down a recipe for a megilp containing a large proportion of wax (a piece the size of a hazelnut in a spoonful of liquid), which (in context with the neighboring entries) probably came from Rembrandt Peale (Sully 1809-71, fr. 0077). In the 1820s Sully's interest in wax was piqued again, and his first notebook entry at this time that deals with waxy painting media is adjacent to two other pieces of information from the Peales (Sully 1809-71, fr. 0095). Sully experimented with mixing wax and mastic together, as he had seen English painters do, sometimes adding it directly to his oil paints and sometimes mixing it with oil to make a kind of megilp. As Sully noted in 1822, when he made a copy after Charles Robert Leslie's copy after William Hogarth's *The Gate of Calais*, he painted the figures

with colour tempered with wax... To a dessert spoonful of mastic, add a piece of bleached wax melted by fire; when this mixture is cold, it will form a thin jelly which may be either used as a magyllip by tempering it with oil, or by adding to the colours ground in oil (Sully 1809-71, fr. 95; see also Dunlap 1834, 2: 137).

The next year, 1823, Sully continued to experiment with a different kind of wax medium used as a retouching varnish, and he tried to improve it when he found that it dried too quickly:

Used a mixture of wax and spirits of turpentine to spread over the surface of a picture to prepare it for retouching --- but I discovered that it dried too fast. I afterwards tried a jelly composed of wax and linseed oil, which has answered the purpose very well --- I am only anxious that it may not turn yellow (Sully 1809-71, fr. 99).

This wax retouching varnish may have been inspired by another entry in one of Sully's manuscripts that was probably made shortly before 1822. Sully recorded directions for making a wax emulsion or "wax milk" invented by Charles Werner of Germany, consisting of wax dissolved in potash and water that could be used for coating paintings or furniture. Sully amended this entry in 1841, saying he had tried the "wax milk" and thought "it may be well enough for furniture, but I disapprove of it for pictures" (Sully 1809-71, frs. 93-94).

To a conservator, the most rash of Sully's experiments (in terms of the potential poor adhesion of subsequent layers and risk of damage during cleaning) was applying a simple solution of wax in turpentine to a painting between sittings. It is not surprising that Sully's grandson wrote much later about one of his grandfather's wax experiments from the 1820s: "in fifty years (1872) the colors flake off, defying all efforts at restoration or cleaning" (Sully 1873/1965, 36n). Thomas Sully may well have seen some of these bad effects during his lifetime, because he himself wrote, in 1858: "The excellence of wax in a vehicle is to be doubted" (Sully 1809-71, fr. 245).

John Neagle copied out Sully's elaborate directions for making Charles Werner's "wax milk," but Neagle also did some experiments of his own to perfect a way of varnishing with wax that would be "quicker than the above." He proposed melting white wax with a little spermaceti in spirits of turpentine, intending first of all that this be used to coat prints, but he also went on to say:

The same composition, when passed over paintings, gives them a fine gloss & brings out the true effect of the colors, & it can be removed at any time with sp. of turpentine & a rag. Would it not be an excellent composition upon gilt frames to prevent injury from flies? And would it not protect a painting by first waxing it and then varnishing, so that when the picture grows old, & the picture

cleaner got to work, he could remove all varnish & wax without endangering the fine glazings & tintings of color on the surface?" (Neagle 1839-, fr. 481; also Neagle 1825-, 20-21).

It seems that it would be difficult to varnish on top of a layer of wax, and Neagle never said whether he actually used this procedure on a regular basis or if it was more in the realm of theory.

Neagle was a more systematic and scientific experimenter than Sully; at one point Neagle did an elaborate experiment over a period of ten years that led him to conclude (the underlinings and exclamation points are Neagle's): "megellups at least with wax in them have a tendency to turn dark!!!" (Neagle 1839-, 8). Neagle also obtained a copy of Müntz's book and took notes from it, although it was a very old book by this time, and it may have been Müntz who gave Neagle the unfortunate idea to try to make a ground with wax as an ingredient. The theory was apparently that wax would give a ground more flexibility, but by 1835 Neagle found that his wax ground was not aging well, and four years later he made some further notes: "I can now say 1839 that the wax did 'chip off', as I dreaded... and I now think it well to record this dangerous practice, so as to bear it in mind" (Neagle 1839-, 18; Neagle 1825-, 70, 78-79; Neagle 1839-, 15).

The American experimenters Sully and Neagle were confirming objectively what had been suspected many years before. As early as the 1770s, the author of the famous French book on varnishes, Jean-Félix Watin, made some very critical remarks about wax paintings, including the observation that compared to oil paintings they were much less solid and were subject to flaking (Watin 1773, 112). There is at least one anecdote from the eighteenth century about the fragility of wax painting --- a passerby accidentally tapped a portrait by Reynolds with his walking stick, and a large part of the face and hand fell off (Talley 1986, 55). And now, after two hundred years, it can be seen that some of the early wax paintings, including the ones done by Vien under the guidance of Caylus, as well as paintings by the authors Fratrel and Paillot de Montabert, have suffered badly from flaking (Gaehtgens and Lugand 1988, cat. nos. 91 and 94, 151-53; Rice 1979, 135, 171).

This is ironic, because one of the biggest motivations for using wax was that it was supposed to last longer than oil painting. Müntz told British readers: "You will have all the effects and sweetness of painting in oil, and the colours will not be liable to fade and change...nor can the colours crack and fall in shivers from off the canvas" (Müntz 1760, 18). Müntz even carried out a series of experiments in which he exposed samples of wax paintings and samples of oil paintings to the sun and rain, to the damp of a cellar, and to the heat and smoke of a fireplace. In almost all cases he found that wax paintings were less affected by this abuse than oil paintings, which became "freckled" or "darker." Müntz then scrubbed his sample paintings with combinations of every corrosive material that he could think of, including spirit of wine (ethyl alcohol), and aqua fortis (nitric acid), and reported that oil paintings "were entirely destroyed" while encaustic paintings "suffered nothing" (Müntz 1760, 127-39). It is moving for a modern conservator to see this kind of primitive science in the service of art, although Müntz drew the wrong conclusions --- it was not so much resistance to weird combinations of chemicals that was important in the preservation of paintings, but other, much simpler things, such as whether wax paint would stick well to the wood or canvas it was applied to.

Another disadvantage of wax painting was noted by Gilbert Stuart, who loved to tell stories at the expense of artists who relied on tricks or special recipes such as West and Reynolds. Stuart said that he was once copying a portrait by Reynolds in a warm room, when he thought he noticed one of the eyes in the portrait begin to move. He looked again, and saw that the eye was sliding downward on the canvas. As Stuart told the story, he instantly realized that the wax that Reynolds had used was melting, so he ran with the painting into a cooler room and eventually worked the eye back into place (Mason 1879, 40-41).

In the 1820s (the same decade in which Sully was experimenting with wax as a paint additive) American artists were also very interested in wax as a means to protect the back of a painting from damp and/or to consolidate a painting that had cracked. John Trumbull (1756-1843) was provoked to take measures in 1828 when he saw his large paintings in the U. S. Capitol rotunda being damaged by the damp walls on which they were hung. It is not clear where Trumbull got the idea to apply wax to the backs of paintings, although a few years later two British treatises recommended the procedure, one of them claiming that Titian had done something similar to protect the backs of his canvases from damp Venetian walls (Carlyle 2001, 179, citing Field 1835 and Fielding 1839). Trumbull proposed applying wax to the backs of the paintings (1:1 with spirits of turpentine), melting it in, then restretching

the canvases over wooden panels (which had many holes cut in them and were painted to make them more stable). Part of Trumbull's motivation for using wax was that scientists had proven wax to be very long-lasting and, as he described it, additional proof was given by the preservation of Egyptian mummies and the preserved body of Edward I (Trumbull 1841, 281-86; see also Sully 1873/1965, 41).

In 1829 Thomas Sully watched Trumbull use his wax infusion process on two paintings that suffered from cracking. Sully, always one to weigh both sides of an argument, said that the paintings "are now in excellent shape," but he also noted that the New York dealer Michael Paff "says the new way of waxing pictures at the back, prevents the re-canvassing [lining] them, and he also condemns the waxing the surface for the purpose of filling up the cracks" (Sully 1792-, fr. 339; Sully 1809-71, fr. 125). A modern conservator might agree that wax would interfere with the attachment of a glue or paste lining, and might interfere with the future treatment of a cracked surface as well.

However, Sully judged Trumbull's process good enough to try out himself in 1839, when he faced the unpleasant task of repairing a portrait that he had painted only seven years before but which had become "much cracked." Sully wrote that he "saturated the back of the canvas with melted bees' wax – the yellow wax – warmed it by the stove until it was soaked into the cloth and then repainted the surface of the picture – no cracks are now visible and I hope are quite covered" (Sully 1809-71, fr. 143).

John Neagle, while aware of Sully's ideas, gives us the most sophisticated discussion of ways to protect the back of a canvas. Neagle agreed with Michael Paff that it was not advisable to melt wax into a painting:

Wax will not do upon the immediate back of the cloth on which the picture is painted, because it could never be lined successfully, for the wax w<sup>d</sup> prevent the material from sticking, & I apprehend, even the wax, in time, would become brittle & injure the painting (Neagle 1839-, 14-15).

Neagle sounds surprisingly modern in these remarks, as he does in knowing that paintings suffer not only from dampness but also from "the sudden changes from cold to hot, or from damp to dry weather" (Neagle 1839-, 14). He proposed what he called "doublebacking" (what a modern conservator would call "loose lining") --- stretching a painting over a second, unattached fabric that had been previously infused with wax --- "to prevent the sudden action of the atmospheric changes" (Neagle 1839-, 14). Neagle went on:

I am fully persuaded, that a painting, if cut in half --- the one part Doublebacked as I have suggested, or by means of a board loose on the back to protect it behind, & the other half without protection in the ordinary way, and both were exposed in the same place, to some changeably dry & moist, & hot & cold atmosphere, that the result, in due time for trial, would prove my notion to be correct (Neagle 1839-, 15).

A modern conservator would probably agree with this. It is also interesting that Neagle's discussion of a loose board behind a canvas shows that he was aware of the principle behind the preservative qualities of a panel-back stretcher.

But by 1842, a conversation with Professor James Jay Mapes, who had lectured at the National Academy of Design between 1832 and 1838 on the chemistry of colors, made Neagle change his mind about "doublebacking." Mapes apparently told Neagle that mold or fungus could grow behind his waxed fabric, and convinced Neagle that a "column of air" created by an unattached, unwaxed canvas, stretched so it did not touch the painting, would provide a safer buffer against climactic changes (Neagle 1839-, 17-18). Mapes, like Neagle, seems modern in his views, especially in anticipating by more than a century the idea that every painting should have a backing board, not only to buffer the canvas against changes in humidity, but to contain a volume of static air that will keep the painting from moving when it is transported or otherwise subject to vibration.

Rembrandt Peale also weighed in on this question, writing down (in an undated note) a recipe that sounds exactly like the procedure used by Trumbull to correct cracks by applying wax to the reverse and ironing it in; Peale noted: "It is said the paint will be drawn together & closed. (Try it.)" (R. Peale [n. d.]). By the time he completed his manuscript *Notes of the Painting Room* in 1850-52, Rembrandt Peale also believed that saturating the back of a *newly* prepared canvas with a solution of wax in turpentine would "be a great protection from the influence of damp" (R. Peale c. 1850-52, 18, 20; see also Swerda 2002 and 2003).

As we go deeper into the nineteenth century, evidence for the use of wax as a painting medium by British and American artists becomes more complicated and sometimes contradictory. On the one hand, the old-fashioned hot wax recipes from the eighteenth century, especially Miss Greenland's (now Mrs. Hooker's) method, continued to be repeated by such authors as Field (1835, 199-200; 1841, 353), and Fielding (1839, 76; 1846, 173). Charles Eastlake's 1847 *Materials for a History of Oil Painting*, the most scholarly book on painting techniques up to that time, reported on German and French techniques for both hot and cold wax painting, giving special importance to Montabert's improvements as described in his 1829 treatise (Eastlake 1847, 163-64, 247n). However, it is difficult to know to what extent these methods were actually used by painters as opposed to merely cited by authors of treatises, who had an incentive to present as large a number of recipes as possible in order to fill the pages of their books.

The simpler method of using wax as an additive to oil paint also appeared in publications, although here too the evidence is somewhat contradictory. For instance, one wonders what British painters made of Fielding's account of a medium made from bleached beeswax in turpentine plus varnish, which he said was "frequently used" as an additive to oil paint, and "gives a beautiful clearness and texture to the colours;" however, Fielding warned that subsequent paint layers "will frequently come off entirely from the canvass, and with them all the former paintings" (Fielding 1846, 168-69). British painters as well-known as John Constable (1776-1837) were said to have sometimes used "a little" wax in a medium that they added to oil paint (Field 1841, 361-62), and paintings by Joseph M. W. Turner (1775-1851) have been found by analysis to contain spermaceti (Boon et al. 1995). The amount of wax used in media intended to be added to oil paint were often relatively small. For instance, Benjamin Robert Haydon (1786-1846) wrote: "Equal quantities of mastic varnish and old raw linseed oil (half a pint each), a bit of pure wax as big as your thumb, and without spermaceti (be sure), makes a divine vehicle" (Haydon 1853, 272-73). In Field's *Chromatography* (1835 and subsequent editions) he suggested a medium made of copal, turpentine and drying oil, "and if about an eighth of pure bees'-wax be melted into it, it will enable it to keep its place in the manner of macgilp" (Field 1835, 209; 1841, 376).

In the middle of the nineteenth-century, American painters sometimes followed the lead of the British in using wax. For instance, the New York colorman John Ridner published in a book (without attribution) Field's recipe for a copal/turpentine/oil medium containing one-eighth part wax (Ridner 1850, 134). William Sidney Mount (1807-1868) copied this same recipe from Field into his diary in the 1850s (Frankenstein 1975, 308, 315), but Mount proposed other experiments of his own with wax media, including mixing wax with the newly available resin dammar to form a medium (Frankenstein 1975, 308). Mount also had the somewhat alarming idea to "Dissolve white wax in turpentine, then use it alone in colors while painting" (Frankenstein 1975, 248), although it is not clear from Mount's account that he actually did this.

By the middle of the nineteenth century, Thomas Sully seems to have had conflicting views about wax as an additive. About 1850 he wrote down a recipe for a painting medium from his nephew, the painter Robert Sully (1803-1855):

Robert Sully, my nephew has made a good magulip as follows: A piece of white wax of the size of a raisin is put into a vessel a table spoonful of drying oil, when the wax is dissolved by placing the vessel on a heated stove, take it off and add a spoonful of gum de mar varnish; as the size of the wax is increased it will retard the drying of the mixture, without the wax, the mixture would dry too quick (Sully 1871, 104).

In 1858 Sully wrote that "The excellence of wax in a vehicle is to be doubted" (Sully 1809-71, fr. 245). But the very next year he recorded in a notebook: "Painted a head in half shadow of a boy, with magilp made of wax, gum damar varnish and oil. It dried in 20 days" (Sully 1809-71, fr. 247).

It is also worth noting that Rembrandt Peale, who had been such an advocate of encaustic painting and adding wax to oil paint earlier in the nineteenth century, did not even mention wax as an ingredient in paint mixtures when he summed up his opinions on painting materials around 1850 (R. Peale c. 1850-52).

By way of postscript, it is probably not well enough known that a thin but continuous thread of interest in wax painting extended right through the nineteenth century in Europe, especially for mural decorations (Rice 1999, 11-13; see also,

for example, Carpentier 1875 and Taylor 1843). In America, John La Farge (1835-1910), who had learned about wax painting in Europe, used the medium in America beginning in the 1860s for both mural painting and easel paintings (Rice 1999, 11). By the 1890s other Americans were experimenting with wax as well (Mayer and Myers 2004b, 241), and this interest would continue sporadically throughout the twentieth century. In fact the revival of wax painting in our own time has been such that there are probably more painters working with this medium in the twenty-first century than at any period since the technique was revived in France in the 1750s (Stavitsky 1999).

### Acknowledgements

The authors would like to thank Malcolm Warner of the Kimbell Art Museum and Theresa Fairbanks-Harris of the Yale Center for British Art.

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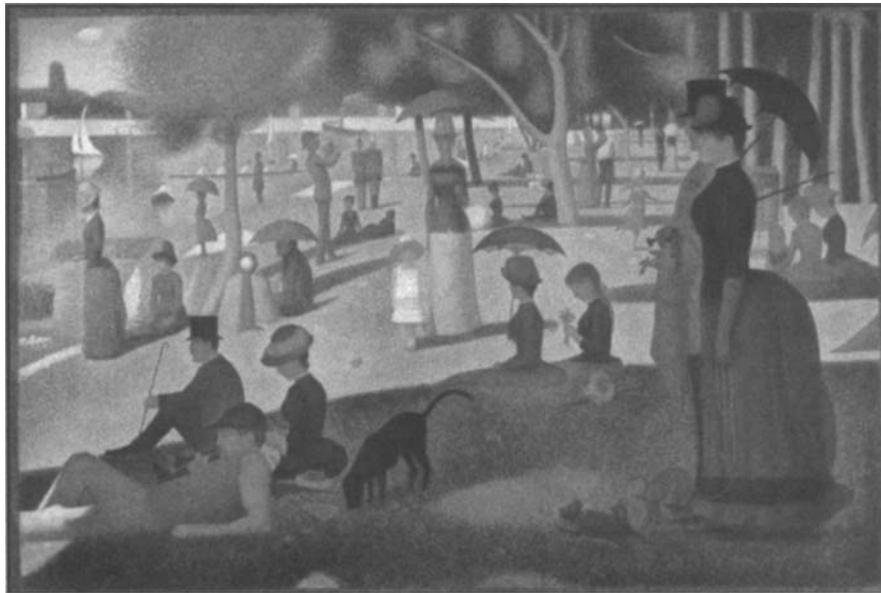
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## SEURAT AND THE MAKING OF LA GRANDE JATTE

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ABSTRACT—In preparation for the exhibition “Seurat and the Making of La Grande Jatte,” A Sunday on La Grande Jatte—1884 was recently reexamined in the Art Institute of Chicago’s conservation department to study Georges Seurat’s working process and the evolution of the painting. The technical examination enabled us to discern the compositional development of the work, and alterations made during the course of painting. The examination also provided clues to Seurat’s use of a number of the studies for La Grande Jatte, uncovering trends in sizes and proportions, and revealing Seurat’s use of grids to enlarge and transfer the composition. We have found that Seurat’s painting technique was systematic but flexible, enabling him to make refinements at every stage in the process. Using a computer graphics program to overlay infrared, x-ray and high-resolution color images of the painting we can look carefully at particular figural groups and the complexity of the development of La Grande Jatte becomes clear.



**Figure 1.** A Sunday on La Grande Jatte—1884, Art Institute of Chicago

### Introduction

In preparation for the exhibition “Seurat and the Making of La Grande Jatte,” the Art Institute of Chicago’s Conservation department conducted a technical examination of the painting and several of the studies to better understand Seurat’s complex painting technique. The exhibition provided us with an opportunity to reexamine La Grande Jatte making use of technical advances that were not available when the painting last underwent extensive study in 1982. The research took about two years to complete and involved a group of conservators, conservation scientists, as well as the Art Institute’s imaging department and a visiting color scientist from the Rochester Institute of Technology.

We examined the painted surfaces under magnification, and used x-radiography and infrared reflectography to study Seurat’s painting process. Using Adobe Photoshop to outline significant features in the x-ray and high-resolution

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color images of La Grande Jatte, we were able to examine individual figures and forms in depth. Pigment samples and paint cross-sections were taken to better understand Seurat's painting materials. High-resolution digital images and spectrophotometric measurements of the surface were used for accurate reflectance measurements of a range of colors on the surface.

The present study documents the evolution of La Grande Jatte: its relationship to the preparatory works; the progressive development and enlargement of the composition; the artist's changes to the composition and to the figural forms that are evident in the x-rays of La Grande Jatte; and the pigments and techniques used during the three distinct painting campaigns. In addition, the technical study further investigated the darkening of the zinc yellow pigment used during the second painting campaign. The Art Institute carried out a unique collaboration to create a life-size digital reproduction that approximates the appearance of La Grande Jatte in the late 1880s.

### **Evolution of the composition**

George Seurat's A Sunday on La Grande Jatte—1884 (Fig. 1) is the result of a long and involved working process that occupied the artist over the course of a number of years. Seurat was both systematic and intuitive in his development of the large canvas. In the academic tradition he used more than fifty studies to develop and enlarge the composition, yet he continually made refinements as La Grande Jatte progressed, altering the forms and identities of his figures and modifying his painting technique in response to new artistic theories.

Seurat began the painting in May 1884 in preparation for a March 1885 exhibition of the Independents. Initially working outside on the island during the summer and fall of 1884, Seurat painted a series of oil studies on portable wood panels measuring approximately 6 x 9 inches, on which he experimented with the placement, poses, and groupings of the many figures within the landscape setting. During the winter he worked in the studio, still painting on small wood panels but also using larger painted canvases to develop the composition, and drawings on paper to further refine the figures and focus on specific details. Most of the drawings appear to have been done at a late stage in the planning process, after the painted studies. The simplified tonal studies often bear a very close resemblance to the figures as they appeared in the first stage of painting of La Grande Jatte, as seen in x-ray.

As La Grande Jatte neared completion in March 1885 the exhibition for which it was prepared was cancelled and Seurat set aside the large canvas for several months. When he returned to the painting in the fall of 1885 Seurat began a second painting campaign using a brighter, refined palette and a new painting technique with which he had been experimenting over the summer. Between October and March he reworked much of the composition using small dabs, dashes and lines of paint, changing the surface character of the painting, adjusting the color relationships, and expanding many of the figural forms. La Grande Jatte debuted at the May 1886 eighth and final Impressionist exhibition. Seurat's work on the canvas was not yet completed however, and he returned to it in a third painting campaign in 1888-1889, when he added the painted border.

Two landscape studies, the painting Landscape Island of La Grande Jatte 1884, border 1885 (private collection) and the drawing Landscape, Island of La Grande Jatte 1884 (British Museum), represent the stage set upon which Seurat would place the figures. The painted landscape may in fact have served a practical function as a canvas against which Seurat could hold up the smaller painted panels to test figural arrangements. Finished in December 1884, the painted landscape nearly depicts the final appearance of the island, however it is squarer in format than either La Grande Jatte or the early panel paintings. For many of the studies, and the final 2-by-3 meter canvas, Seurat used a 2-to-3 height to width ratio, which is apparent in the drawn landscape. Probably completed after the painted version, the drawing shows Seurat revising the view of the island, essentially cropping the top and bottom of the scene, to create the panoramic landscape view that would remain constant from this point onward.

The large painted sketch from the Metropolitan Museum of Art, Compositional study (large sketch) for La Grande Jatte 1884, border 1888-9, was a departure point for the final canvas. It measures exactly one third the size of La Grande Jatte and also fits the 2-to-3 proportion. In this study Seurat appears to have modified a larger canvas to fit the proportion; he originally left the top and bottom strips of a 73 x 100 cm canvas exposed in order to make the painted image fit a 66.6 x 100 cm window. The painted edges were added later. Microscopic examination indicated that the blank strips of canvas, above and below the composition, were at an earlier stage covered with metallic, gold colored paint.

The Metropolitan painting is one of three studies with evidence of the grid system Seurat used to enlarge and transfer the composition. The grid under the paint was discovered by examination with an infrared camera, which delineated the set of grid lines dividing the canvas into square sixths with an additional central axis line.<sup>1</sup> The presence of the grid lines under the paint on the Metropolitan study implies that the design was transferred from another source. A lost painted sketch of the full composition, Small compositional study for La Grande Jatte 1884, formerly in the collection of the artist Paul Signac, may be the source from which the Metropolitan study was transferred. Known only from a black and white photo, it appears to be the earliest study depicting a similar composition to the final painting.

Although it had been hypothesized that a grid lay beneath the surface La Grande Jatte, we had been unable to observe a grid with past infrared examinations. However, after more careful scrutiny a series of marks and tack holes corresponding to a grid were found along the edges of the painting. The marks along the left side appear to have been incised into the ground layer and then coated with a red-pigmented material. A small portion of a horizontal red line was found in the thinly painted reeds at the left edge of the painting suggesting that more lines may be present under the surface. If this line is indicative of a complete grid, its red color may explain why it was not detected with infrared in earlier examinations. When marks at the edges of La Grande Jatte are connected a square grid emerges that divides the composition evenly into 24 squares. (Fig. 2) The uniform sections would not only have provided a system for enlargement and transfer, but the vertical lines may have served as axes for positioning significant compositional features.

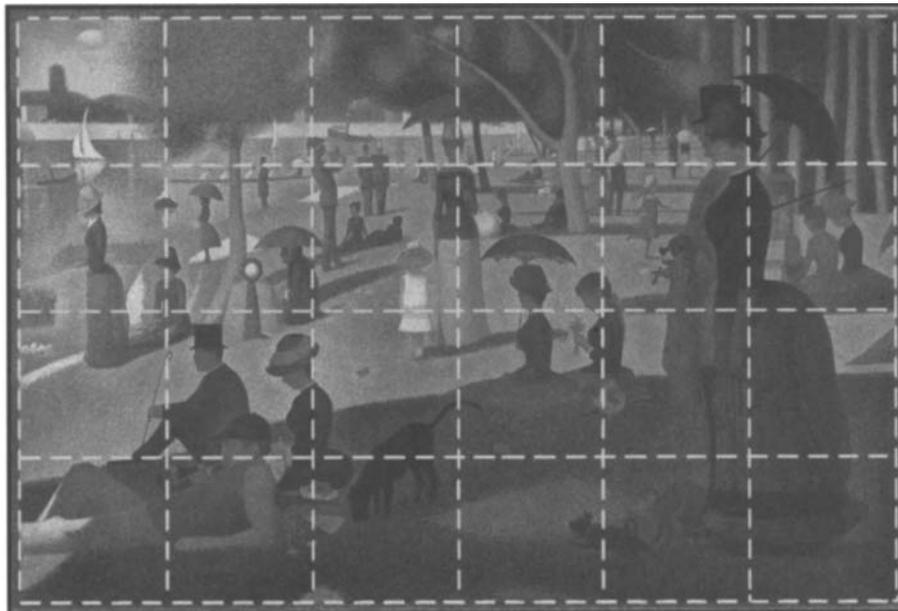


Figure 2. La Grande Jatte with an overlay of the grid structure indicated by holes and marks found on the canvas.

There is also evidence of a grid on the painted sketch, The Couple 1884 (Fitzwilliam Museum, Cambridge), as well as hatch marks along the edges of the drawing of the same subject, The Couple 1884 (British Museum). The grid structures on these two studies of the right half of the composition correspond almost exactly to the squared grid on La Grande Jatte. The painted study has tacks and lines on the edges of the painting that line up with the drawn grid that lies under the paint. The tacks on the edges may have served to stretch string across the surface of the painting to facilitate drawing of the lines.<sup>2</sup> It is also likely that string may have been used after the painting was finished to provide a 3-dimensional grid that Seurat could use to transfer the composition to the larger canvas of La Grande Jatte.

The late studies with the grids are particularly important in the information they provide about Seurat's working process. The Metropolitan study, which we believe to be the earliest of the three, has a dark tonality similar to the

wood panels. The painted Fitzwilliam couple most likely served as a later color study for the final painting. It has a similar off-white ground and may have been a test canvas for laying in the colors. As such it may provide a clue to the appearance of La Grande Jatte in its very earliest stages of painting. The British Museum drawing of the couple, like many of the other drawings, works as a tonal study. Its close resemblance to the final forms on La Grande Jatte indicates that it was probably created at a later stage than the other works.

Comparing La Grande Jatte to the late studies one can see the many little changes Seurat made to the composition. For example, the promenading man carries an umbrella pointed down to the ground in the painted Fitzwilliam couple. This umbrella is seemingly absent from the other three works, yet examination of the Metropolitan's painting and x-ray reveals that the umbrella was once in this composition as well, but was later painted over. Seurat made many modifications to the Metropolitan study, most of which correspond to changes we see on La Grande Jatte, indicating that he continued to work on the Metropolitan canvas as he painted the final canvas. Another change to note is the brown form along the shoreline on the painted study of the couple from the Fitzwilliam Museum. Either a cow or a horse at the water's edge, this animal is also seen in the same location on one of the painted panels, Standing Man 1884 (The National Gallery, London). In our research we discovered that this form was once present on both the Metropolitan and Chicago canvases but was painted out on both and partially replaced with a small boat carrying a French flag. Many other modifications are more obvious upon comparison of the Metropolitan study and the final canvas. The white dog, for example, moves from one side of the tree to the other. The boatman in the lower left corner loses his sleeve in the final painting and his companion gains a top hat and cane. The woman fishing on the left bank is larger in scale on La Grande Jatte, a change which at once alters the topography and sense of distance; her companion is turned slightly toward the viewer. On the final canvas a small leaping dog takes a place in the foreground, joining the monkey.

Although x-rays of La Grande Jatte (Fig. 3) were made about 20 years ago, they did little to enhance our understanding of the painting and of the artist's working process. The one change that was readily visible, due to the significantly higher density at the margins, was the extension of the tacking edges, done when the painted border was added. Apart from this one revision, changes were not immediately apparent and the x-rays were difficult to interpret. Our recent study of the painting was greatly enhanced by the use of computers and graphic imaging software, which we used to overlay images of the various paintings, drawings, and x-rays to facilitate comparison. The ability to manipulate the scale, value, and contrast of the scanned x-rays also extended our ability to make observations that led to a better understanding of the works, their role in the artist's working process and of their interconnections.



Figure 3. X-ray of La Grande Jatte

Seurat began by painting the landscape, including the trees and shadows, and the large figural forms in the foreground. These areas appear dark in the x-ray indicating that Seurat reserved space for them from the outset. As Seurat worked on the painting he added the figures positioned further back in the landscape, including the running girl right of center and the couples in the distance behind her. In the x-ray the shadows and landscape forms run through a number of these figures. At a late stage in painting Seurat added a number of small figures; some at the shoreline are painted over the completed water. One surprising find was the late addition of the monkey: it does not appear in the x-ray. Close examination of the painting revealed it to be painted over the finished grass and the shoes and skirt of the neighboring figures. While the overall arrangement of most of the forms was established from the beginning and remained constant, Seurat made numerous minor modifications. By looking at specific figural groups in the x-ray we can see how the artist progressively altered the contours of the forms as he painted.

The skirt of the promenading woman on the right half of the painting had at least two distinct shapes before March 1885, predating Seurat's revision of the painting with dots, dashes, and lines. (Fig. 4) Originally the woman's form was slimmer, with a thin waist and a straight skirt with a sharply sloping bustle. As the painting progressed Seurat widened the skirt, adding a protruding rear bustle, internal folds and definition, and raising the hem. At the same time he appears to have widened her companion's form as well. During the second painting campaign the skirt changed once again; Seurat widened the skirt, further exaggerating the bustle. The right edge of the skirt extends over portions of the landscape. The horizontal band at the bottom of the skirt was left undisturbed, giving an idea of the garment's width before Seurat added the final flared back. Painted and drawn studies of the promenading woman suggest that Seurat experimented with a number of skirt fashions as he conceived of the figure. Two studies, Skirt 1884/85 (Musée Picasso) and Woman with a Parasol 1884 (Private collection), represent skirts with internal folds and forms that may relate to the intermediate additions we see in the x-ray.



Figure 4. Detail of the promenading couple from La Grande Jatte, at left. Detail of the x-ray of the painting, at right, with lines delineating the progressive changes to the figural contours, as seen in the x-ray.

Similar contour changes are evident in the x-rays of the mother and child from the center of the painting. (Fig. 5) The initial painted form of the mother was significantly narrower and more columnar; her skirt was longer and cast a short shadow to the right. The mother and child originally looked similar to the figures in the Metropolitan study. The little girl's hat and dress differ, but her arm extends up toward her mother's in both works. Only later did the forms take on their final appearance. When Seurat reworked the canvas he widened the mother's form, particularly on the right side, and raised the hem of her skirt. He modified the girl's arm, making it extend horizontally. Additionally he extended the shadow underneath the forms creating the peculiar illusion that the mother is floating

above the ground. Seurat's modifications to the figures of the mother and child from the center of La Grande Jatte are also evident in a number of the early panels; they appear separately and together. Seurat appears to have debated their placement on the landscape. On one panel, Rose-Colored Skirt 1884 (Private Collection), the mother's figure is reversed her right hand holding the parasol instead of the left.



Figure 5. Detail of the mother and child from La Grande Jatte, at left. Detail of the x-ray at right, with lines delineating the progressive changes to the figural contours, as seen in the x-ray.

### Painting materials

Seurat painted La Grande Jatte on a fairly coarse linen canvas that was commercially primed with a lead white ground tinted with a small amount of carbon. Because of the large size of the canvas Seurat probably had to order a special oversized fabric. Seurat initially blocked in the composition using broad rectangular brushstrokes over a white ground, similar in technique to the Fitzwilliam Museum's The Couple.

In the first painting campaign, begun in 1884, Seurat worked in a style similar to that of the Impressionists, but with somewhat more ordered, regular brushwork. A good example of the first painting campaign can be seen in the upper left portion of the painting. Seurat's brushwork varied according to the forms he was depicting. Most of the foliage is painted in short criss-crossed brushwork. Short, disconnected bands of paint simulate the surface of the water. The white sail is comprised of blended, linear strokes that follow its curve. During this stage Seurat was using a large array of pigments including earth colors, which he would later abandon. Seurat typically combined four or five pigments to achieve the desired tone. The water, for example, is composed of lead white with some viridian, emerald green, and ultramarine blue. Seurat used black but sparingly; for most of the colors perceived as black on La Grande Jatte he would instead use mixtures of colored pigments. The black dog in the foreground, for instance, is composed of ultramarine blue and red lake in varying proportions.

Seurat's reworking of the painting during the second painting campaign, beginning in October 1885, was due in part to his evolving commitment to contemporary writings and ideas about color. In the 19th century color scientists such as Eugene Chevreul and Charles Blanc discussed the fundamentals of color perception. Seurat was influenced by their work and the writings of a number of other color theorists. He was interested in two optical effects in particular: simultaneous contrast and successive contrast. Simultaneous contrast occurs when two complementary colors are placed side-by-side, red next to green, or blue next to orange for example, making each color appear more vivid. Successive contrasts occur when a complementary after-image of a color is retained in the eye after one has ceased looking at it; one sees orange after staring at a blue form and then turning away, for example. Seurat's increased interest in color theory led him to simplify his palette in 1885 to a selection of eleven spectrally pure hues and white. He stopped using earth colors as well as complex mixtures of pigments, instead using minimally mixed bright tones side by side to create a more complex and luminous surface. Analysis of the pigments on La Grande

Jatte confirmed the use of a more limited range of colors in the second painting campaign than in the first. (Fig. 6) He eliminated burnt sienna, iron oxide yellow, and black while adding zinc yellow. Seurat used two reds - vermilion and red lake; three yellows - chrome yellow, zinc yellow, cadmium yellow; two greens – viridian and emerald green; 2 blues - ultramarine blue, cobalt blue; and lead white.

	Stage 1 (1884-85)	Stage 2 (1885-86)	Stage 3 (borders > 1889)
Vermilion (mercuric sulfide)	●	●	●
Organic Red Lake (unidentified)	●	●	●
Burnt Sienna (calcined iron oxide)	●		
Iron Oxide Yellow (hydrated iron oxide)	●		
Chrome Yellow (lead chromate)	●	●	●
Chrome Orange (basic lead chromate)			●
Zinc Yellow (zinc potassium chromate)		●	
Cadmium yellow (Cadmium sulfide)	●	●	●
Viridian (hydrous chromium oxide)	●	●	
Emerald Green (copper acetoarsenite)	●	●	
Ultramarine Blue (sodium aluminium sulfo-silicate)	○	○	
Cobalt Blue (cobalt aluminate)	○	○	○
Lead White (basic lead carbonate)	●	●	●
Charcoal or Bone Black	○		

Figure 6. Comparison of pigments on La Grande Jatte

During the second campaign Seurat used a new technique for applying paint: small, ordered but varied brushstrokes in the form of small dabs, dashes, dots, and lines. During the second painting campaign Seurat added finely painted outlines, often in pink, and small multicolored brushstrokes around the edges of figures to define their contours. Seurat altered the forms of many of the figures, widening them to create curved, and scalloped contours. Seurat also painted bands of dots in contrasting colors next to a number of the figures to create a “halo” effect.

Sometime in 1888 Seurat formulated the idea of colored borders and frames and began adding painted edges to most of his pictures. With these additions he wished to provide a visual transition between the interior of the painting and the frame. To add the border to La Grande Jatte Seurat enlarged the stretcher and restretched the canvas to expose portions of the canvas support previously turned over the edges. He applied a lead white paint layer as a ground, followed by blue, red, orange, and yellow dots. Some sections of the border are accompanied by a series of large dots within the painting itself in orange, yellow, blue, and green.

### Zinc yellow

Felix Feneon, a contemporary of Seurat, described a darkening of La Grande Jatte six years after it was completed. He stated: “Because of the colors which Seurat used toward the end of 1885 and in 1886, this painting of historical importance has lost its luminous charm: while the reds and blues are preserved, the Veronese greens are now olive-greenish, and the orange tones which represented light now represent nothing but holes.”<sup>33</sup> Research on the painting has determined that darkening has taken place and the cause can be attributed to the pigment zinc yellow, which was used in the second painting campaign. Zinc yellow was used alone and in mixtures with vermilion red, lead white, and emerald green. The visual effect of the discoloration is most prominent in the sunlit grass, but the pigment was used throughout the painting in discrete touches of color. Due to the darkening, bright yellows now appear ochre-like, bright greens now appear a drab olive-green, and bright oranges now appear reddish-brown.

In an effort to understand the degree of darkening and to create a digital simulation of the painting without the darkened dots, the Art Institute of Chicago collaborated with color scientist Roy Berns from the Rochester Institute of Technology. For the project we used a device called a spectrophotometer, which measures the spectral reflectance of a surface; it essentially measures the intrinsic color value of an area, reading it as a wavelength or numerical value. Every color has a characteristic wavelength, a fingerprint that can be used to identify its visual properties. Color measurements were made on selected areas of the painting (Fig. 7) and on freshly painted samples of pigments.

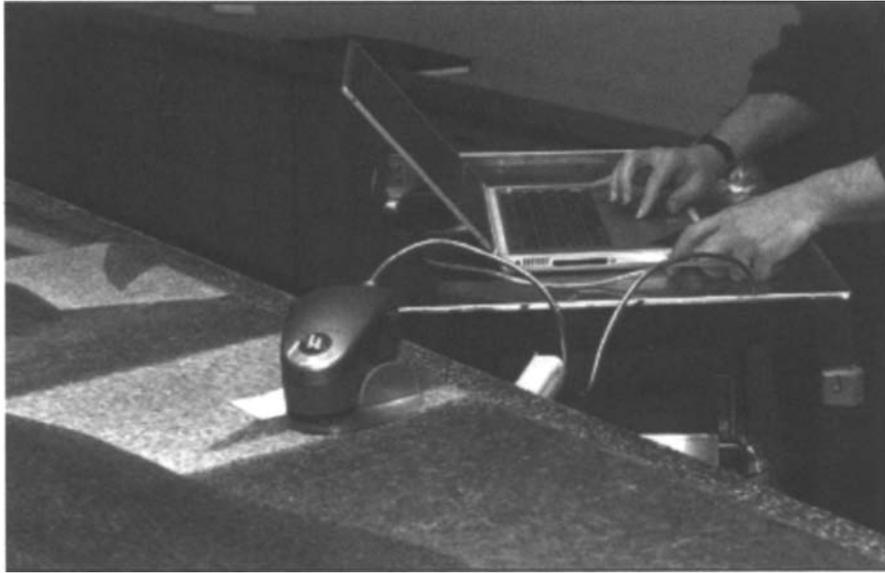


Figure 7. Taking spectrophotometric measurements on the surface of La Grande Jatte.

The pigment zinc yellow was not widely used and is no longer available as an artist's pigment, though it continues to be used for industrial paints. Optical microscopy, Scanning electron microscopy (SEM/EDS) and Raman microscopy were carried out by our microscopist Inge Fiedler and conservation scientist Francesca Casadio to identify the pigment. Zinc yellow ranged in tone from lemon yellow to a marigold yellow; the tests on the aged zinc yellow indicate Seurat most likely used a light, lemony version of the pigment. Samples of the zinc yellow Seurat used on La Grande Jatte were found to have starch grains mixed into the paint. The starch was most likely added as an extender or filler by the paint manufacturer, and its inclusion may have contributed to the rapid deterioration of the zinc yellow. Studies on the zinc yellow and its darkening mechanism continue at the Art Institute.

To develop digital approximations of the undarkened zinc yellow mixtures similar to those Seurat may have used, we used data from the spectrophotometric color measurements, information about the relative proportions of pigments used in specific color mixtures, and information about the layer structure of the painting. Additionally we had to factor in the overall darkening of the painting's oil medium over time. The resulting numerical data were then translated into a visual equivalent that could be applied to a digital image of the painting. The transformation was done literally dot-by-dot on a one-to-one digital image of the painting using Adobe Photoshop software, by the Art Institute's Imaging Department working in collaboration with the conservators and scientists.

Upon close examination of the resulting life-size digital image, the individual brushstrokes of the zinc yellow-containing paints appear bright and vibrant. Further away the effect is much more subtle. The paint surface appears more unified and less "dotted", as the different shades of yellow and green blend together. Comparing the digital reproduction to La Grande Jatte, we would say that the original has not lost its luminosity, as Felix Feneon contended. Though the sunlit grass is somewhat brighter, the zinc yellow dots are just one of many elements that contribute to the monumental painting. La Grande Jatte has aged remarkably well. It remains unlined and unvarnished, and is on its original stretcher. The surface has retained a freshness and vitality, despite the subtle changes of time.

Our recent reexamination and documentation of La Grande Jatte has elucidated the artist's complex working process to some extent, but our discoveries only partially explain Seurat's grand and enigmatic masterpiece. We look forward to exploring the painting's making and meaning for many years to come.

**Acknowledgements:**

We are indebted to Inge Fiedler, Francesca Casadio, and Roy Berns for sharing their work and letting us present portions of it here. We would like to thank Bob Herbert, Douglas Druick, and Gloria Groom for their support and encouragement of this study. Also thanks to Charlotte Hale and Kate Stonor for sharing information and research materials. And a final thank you to Alan Newman and the Imaging Dept of the Art Institute of Chicago for their assistance and involvement throughout the study.

**Endnotes**

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<sup>1</sup> The grid beneath the surface of the Metropolitan sketch has been described by Charlotte Hale, Paul Smith, and Robert Herbert. Hale and Smith differed in their descriptions of the grid. Hale examined the painting with infrared imaging and a binocular microscope in 1990; see her Technical Examination Report, New York: Metropolitan Museum of Art, 1990. Our recent reexamination of the painting with IR confirmed her description. Smith scrutinized the painting with infrared imaging in 1980 and published his findings in 1997; see Paul Smith, *Seurat and the Avant Garde*, New Haven: Yale University Press, 1997, pp. 19-20. Herbert also discussed the grid of the Metropolitan work, basing his description on Hale's comparison; see Robert Herbert et al., *Georges Seurat, 1859-1891*, New York: Metropolitan Museum of Art, 1991, p. 211.

<sup>2</sup> The grid on the Fitzwilliam painting was thoroughly described by Kate Stonor; see her Conservation Examination Report of The Couple, Cambridge, Eng.: Hamilton Kerr Institute, n.d.

<sup>3</sup> Felix Feneon, *Oeuvres plus que completes*, Ed. Joan U. Halperin, Geneva: Droz, 1970, pp. 212-213.

# A RUBENS PORTRAIT RE-EXAMINED: HOW CONTEMPORARY COPIES AND HISTORICAL DOCUMENTATION AIDED IN INTERPRETATING A REWORKED PORTRAIT

Linnaea E. Saunders

**ABSTRACT**-Peter Paul Rubens's *Portrait of a Helena Fourment*, was recently the subject of technical study and treatment. The presence of large *pentimenti* identified in the x-radiograph demonstrates that an earlier version of the painting lies beneath the current painting, calling into question the identification of the sitter and the attribution to Rubens. This paper will discuss the technical investigation and treatment and clarify the placement of this painting in Rubens's oeuvre, utilizing the "documentation" provided by contemporary and later copies, as well as information from historical treatises on painting technique.

## 1. INTRODUCTION:

During a Kress Conservation Fellowship at the Royal Cabinet of Paintings, Mauritshuis, 2003-2004, I was responsible for the technical study and treatment of Peter Paul Rubens *Portrait of Helena Fourment* (Figure 1). When the study began, it was known that this was a reworked portrait, with the initial portrait dated for stylistic reasons to c.1625. It was not clear when and by what hand, the painting was reworked.

The portrait was a particularly intriguing painting for study since it has been generally accepted that the painting was part of Rubens's collection at the time of his death. In the inventory of Rubens estate, compiled in 1640 under the advice of the artists Frans Snyders, Jan Wildens and Jacques Moermans, item number 102 is described as "The picture of a woman with a black cap and flowers in her hand."<sup>2</sup> Furthermore, the sitter has been popularly identified as Helena Fourment, Rubens's second wife. A three-quarter length portrait of a woman wearing a light blue satin dress, a black cloak with flea fur and black cap with ostrich feathers, creates the image of a woman in fanciful 16<sup>th</sup> C. Venetian dress. The woman holds two pink flowers in her left hand and rests the finger tips of her right hand firmly on the bottom edge of the picture.

The painting is one of a pair of female portraits attributed to Rubens, collected in the 1730s/40s by Govaert van Slingelandt, whose collection forms the historical core of the Mauritshuis collection. The second portrait has been thought to depict Isabella Brandt, Rubens's first wife.<sup>3</sup> Von Slingelandt would have been justifiably proud of owning portraits of Rubens two wives and would have displayed them as pendants, customary to the symmetrical hanging style of the time period. However, there exist a number of 17<sup>th</sup> C. portraits of women that resemble either Isabella Brandt or Helena Fourment, which are clearly not by Rubens or indeed portraits of his two wives. The Mauritshuis portrait of Isabella Brandt is now considered an unknown sitter by an unknown follower of Rubens.

Beginning in the late 19<sup>th</sup> C., during the period of intense study and classification of Rubens oeuvre, the subject and attribution of the painting began to be reconsidered. The catalogues of the collection provide incite into the reception of the painting including information related to technical study.<sup>4</sup> In the catalogue of 1874, the painting is listed for the first time as "Portrait of Helena Fourment" and includes a thorough description of the painting and panel construction. In the 1895 description it is suggested that the painting was expanded in the 18<sup>th</sup> Century to make it the same size as the pendant (the pendant is in fact approximately 8 cm narrower than the painting under study). By the 1935 catalogue the painting had been x-radiographed by M. De Wilde and the widths of the three panel additions are listed, as well as the suggestion that the enlargement was probably by Rubens himself (Figure 2). At this time it is suggested that the portrait was repainted by an unknown artist, prompting speculation that the Venetian-style costume was by an unknown later hand. The first version of the painting visible in x-ray depicts a sitter wearing a pearl tiara rather than a hat, and wears a dark cloak with white satin border rather than a flea fur. She holds three flowers rather than the two now seen. An overlay of the image with its x-ray (Figure 3) helps to show what the first version of the portrait would have looked like.

The 1935 catalogue also mentions a painting identified by Burchard at that time in the Staatsgalerie Stuttgart,<sup>5</sup> but now unknown. The Stuttgart painting appears to be a close copy of the first state of the Mauritshuis painting, copying

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even small details subsequently painted out during the addition of the Venetian costume. The Stuttgart painting is not by Rubens hand and the face of the sitter is significantly different than the first state of the Mauritshuis portrait. The photograph of the Stuttgart painting, clarifies the presence of a curtain that filled the left and right background.

Because the reworking of the Mauritshuis painting was not understood and preliminary study suggested that at least some of the reworking dated from the 18<sup>th</sup> C or later, the current technical study and treatment were initiated. Interest in the picture had been renewed when it was requested for the exhibition *A House for Art: Rubens as Collector*, held at the Rubenshuis, Antwerp, Spring 2004, which brought together works of art listed in the inventory of Rubens's estate.<sup>6</sup> The poor aesthetic appearance and importance of defining the attribution of the reworking lead to the omission of the Mauritshuis painting from the exhibition.

The reworking poses several questions: What prompted the repainting of the first state? When and by what hand was the reworking done? Is the Mauritshuis portrait identical to item 102 in Rubens's inventory?

## 2. TREATMENT:

To aid in the technical study, all repainting clearly established as 18<sup>th</sup> Century or later were removed where cleaning could be done safely.<sup>7</sup> A thick fluorescent varnish layer distinguished the 18<sup>th</sup> C. and later repainting from the reworking of the composition. The repainting obscured the cloak and background as well as portions of the hair and the transition to the hat. Isolated passages of Prussian blue glaze were removed from the left sleeve and bodice. In the chest, the removal of a broad passage of coarse particle yellowish flesh paint that lay in the mechanical cracks revealed the appearance of the figure in an early drawn copy of the painting in the collection of the Hermitage<sup>8</sup> The quality and attribution of the drawing remains unclear, and the fact that this is clearly a copy of the finished painting cast further doubt on its attribution to Rubens. Surviving drawings by Rubens related to portraiture are exclusively preparatory drawings or drawings made during the course of painting to work out details, lending further support that this drawing is a copy by an unknown hand.<sup>9</sup>

## 3. TECHNICAL STUDY AND COMPARISON WITH RELATED PAINTINGS:

In the following I will define the evolution of the painting, beginning with a description of the first state which depicts a traditional court portrait. This composition was begun on the central panel which was then expanded on three sides to accommodate the composition. Then I will describe the approach to repainting that creates the second state, including pigment and layer build up. Because relatively few late painting have been studied with the use of cross sections, stylistic comparisons to paintings from the late 1630s will serve as comparative examples.

### 3.1. THE PANEL SUPPORT:

The composite oak panel support consists of an unusually broad central panel (62.85 cm x 85 cm) with narrow additions to the right and left sides (4.85; 7.75 cm) and a wider panel (11.9 cm) added to the bottom edge. The reverse of the central panel is marked with a partial brand mark of the city of Antwerp and the letter "A", dating the panel to 1621-22.<sup>10</sup> The inscribed initials "MV" indicate the panel was made by Michael Vriendt, whose mark is also found on a number of Rubens panel supports.<sup>11</sup> Dendrochronological analysis further supports the first use of the panel during Rubens's lifetime. The earliest felling date of the central panel is between 1597-1616, with a creation date of 1603 and upwards, while the earliest felling date for the horizontal panel between 1621 and 1627, with a creation date of 1625 and upwards.<sup>12</sup> This dendrochronological analysis supports the c.1625 dating of the first state which previously relied on stylistic analysis.

The placement of the panel marks at the top edge of the central panel is unusual as similar marks are usually placed near the center of the approved panel. The absence of the lower portion of the brand of Antwerp and the fact that the top edge has been trimmed suggests that the panel was cut down from a much larger board. It may have been approved as a 26-stuiver size (85x110 cm), usually reserved for painting landscapes.<sup>13</sup> There are two published examples of paintings by Rubens which were also begun on broad central panels: the *Portrait of Helena Fourment in her Wedding Dress* in the Alte Pinakoteche in Munich (central panel measuring 75 x 108 cm)<sup>14</sup> and the *St. Cecelia* in the Gemaldegalerie, Berlin which is begun on an even larger panel (central panel measuring 70.7 x 117.35 cm).<sup>15</sup> Both of these panels are closer in size to the 26-stuiver panel dimension.

### 3.2. THE FIRST STATE: A TRADITIONAL COURT PORTRAIT:

Rubens began the portrait on the broad central panel prepared with a chalk ground and relatively thick streaky grey imprimatura consisting of lead white and charcoal, visible in surface examination along the upper edge. The streaky grey imprimatura and the red drapery extend to the edge of the central panel only.

Painting appears to have been begun directly on the grey imprimatura; no underdrawing was detected using infrared imaging. The portrait appears to have proceeded to a high degree, creating an image that filled the dimensions of the single central panel before it was expanded. The figure was placed against a red curtain that formed a gentle drape at the left edge. The face and bust appear to have been highly finished, although only the lower portion of the face and the neck are now clear of extensive reworking. Along the left side, the arm was painted to the edge of the central panel. The white satin border is sketched with a few brushmarks that fall just short of the edge and the lower portion of the virago sleeve is painted within the boundaries of the central panel.

An understanding of the original appearance of the portrait can be gained by looking at other female court portraits. The virago sleeves were painted using tones of grey and white to define forms and shading, while the bodice was underpainted using dark grey. The *Portrait of a Lady* c.1625, in the Dulwich Picture Gallery<sup>16</sup>, an example of a variant autograph composition, in which the placement and details of the element of the composition are more freely executed and the right hand was never included in the composition. In the Dulwich picture, a satin dress is depicted, while in the Mauritshuis portrait a different type of fabric was rendered. In the Mauritshuis portrait, a thick layer of coarse particle azurite was applied to the dress overall and to the stripes in the sleeves. Highlights were painted using a mixture of lead white and azurite, now visible only in the left sleeve. It is important to note that this use of an overall layer of pure color followed by highlights using the same pigments plus lead white, is described by Van Mander and De Mayerne as a method for representing velvet fabric. Van Mander describes the rendering of the velvet as different from that of other drapery: “you make this entirely dark and just apply the reflections on the sides [of the folds] and flat highlights”. The texture and rich color imparted by the coarse particle azurite would enhance the effect of velvet.<sup>17</sup> This can be illustrated by the *Portrait of a Lady*, c.1637 in the Gemäldegalerie, Berlin.<sup>18</sup> The Berlin painting--also on a composite support that was expanded during the course of painting--serves as an indication of the probable level of finish the first version of the Mauritshuis painting was brought to. Here we see the highlights to the blue drapery, the streaky grey imprimatura being used as the base tone for the white fabric at the chest and the unfinished nature of the lower portion of the composition. There are passages of flat black that block in the forms of the cloak, the brown toning of either the imprimatura or dead colouring on the panel extensions, and there is even a reworking of the left sleeve that is similar to the reworking of the left sleeve in the Mauritshuis painting.

### 3.3. PANEL ADDITIONS AND EXPANSION OF THE FIRST STATE:

The composition was enlarged once with the addition of three narrow panels that were added as part of a single enlargement of the composition made during the painting of the first state. The two narrow additions to the left and right edges are secured with a butt-join while the horizontally oriented panel is secured across the bottom using a z-shaped chamfered join. All three additions appear to be cut from larger panels and were prepared with a ground layer before being secured. A narrow band of surface fill was applied along the front of the join (visible in raking light) which appears to be a studio preparation as it includes palette scrapings. All three additions were then toned, after they were added to the central panel, with a warm brown imprimatura consisting of earth colors, with small amount of charcoal black and lead white, which overlaps the grey imprimatura of the central panel. Once the composite structure was complete, the reverse of the panel was beveled along the top and two side edges and fitted with a working frame. The working frame covered the outer 7-8 mm of all four edges resulting in an unpainted edge where the ground and imprimatura are now exposed. The first state to the painting was expanded within the frame and a barbe is present along all four edges.

The expansion of the panel allowed for the modification of the background to the left of the figure. Immediately to the left of the red curtain a tassel was added and the blue sky consisting of lead white and ultramarine was painted around the tassel, extending to just above the elbow. The blue sky appears to have been painted out during the first composition, as the brown paint (lead white and earth colors) used to cover the lower left corner is brought up the left side, applied around the tassel.

The horizontal addition allowed for the inclusion of the right hand and extension of the skirt. The composition in the lower portion of the image was to some degree left unresolved. The placement of the cloak to the left of the skirt is indicated by three pentimenti and the cuffs remain at an initial stage. The slightly different color and quality to

the hands may indicate the left hand was painted before the horizontal panel was added.

#### 3.4. THE SECOND STATE: THE PORTRAIT REPAINTED:

The reworking of the painting transformed the traditional court portrait (represented by the Stuttgart painting), into the image of a woman in fanciful Venetian dress.

The modifications to the painting were begun by blocking out the red drapery to the left of the figure and around the head using several layers of a brownish grey paint applied directly on the original red paint of the drapery. In a cross section prepared from a sample taken from the hair to the left of the face, we see the white chalk ground, grey imprimatura of the central panel, and several layers of red paint that formed the drapery of the initial composition. Directly on top of the red paint are several layers of the brownish-grey mixture—the initial paint layers of the second state—that formed the background. Directly on top of this is the yellowish paint mixture that formed the hair. As with most passages of the repainting forming the second state, no varnish interlayer is present.

The artist utilized the brownish grey paint as a base tone over which the hat with ostrich feathers were painted. Charcoal black paint was used to block in the form of the hat, using grey paint to define the outer contours in a similar manner to the approach used in the *Portrait of Helena Fourment with Gloves*, c. 1632 in Munich.<sup>19</sup> As part of the Lead Isotope Project being conducted by Daniel Fabian and Dr. Giuseppino Fortunato, Switzerland, a sample of lead white from the ostrich feather (part of the second state) was compared with a sample from the original passage of the virago sleeve. The ratios were found to be different—indicating different batches of lead white were used—but both samples were consistent with samples from other paintings attributed to Rubens and studio.<sup>20</sup>

The negative space around the head was redefined using two types of opaque red paint, the pinkish lead white, vermilion, red lake mixture and the intensely colored red mixture of vermilion and red lake. To the right of the figure, the negative space around the face is defined using a similar approach as the red drapery in the Dulwich *Venus, Cupid and Mars*, 1635.<sup>21</sup> The linear rendering of drapery is also similar in surface color and technique to drapery depicted in two paintings in the Gemaldegalerie that were part of Rubens estate, the *St Cecilia* and the *Andromeda* both of 1638/40.<sup>22</sup>

The changes to the hair lead to the reworking of the face, as an effective transition between the hairline and fleshtones needed to be created. In addition to the hairline, the eyes were reworked, and the right side of the nose was refined. The slightly yellowish tone, and delicate brushstrokes are characteristic of the reworking of the face. It is not clear whether the reworking of the face significantly altered the appearance of the sitter.

Below the pearl necklace the bust has been almost completely repainted, and was done as part of the reworking of the cloak and bodice. Passages of wet-in-wet mixing of paint indicate where the flesh paint was painted at the same time as the addition of the flea fur and white fabric.

The original dark blue velvet was reworked in the bodice and virago sleeves to create the effect of bright blue satin. In cross section we see the original azurite is covered with an opaque blue mixture of lead white and indigo<sup>23</sup> with a thin layer of natural ultramarine. This type of layer structure—lead white and indigo with either an azurite or ultramarine glaze—is typical of 17<sup>th</sup> C. painting from this period. Abrasion to the painting has revealed passages of the white borders of the original cloak and the third rose partially covered by the blue reworking of the bodice.

The least satisfactory area of the repainting covers the original black cloak with white borders but has suffered from past abrasion. A similar pigment mixture to the original black cloak was used to rework most of the cloak and is applied over what appears to be a saturating varnish. In the right arm, the original boundaries are retained, reserving the full portion of the blue and white striped virago sleeve. In the left arm, the upper portion of the virago sleeve was initially painted out, and then the stripes added at a slightly different angle.

#### 4. CONCLUSION:

The technical study of the Mauritshuis *Portrait of Lady* demonstrates that the portrait as we see it now is the second state of an earlier portrait in which portions of the first state were reserved and reused in the final state. The first state of the painting c.1625/1630, was begun on an unusually broad panel that was extended on three sides during the course of painting. It was fitted with a working frame, probably to add stability to the horizontal cross-grain join. The painting existed in the first state long enough for it to be copied by the artist responsible for the Stuttgart version. It is possible

that the first state was used as an example or *modello* for other portraits that are similar in composition, such as the Dulwich *Portrait of a Lady*. The painting remained in the working frame when it was reworked to form the second state, in which the traditional court portrait was transformed into the woman in Venetian dress.

It is possible to suggest that the reworking was done relatively soon after the first state. The painting retained the working frame, the reworking was completed directly on the paint surfaces of the first version (with the exception of the saturating varnish used in the black cloak), and the pigments and layer structure of the reworking are consistent with 17<sup>th</sup> C. Flemish technique and in some instances with the materials used in the first state.

The reworking appears to draw on knowledge of Rubens late paintings, as suggested by the comparison with the rendering of drapery in the two Berlin paintings that came from Rubens's estate. The source for such a transformation may lie in Rubens's copy after Titian, the *Portrait of Isabella D'Este* in the Kunsthistorisches Museum, Vienna, which was also in Rubens's estate.<sup>24</sup>

While Rubens was known to rework paintings and drawings in his collection, it is not possible to assert that his hand was responsible for the reworking of this portrait. It is more likely that a studio assistant, knowledgeable about Rubens's technique, sources, and late paintings, was responsible for the repainting.

The impetus for reworking a painting brought to a relatively high level of finish may be found in the function of the painting in the studio: if the first state of the painting was not sold or if it functioned as a *modello* c.1625, by the late 1630s the costume and composition would have been outdated. Changing the costume and therefore the subject of the painting would then make it a salable painting. A similar argument is proposed by Ernst Van der Wetering in the catalogue for the exhibition *Rembrandt's Hidden Self portraits*, held at the Rembrandthuis, 2002.<sup>25</sup> In the catalogue for the exhibition, Van der Wetering describes several of Rembrandt's self portraits that were reworked, leaving portions of the original faces in reserve.

If we accept that the Mauritshuis portrait was reworked under Rubens supervision, it is indeed probable that the painting is identical to item 102 in the inventory of Rubens's estate. Alternatively, it may have existed in the first state until Rubens death, and would have been a partially unfinished out-of-date portrait in his estate. An effort was made to sell the paintings in Rubens estate before its rendering in 1645, and several artists who had worked with Rubens were employed by Helena Fourment to complete unfinished paintings including Jacob Jordeans, Gerard Segers, and Jan Bockhorst.<sup>26</sup> Further study of paintings from the estate and those known to have been completed by Rubens assistants could provide further comparative material that would aid in the understanding of this painting.

#### ACKNOWLEDGEMENTS:

The author would like to thank the Samuel H. Kress Foundation for providing funding for a one-year Kress Conservation Fellowship, 2003-2004, at the Royal Cabinet of Paintings, Mauritshuis. Particular thanks to the member of the Restauratie Atelier: Jørgen Wadum, Petria Noble, Carol Pottasch, Sabrina Meloni, Annelies Van Loon, Johanneke Verhave and Registrar Andre Jordan.

Many researchers provided analysis of samples and references to historical documentation that proved invaluable to the interpretation and understanding of the painting: Katrien Keune, FOM Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands: SIMS, FTIR, SEM-EDX; Karin Groen, Instituut Collectie Nederland, Amsterdam, analysis of samples during initial study, 1997; Giuseppino Fortunato, Swiss Federal Laboratories for Material Testing and Research, EMPA St. Gall and Daniel Fabian, Painting Conservator in Private Practice, for analysis and interpretation of lead white samples; HPLC-PDA analyses of red dyestuff performed by Ina Vanden Berghe and Marie-Christine Maquoi, at the Laboratory for Materials and Techniques (head: Dr. Jan Wouters) of the Royal Institute for Cultural Heritage, Brussels, Belgium; Prof. Dr. Peter Klein, Zentrum Holzwirtschaft, Universität Hamburg; dendrochronological analysis of panel support; Dr Margriet van Eikema Hommes, Stichting Restauratie Atelier Limburg (SRAL), reference and translation describing of rendering of velvet drapery

Many thanks to my colleagues at the following institutions who facilitated the study of paintings and/or provided technical information about paintings for comparative study: Dulwich Picture Gallery, England; Alte Pinakotek, München; Gemäldegalerie, Berlin; Royal Collection, Windsor Castle, England; National Gallery, London; National Gallery of Art, Washington D.C.; Cleveland Museum of Art, Cleveland.

## Endnotes

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<sup>1</sup> Mauritshuis Inventory No. 251, oil on oak panel, 97.7 x 75.3 cm.

<sup>2</sup> See Jeffery Müller, *Rubens: The Artist as Collector*, Princeton NJ, Princeton University Press, 1989. For a further discussion of Rubens's personal collection see the introductory essay by Müller in *A House for Art: Rubens as Collector*, exhibition catalogue by Kristin Belkin and Fiona Healy, Rubenshuis & Rubenianum, 2004.

<sup>3</sup> Mauritshuis Inventory No. 250, oil on oak panel.

<sup>4</sup> Refer to complete inventory of catalogues in the Mauritshuis curatorial offices.

<sup>5</sup> The Stuttgart painting was deaccessioned and the current location is not known. A black and white photograph provided by the Staatgalerie Stuttgart is housed in the Mauritshuis conservation file.

<sup>6</sup> See catalogue referenced in footnote 1, above.

<sup>7</sup> I argue that these repaintings date to nineteenth century for a number of reasons. The smooth surface and uniformity established by the repaint is visible in the 1886 photograph and is reflected in an engraving from 1892 (see reproduction in conservation files). Written documentation indicates that the painting underwent treatment several times in the nineteenth century including probable treatment when the painting was removed to Paris under Napoleon, 1795-1815. Written documentation in the Mauritshuis files indicates that in the 19<sup>th</sup> C. the painting was repeatedly varnished and in some instances washed with a damp sponge (1816x2; 1817; 1841x3; 1845). Interpretation of documentation during this time period suggests that the collection was revarnished on an annual basis to combat the blooming in the varnish layers that occurred, probably as a result of the paintings hanging in a humid environment of a building surrounded by water. Comparison of the painting after cleaning shows details depicted in an engraving in the 1826 catalogue (entry no.10) that are omitted in the 1892 engraving, hence providing a relatively short time frame between 1826-1892 during which the thick varnish and resinous repainting could be dated.

<sup>8</sup> The Hermitage drawing is reproduced as number 209 by Gustav Glück and Franz Martin Haberditzl in *Die Handzeichnungen von Peter Paul Rubens*, Julius Bard Verlag, Berlin 1928.

<sup>9</sup> This observation was first brought to my attention by Anne-Marie Logan via personal communication and is further discussed in her essay "Consistency and Change in Rubens's Drawings," *Concept Design and Execution in Flemish Painting (1550-1700)*, ed by Hans Vlieghe, Arnout Balis and Carl Van der Velde, Brepols 2000, pp.175-191. See also her essay, "Peter Paul Rubens as a Draftsman," in *Rubens: the Drawings*, exhibition catalogue, Metropolitan Museum, New York, 2005, pp.3-34.

<sup>10</sup> See Jorgen Wadum, "The Antwerp Brand on Paintings on Panel", *Looking Through Paintings*, ed. Erma Hermens, pp.179-198.

<sup>11</sup> See for instance the discussion of panel marks by Jo Kirby in "The Painter's Trade in the Seventeenth Century," National Gallery Technical Bulletin 20, National Gallery Publications Limited, 1999, pp.20-22.

<sup>12</sup> See letter reporting dendrochronological analysis by Prof. Dr. Peter Klein in the conservation file at the Mauritshuis.

<sup>13</sup> See J. Wadum, "Recent Discoveries on Antwerp Panel Makers' marks," *Technologia Artis* (3), 1993: 96-100 and B.Broos and J. Wadum, "Vier panelen uit een boom/ Four panels from one tree", *Mauritshuis in Focus*, 6, no.1, Mei 1993, p.x-x.

<sup>14</sup> *Helena Fourment im Brautkleid*, Alten Pinakothek, München, Inv.-Nr. 340. Veronika Poll-Frommel and Jan Schmidt, "Anstückungen bei Tafelgemälden von Peter Paul Rubens: Technik und Ausführung," *Restaurorum*, Restauo 6/2001, pp. 436. In this example, the artist began with the large single panel and the composition and format evolved during the course of painting with the addition of six boards and final dimension of 163.5 x 136.9 cm. It is interesting to note that the final dimensions of the Mauritshuis painting are close to those of the initial board of the Munich painting.

<sup>15</sup> *St. Cecelia*, 1638/40, oil on composite panel, 177 x 139 cm, Berlin, Staatliche Museen zu Berlin—Preussischer Kulturbesitz, Gemäldegalerie, Catalogue number 781. See discussion of panel construction in Jan Kelch, *Peter Paul Rubens: Kritischer Katalog der Gemäldeim Besitz der Gemäldegalerie Berlin*, Berlin-Dahlem, 1978, pp.52-58.

<sup>16</sup> Rubens, *Portrait of a Lady*, known as *Portrait of Catherine Manners, Dutchess of Buckingham*, c.1625, oil on oak panel, 79.7 x 65.7 cm. See image reproduced in Richard Beresford, *Dulwich Picture Gallery: Complete Illustrated Catalogue*. Published with the support of the Leopold Muller Estate, Unicorn Press, London, 1998, p.210.

<sup>17</sup> I am indebted to Margriet van Eikema Hommes for providing these references. See also her publication, *Changing Pictures: Discoloration in 15<sup>th</sup>-17<sup>th</sup>-Century Oil Paintings*, Archetype Publications, London, 2004.

<sup>18</sup> Rubens, *Portrait of a Lady*, c.1637, oil on composite oak panel, Berlin, Staatliche Museen zu Berlin—Preussischer Kulturbesitz, Gemäldegalerie, Catalogue number 762A. See Kelch 1978, pp.13-20.

<sup>19</sup> Rubens, *Portrait of Helena Fourment with gloves*, c.1632, Munich, Alte Pinakothek, No. 95, reproduced in Konrad Renger with Claudia Denk, *Fla mische Malerei des Barock in der Alten Pinakothek*. Köln : Pinakothek-DuMont, 2002.

<sup>20</sup> See report in Mauritshuis conservation file summarizing results of analysis conducted as part of Lead Isotope Project, Giuseppino Fortunato, Swiss Federal Laboratories for Material Testing and Research, EMPA St. Gall and Daniel Fabian, Painting Conservator in Private Practice.

<sup>21</sup> Rubens, *Venus, Cupid and Mars*, 1635, oil on canvas, 195.2 x 133 cm, Dulwich Picture Gallery, DPG 285, reproduced in Beresford 1998, pp.212-213.

<sup>22</sup> Rubens, *Andromeda*, c. 1638/40, oil on composite oak panel, 189 x 94 cm, Berlin, Staatliche Museen zu Berlin—Preussischer Kulturbesitz, Gemäldegalerie, catalogue number 776 C. See Kelch 1978, pp.29-36.

<sup>23</sup> The molecular structure for indigo was identified in cross section by K. Keune using Secondary Ion Mass Spectrometry (SIMS) at the FOM-AMOLF Institute, Amsterdam. See also her publication, *Binding medium, pigments and metal soaps characterized and localized in paint cross-sections*, MOLART report no 11, Archetype Publications, London 2005.

<sup>24</sup> Rubens, after Titian, *Isabella d'Este in Red*, canvas, 101.8x81 cm, Vienna, Kunsthistorisches Museum, reproduced in Belkin and Healy 2004, p.24.

<sup>25</sup> Ernst Van der Wettering, *Rembrandt's Hidden Self-portraits, Rembrandts verborgen zelfportretten*. Museum het Rembrandthuis, Amsterdam 2003.

<sup>26</sup> Jan Bockhorst is a particularly intriguing artist for further study as the Hermitage drawing after the Mauritshuis portrait has been linked to Bockhorst. See notation on image in curatorial file and personal communication with Ann-Marie Logan. For instance, a portrait by Bockhorst, *Portrait of A Woman*, 111cm x 94 cm, Münster, Städtmuseum, depicts a woman wearing a similar hat and holding flowers and would be an intriguing portrait for study. Furthermore there is a related drawing by Bockhorst of the same composition, which varies only in a few details from the finished painting. See Hans Galen, *Johann Bockhorst : der Maler aus Münster zur Zeit des Westfälischen Friedens*. Münster: Stadtmuseum, 1998.



Figure 1: Peter Paul Rubens, *Portrait of Helena Fourment*, Royal Cabinet of Paintings, Mauritshuis, The Hague Netherlands, Inv. no. 251, 97.7x75.3 cm



Figure 2: x-radiograph composite of Mauritshuis 251 showing first state of portrait dating to c. 1625.



Figure 3: overlay of x-ray composite and overall image to clarify pentimenti.



Figure 4: overall after treatment image of Mh 251

All photographs courtesy of the Mauritshuis.

Presented at the AIC annual meeting in Minneapolis, Minnesota, June 8-13, 2005.  
This paper has not undergone a formal process of peer review.

## CONTEMPORARY ENCAUSTIC TECHNIQUES – JOHNS, MARDEN, THEK

Michael Duffy, Conservator

**ABSTRACT** - This paper focuses on the materials and techniques of three American artists working in wax-based mediums: Jasper Johns (born 1930), Brice Marden (born 1938), and Paul Thek (1933-1988). As early as the 1930s artists such as Arthur Dove, Hilaire Hiler, Diego Rivera, and David Alfaro Siqueiros were embracing this medium and praising wax for its pleasing brightness and clarity. In the mid 1950s Jasper Johns used encaustic techniques almost exclusively for his paintings of maps, flags, and targets. Johns directly influenced artists such as Paul Thek to follow suit in the 1960s. By the 1970s Brice Marden exploited a molten wax and oil medium to produce the lustrous surfaces of his monochrome paintings. While the incorporation of wax has its optical advantages it may result in a surface that is susceptible to marring or abrasion. Since the encaustic surfaces are not compatible with surface coatings the surface remain vulnerable unless they are glazed or somehow protected. Some solutions to the problems encountered when dealing with encaustic and oil-wax paint films will be offered based on the author's experience with the Jasper Johns retrospective (MoMA, 1997) and recent research into Paul Thek's methods and materials. Examples where artists or the artist's assistant have restored their own works will be noted. Materials and methods from past treatments of encaustic works from MoMA's collection will be discussed as well as more recent treatment strategies.

The re-emergence of encaustic technique as contemporary art medium has been the subject of several recent books and exhibitions. While wax-based techniques were used by a variety of artists throughout the 20<sup>th</sup> century it wasn't until the 50s and 60s that the medium came to be exploited for its versatility and compatibility with a wide range of techniques, methods and materials.

*Encaustic Methods and Materials*, published in 1949 by Frances Pratt and Becca Fazel, helped spur interest in the technique. They described encaustic as a "burning in" process "wherein the heat from the action of the fire is used to fix or seal the quality of the painting, both during the progress of the work and after completion as a final preservative against the inroads of time."

Artist and educator Karl Zerbe (1903-1972) was one of the first adherents of the encaustic technique. His formula consisted of 8 parts beeswax, 1 part dammar, and 1 part Venice turpentine. He would apply pigment in this medium in thin layers and then fuse them with a final burning in process with an electric heat lamp.

In the 50s encaustic paint began to be offered in a user-friendlier format. This advertisement from Joseph Torch in New York City appeared in *Art News* in November 1950:

"Encaustic Paints, previously difficult to obtain and laborious to use, now offered in stick form along with an electrically heated palette, a combination which promises to simplify greatly the process of working with this ancient and permanent medium."

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In 1951 a new wax-based medium called Dorland's Medium came on the market. Dorland's could be mixed in varying proportions with oil paint for either encaustic or cold wax painting techniques. Cold wax techniques using wax emulsions were also used to produce a silky matte surface as described in Reed Kay's *The Painter's Companion* (1961). Wax based painting techniques have an extensive repertoire since they can be used to create opaque or transparent paint films depending on their application. These methods also included etching and subtractive techniques as well as inlaying and 3-D techniques including collage. The versatility of the wax medium appealed to artists who were seeking to use new materials with a medium that had stood the test of time.

### JASPER JOHNS

Jasper Johns has been credited for single-handedly reviving encaustic painting with his paintings of flags and targets of the mid-1950s, subjects described as "things the mind already knows". Johns continues to use encaustic techniques in his most recent paintings – in a career now spanning half a century.

Here Johns is pictured in his Studio NYC 1973 surrounded by materials for making paintings including a hot plate for keeping wax medium warm. He likes working in encaustic because it "preserves the character of every stroke of the brush"

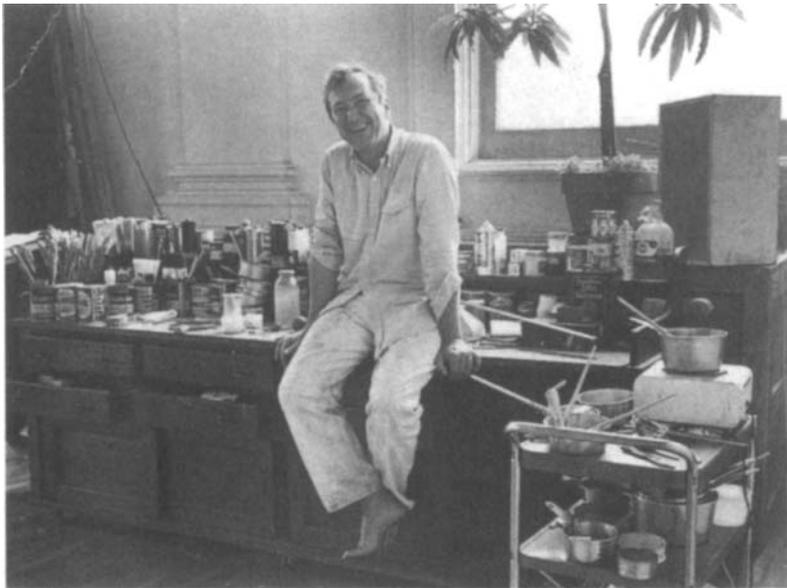


Fig 1 Jasper Johns

Johns' image of the American flag is built up with collaged elements dipped into wax and applied to the canvas and encaustic applied directly with a brush. In a letter to MoMA Johns described his process as:

"Dipping pieces of paper and cloth into hot melted encaustic and fixing them to the surface before the encaustic had solidified. In this way some areas may not include the use of the brush. The two ways of applying paint – with a brush or with material dipped in the hot medium – have equal value and follow no particular sequence." (1977 letter to Bill Rubin)

Johns also remembers "the painting was begun in either enamel or oil on a bed-sheet. Then I switched to encaustic and collage. I backed the painting with plywood before it was sent to the Venice Biennale in 1958, using a contact cement." Johns repainted parts of the work in oil and collage sometime in 1956 after the painting was damaged while still in his possession. This explains why, although the painting was apparently completed in 1955, there are

collage elements from a newspaper dated 1956. Since the painting was acquired from Philip Johnson in 1973 it has required only minimal treatment mostly related to lifting paint and some minor losses.

In *Target with Four Faces* (1955) Johns combined encaustic painting on canvas with sculptural elements. On the verso you can see he used a keyable stretcher recessed into a wooden framework that enclosed the plaster casts at the top. The hinged lid of the boxes enclosing the casts opens and shuts – Johns was interested in the activity of manipulation although now the lid is kept open permanently for display. Plaster casts of Johns's friend Fance Stevenson were cut to fit inside the boxes. The verso reveals the strokes of warm encaustic, which partially soaked the cotton duck canvas. The technique for the target is similar to *Flag* with the image built up with layers of newsprint and other paper embedded in encaustic with brush-applied encaustic on top. The encaustic also covers the plaster casts and adjacent spaces inside the boxes.

At MoMA artist's questionnaires are used to gather information on the artists' technique and other valuable information once works are acquired – in this case in 1958. In this questionnaire from MoMA's files dated from 1959 Johns describes the sequence in making of the plaster casts. The response to some other questions related to technique is a large "X". Johns's *Green Target* (1955) includes collage elements of cloth, newsprint, and other printed paper adhered to canvas with pigmented wax medium. For *Green Target* he used a six-member wooden strainer with a cotton canvas auxiliary support. This is covered with another fabric support estimated to be a sized plain weave linen. This would have provided a heavier support that would have allowed him to work with the canvas flat while he placed the collage elements while the encaustic cooled. Recent studies using Infrared-imaging techniques have allowed conservators to delve into the sources of some of Johns's collage elements and provide curators with clues to decipher his imagery.



Fig 2 IR detail of *Green Target* by Jasper Johns

Some of the collage elements include pages from the book entitled *Philosophy in a New Key: A study in the Symbolism of Reason, Rite, and Art*, a 1942 publication by Susan Langer. The Chapter "On significance in Music" begins "What distinguishes a work of art from a 'mere' artifact?" Other sources revealed by IR examination include an account of the discovery of King Tut's tomb, which Johns embedded in encaustic. While the artist has yet to comment on the significance of these texts they are presumably not random selections from current literature.

Early on, treatments were done using Multiwax W-835 to support lifting collage elements. This same treatment was used on *Flag* and *Green Target*. According to a treatment report from the 1970s the lifting paper coated with encaustic was set down by injecting the softened wax underneath the lifting area and held in position until cool and excess removed with scalpel. A heated stylus used to reattach some areas. Minor losses were inpainted using Magna/methacrylate. Subsequent treatments for lifting paint have included using PVA emulsion & a little heat (1981) More recently we have chosen to consolidate losses and treat lifting with Beva D-8 (ethylene vinyl acetate emulsion).

For all these collage and encaustic works on canvas polyester batting was inserted into the spaces formed by the stretcher bars to cut down on vibration during handling and transport. The works are glazed with laminated safety glass or Plexiglas for transport and Amarin water-white non-reflective glass while on view.

In the 50s and 60s Johns used structural supports that became increasingly more complex. *Highway*, A work from 1959 incorporates 2 smaller stretchers at the bottom, which have been incorporated into a larger expansion bolt stretcher. By 1962 he was using up to 5 or 6 large stretchers to make a single work. He also began attaching 3-dimensional objects to the works, a trend that continues with his most recent paintings.

In the 60s & 70s Johns increasingly used a multi-canvas format for large-scale works that also combined media in new ways. In the 3-panel work titled *Scent* the artist painted the left panel in encaustic and the right 2 panels in oil. The center panel is oil on unprimed canvas and the right panel is oil on primed canvas. The subtle differences are much more apparent in the work in person but these details give you an idea of the variety of the surface textures juxtaposed in a single painting.

This is a detail of *Scent* showing underdrawing in pencil outlining brushstrokes of encaustic paint. Johns left the underdrawing visible as a testament to his working methods and his methodical approach to what is essentially an abstract painting.

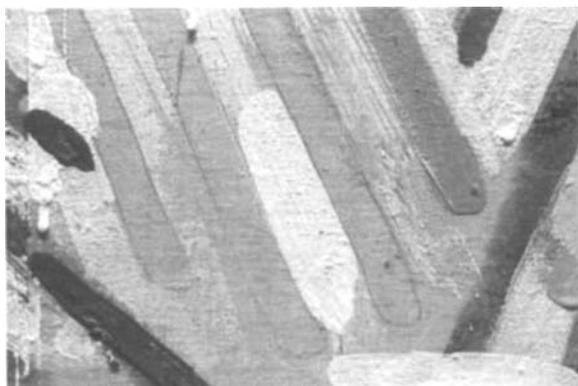


Fig 3 Detail of *Scent*, 1973-74

In the 1980s and 90s Johns would sometimes work on paintings in his studio in the Caribbean and then roll them up for transport to New York where they would be restretched onto ICA constant tension stretchers. In cases where the paint film cracked Johns would re-heat areas to fuse cracks. Evidence of artist repair is visible here as a canvas patch attached with encaustic medium on the verso of *Montez Singing*, 1989, which has an encaustic paint film mixed with sand – presumably from Saint Martin.

By the 1980s Johns is pushing the medium to extremes by heating areas and allowing the encaustic to liquefy and re-fuse in new patterns. In some cases intricate patterns of molten paint are formed as under-layers melted and shed the top layer of paint. As the paint re-formed and cooled it sometimes appeared as areas of paint loss when in fact they are intact.

In *Perilous Night*, 1982, many of the techniques of encaustic painting are combined with 3-D elements including cast body parts. Lightweight hollow casts of forearms and hands made of plaster gauze and encaustic are hung from hooks protruding from the top of the canvas. A thin strip of wood cantilevers out from the right side. Johns mapped out the complex imagery in these paintings with the aid of a projector.

Mobile elements such as the wooden bar and other attachments continue to be combined with encaustic paint surfaces in his most recent work. More recent works from 2003 include motifs that are partly derived from the catenaries or curves formed by a cable connecting two points.

### *PAUL THEK*

Jasper Johns directly inspired American artist Paul Thek. He recounted, "I went to a Jasper Johns show and I saw that he was working with wax and I started to work in wax. Then the meat pieces happened. Very clearly I saw this meat on a wall, almost crucified, hanging on a wall like a painting" The meat pieces Thek refers to are from a series entitled *Technological Reliquaries*, which he worked on from 1964-66. These pieces combined a minimalist exterior case of Plexiglas with lifelike representations of flesh fabricated from foam rubber, plaster, textile fragments, string, and beads coated and embedded in layers of encaustic and oil paint. Although Thek worked throughout his career as a painter, he is best known for his encaustic and latex constructions of the mid 60s

Thek is pictured here in NYC studio ca. 1966 working on a plaster cast of *Warrior's Leg*. You can see the mold in the foreground and some other materials including bunches of hair hanging on the wall behind him.



Fig 4 Paul Thek

The cast was coated with wax to provide a skin like surface, using a technique similar to the faces in Johns's *Target with Four Faces*. *Warrior's Leg* was also dressed in painted leather armor and eventually enclosed in a Plexiglas vitrine. Thek commented that:

“The body pieces began appearing because I was trying to figure out how to make a full body cast. I'd never done molds or anything like that before. I was working with dentist's moulage, which is used for open wounds and is extremely quick setting. I had a studio filled with imperfect limbs covered with different-colored wax, to test the tinting, so it was an easy natural thing to make use of them.” He continued, “I knew technique was of no importance.”

Despite Thek's apparent disregard for technique, and his unorthodox combination of materials many examples of his work have survived in good condition, thanks to their protective exteriors.

About his materials Thek stated in an interview that:

“The dissonance of the two surfaces, glass and wax, pleases me: one is clear and shiny and hard, the other is soft and slimy. I try to harmonize them without relating them, or the other way around. At first the physical vulnerability of the wax necessitated the cases; now the cases have grown to need the wax.”

Other works from the technological reliquary series include this work incorporating a Brillo box by Andy Warhol. This is not a collaborative work but an example where Thek appropriated a pop art icon to provide a contrast to his

lifelike encaustic constructions. Thek's reliquaries also critiqued the current trend in minimalist art. He stated:

"I was amused with the idea of meat under Plexiglas because I thought it made fun of the scene. Nobody ever mentioned anything that seemed real...For me it was absolutely obvious. Inside the glittery, swanky cases – the "modern art" materials that were all the rage at the time, Formica and glass and plastic was something very unpleasant, very frightening, and looking absolutely real." MoMA was given a work from the *Technological Reliquaries* series in 1991 by Artist Neil Jenney, who was also Thek's assistant for a large cast wax installation piece from the early 60s. Jenney remained friends with Thek and acquired *Hippopotamus Poison* from him in the mid-80s. In early 1997 the gift was suddenly withdrawn and the work returned to Jenney. A few months later after the terms of the gift settled, Jenney finally returned the work to MoMA, but in the meantime he proceeded to clean and restore *Hippopotamus Poison*. . Some losses were no longer visible when the gift was returned to MoMA and the registrar's file noted that the interior of the Plexiglas case had been cleaned. In an interview with Jenney he described restoring *Hippopotamus Poison* with the same techniques that Thek used. This involved heating up beeswax in small tin cans. Oil paint was then mixed into the wax using a palette knife on glass.

Examined without its Plexiglas vitrine, the surface of *Hippopotamus Poison* exhibits very similar conditions to encaustic paintings of the 60s. There are networks of cracks that formed as the molten wax cooled and evidence of whitish bloom where wax deposits are visible on the gray surface. The liquid wax mixture was also used as a binder to adhere non-traditional art materials into the matrix and build up a translucent layer similar to living skin. In some cases the molten wax was used to adhere the meat pieces inside the vitrine. Thek imitated sinew, fat, and flesh by dipping string, fabric remnants, and "pop-it" rosary beads in molten wax and layering them around a solid core made of Styrofoam and plaster. Successive layers of encaustic were applied with additional resin or oil to make the surface more shiny and vitreous in areas. A final layer of pigmented oil or wax was sprayed on to lend the surface additional detail and texture. This detail shows Thek's use of fabric and string and beads adhered with wax to a support that the X-ray reveals to be incorporating wire mesh:

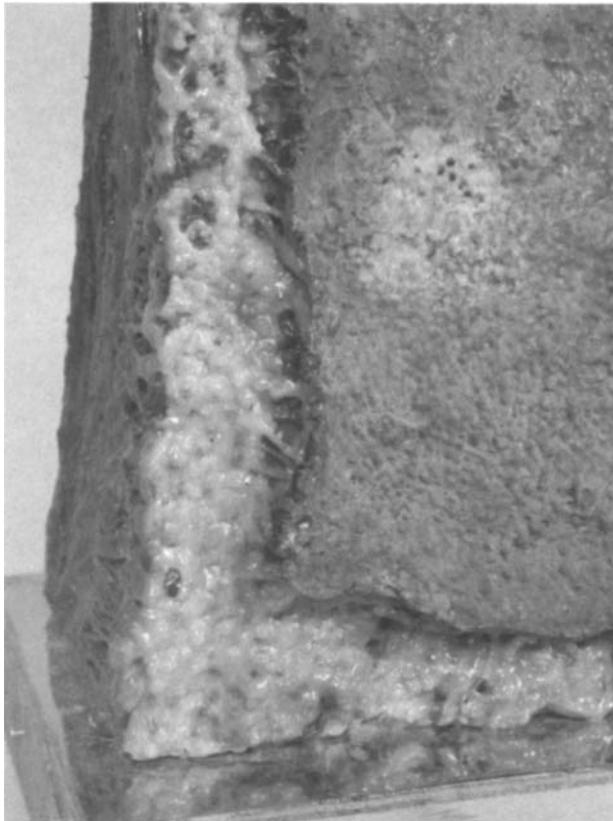


Fig 5 Detail of *Hippopotamus Poison*

This view of *Hippopotamus Poison* under UV illumination shows the extent of the restoration on the perimeters. The restoration is may be the result of mishandling of the work when it was not protected in the vitrine since the meat pieces and other works were sometimes reused in subsequent installations. There is an underlayer of plaster visible in some places, and the carpet fabric element may have begun to lift and separate.

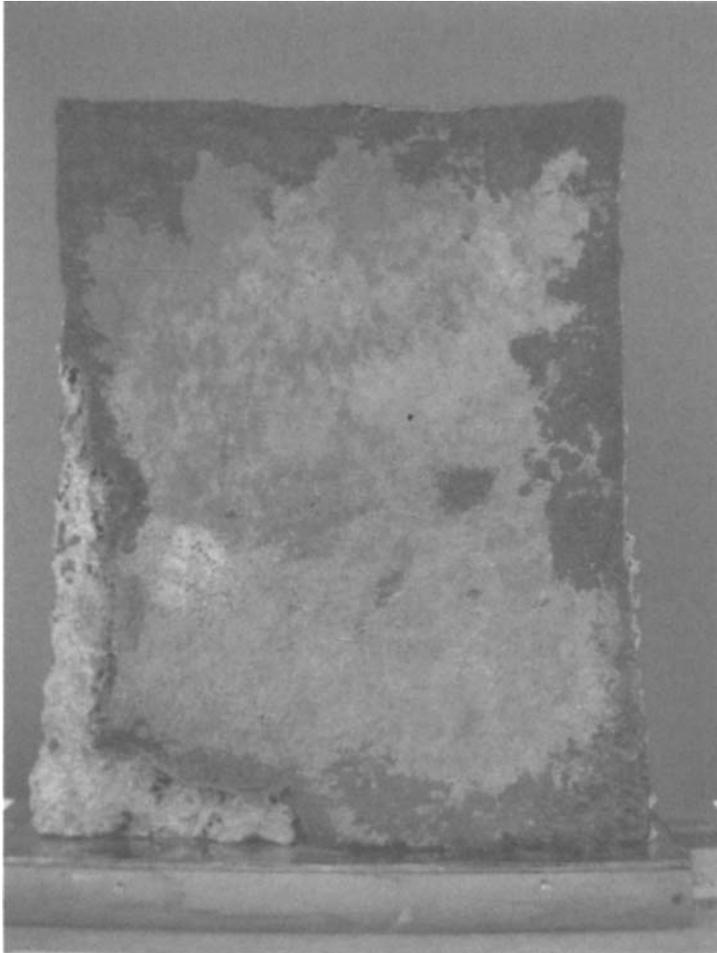


Fig 6 *Hippopotamus Poison* UV

We do not know to what extent *Hippopotamus Poison* was restored prior to Jenney's acquisition of the work from Thek. Thek is known to have reintegrated his works into elaborate installations so it is possible that the conditions that prompted this treatment would have been acceptable to Thek as evidence of the work's prior history of use. Since Jenney's restorations on the perimeter of the work were carried out in the same encaustic technique that Thek employed they are not reversible in the ideal sense. Even so, these restorations are in keeping with the original spirit of the work, which makes it easier to accept them without further intervention.

For some minor consolidation a solution of Aquazol 200 in water was chosen. Aquazol has been used as a consolidant on encaustic surfaces and testing indicated that it would be an appropriate consolidant here. Evaluation of an appropriate fill material was done as well since there are some losses on the face of the work, but since these losses were not visually distracting seen through the tinted Plexiglas case no compensation was done. Tests also indicated that a mixture of Aquazol 200 in a 20% solution in water / Toasted cellulose / dry pigment was promising for matching the encaustic surface but further testing needs to be done to determine the long term stability of this mixture.

## BRICE MARDEN

Brice Marden studied with Reed Kay and Karl Zerbe at Boston University. Marden credits Kay with helping him develop his ideas about color (1973 interview with Paul Cummings), and instructing him among other things, not to use acrylic paint! Marden also credits fellow artist Harvey Quaytman for suggesting a wax-based medium as a way to achieve a matte surface since the shininess of the straight oil paint did not appeal to Marden.

The formula Marden used in the late 60s and 70s was heated mixture of one part beeswax to four parts turpentine combined with oil paint. Marden applied the paint in layers with brush & reworked with spatula and palette knife. Marden describes the medium as becoming gummier with evaporation so he would have several cans of medium going at once. Despite the addition of wax Marden stated “oil remains the primary binder as opposed to encaustic where the wax is the binder.” Marden’s work is not true encaustic because he does not employ heat or the final burning in process. Without the burning in of true encaustic, the cold wax technique results in a mellower more translucent surface.

Brice Marden was familiar with Johns’s work from the 1963 exhibition at the Jewish Museum. Like Johns, Marden often uses supports made up of two or more canvases. For *Avrutun*, 1971, he attached 2 canvases together – one stacked on top of the other. Marden used a cotton canvas primed with lead white and sanded. This would have provided a highly reflective surface on which to work. Marden considered the ground the first layers of the painting process. Successive paint layers are applied on top of the ground with a brush and manipulated with a baker’s spatula until set. On the top panel he applied yellow ochre over a cool purplish-brown. The darker color is visible at the bottom where the two panels join. For the lower panel three layers are visible - a cool brown followed by dark green and then a light greenish-gray. Marden would scrape down layers until he got the combinations right, with the color balanced from panel to panel. He would mask off the panel he wasn’t working on so that paint would not transfer to the adjacent canvas.

According to Rob Storr “Through this direct confrontation of the two main hues (one warm, one cool), an opposition further activated in the discreet contrasts provided by the marginally visible underpainting, Marden creates a vibrant chromatic composite out of subdued monochrome layers superimposed upon or adjacent to one another” The lustrous surfaces are very fragile and susceptible to marring by scratches or burnishing marks. Some of these are difficult to discern from marks made by the artist manipulating the surface with the palette knife. Perhaps because of the excessive manipulation of the paint film or because of the brittle ground hairline cracks are also visible around the stretcher bars. Circular impact cracks are also apparent in some works, indicating the need to protect these works from the verso. Since the acquisition of *Avrutun* in 1996 no treatment has been done other than to apply a backing board to protect the verso. For handling and storage the painting is housed in a wooden travel frame, which is kept wrapped in polyethylene.

*Grove Group I* is from a series of paintings inspired by the colors of olive groves (1973-76). This painting was acquired in 1973, the same year Marden started this series. Responding to the questionnaire about the installation and maintenance of this work Marden wrote: “The surface of the painting is extremely fragile. All attention should be given to prevent any contact with the painted surface.” In some cases a visual barrier or stanchion of some type is installed on the floor to keep visitors at a safe distance. Recently however, the decision has been made to show the work framed behind Plexiglas to provide further protection. Unfortunately the reflection of the Plexiglas considerably interferes with the appreciation of Marden’s surface, underscoring the difficulty of both preserving these works and displaying them in a crowded gallery setting.

The wax-based techniques used by Johns, Marden, and Thek demonstrate the versatility of the medium, a medium which still provides contemporary artists with inspiration, and future challenges for conservators.

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## *Acknowledgements*

Thanks to Carol Mancusi-Ungaro, Carol Stringari, and Julie Barten for access to unpublished interviews

# THE HISTORY OF CONSERVATION DOCUMENTATION AT WORCESTER ART MUSEUM

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## Abstract

**There has been a long tradition of conservation documentation at the Worcester Art Museum. It was not however, until Edmond de Beaumont's arrival in 1936 (who had previously assisted George Stout at the Fogg Art Museum), that the Museum had a permanent staff member whose duties included the documentation of the conservation of the collection.**

**This paper will investigate the early history of documentation at Worcester Art Museum. It will identify who were the main exponents of the value of documentation, and what procedures they favored. The paper will also critique the various methods of documentation used, by exploring their limitations and evaluating their contribution to the current forms of documentation used by the conservation department.**

In 1934, in a preface to Helmut Ruhemann's article entitled 'A Record of Restoration' published in *Technical Studies in the Field of Fine Arts*, the board of editors which included George Stout, Alan Burroughs and Rutherford Gettens, said that the article not only commanded technical interest but that 'such a record has value in our whole problem of conserving works of art [and] until such records are consistently made and kept, the care and treatment of paintings will have to be carried out with a severe and quite unnecessary handicap' (Ruhemann, 1934).

The increasing awareness of the importance of documentation and record keeping during the thirties, as evidenced by an increased frequency of mention in published and unpublished texts by authors such as de Wilde, Laurie, Wehlte, Stout, Gettens, and others (Marceau, 1938), shows that the subject of documentation was beginning to gain serious momentum in the nascent years of professional conservation.

In 1928, Worcester Art Museum, Massachusetts declared in its published annual report, of its commitment to prioritise conservation over curation. It said that 'the physical care of the museum collections is a matter of more immediate necessity than classification' (Eggers, 1928). This distinct concern for conservation combined with the early formation of the conservation department in 1936, makes Worcester an interesting case study seen against the wider backdrop of a dramatic period of development in the methods and philosophies of conservation documentation.

This paper will discuss the use of documentation at Worcester from 1898 when the museum opened until 2002. The historiography will be formed of two sections; from 1898-1936 when the museum relied on outside conservators and restorers, and from 1936- 2004 when the museum established its own in-house conservation department. It must be noted with caution though, that with all surveys of historical archival material, the conclusions drawn upon scattered, disordered and possibly absent records could be compromised ones. It is hoped however, that a broadly reliable, but by no means exhaustive, history of conservation documentation at Worcester can be constructed.

The early history of documentation at the Museum mirrors many 19<sup>th</sup> century American museums where a permanent in-house conservator was not yet the established norm. No specific treatment records were recovered from the period 1896-1914 but rather the activities from a wide range of private restorers were evident from the large amount of hand-written invoices that exist.

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Figure 1. Selected invoices from file 'RESTORATION-Miscellaneous', Fuller Laboratory, Worcester Art Museum.

These invoices were not in any sense intended to provide any treatment record but the groupings of these documents in a conservation file rather than a financial file<sup>1</sup>, would seem to imply that in the absence of any type of condition or treatment report, they were collected as stand alone records with emphasis on their varying degrees of information on an object's treatment.

Only one instance of early photographic documentation from 1905<sup>2</sup> was unearthed and this was certainly not representative of routine visual documentation but done to describe a single occasion of damage to a loaned painting to its owner who lived a significant distance from the museum. By 1928, due to the death of a regularly used New York-based paintings restorer, H A Hammond Smith, who had worked annually on the collection from 1914<sup>3</sup>, the debonair Paris/New York based restorer Gaston Levi was engaged for continued work on the paintings of the museums collection<sup>4</sup>.



Gauguin, Paul La femme accroupie  
 1930 Jan. Cleaned, spots touched up, revarnished, relined

Figure 2. From file 'RESTORATION \* LEVI' Basement archives. Worcester Art Museum.

Levi's method of documentation was deliberate, sophisticated and advanced compared to the sparse information held haphazardly on the invoices of previous years. Levi made large format photographs after treatment with dates and summaries typed neatly on the reverse, albeit with extreme brevity. Levi's tenure at the Museum ended four years later however, when the directorship of the museum changed from George W. Eggers to Francis Henry Taylor, the services of another favored restorer caused Levi to be declined further work<sup>5</sup>.

The new restorer David Rosen had established himself as an authority in the conservation of all museum objects and expert in the application of analytical methods. By 1932, Rosen was well up on the rungs of the museum establishment working extensively on objects and whole collections from the holdings of at least seven major American museums as well as sustaining a private studio in New York<sup>6</sup>.



Figure 3. David Rosen. Early 1930's. Conservation archive. Walters Art Gallery, Baltimore. Reproduced with the kind permission of the Walters Art Gallery.

Rosen also frequently wrote for the museum journals such as *Technical Studies* (Rosen, 1934, Rosen & Marceau 1937), *The Journal of the Walters Art Gallery* (Rosen, 1950, 1952, 1941) and *The Magazine of Art* (Rosen, 1941) and more significantly, was a committee member of the conservation documentation group of the American Association of Museums (Stout, 1935).

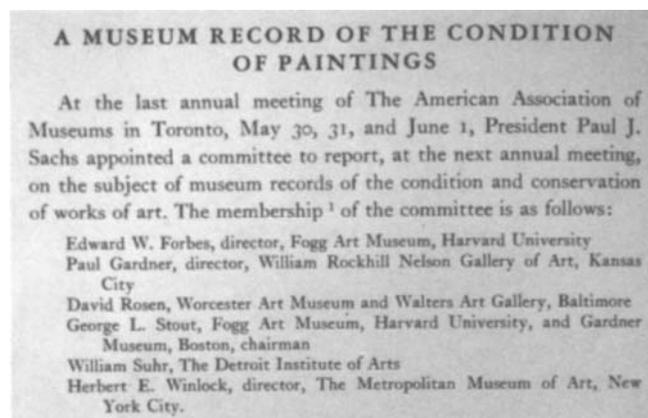


Figure 4. Excerpt from George Stout's article 'A museum record of the condition of paintings' which appeared in *Technical Studies* in April 1935.

Rosen's article published in *Technical Studies* in 1937 detailing different methods of photographic documentation to aid examinations of paintings was highly influential in the museum sector and records from Philadelphia showed that Worcester Art Museum ordered 13 copies of this issue<sup>7</sup>.

Rosen's methods and philosophies of record keeping should have appeared to be advanced and highly considered and so it is surprising that virtually no Rosen documentation at Worcester has been found despite him working there intermittently for about ten years and perhaps longer.

Similarly at Philadelphia Museum of Art no records could be identified with certainty to be by his hand and at the Walters in Baltimore it was discovered that Rosen's assistant Elizabeth Packard was responsible for documenting his treatments. The extent of the recordings she made were dependent on whether she was timely enough to witness his treatments<sup>8</sup>.

Rosen's seeming failure then to practice what he preached, makes it hardly surprising that no innovative documentation techniques originating from him have impacted upon record making at Worcester. Rosen's promotion of scientific documentation was often flawed by his interpretation. At times he seemed to have an imperfect understanding of those methods he used and viewed them as confirmatory tools to demonstrate that his restoration of an object was legitimate rather than means by which material and technique of manufacture could be interpreted and documented. In a letter to a private client he says that 'A study of the radiograph and the infrared photograph in comparison with the painting shows that the essential drawing and character has been preserved and that restoration has been properly done'<sup>9</sup>.

At other times Rosen used such methods as a vehicle for self-advertising. For example in a photograph of an X-ray plate his name is prominently displayed by the lead lettering, on the plate itself where perhaps an accession number or date may have been more meaningful<sup>10</sup>.

By 1936 however, Worcester Art Museum was to take on its first full time technician and photographer who would become the first official in-house conservator. Edmond de Beaumont, a Swiss immigrant, had begun his training under Stout and Burroughs at the Department of Conservation at the Fogg Museum of Art, Harvard University, sometime between 1928-29 ( Densmore and Kressler, 1989 ). As well as having experience in photographic documentation, de Beaumont also became adept at taking X-rays and using IR photography.



Figure 5. Edmond de Beaumont c. late 1930's photographing 'The Artist's Daughters' by Gainsborough. Worcester Art Museum.

De Beaumont's early years at Worcester overlapped with many of Rosen's visits, but in his oral history (Densmore and Kressler, 1989) de Beaumont said that in spite of the opportunity, Rosen could not introduce him to any new

techniques, materials or methods, but was a man who was defined by old fashioned training who rarely did a thorough job.

In contrast, de Beaumont had received a well-rounded and progressive training from his time at the Fogg. He brought to Worcester Art Museum an entirely new, structured and thorough form of textual and visual documentation, which focused not only on the recording of treatment and condition in discrete cases, but also on the routine monitoring of the condition of objects on display and in storage.

Documents from 1937, the year after de Beaumont began at Worcester, show that he recorded the activities of the lab in typed form carefully ascribing treatment decisions to those who made them, in this case Rosen<sup>11</sup>.

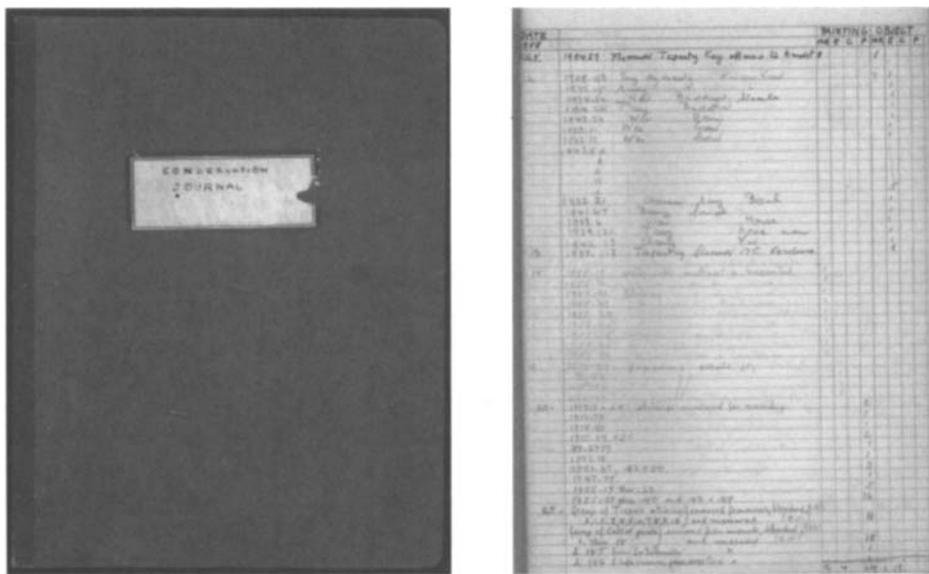


Figure 6. Edmond de Beaumont's 'Conservation Journal'. 1949-76. Conservation archive. Worcester Art Museum.

Ten years later however, this recording of future and ongoing conservation work was not typed up in the form of small single page documents but had to expand to reflect the increased work rate of the lab. In 1949, de Beaumont began to note work carried out in his 'conservation journal'<sup>12</sup>. A more manageable tabulated system with columns and a key was introduced four years later and this was used consistently for another 22 years until de Beaumont retired in 1976.

De Beaumont also used a system that was to make the monitoring of objects in specific areas of the museum a sustained and recordable activity. He used index cards arranged according to the division of museum area into zones where ranges of objects would be displayed. These zones were listed with space for continued comments on change in condition or the recording of routine activities like dusting. The cards showed that recording simple monitoring was quick, allowed for general assessment of the museum environment in one area and simultaneously provided an opportunity for the reassessment of individual objects at regular intervals.

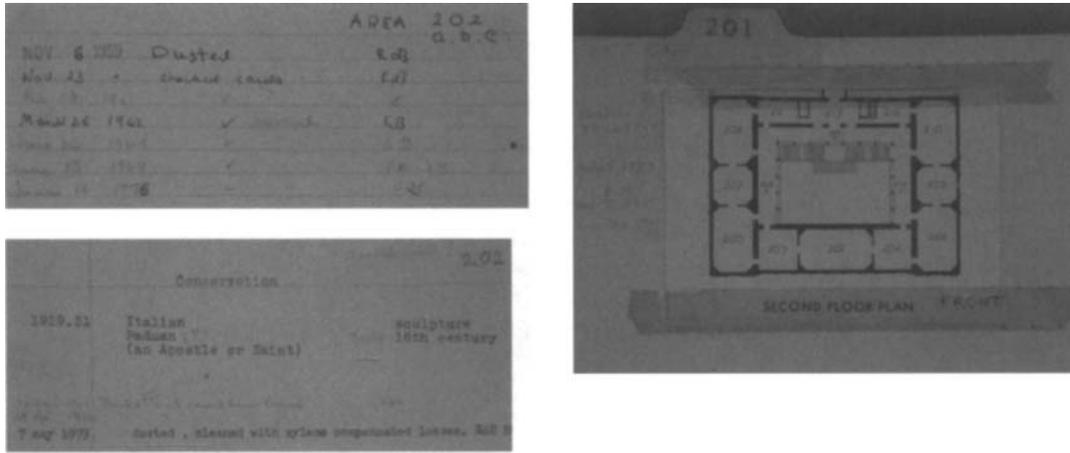


Figure 7. Edmond de Beaumont's index card system.

When documenting the treatment and examination of objects de Beaumont used three methods to present information. His experience at the Fogg combined with Stout's publication in *Technical Studies* in 1935, (Stout, 1935) and again in 1939, (Stout 1939) exposed him to a new tabulated condition report form. The lengthy four page form which Stout published in 1934 was only used by de Beaumont until 1937. De Beaumont adopted Stout's condensed one page form in 1938<sup>13</sup> a year before it was published, proving that he was still in close contact with Stout about the use of forms, and he continued to use it and variations on it until the late 60's. The form, and any supplementary papers which de Beaumont occasionally produced, combined with photography, became a conservation file.

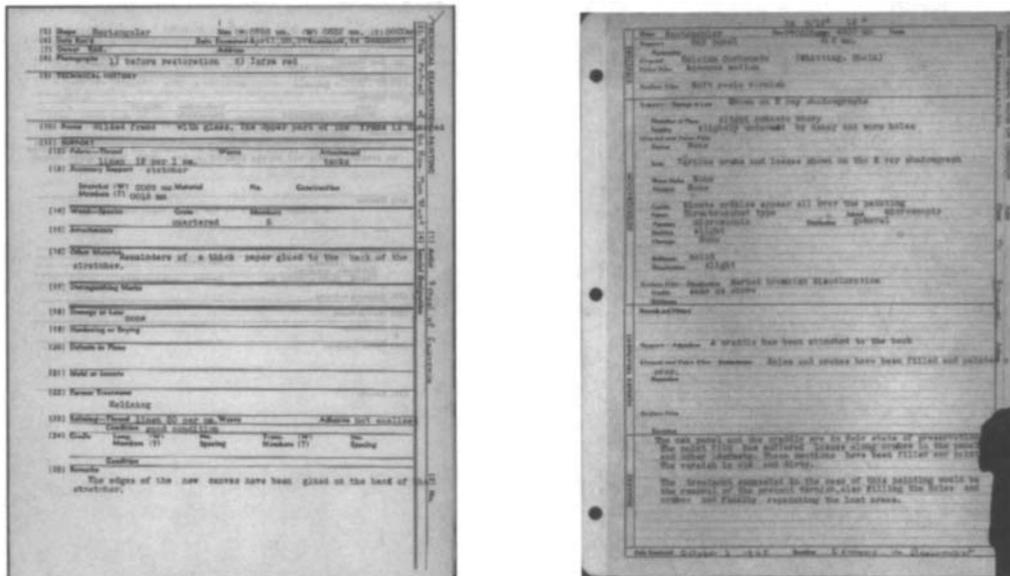


Figure 8. Edmond de Beaumont's use of:  
A) Stout's condition report form of 1934.  
(actually used in 1937)

B) Stout's condition report form of 1939.  
(actually used in 1938)

The continuity of an object's documentation history and availability of that accumulated information over time to succeeding conservators was also something that de Beaumont established and maintained. He introduced another simple convention to each conservation file that ensured that this information was available and was easily viewed as a chronology. He collated treatment information about the object as a sort of 'running tally' with simple notations

of treatment, its date of execution and the conservator responsible for the work arranged in columns.

De Beaumont also showed his concern for continuity in the documented treatment or examination history of an object and elected to retrospectively fill in the gaps in documentation where he could. In the case of documentation relating to the excavations of the Antioch mosaics he described the procedure by which they were removed from their site, and how they were treated in preparation for transport even though he was not present for either event<sup>14</sup>.

De Beaumont also placed importance not only on photographs as visual records but also on the new advances in other methods of visual documentation. He felt that photographs were essential parts of an object's documentation and often found that photographs he had placed in files would go missing (Densmore and Kressler, 1989). This protection of material may have been his motivation in creating the duplicate file that would become a dossier solely devoted to conservation records and held in the laboratory itself.

De Beaumont also had had extensive experience of X-radiography and infrared photography at the Fogg. At Worcester the value of technical art history, as well as treatment motivated analysis was already acknowledged.

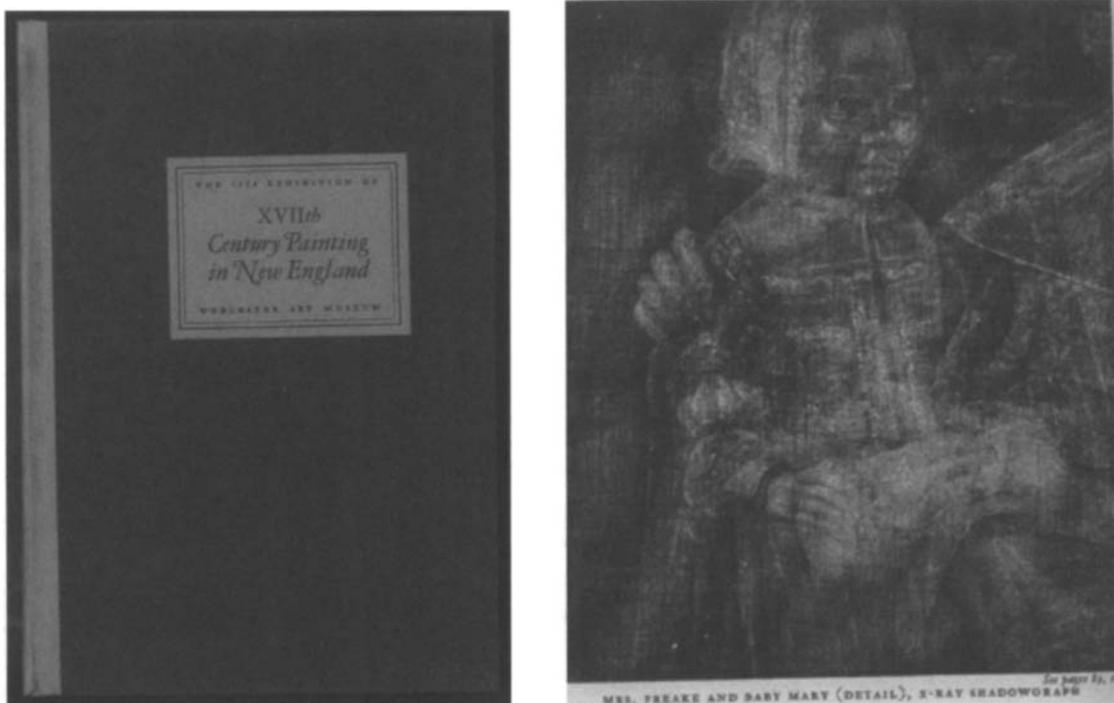


Figure 9. Catalogue of the 'Seventeenth Century Painting in New England' exhibition held at Worcester Art Museum in 1934. With X-radiography and reports by Burroughs.

In 1934, Worcester became the first American museum to publish technical documentation in connection with an exhibition. This was carried out in collaboration with Alan Burroughs at the Fogg who took x-radiographs and provided a laboratory report on paintings exhibited, and Louisa Dresser, Associate Curator at Worcester Art Museum. (Dresser, ed, 1934)

By the late forties and early fifties the national and international field had developed mutual and sharply focused concerns about conservation documentation. For example, in 1946, a document outlining the proposed reorganization of the Fogg, said that 'the dissemination of the information on the conservation of the museums holdings' was to be the underscored responsibility of two staff positions<sup>15</sup>.

In 1956, the British Council issued an international invitation to evaluate developments in the field. Documentation represented one of the five themes that would receive attention over the course of the 14-day event<sup>16</sup>. In 1958, at a

conference on education in the profession held at the Brooklyn Museum of Art, the Kecks, Stolow and others argued that educating other museum professionals and collectors about conservation documentation would be of immense value<sup>17</sup>.

Stout's directorship of Worcester Art Museum starting in 1947, did not confine him merely to the activities of the head of the museum. It is evident from reports that he was also an active participant in condition reporting and was regularly involved in technical analysis and treatment in the lab.

The broader educational aspects of visual documentation were publicly promoted by Stout at Worcester in the form of an exhibition called 'Condition: Excellent' which exhibited examples of works in a good state of preservation alongside the photomacrographic documentation of the paintings.

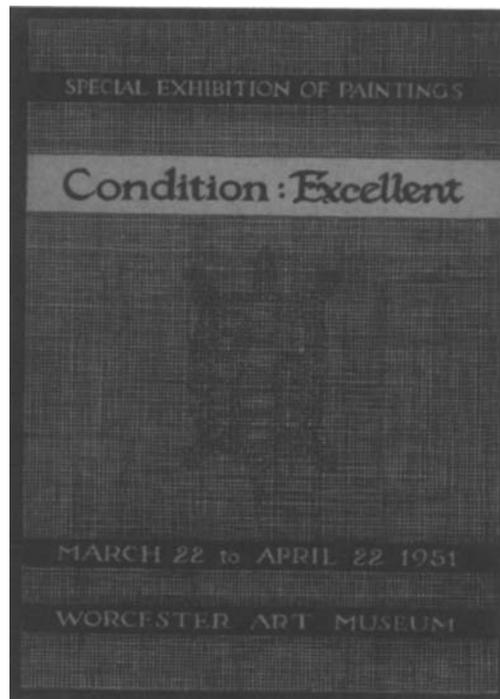


Figure 10. Catalogue of 'Condition: Excellent' exhibition. 1951. Worcester Art Museum.

Worcester continued with this sentiment, and continued the discussion of this topic with staff and volunteers in a newsletter in 1966. In the article types of photography and technical analysis are explained, and terms such as 'recording of data and condition', and 'conservation record' are italicized and given definition (Karet, 1966) .

In 1991 an entire exhibition named 'Behind the Seen' held at Worcester Art Museum would be devoted to introducing the technical forms of documentation to the public with X-rays shown alongside paintings and live demonstrations of I.R reflectography.

In the 80s and 90s textual documentation methods at Worcester stayed largely the same. At this time however some reports were stored only on floppy disc and this has created a significant gap in records as the discs are no longer readable without specialized technical assistance. De Beaumont's brief chronologies were kept up, but the use of zoned index cards had been phased out.

A little later advancements in computer technology allowed for a more standardised version of the prose format of condition and treatment reports. Most followed the basic form of Stout's condensed tabulated form with obvious deviations in structure for objects and paper records where a more diagrammatic approach was needed, but

significantly more space was available for recording treatment rationale and accommodating a more discursive tone. These types of reports certainly were more frequently produced when technical analysis was included, as more text was required for the explanation and interpretation of methods of analysis carried out. The tabulated form however, had something of a renaissance in the late 80s and early 90s, when its usefulness for routine and loan condition reporting was re-evaluated. The form, as before, allowed the conservator to deal quickly yet thoroughly with the recording of an object's condition and was especially useful as the rate of loans, both incoming and outgoing increased steadily and the collections grew.

In 1985 Judith Walsh, who was paper conservator at the museum introduced a standardised form for paper-condition recording based on a model developed by Robert Futernick. The form allowed the conservator to record the usual condition data and summarise a treatment strategy. Walsh went further adding the detachable corners, which would be removed if the object concerned had treatment pending or needed matting. The records could then be viewed at a glance in their filed locations and, those records indicating that treatment was required, could be identified very quickly and sorted without scanning each report for that information, thus saving valuable time.

Figure 11. Condition report form for prints and drawings introduced by Judith Walsh based on a model by Robert Futernick.

In 2002 a condition report form was revised by Rita Albertson incorporating ideas from the Tate with a model she had co-developed at the MFA, Boston. The form closely followed the order of the structural arrangement of the painting just as Stout's did. To be more exacting, and to economize on time, tick box options were ascribed to each component to describe condition rather than leaving a blank space for prose elaboration. Stout's form included a section to evaluate the frame, but in this form a frame diagram was also added for annotation reflecting a more holistic and modern view of the painting and its frame as a unified object. The form's 'Re-examination' section, was designed for multiple examinations that would take place in the case of loaned works. These forms are used predominantly for incoming and outgoing loans, new acquisitions and condition surveys.

This form is designed to be used in conjunction with a photograph that is taken around the same as the form is filled out. The photograph is usually annotated by marking a transparent polythene envelope that contains the photo so that the information on the form can be interpreted more accurately. These forms and their associated photographs form part of thorough conservation dossiers, which are built up over time with expanded treatment documentation and additional technical information.

Figure 12. Condition report form revised by Rita Albertson from models at the Tate and Museum of Fine Arts, Boston.

The laboratory at Worcester Art Museum is now a multidisciplinary center for the study and treatment of objects, paintings and paper. Worcester now has enviable scientific capabilities and a staff member who facilitates the implementation and documentation of a number of forms of technical analysis including XRF, FTIR, PLM, X-radiography and IR reflectography.

The extensive and in depth technical examinations or treatment procedures of today generate a large amount of data of both a textual and visual nature. In 1998, funding was obtained from the Henry B. Luce Foundation to technically examine the early American painting with the aim of creating an online catalogue (accessed via [www.worcesterart.org](http://www.worcesterart.org) and a more expanded version on CD ROM) . The technical documentation aspect of the project was headed by then Henry. B. Luce Intern, Philip Klausmeyer and culminated in the impressive digitisation of both visual and textual data. The types of documentation methods used allowed a large body of documentation to be drawn together, some of which was presented in an integrated manner. This aided visual comparison and made for a more informed interpretation of each strand of documentation. It also allowed for the separate consultation of stand-alone images.

### Conclusion

In evaluating the history of documentation at Worcester we must conclude that Edmond de Beaumont was indeed the most influential figure. Not least because his forty-year service spanned the most rapid period of evolution in the profession and the establishment of its modes and practices, but because his willingness to learn and absorb the expertise from his older colleagues, both international and national, made him a conservator whose awareness of new documentation techniques was always underpinned by a methodical ability to apply them as well as an inexhaustible commitment to maintaining them. From the beginning of de Beaumont's tenure he showed that the management and production of documentation was an intrinsic part of not only individual treatments or examinations but also of lab management and collections care.

On a routine basis, he would record what the lab was concerning itself with at that time in terms of treatments and examinations giving us insight into his daily work. He initialized documentation systems for the routine monitoring of objects, showing his concern for detecting the changes in condition putting him well ahead of his

time as exponent of preventive conservation. He also devised a method for recording over time the accumulation of information about an object in such a way that its entire conservation history could be accessed quickly from one single source.

While today we strive to emulate de Beaumont's rigorous standards, we aspire to expand upon them. It should be noted that de Beaumont's brand of documentation was a product of its age when the climate of ethics and accountability had not yet demanded that recording rationale be the *modus operandi* of the professional conservator.

Viewed in retrospect, in isolation and critically, his remarks seem coldly routine and focused solely on what procedures were carried out on an object rather than showing an awareness of aesthetic qualities or how treatment or condition affects the technology or artist's intention within a specific object. The documentation we are faced with probably tells us only a fraction about de Beaumont's practice as a conservator as his documentation is devoid of discussion. In this sense however it is conspicuous by its absence, and this can only tell us that the dissemination of the process of his decision-making regarding a course of treatment or analysis was not considered of prime importance and communicating this is very much the preserve of modern conservator.

Nevertheless, de Beaumont's methods of recording were effective, useful and useable, not only to him but also to his successors. He quickly established these conventions in every discipline and maintained his documentation procedures rigidly until he retired. Consequently, his documentation legacy is an enormously rich, consistent and useful archive that continues to be of the utmost value to conservators at Worcester on a daily basis. Therefore, it seems fitting to concur with the editors of the museum newsletter of 1966 (Karet 1966) when they said simply, 'Mr de Beaumont, he deserves our salute!' and indeed to dedicate this small piece of research to Edmond de Beaumont.



Figure 13. Edmond de Beaumont completing documentation in September 1962.

## Acknowledgements

I acknowledge with gratitude the assistance of the Andrew.W. Mellon Foundation. I also thank conservators at Worcester Art Museum, in particular Rita Albertson and Philip Klausmeyer for their ongoing advice. I would like to thank Susan Anderson and Mark Tucker at the Philadelphia Museum of Art and Terry Drayman-Weisser and Rhiannon Dowling from the Walters Art Gallery, Baltimore for allowing me to consult their archives and for supplying me with materials. I am grateful to Francesca Bewer from Fogg Art Museum for answering many of my queries, and I thank Susan Ulrich and Colleen Germain for their extensive survey and indexing of Worcester Art Museum publications.

## Notes

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- 1 From file 'RESTORATION-Miscellaneous'. Central draw stack marked 'A-U'. Conservation filing cabinets. Back hallway. Fuller Laboratory. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 2 From file 'Rosl 81'. Alphabetically arranged 'Archival Correspondence' cabinets. Filed with 'Roseland' correspondence. Main corridor. Basement archives. Worcester Art Museum.
- 3 From file 'RESTORATION\* SMITH, H.A, Hammond. 1914-1928' Central draw stack marked 'A-U'. Conservation filing cabinets. Back hallway. Fuller Laboratory. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 4 From file 'RESTORATION \* LEVI'. In unlabelled central draw of stack cabinets. End of main corridor. Basement archives. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 5 From file 'RESTORATION \* LEVI'. In unlabelled central draw of stack cabinets. End of main corridor. Basement archives. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 6 From 'Historical Note' . [www.philamuseum.org/resources/mellon/archives/findingaids/findingAidCTR.xml](http://www.philamuseum.org/resources/mellon/archives/findingaids/findingAidCTR.xml). Accessed. January 2005.
- 7 Box. 4. Folder 13. Mailing list. Writings- Marceau. Conservation and Technical Research Collection. Mellon Archives of Philadelphia Museum of Art.
- 8 Personal communication from Terry Drayman-Weisser. Walters Art Gallery. January 2005.
- 9 Typed report December 1935. E and Silberman. Report No. 0255. From Conservation Archives at Walters Art Gallery. Uncatalogued.
- 10 Unlabelled photograph of X-ray plate. From Conservation Archives at Walters Art Gallery. Uncatalogued.
- 11 From file 'Conservation Journal WAM' Central draw stack marked 'A-U'. Conservation filing cabinets. Back hallway. Fuller Laboratory. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 12 From file 'Conservation Journal WAM' Central draw stack marked 'A-U'. Conservation filing cabinets. Back hallway. Fuller Laboratory. Worcester Art Museum. Archivisation and compilation of finding aid in progress.
- 13 This form was used to document the condition of *The Annunciation* by an unknown artist. Property of Mr. Sawyer. Private papers of Edmond de Beaumont. Fuller conservation laboratory. Worcester Art Museum.

Arranged alphabetically according to owner's name. Archivisation and compilation of finding aid in progress.

- 14 Antioch Mosaic Excavation Files. Object laboratory. Fuller conservation laboratory. Worcester Art Museum.
- 15 .Unknown author, ' Proposed reorganization of the department of conservation, Fogg Museum of Art, Harvard University, as a center for investigation and for service to other museums. November 1946. Box 1 Folder 7. Conservation and Technical Research Collection. Mellon Archives of Philadelphia Museum of Art.
- 16 Program for a course on the conservation of works of art. British Council. September 1956. Box 1 Folder 3. Conservation and Technical Research Collection. Mellon Archives of Philadelphia Museum of Art.
- 17 Education. Brooklyn Museum. Exploratory conference on the conservation of works of art. Papers presented Box. 1 Folders 4-6. Conservation and Technical Research Collection. Mellon Archives of Philadelphia Museum of Art.

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## WHERE'S THE BEEF? A STUDY OF EXTENSIVE OVERPAINT TO A NINETEENTH CENTURY PAINTING

Stephanie Grant, Conservator of Paintings

Conservators are often faced with the challenge of previous restoration, some of which may be overpaint. Many times the overpaint is inpainting gone amuck, due to failed attempts at color matching to the existing paint film. Other times it is used in an attempt to hide a disastrous over cleaning from the past. It is the latter that was discovered in the genre painting discussed here.

A nineteenth century painting was delivered to our studio and it was obvious immediately to all who saw it that there was heavy previous restoration. There were three patches on the verso, as well as 14 visibly repaired areas where patches had been, but were now gone. This was discernable from darkened adhesive residue in these areas on the verso.

The painting had been edge-lined with pre-primed canvas with an interleaf of newspaper. It was determined that the stretchers were not original as the bottom lower-left edge of the painting, containing what remained of the signature, was wrapped around and stapled to the stretchers.

The paint film appeared to be stable. Examination under ultra-violet light showed a surface coating applied so heavily that it had dripped and pooled vertically on the surface. Testing indicated that the surface coating was polyurethane.

A solution of xylene, dimethylformamide, toluene, and ethylene glycol monobutyl ether applied with 100% cotton swabs caused the coating to swell allowing it to be removed. This solution was neutralized and removed from the surface with mineral spirits also applied with 100% cotton swabs. This method removed some of the overpaint as well, and proved safe for the original paint film.

Another solution of alcohol, ethylene glycol monobutyl ether, and ammonium hydrate was required for more tenacious areas of overpaint, particularly in the sky and some locations in the water. It was during the first cleaning that the cow on land appeared. "Where's the beef? There's the beef." During the second round of cleaning another cow was discovered in the water... beef squared. It was quite clear that over cleaning in the past had led to the "cover up job."

There was also extensive overpaint to the sky and trees. There was evidence of slight over cleaning to the trees centrally located, but the amount of overpaint and the difference in palette, leads one to believe that perhaps a change of seasons was desired. The overpaint of yellow-greens onto all the trees did more than conceal the removal of original paint.

Whatever the reason, we were lucky to be able to remove almost all the overpaint and return this painting to its owner with more of the artist's original intent intact. The composition and palette were restored to, in my opinion, their more interesting and sensitive beginnings.

---

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During treatment



After treatment



Before treatment



During treatment



During treatment



After treatment



Before treatment



During treatment

## A NOTE ON A DISCOLORED OIL COATING ON A NINETEETH-CENTURY GERMAN PAINTING

Elise Effmann, Assistant Conservator of Paintings  
Ken Sutherland, Scientist

In 1978, a large painting depicting *Elijah in the Desert* was donated to the Philadelphia Museum of Art (PMA) (Fig. 1).<sup>1</sup> Painted in 1834 by Moritz Berendt (1803 - after 1844), a little-known German artist who trained at the Düsseldorf Academy, the academic style, biblical subject matter, and sound painting technique clearly display the influence of Berendt's professor, the Nazarene painter, Wilhelm von Schadow (1788 - 1862). Upon its acquisition by the PMA, the painting was put in storage pending cleaning and the availability of gallery space for a work of such relative obscurity.



Fig. 1. Moritz Berendt, *Elijah in the Desert*, 1834, 159 x 167 cm, Philadelphia Museum of Art, 1978-8-1. Partially cleaned section visible on left side.

Spurred by the interest of curators at the museum, the painting was taken out of storage and brought to the conservation studio in 2003. Immediately noticeable was a deep reddish-amber-colored coating that had been brushed on in a very liquid form, and consequently had pooled and dripped across the surface (Fig. 2). However, despite this disfiguring, dark coating, the painting remained in superb condition. Preserved in large part by luck and benign neglect, the work retained what appeared to be its original dammar varnish.<sup>2</sup> It was also unlined on its original stretcher and in its original frame. In fact, the only significant intervention in its 170-year life was the application of the now-discolored coating.

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Fig. 2. Detail showing dark drips of linseed oil coating.

The upper coating, presumably used to improve the saturation of the thin early varnish, was applied later enough in the life of the painting that a dirt interlayer was visible in cross-section between the two varnish layers. Due to its extreme discoloration, the dark, upper coating was initially presumed to be some type of resinous varnish, perhaps formulated with pine rosin or another impure and readily oxidizing resin. However, the coating's pinkish fluorescence under ultraviolet light, solubility in saliva, and pliant nature contradicted this visual assessment. Samples of the coating were analyzed using Fourier transform infrared spectroscopy (FTIR) and gas chromatography-mass spectrometry (GCMS), which identified it as linseed oil.<sup>3</sup> This was surprising given its visual properties and solubility characteristics. The long-term aging properties of drying oils are complex, and the failure of this coating to form a hard, insoluble film may relate, among other factors, to the absence of pigments, and possibly of driers (although the presence of driers was not investigated in this study). GCMS analysis indicated a high degree of oxidation in the coating, which, in combination with its poorly polymerized character, may have enhanced its solubility in more polar solvents, providing the serendipitous characteristic of its being removable from the dammar layer with a solvent as mild as saliva.

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<sup>1</sup> Elise Effmann wishes to thank Mark Tucker, Senior Conservator of Paintings at the PMA, for his support during this project, which was undertaken while the Andrew W. Mellon Fellow in Paintings Conservation in 2003.

<sup>2</sup> A sample of the varnish was analyzed in the Scientific Research and Analysis Laboratory of the PMA using FTIR spectroscopy and gas chromatography-mass spectrometry, which identified it as dammar. If an original varnish, this is an extremely early instance of the use of dammar, which was likely introduced in Germany in the late 1820's. See R.L. Feller, "First description of dammar picture varnish translated," *Bulletin of the American group: International Institute for the Conservation of Historic and Artistic Works* 7 (1966) 8-20.

<sup>3</sup> A Technical Analysis Report is on file in the Scientific Research and Analysis Laboratory of the PMA, dated 15 April 2003.

**KEES VAN DONGEN'S *RECLINING NUDE*:  
PRELIMINARY NOTES ON THE ARTIST'S VARNISH AND AN UNRELATED  
SURFACE PHENOMENON**

Morwenna Blewett, Andrew W. Mellon Fellow in Paintings Conservation.  
Philip Klausmeyer, Andrew W. Mellon Conservator in Paintings and Conservation Science.  
Worcester Art Museum

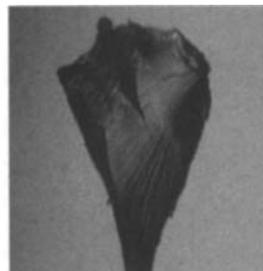


*Reclining Nude*. Oil on canvas. c1920-25.  
Worcester Art Museum. Before treatment.

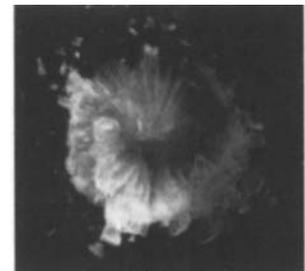
This painting was recently given as a gift to Worcester Art Museum. The Dutch Fauve, Kees Van Dongen, worked in Paris from the turn of the 19<sup>th</sup> century, painting numerous society beauties until his death in 1968. Technical analysis was initiated to glean general information about the artist's technique and materials use, and to answer specific questions that arose in the course of treatment. Additional examinations of other works by the artist were also conducted to inform the observations and conclusions drawn from the study of the Worcester painting.



Detail in ultra-violet light



Sample viewed in  
transmitted light



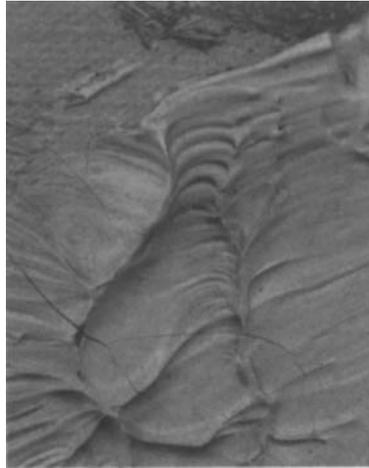
Sample viewed in ultra-  
violet light

*Anna de Noailles, Countess de Brancovan*.  
Oil on canvas. 1931.  
Stedelijk Museum, Amsterdam

(Samples x10 at capture)

The artist generally left his paintings unvarnished but on some works he chose to partially varnish areas of impasted highlights on either flesh or drapery. *Anna de Noailles, Countess de Brancovan* had localized applications on the figure. This painting has not undergone recorded surface treatment and the varnish is likely to be original.

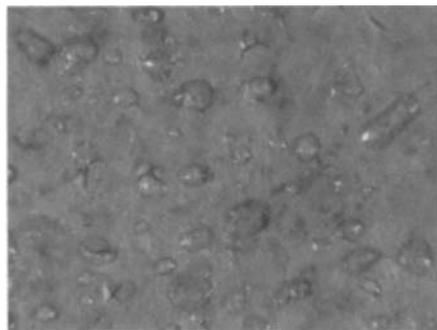
A sample of the varnish coating was taken from a white highlight. A microscopic shard of the sample was assessed visually with a Polarised Light microscope. The sample was then pressed out using a diamond point ATR objective, shattering in the characteristically fragmentary manner of a brittle varnish. When viewed under ultra-violet epi-illumination, the sample exhibited the strong fluorescence associated with an aged natural resin varnish. The sample was then analysed using an FTIR microspectrometer coupled to a microscope. It was found to have peaks consistent with a natural resin varnish, with a best spectral match to mastic varnish.



Detail of partial varnish on the impasto of the bed. *Reclining Nude*, Worcester Art Museum.

While the Worcester picture does not have an overall varnish, some localized thin applications appear on the white impasto highlights of the drapery. FTIR analysis was also carried out on a sample from the Worcester picture and again, the spectrum obtained showed a good match to mastic varnish.

So, in view of finding the same varnish type with distinctive distribution in two paintings with no history of surface treatment, it would seem reasonable to conclude that this is characteristic of Van Dongen's working practice. The function of his varnish was to enhance the luminosity to the textured highlights and passages of flesh, by imparting a differential gloss to those areas.



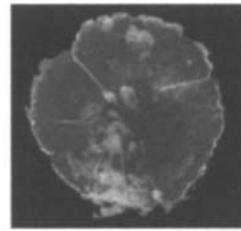
Detail of exudate on the flesh paint. ( x3.5at capture)

During an examination of the surface it was noted that a specific area of the flesh painting exhibited a type of transparent bead-shaped exudate. This material was found in one area of flesh painting and in a number of other grey areas. When viewed overall in visible light, these areas of paint seemed to have the same body and quality of brushwork seen in surrounding flesh paint, on examination in U.V light however, these areas had a quality of fluorescence which was distinct from the rest of the surface.

The status of this paint was investigated and it was concluded that it was not later overpaint, but an artist's revision or addition in each area. A sample of the exudate was taken from the flesh area, and as with the varnish samples, it was viewed under the microscope in its pressed out state with both transmitted light and U.V. epi-illumination. The action of pressing out alone was revealing in terms of the how the material behaved. It did not fracture dramatically but instead squashed down retaining its circular form without any major ruptions or breakage. In transmitted light we see that the sample is not homogeneous and contains a small amount of an opaque component. In U.V. the two materials present exhibit different qualities of fluorescence.



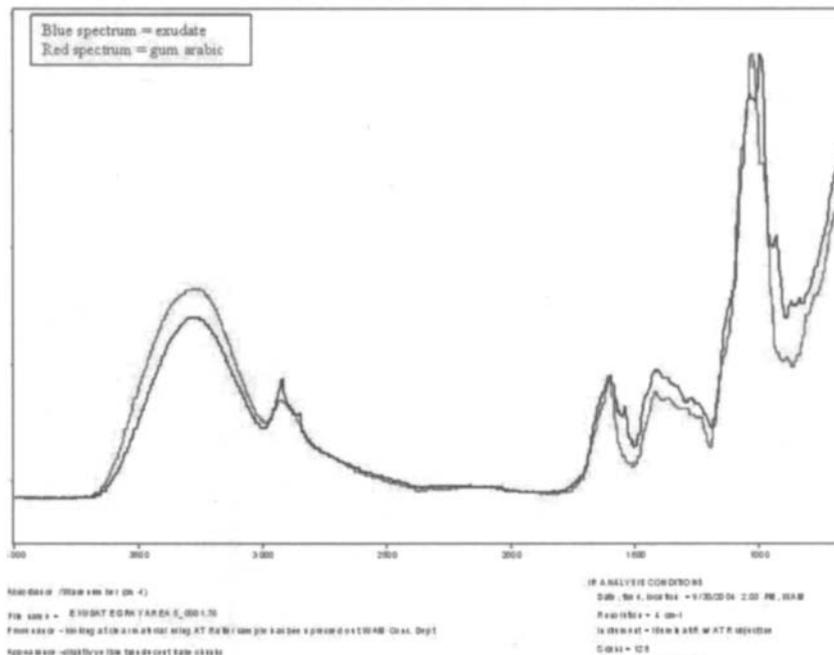
Sample viewed in transmitted light



Sample viewed in ultra-violet light.

(Samples at x10 capture)

Technical analysis was carried out again using an FTIR microspectrometer coupled with Polarized Light microscope. The spectrum obtained corresponds to that of gum arabic, except for some deviations that are likely to be associated with the darker material seen in the transmitted light image.



Gum arabic and exudate spectra

Based on the physical appearance of the paint surface and the fact that gum arabic is the common binder for watercolour and gouache, one theory is that the exudate on the surface is the result of an unstable paint formulation. This formulation may incorporate both the water-soluble gum arabic along with oil paint. The unstable nature of the emulsion has resulted in the separation of the hydrophilic gum from the hydrophobic oil paint and consequently this surface exudate is formed.

Future analysis involving spectral subtraction is currently underway to explain the appearance of the two non-conforming peaks. Spectral subtraction work to date has yielded some interesting results including the possible

presence of glycerin, which is component often used in watercolor formulations, and a laureth sulfate which may be derived from a soap used to make the emulsion.

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Presented at the AIC annual meeting in Minneapolis, Minnesota, June 8-13, 2005.  
This paper has not undergone a formal process of peer review.

## **PAINTINGS WITHOUT GROUNDS**

Mark Lewis, Painting Conservator

Over the course of time we have run across a number of paintings that were painted on canvas without the use of a pigmented ground layer. Presumably, the canvas received some sort of size layer to isolate it from the paint layers. In these examples, it seems to have been the artist's intent to utilize the color of the fabric itself as a sort of midtone element. The challenge for the conservator is what to do when the tonality of the fabric has shifted and darkened with age, altering the original tonal relationships.

One particular example of this situation was encountered while treating the painting, *The Laundress*, by Edgar Degas in the Reading Public Museum. Areas of unprimed canvas, which were once a pale straw color, had aged to a deep chocolate brown. The oxidized varnish to some degree had camouflaged this change. In the course of cleaning and varnish removal, it was discovered that any solvent exposure in these areas of unprimed bare canvas resaturated the varnish and the age darkened canvas which made a dramatic and jarring contrast. Gelled solvents were also tested but gave similar results. Ultimately, the varnish was left in place in these areas of bare canvas to prevent the saturation of the darkened canvas.

Since encountering this situation, we have seen other paintings by Degas where the artist utilized the color of the bare canvas. We have also seen paintings without pigmented grounds by Berthe Morisot, Ernest Lawson and Frederick Carl Frieseke. We would be interested to hear from other conservators who have dealt with this dilemma.

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# THE USE OF A NEW PRODUCT TO TREAT CANVAS IRREGULARITIES, TIGHT-N-UP, ITS EFFECTS ON ONE PAINTING AND THE TREATMENT OF THOSE EFFECTS

Niccolo Caldararo Director and Chief Conservator Conservation Art Service

Abstract - This article briefly covers the treatment of a painting that had been sprayed with the commercial product, Tight-N-Up which is marketed to rectify sagging old canvases. The product is sprayed onto the back of paintings and the manufacturer claims it causes the canvas to shrink back to its original "tight" condition. In the case of the painting which came into our laboratory after being sprayed with this product, the canvas did shrink, but so much that the paint film was stressed and literally forced off the canvas in the process. Testing of the product showed it darkened when applied to test canvases and placed in a testing oven at 100 degrees C. The product introduces to potential problems for conservators: 1. the initial physical change in the canvas which destabilizes the pigment layer from the canvas, and 2. the long term effects of the aging of the product. The cracked and flaked paint was reattached to the canvas using a hot tool device and a wax/resin consolidant. Recent reanalysis of the test canvas showed that the canvas threads had so deteriorated that they were unable to stand the pressure of normal pressure on a canvas (e.g. keying out) without tearing.

## Introduction

In August of 2004 I was called to a local frame shop to examine and produce an estimate for treatment of an oil painting on canvas. The canvas measured 20 inches by 30 inches and was painted on a thin, commercially prepared canvas (Figure 1). The canvas appeared weak and brittle, though the paint seemed well adhered to a thin gesso ground. I was told that the proprietor had sprayed the canvas with a product called, Tight-N-Up to relieve some serious sagging present when the painting was brought in by the owner for reframing. He stated that he had done this many times before without unexpected results, but in this case the canvas seemed to shrink dramatically and caused the paint film to crack and flake. He stated that fragments of the paint film had literally jumped off the canvas. I was brought before a large, flat photographic film box in which laid a very damaged painting (Figure 2). Dozens of small flakes of paint sat on the surface of the painting in grand disorder like a partly unset jigsaw puzzle. It appeared that the shrinking of the canvas had forced the tenting and cracking of the paint layer. It may also be that the canvas was weak to begin with and that the thin gesso may have contributed to the problem. It also seemed possible that since the back of the painting available to the spray was only that up to the stretcher bars that the force of shrinkage was severe at the edge of this area between dry and sprayed producing a gradient of stress at this point. One can see in the figures that the damage was concentrated at this point all along the painting.

## Mechanisms of Damage

It has long been known that a small amount of water applied to the verso of a painting can cause a reduction in planar distortion, and also local dents and other deformations in the canvas (Meyers & Meyers). This particular chemical preparation, Tight-N-Up, was unknown to me. Websites of commercial enterprises selling this product promise that the results of shrinkage will not be more remarkable than water, but that the change will be permanent. Before embarking on treatment I attempted to contact the manufacturer to discuss the formula of the preparation. This proved impossible and so I wrote to them and received a fax of their MSDS. This did not divulge any chemical components. The only information that was divulged was that it contained Nitrogen compounds, had a pH of 8.25, % solids by weight of 12, and a specific gravity of 1.02. It was assumed that some consolidant was contained in the spray that was water soluble. The framer gave me the container he used and I produced a test canvas of similar thinnest and weave, in cotton. I applied it to a metal test strainer allowing for a degree of sag in the canvas (Figure 3, 3a).

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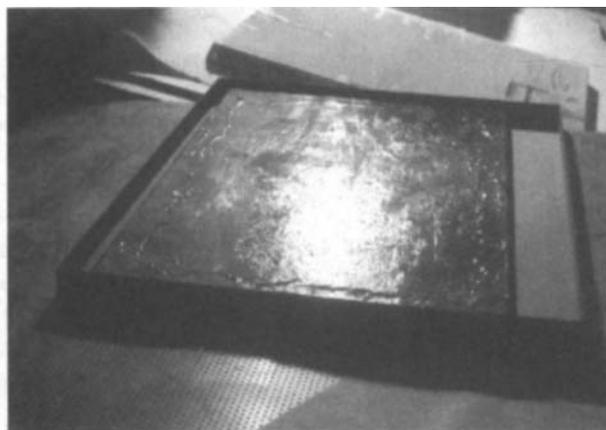
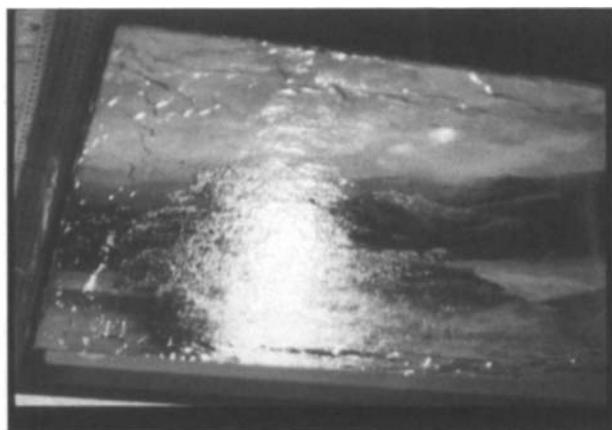
Niccolo Caldararo, Director and Chief Conservator, Conservation Art Service  
P.O. Box 77570, S.F., Ca. 94107

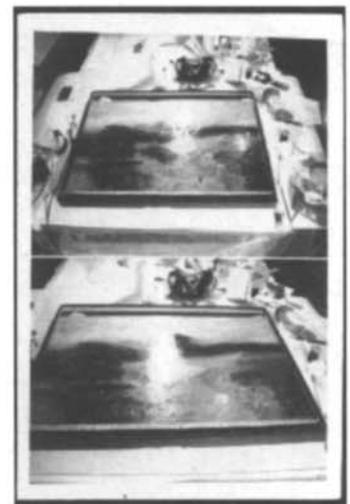
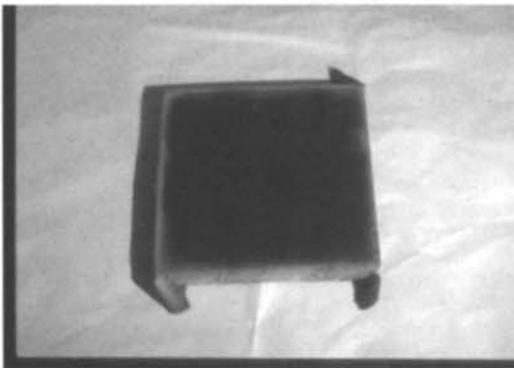
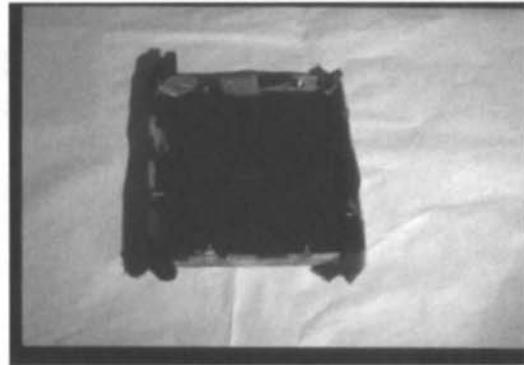
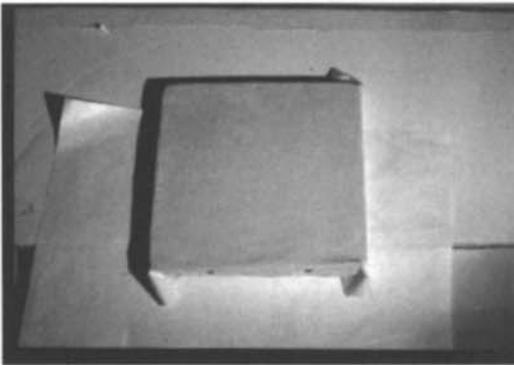
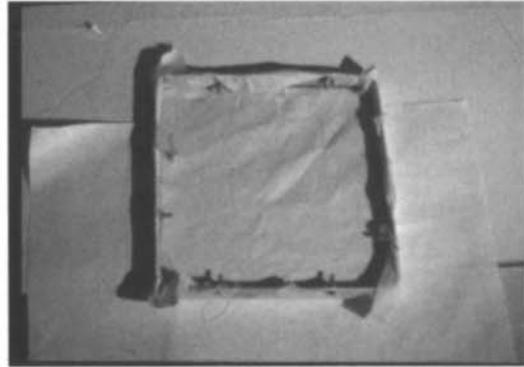
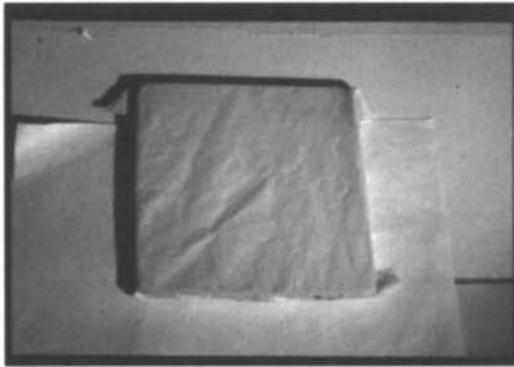
The verso was sprayed in the manner directed by both the framer and the instructions on the container and in the websites. The canvas tightened nicely (Figure 4). This was placed in a test oven and exposed to 100 degrees F environment. However, before even 10 minutes had elapsed the canvas had turned a dark black color every where it had been sprayed (Figure 5) but not where it had not been sprayed, but also clear through to the recto (Figure 6).

Some consideration was made to attempting a removal of the substance or perhaps trying to alter its chemistry to reduce the potential for future damage given these experimental results. However, the client would not pay for the analysis or chemical treatment if one was found. We therefore simply used a number of specially made tips for our heat device and using a wax/resin mixture set the fragments into place one at a time and then removed excess with toluene and xylene. Some fragments were lost, so Golden Gesso was used to fill these followed by inpainting using Gamblin pigments. While the client was happy this treatment was less than satisfying given our experimental results. If the canvas was further weakened by the Tight-N-Up and aging would result in a parallel to that which we found in our test canvas, our treatment was only cosmetic and short lived. Unfortunately the client did not want to invest in testing to determine the components of Tight-N-Up, nor in some potential treatments to reduce the weakening of the canvas. This was understandable, for if the canvas now contained a substance that would degrade it further, lining would be of little use. Transfer of the pigment layer would be a possibility, but beyond what the client was willing to invest or the value of the painting could justify. Since we did not know the chemical nature of Tight-N-Up we could not devise a chemical treatment to reduce or neutralize its effects.

One year after the test frame was exposed to heat as described above, we tested the strength of the fabric still on the frame by placing weights on the surface of the fabric from the recto. The fabric tore easily under the weight of less than 5 lbs. One would hope that the chemical nature of Tight-N-Up could be identified. Perhaps there was a unique interaction between the gesso or other preparation compounds of the client's painting canvas and the Tight-N-Up. It is also possible that the framer applied too much and did not realize it. It is also possible that the canvas was already very degraded before the spraying as described by Young & Hibberd (1999) for some 19<sup>th</sup> century paintings. Nevertheless, this case remains a mystery.

1. Young, Christina & Hibberd, Roger, "A comparison of the physical properties of 19<sup>th</sup> century canvas linings with acid aged canvas," in 12<sup>th</sup> Annual Meeting, Lyon, 29 August-3 September, Preprints ICOM Committee for Conservation, ed. Janet Bridgland, 1999:353-360.





Presented at the AIC annual meeting in Minneapolis, Minnesota, June 8-13, 2005.  
This paper has not undergone a formal process of peer review.

