The AIC Painting Specialty Group

POSTPRINTS

VOLUME TWENTY-FIVE 2012

The American Institute for Conservation of Historic and Artistic Works

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VOLUME TWENTY-FIVE 2012

Papers Presented at the 40th Annual Meeting of the
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Cover photograph: Maurice Brazil Prendergast. *The Beach* (detail), c. 1915. Oil on canvas, 24¾ × 34¼ in. (62.9 × 87 cm). BF319. © 2015 The Barnes Foundation

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AIC PAINTINGS SPECIALTY GROUP

POSTPRINTS
VOLUME 25 2012 ANNUAL MEETING

Papers Presented at the 40th Annual Meeting of the American Institute for Conservation of Historic and Artistic Works
Albuquerque, New Mexico May 8-11, 2012

PAINTINGS SPECIALTY GROUP

May 9, 2012

Understanding the Painter: Documentation and Technical Examinations of Painting Practices

Condition Issues, Challenges, and Treatment of Modern & Contemporary Paintings

May 10, 2012

Outreach in Paintings Conservation: The Dissemination of Information Outside the Field and Within

KRISTIN deGHETALDI

Print or Painting? The Treatment of a Penschilderij by Willem van de Velde the Elder

ABSTRACT

Though Willem van de Velde the Elder produced hundreds of maritime sketches and oil paintings, he may be best remembered for his elaborate penschilderij. Penschilderij *or "penpaintings" typically involve the application of ink atop a panel or canvas substrate that has been prepared with layers of lead white bound in oil. Beginning as early as 1638, van de Velde's unique penpaintings became popular with wealthy patrons throughout Europe. Van de Velde's compositions provide an extraordinarily complete record of the ships and small craft of Holland and England in the late 17th century. Van de Velde was one of the first to work with this technique although penpaintings from at least eight Dutch artists have survived. It is important to realize that van de Velde and his contemporaries used varied and disparate methods when comparing his works to penpaintings by Experiens Sillemans or Adrien van Salm. Van de Velde's style changed throughout his lifetime as he began adopting a more fluid approach by the late 1650s, applying subtle washes in areas of shadow in place of the fine cross-hatched lines seen in many of his earlier works. Very few penpaintings have found their way into public institutions with the exception of the Rijksmuseum and the National Maritime Museum in Greenwich. In 1994,* Dutch Ships near the Coast *by van de Velde was gifted to the National Gallery of Art in Washington DC, becoming the very first penpainting to be housed in an American public collection. When the author began the treatment in 2010, the conservation staff was able to take a closer look at the materials and techniques used to create this particular penpainting using SEM-EDS, GC-MS, and cross-sectional microscopy. Though much was discovered with the help of analytical tools, many questions still remain regarding this curious artwork. The analytical findings will be discussed and compared to previous studies. The treatment of* Dutch Ships near the Coast *and the challenges encountered will also be covered.*

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Gauguin's *Brittany Landscape's:* Compositional Transformation and Intentional Ambiguity

ABSTRACT

In Gauguin's 1888 Brittany Landscape, *the artist painted on a single canvas over the course of about a week a succession of landscapes that shared the same sky and hill line. These compositions are revealed by X-radiography and infrared reflectography, and the close time frame of their creation is confirmed by examination of paint cross-sections. Shapes from the lower compositions were re-used in the final image, creating ambiguous forms preferred by Gauguin. A theory of the sequence of the compositions is proposed, and Gauguin's re-use of underlying forms, intentional without being fully conscious, is discussed. The painting's function as a painted "document" rather than a fully realized "tableau" is explored, enabling a reconciliation between Gauguin's concept of himself as a spontaneous artist and his use of various mechanical transfer techniques.*

Gauguin painted the signed and dated *Brittany Landscape* (fig. 1) in the late winter of 1888, during his second visit to the Breton village of Pont-Aven. The town's situation on the Aven River, which is bisected here by a long rocky outcrop, creates a natural mill race that enabled the construction of at least twelve mills along the river. These mills provided the economic base for the village before tourists and artists began to visit in the late nineteenth century. This view of the Aven river valley looks downstream at a bend in the river just above where the artist painted frequently in 1886 and 1888. Since Gauguin left Pont-Aven in mid-October of 1888 to join Van Gogh in Arles, the obviously wintery scene can have been painted only much earlier, after the artist arrived in late January but before spring came, presumably around March. It is unusual in Gauguin's practice that he chose a spot so solitary, and it reflects his psychological state at the time.[1]

Figure 1. Paul Gauguin, *Brittany Landscape*, 1888, canvas, 71.1 × 89.5 cm, Chester Dale Collection. National Gallery of Art, Washington, 1963.10.148.

The first few months of the artist's second stay in Brittany were not extremely productive. Sick with malaria and dysentery caught in Martinique, he was bed-ridden much of the time, so that he complained of feeling isolated.[2] Therefore, the early part of his 1888 Brittany sojourn was a period of solitude and irresolution. These months allowed Gauguin to evolve his painting style in a sort of free and unsystematic way, painting a few innovative works among a greater number of simple *plein air* landscape studies.[3] While the more revolutionary paintings he would create later in the summer often focused on foreground figures in a landscape, most of the early paintings of 1888 either contain no figures or figures seen from a great distance. *Brittany Landscape* is typical of the paintings Gauguin created in the early months of 1888, and the painting is in a sense a document of his state of irresolution, since it contains three separate compositions painted one on top of the other within a short period of time, as well as preliminary preparations for a fourth composition never completely realized.

Although *Brittany Landscape* reveals in its small hatched brushstrokes with complicated color juxtapositions an artist still

under the influence of Pissarro, it contains the seeds of Gauguin's later abstraction and ambiguity. While at first glance the picture appears to be a traditional Impressionist landscape, a closer inspection reveals a number of unusual features, including a slightly awkward composition and several peculiar visual motifs such as the odd, rather small pyramidal hills in the right middle distance, somewhat strange cloud formations, and a reflection in the water that does not mirror the surrounding landscape. It is possible that these unusual design choices are the result of non-conscious influence by the forms in the underlying compositions.

These earlier compositions are visible by several different means. An earlier idea for higher hills is revealed in a line of cobalt blue underdrawing in the sky that is visible to the naked eye; the line is not completely covered by the upper paint layer. Examination of a cross-section paint sample in this area does not reveal any underlying paint layer of hill color to indicate that this idea was ever carried further than the brief underdrawn line. However the X-radiograph reveals two separate compositions, one of which may relate to this higher hill line. The clearer of the two compositions is of a large building on the right, with central chimney and perpendicular one-story addition (fig. 2). The X-radiograph also reveals another fainter group of buildings that, because of their size and position on the canvas, may be related to the higher hill line underdrawing. This group includes a church spire in the sky on the right, and on the left, the large steep roof of a building whose lower section is hidden by a rise of land (see also fig. 2). The spire is undoubtedly that of the church of Pont Aven, which Gauguin included in the background of many Brittany paintings.

The more prominent composition revealed by X-radiography is difficult to interpret. Its central chimney does not appear in any of the buildings documented in the Wildenstein archive (however that collection records only a very small number of structures existing at the time). Its position relative to the river is also unclear. The riverbank may run diagonally from the middle right to the lower left in the same orientation as the surface image. However, that diagonal area of white in the X-radiograph may represent the waterfall/outlet of a mill complex. If so, the house on the right is too proportionately large for the outlet/waterfall and may instead relate to another image. It seems likely in either case that the highlighted (X-ray-opaque) forms in the lower right quadrant are the rocks that stud the Aven River. Examination of paint cross-sections indicates that the two compositions revealed in the X-radiograph are at the lowest level within the paint structure. Other evidence for this placement comes from the black outlines around the buildings in the X-radiograph. These are due to Gauguin's practice, learned from Pissarro, of first sketching his composition in thin dark blue paint and then filling in the forms, painting up to but not over the outlines with lead white-containing paint. If these buildings were part of a later composition, higher up in the paint structure, the outlines might not appear as dark.[4]

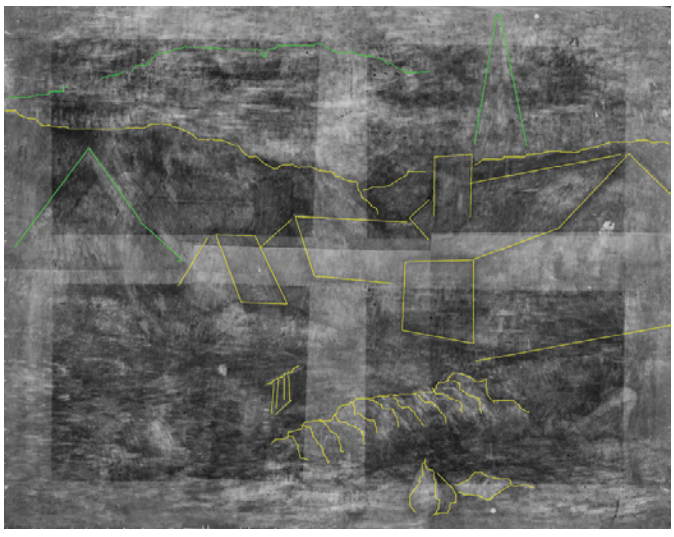

Figure 2. The lowest fully painted composition (yellow lines) as seen in the X-radiograph. An unfinished sketch of a different composition (green lines) is also evident.

A separate composition is revealed through the use of spectral infrared imaging (fig. 3),[5] which sometimes more clearly shows complex paint changes through the use of narrow spectral band images.[6] Here a false color infrared image, rather than a traditional infrared reflectogram, is found to better visualize the other underlying compositions. This image shows a mill complex seen at a greater distance, with a mill wheel on the left. The blue in the false color image is due to the presence of cobalt pigment. The same undershot mill wheel appears in the same position in Gauguin's 1886 *La Baignade au Moulin du Bois d'Amour* (W272) and in the 1888 *Jeunes Baigneurs Bretons* (W275), but the site is certainly not that mill, which is on the right bank of the Aven, with no buildings on the bank across from it. It is also unclear which way the river in the foreground is flowing, and comparison with Pont-Aven photographs did not yield any site identification. As in the compositions revealed by X-radiography, this one shares the sky-hill interface with that of the surface painting. The spire of the Pont Aven church is faintly visible behind the buildings on the left side of this composition. The limitations of infrared reflectography are revealed in this image, which actually may show several different compositional ideas from different layers within the painting, although none of them seem to relate to the images revealed by X-radiography. Since this image is closer in composition to the surface image, sharing the shape of the foreground river and its banks, it probably lies above the composition revealed by the X-radiograph.

When the underlying compositions were discovered, it was first assumed that *Brittany Landscape* was painted over an older

Figure 3. A composite false color infrared reflectogram of Gauguin's *Brittany Landscape* using spectral bands at 1200, 1400, and 1600nm. The image reveals a number of buildings and objects, such as the water wheel, which are not apparent in the X-ray or final composition. The colors highlight pigment differences, and the spectra data obtained suggest the use of cobalt blue in the area, not only of the drawing, but also in the blues of the sky.

painting, discarded but re-used when supplies became short. Due to Gauguin's impoverished circumstances at the time, he often painted over older canvases he considered unsuccessful. However, examination of cross-section paint samples revealed that there is no clear hard line of demarcation between successive paint layers; the interfaces between these layers are in some cases completely indistinct, the result of wet-into-wet application, while in other places the interfaces are distinct, but softly blurred, as would be the case if paint were applied over a lower incompletely dry but still tacky layer (fig. 4). Drying time of paint varies according to the pigment and the amount of medium mixed with it, but research has shown that in general it is firm after at least several days.[7] Drying might occur more quickly in Gauguin's paintings, since he used an absorbent ground that would leach out some of his paint medium, making his paint very lean. The most likely explanation for the combination of wet-over-wet paint and wet-over-soft paint is that Gauguin painted *Brittany Landscape* with its many alterations over the course of at least three days and no more than a week. The only completely firm line visible in the cross-section is a top stroke of orange highlight applied in the hills, a "*tache*" that the artist may well have added in the studio after the *plein-air* work was done.

The shared line of sky and hills in all the compositions is difficult to explain. The fact that all were painted within a short time frame suggests that Gauguin moved his easel to at least three different sites within the space of a week, but it does not seem possible that all three compositions would have the same hill line, though the meeting of low hill ridges in the area is a general topographic feature. If the painting were done on site, Gauguin would have had to walk to a spot that he liked that also corresponded to the pre-painted sky line from the underlying compositions. It seems more likely that Gauguin did not paint the picture entirely from nature even at the planning stages. Fellow Pont-Aven painter Charles Delavallee recalled that in 1886 Gauguin had painted a studio-based landscape, which he said he would finish outdoors,[8] so it is possible that he followed a similar process in *Brittany Landscape*. He might have begun the painting in his studio while weakened by illness, later carrying the canvas outside, changing the composition at several different sites over the course of a week. If the artist began his composition indoors and then made compositional changes once outdoors, altering different parts of the painting in a rather unsystematic way, it is likely that the mill scene immediately preceded the surface image, with the collection of farm buildings belonging to earlier compositions. The artist's determination to re-use the sky-hill line may explain some of the compositional awkwardness, especially in the landforms on the right side of the composition.

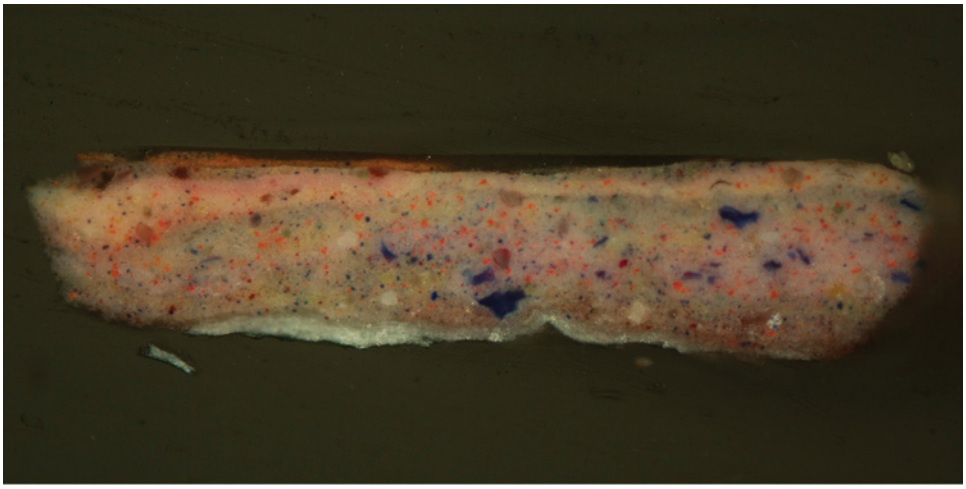

Figure 4. Cross-section, *Brittany Landscape*, reflected light, 50x, taken from the small hill on the far right. No clear interface between paint layers suggest each new composition was painted before the one below had dried and therefore within a short time frame.

The small pyramidal hills in the right middle distance of *Brittany Landscape* do not appear in contemporary photographs showing the topography of Pont Aven nor are they present in other paintings by Gauguin of nearby scenes, so they are something of a mystery. One

explanation for their origin may be found in recent neuroscience research described in an article about non-conscious thinking in seventeenth-century Dutch painting by E. Melanie Gifford.[9] The essay describes examples of non-conscious thinking, as opposed to analytical or conscious thought, that may lead an artist to make choices that may be said to be intentional without the artist being fully aware of his artistic choices. Neuroscience research documents differential brain activity in conscious and non-conscious thought.

Astoundingly, examination of cross-section paint samples taken from *Brittany Landscape* shows that Gauguin did not block out the lower compositions when he painted on top of them, exhibiting an extraordinary ability to focus on the new composition despite the fact that the old one was clearly evident in front of him. Unlike Vermeer, who, in the instance cited by Gifford turned the painting upside down, Gauguin painted the upper picture in the same orientation as the ones beneath, using the line of hills and sky as an anchor in all three compositions. However, at some level he must have been conscious of the peaked roofs of the underlying farmhouses, because he echoes them in the strangely shaped hills that appear nowhere else in his work (fig. 5). According to the research of Kouider and Dehaene, this type of awareness is categorized as pre-conscious processing, in which an image is fully visible while one's focus is elsewhere. Despite not being aware of it, the cerebral cortex is nevertheless processing the information, resulting in a 'priming" effect that makes it more likely that Gauguin, while painting the later compositions, would non-consciously echo the forms of the lower painting.

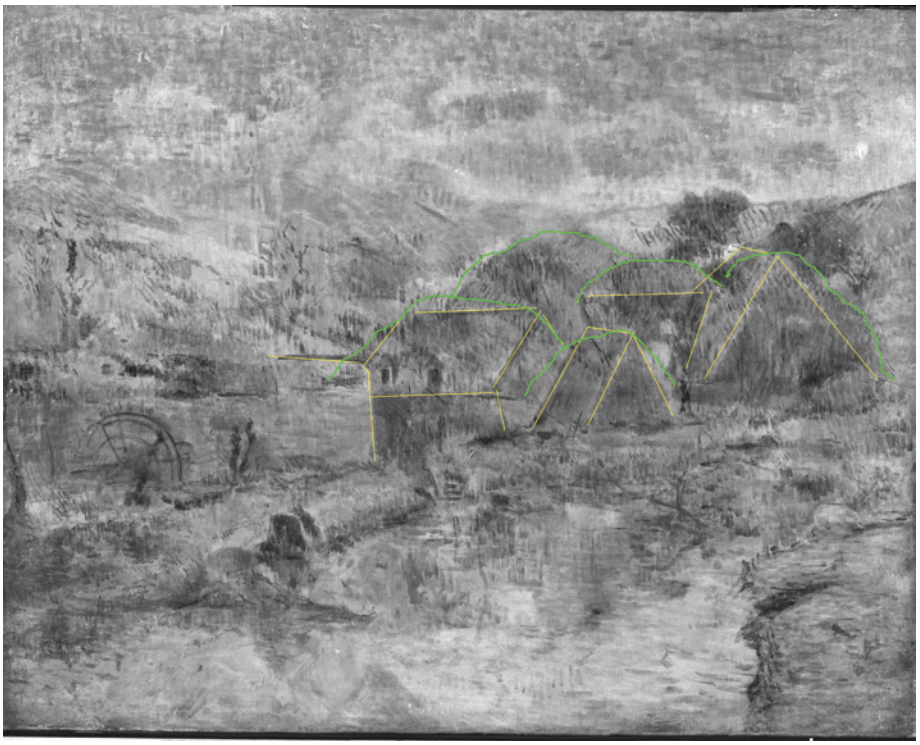

Figure 5. Infrared reflectogram. The small hills in the surface painting (green lines) seem to echo the forms of the buildings (yellow lines) in the underlying composition, an example of pre-conscious processing.

A similar phenomenon exists in the lack of concurrence between the landscape and its reflection in the Aven River. The tall narrow profile of the reflection mirrors the shape of the steeple seen on the right in the X-radiograph rather than the line of hills and trees on the surface. It seems likely that Gauguin unconsciously re-used the reflection of this earlier shape. A third instance of this process occurs in the design of the clouds in *Brittany Landscape*. They follow a line of underdrawing that demarcated the higher ridge of hills. These cloud shapes are unlike other skies Gauguin painted during his Brittany sojourn, and their unusual form may be due to non-conscious repetition of the earlier underdrawn line of hills that forms a lower layer in the painting.

However, the issue of conscious versus non-conscious choice is more complicated in the case of Gauguin than in that of Vermeer, because while Vermeer was certainly not conscious of his repetition of an underlying shape, Gauguin expressed both in his writings and in the evidence of his paintings a preference for the mystery created by non-conscious thought and visual ambiguity. Gauguin thought of his painting process as a sort of violent birth arising out of a deep well of unconscious feeling. In an 1898 letter he wrote, "Where does the execution of a painting begin, where does it end? At the moment when the most intense emotions are in fusion in the depths of one's being and when thought comes in like lava from a volcano, is there not then something like an explosion? The work is created suddenly, brutally if you like, and is not its appearance almost superhuman? The cold calculations of reason were not present at this explosion but who knows when the work began?"[10] It is therefore clear that he valued the non-conscious mind as a source of inspiration. This idea was hardly original; it is similar to certain aspects of Neo-Platonism, with which the artist was familiar through discussions with colleague Paul Serusier,[11] but nevertheless, he clearly considered it essential to his creative process.

It also seems clear that Gauguin considered both visual and iconographic ambiguity a byproduct of this mysterious creative process. While *Brittany Landscape* functioned as a landscape study rather than what Gauguin called a "tableau" (an important work based on landscape paintings and preparatory figure sketches), the germ of visual ambiguity is already present in what first appears to be a simple *plein air* study. For example, a close inspection of the leafless trees along the river bank in *Brittany Landscape* reveals that there are no clear boundaries between the upper sections of the leafless trees and the brushstrokes of the hills behind, so it is unclear where one begins and the other ends. This ambiguity may be as much non-conscious as analytical and may also be a result of non-conscious awareness of competing underlying forms.

The evidence of *Brittany Landscape* therefore suggests that Gauguin's painting process might need to be re-evaluated in terms of the balance between analytical and non-conscious thought, at least in instances where he made changes to his composition. Earlier analysis of Gauguin's painting procedure by this writer revealed a discrepancy between the artist's description of his creative process and his actual painting practice. For example, his often quoted assertion that he created his masterpiece *Where Are We Going* in a flurry of fevered activity without preparatory sketches seems to be refuted by the existence of an elaborate preparatory drawing squared for transfer. His frequent re-use of the same figure studies in different paintings and his practice of transferring his preparatory sketches onto canvas by squaring up or even by using pounced cartoons is of course the very opposite of non-conscious process. Because there is a self-promoting aspect to Gauguin's personality, this discrepancy between his description of his creative process and the evidence of the paintings can seem like dishonesty.

However, examination of *Brittany Landscape* suggests that in the multiple spontaneous alterations of the composition and the re-use of underlying forms, there is a truly non-conscious component to the artist's creative process. This may explain why Gauguin thought of himself as a spontaneous artist, despite his use of preparatory drawings and various mechanical transfer techniques. Therefore no single way of looking at his creative process is appropriate. An artist with a more rigid approach to painting might have covered each lower composition before starting on the next, but Gauguin preferred to proceed in a less systematic way, changing some sections of his compositions while re-using others. As with all of us, Gauguin's creative process is a mixture of analytical and non-conscious thought. This becomes even more apparent if one regards hybrid studio-*plein-air* studies such as *Brittany Landscape* as just the first spontaneous and in certain respects non-conscious step in a long process of image refinement eventually producing the desired "tableau." Therefore we learn that for Gauguin, paintings did not serve a single function. While the works Gauguin considered important, works such as *Where Do We Come From*, rarely have alterations below the surface, because they are carefully composed stages on which many preparatory studies come together, there may be another class of paintings with many changes, and these paintings act in a way analogous to the artist's drawn sketches, vehicles for the exploration of new ideas.

Study of *Brittany Landscape* has revealed in a single painting a whole range of these ideas, explored by the artist at a time when he was about to move forward stylistically and painted during a period of incubation in which he tested many different compositions on one canvas. It is also an early instance of the non-conscious re-use of forms in paintings that the artist altered. Although other examples of this phenomenon are known in Gauguin's painting practice, it is likely that many more will be discovered as more of his paintings are examined with X-radiography and infrared reflectography. *Brittany Landscape* also reveals the seeds of a preference for visual ambiguity, in this case influenced by underlying forms, that becomes a hallmark of Gauguin's later work, and it allows us to understand Gauguin's conception of himself as a spontaneous artist despite his use of various mechanical transfer techniques.

ACKNOWLEDGMENTS

Thanks to Sylvie Crussard, Wildenstein Insitute, Paris, who read an early draft of this essay and compared the X-radiographs and infrared reflectograms with photographs of Pont-Aven sites. Thanks also to Society for the Preservation of Old Mills member Mike Moran for helping me understand the various structures that make up a mill complex, an important step in interpreting the painting's lower compositions. At the National Gallery of Art, E. Melanie Gifford's research and comments provided a key to many puzzling aspects of *Brittany Landscape.*

ENDNOTES

1. Merlhes, 171, 174, 175.
2. Merlhes, 186.
3. Crussard, 366.
4. Jirat-Wasiutynski et al, 71 and 95
5. A custom hyperspectral infrared imaging camera (Surface Optics Corp, CA), which provides 128 spectral band images, having 640 × 640 pixels, over the spectral range of 950 nm to 1700 nm, was used to create a composite image cube of the painting at 58 dpi. Two tungsten halogen photographic lamps with diffusers were used to illuminate the painting at a lux level of 200. The image was processed and mosaiced in ENVI.

6. Delaney et al, 739103–108.
7. Bomford et al, 92
8. Chasse, 44–45.
9. Gifford, 165–172.
10. Segalen, 165–172.
11. Amishai-Maisels, 400–401.

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At the National Gallery of Art, Michael Palmer prepared and interpreted paint cross-sections, while John Delaney, Douglas LaChance, and Paola Ricciardi captured the infrared reflectograms and hyperspectral images.

ALAN PHENIX AND THOMAS McCLINTOCK

Frederick Hammersley: An Artist's Documentation of his Painting Practice

ABSTRACT

Frederick Hammersley (b. 1919; d. 2009) was one of the leading abstract painters in Southern California in the postwar period. He first gained widespread acclaim when, together with Karl Benjamin, Lorser Feitelson and John McLaughlin, his work featured in the landmark exhibition Four Abstract Classicists *whose style would very soon come to be known as "West Coast Hard-Edge". A particular feature of Hammersley's practice was his meticulous documentation of painting process and materials, and great concern for the permanence of his work. The artist-endowed Frederick Hammersley Foundation retains a variety of archival material that is pertinent to his painting technique, including a series of notebooks that describe in detail the creation of individual works. Among the various notebooks left by Hammersley, his four* Painting Books, *which are chronological lists of finished paintings that include, to varying degrees of precision, details of materials and process, together with thumbnail sketches of the compositions. The paper presents a general introduction to the practice-related archive materials at the Frederick Hammersley Foundation that have significance for understanding of the artist's working methods, and offers some initial interpretations in terms of the relationship between his artistic intentions and materials/technique, and of his perspectives on the durability of his work.*

INTRODUCTION

Between October 2011 and March 2012 Southern California was home to a major cultural event: initiated by the Getty Foundation and Research Institute, more than sixty institutions collaborated to host a series of exhibitions and other programs under the banner *Pacific Standard Time: Art in L.A. 1945–1980,* the aim of which was to showcase and celebrate the birth of the Los Angeles art scene in the decades after the Second World War. The Getty itself put on three separate *Pacific Standard Time* shows: an exhibition of LA photography, *In Focus: Los Angeles, 1945–1980;* an object-in-focus show organized by the Getty Conservation Institute (GCI) *From Start to Finish: De Wain Valentine's Gray Column;* and the survey show *Pacific Standard Time: Crosscurrents in L.A. Painting and Sculpture, 1950–1970* curated by the Getty Research Institute (GRI) (Peabody et al. 2011).

During preparations in 2010 for the Getty's exhibition contributions to the *Pacific Standard Time* initiative, a group consisting of GRI and GCI staff had the fortunate opportunity to visit Albuquerque, New Mexico, where is located the home-studio of painter Frederick Hammersely (b. 1919; d. 2009), now the base for the artist-endowed foundation set up in his name after his death.[1] Hammersley had been one of the leading abstract painters in Southern California in the postwar period. Alongside Karl Benjamin, Lorser Feitelson and John McLaughlin, he first came to prominence as part of the group first exhibited as *Four Abstract Classicists* (at San Francisco 1959; LACMA 1959; ICA London 1960; and Belfast 1960) whose style would very soon come to be known as 'West Coast Hard-Edge' (Los Angeles County Museum 1959). Hammersley had studied art in Los Angeles in the 1940s at the Chouinard Institute, and later at the Jepson Art Institute where he continued in a teaching capacity after his studies. Subsequent teaching positions in Southern California included Pomona College, Pasadena Art Museum, and Chouinard. In 1968 he moved to Albuquerque where he continued his teaching career at the University of New Mexico, until 1971 when he left in order to concentrate on his painting. He carried on painting until late in life; albeit with intermittent periods of 'retirement,' Hammersley was still working on new compositions well into his late eighties.

In that first visit to the Hammersley Foundation, its director Kathleen Shields introduced the Getty team to works by the artist that it still retained, and to the fascinating collection of archive materials that was held at the home-studio. Among the collection of Hammersley's memoranda are various notebooks he compiled over the course of nearly five decades, from the late 1950s through to the end of his working life. The value of the material contained in Hammersley notebooks for understanding of the artist's

technique was immediately recognized: such a comprehensive record of production processes, material considerations and artist's intent has few parallels; it was clearly deserving of further study and interpretation. The opportunity to examine the Hammersley archive material more closely arose in early 2012. In March, the present authors spent several days at the Frederick Hammersley Foundation examining and photographing the notebooks, selected volumes of which are now (at the time of writing) being transcribed into digital text form, and edited, with a view to entering the contents into a searchable database that would serve as research tool for detailed analysis of the painter's practice. Pending completion of the transcriptions, the essential purposes of this present paper are: to introduce the various archival materials retained at the Hammersley studio that have significance for understanding of the artist's practice; to pick out some distinctive features of his approach to painting; and to offer some initial interpretations in terms of the relationship between his artistic intentions and technique, and of his perspectives on the durability of his work.

Hammersley has received a considerable degree of critical and art historical attention since he first came to prominence in the late 1950s as one of the *Four Abstract Classicists,* and there are many commentaries on his work in the catalogs of the group shows and, especially, the several one-man exhibitions of which he was the focus. [For further details of exhibitions in which his work is featured and discussed, see "Additional sources consulted"]. Since Hammersley's death in 2009, the artist has continued to be exhibited through the galleries that represent the Foundation, as in the 2011 show F*rederick Hammersley: Organic & Geometric* at Ameringer, McEnery & Yohe Fine Art (New York, NY),[2] and the recent (March to May 2012) exhibition at LA Louver (Venice, CA)[3] *Frederick Hammersley,* the catalogue of which (LA Louver 2012) gives a fully comprehensive list of exhibitions and books, as well as providing an elegantly concise synopsis of the artist's life and work (East 2012). The major monograph on Hammersley is that by King & Armitage 2009 which, in addition to various essays and presentations of his work, includes a short interview between him and Sarah S. King. There exist also two transcribed, but unpublished, oral history interviews with Hammersley that are very informative: one commissioned by LA Louver and conducted in 2003 by Lawrence Wechsler, with Douglas Dreishpoon and Peter Goulds (Wechsler 2006), and another also conducted in 2003 by Glenn Phillips, research specialist at the Getty Research Institute (Phillips 2003). A short documentary film *Frederick Hammersley—Never let the screen door slam* by Vanessa Smith 2010 also consists of an interview with the artist in later life, but it includes also some brief sequences of the artist at work at the easel in his home-studio. The home-studio is a modest single-family dwelling in suburban Albuquerque that contains, off the living room, a small workspace with desk, easel, and painting table where Hammersley created his paintings (figs. 1 and 2), plus another work area off the kitchen where he made their frames by hand (East, 2012: 22).

Figure 1. The painting space at Frederick Hammersley's home studio. Photograph: Alan Phenix, Getty Conservation Institute.

Figure 2. The artist's painting table with tubes of oil paints (mostly, but not exclusively, Winsor & Newton) organized by hue. For each paint type, Hammersley had prepared a color swatch at full strength and in tint with white. Photograph: Alan Phenix, Getty Conservation Institute

An early Hammersley record of the development of a painting

Hammersley worked in a variety of media, but abstract paintings in oil were the dominant form of his creative output. The early works from 1953 through to the late-1950s that first drew the attention of critic and curator Jules Langsner were what Hammersley called his 'hunch' paintings: compositions that unfolded on the canvas or panel by the painter sequentially adding shapes guided purely by intuitive responses to compositional elements that he had laid down already (Shields 1991; East 2012: 17).[4] By the early 1960s Hammersley's painting would diverge into two quite distinct creative modes that recurred and

Figure 3. *In front of,* 1956. Oil on masonite in handmade frame, 24¼ × 36 in. © Frederick Hammersley Foundation. Reproduced with permission.

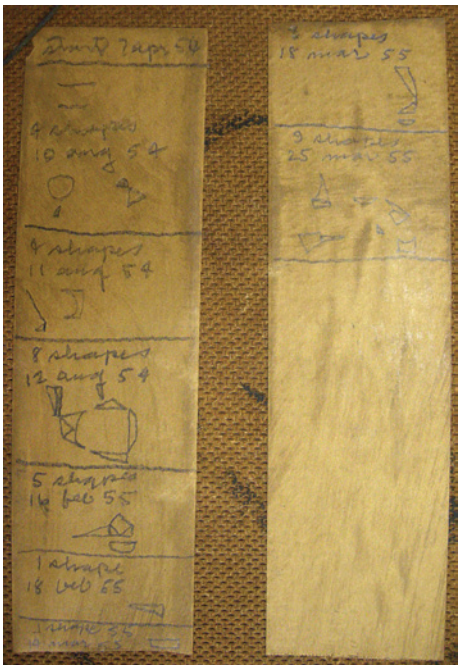

Figure 4. Labels on the reverse of *In front of,* 1956, with Hammersley's notes of the dates on which particular shapes were added. Photograph: Alan Phenix, Getty Conservation Institute © Frederick Hammersley Foundation. Reproduced with permission.

alternated throughout his working life: his 'geometrics' which were pre-planned, analytically conceived 'hard-edge' compositions, and his 'organics' which were fluid arrangements of curvilinear shapes composed following an intuitive, responsive approach that had origins in the 'hunch' works. One of his early 'hunch' works of the mid-1950s bears evidence of Hammersley's inclination towards recording his creative process, which would become progressively more structured over the next decades: his 'hunch' painting *In front of,* 1956, still retained by the Hammersley Foundation, has on its reverse side a pair of brown paper labels with notes in Hammersley's hand that record the dates on which particular sets of shapes were added (figs. 3 and 4). The notes are not perfectly complete—a number of shapes in the finished composition are missing from Hammersley's annotations—but they are sufficient to reconstruct the general sequence of intuitive responses through which the composition evolved on a blank, palette knife-scraped gray-white priming.[5]

The artist's notebooks and other memoranda

But the early instance on *In front of,* 1956, just described of the artist recording his practice of painting pales when set against the notebooks and other memoranda that Hammersley started compiling systematically from 1959 onwards. The notebooks and papers are quite well known to Hammersley scholars and commentators, and excerpts from some of them have already been reproduced in print, most notably in Traugott, 1999: 14-15, 24-25 and East 2012: 18, with perhaps the most extensive presentation being that in King & Armitage 2009: 50-59. However, to our knowledge their contents have not been studied in depth, especially with regard to the light they shed on technical aspects of Hammersley's practice. Understandably enough, considerable interest has been attached to his distinctive approach to creating and assigning painting titles, which are often puns or plays on words: among the collection of artist's memoranda is a folder containing loose sheets of manuscript notes (over 100 pages in total; somewhat inconsistently numbered and dated), compiled as lists in columns, of possible titles created by free association of thoughts (fig. 5).[6] Words or phrases that caught Hammersley's attention as candidates for titles would typically be circled, and the same device might be used for instances of a title being assigned to a particular painting, though this process is also occasionally indicated also by small compositional sketches of the works concerned.

At the time (end of the 1950s) when Hammersley's painting began to diverge into the separate modes of 'geometric' and 'organic' painting, he started compiling different series of books that served various purposes connected particularly with the geometric compositions. The artist's self-compiled books fall essentially into three categories: *Notebooks* (his term), *Composition books* (our term) and *Painting books* (also his term). In order to see the role of these books in Hammersley's creative process, it is perhaps most convenient to look at these books separately in turn.

Hammersley's *Notebooks*

The set of four books that Hammersley called his *Notebooks* are essentially sketchbooks in which he explored, by means of small schematics, compositional arrangements of shapes, a

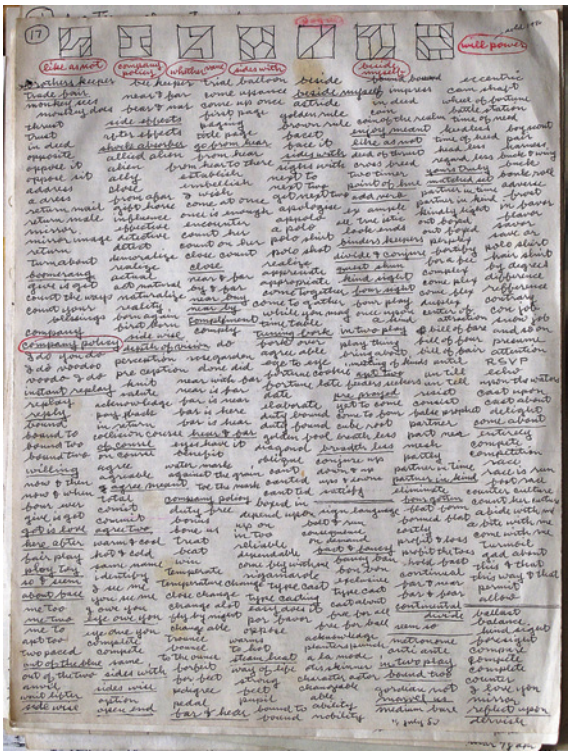

Figure 5. Page from folder of loose sheets manuscript notes of possible titles which Hammersley compiled by free association of thoughts. The titles are often plays on words or puns. This page, from mid-1980, also includes small compositional sketches of the paintings to which specific titles are assigned. The composition third from left corresponds to the finished work *Whether vane* (#2-1980) (fig. 6). Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

Figure 6. Frederick Hammersley *Whether vane,* #2-1980. Oil on linen, 45 × 45 in. (114.3 × 114.3 cm). Private collection, Houston, Texas. © Frederick Hammersley Foundation. Reproduced with permission.

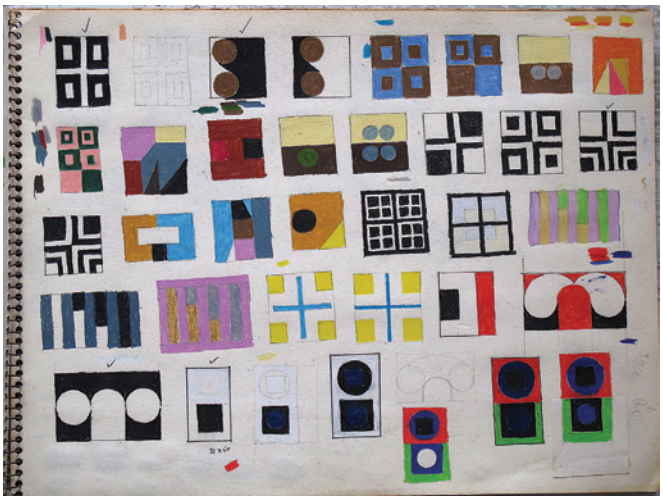

Figure 7. Page from Hammersley *Notebook #2* showing a series of compositional trials for his geometric paintings. Some of the compositions are ticked to indicate his approval. The sketch extreme top left corresponds to the painting *Bound* (#5-1963). Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

substantial proportion of which are worked up in color (figs. 7 and 8). Color is mostly rendered by colored pencil, but later on, (oil) paint is used occasionally. The *Notebooks* are numbered in sequence #1–#4; the first starts in the late 1950s and continues into the early 1960s (it contains recognizable sketches for paintings from this period, such as *Now #5*-1961); *Notebook #2* appears to cover the period 1961–1965; *Notebook #3* covers the period from 1964/5 through to the late 1970s; and *Notebook #4* runs from March 1980 through to the late 1990s, dates from which years occur on the last pages.[7]

The *Notebooks* become progressively more consistently structured as time passes, such that by the middle of *Notebook #3,* which is on ruled paper, the compositional sketches are neatly arranged in 5 × 6 grids (fig. 8). In many cases, the sketches clearly show conscious explorations of particular compositional ideas (such as combinations of diagonals with orthogonals) and color schemes. Individual sketches are often annotated, for example to indicate the top edge to the work or to suggest reversal of the composition; but the most common annotations are indications of approval by ✓ marks, with further assent indicated by double ticks, circling or underlining. Multiple annotations of approval by Hammersley do not necessarily correlate with his working up of the composition to larger format (in one of the composition books or to a completed painting): un-ticked sketches were, it seems, still often worked up to a finished painting. Also, exactly corresponding preliminary compositional sketches cannot always be found for finished paintings.

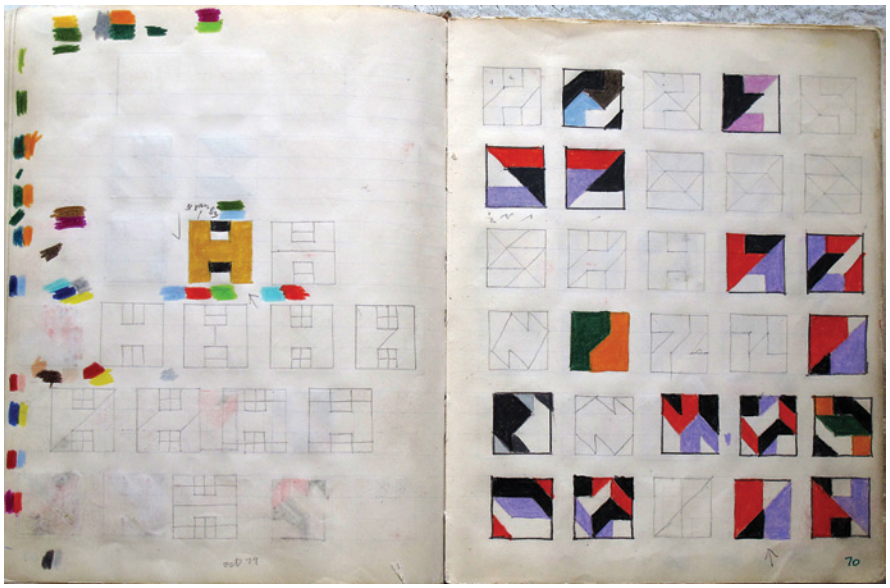

Figure 8. Page from Hammersley *Notebook #3* showing trials for his geometric paintings. The sketch row 3/column 4 becomes *Whether vane* (#2-1980), and the sketch row 4/column 5 becomes *I agree* (#4-1980). Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

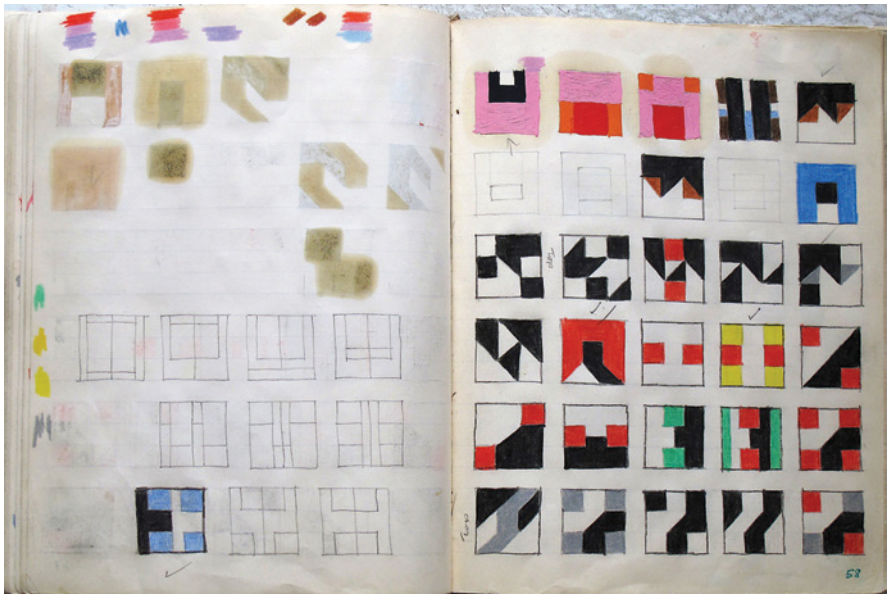

Figure 9. Hammersley *Notebook #3,* f.57*v* and f.58*r*: compositions from 1977. The double-ticked sketch in the fourth row of f.58*r* corresponds to that of an unfinished painting that the artist only commenced painting in 2005 (fig. 10). f.57*v* shows bleeding of the oil paint used to color compositional sketches on the recto. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

The notebooks are especially interesting for the way they reflect Hammersley's thought processes and illustrate his explorations of particular compositional devices. We see the trials involved in the evolution of particular compositional arrangements that eventually lead to finished paintings. There is good reason to think that the artist continually referred back to earlier compositional trials, as recurrent themes are evident in the notebooks, instances of which are sometimes separated by quite long periods of time. Hammersley's inclination to return to compositions devised many years earlier is perhaps nowhere better illustrated than by a compositional sketch on f.58*r* of *Notebook #3* (fig. 9): that second from left in row 4. He re-visited this 1977 composition much later in life and an unfinished, unsigned painting of this composition, commenced in 2005, remains at the house/studio (fig. 10).

The *Composition books*

Together with the small format notebooks described above are two larger format (US letter size) books that we have called *Composition books*. Apart from the first two pages of *Composition book #1* which contain drawings of hands, they are essentially devoted to colored compositions for geometric paintings elaborated from the sketches in the *Notebooks* (fig. 11). *Composition book #1* is signed and dated Oct. 1964 and extends seemingly to the middle of 1981; it includes on the first page a note in Hammersley's hand: *"ones that are checked (✓) are ones I painted—mostly 45 × 45″."* *Composition book #2* is signed and dated Nov. 1979 on the inside cover and entries in it continue from then right through to 2005.

Starting off somewhat irregularly organized on the page, the colored compositional trials become progressively larger and more systematic in the early part of *Composition book #1*, finally settling into a consistent format of 6 per page at f.26 (fig. 12). In similar fashion to the *Notebooks*, at first the compositions are mostly hand-colored with colored pencil, but for compositions made in the early 1970s (*Composition book #1*, ff.22–43)

Figure 10. Unfinished painting by Hammersley on his easel in the studio, set up together with one of the two entries for this design in *Composition book* #2, and the entry for the work in *Painting book* #4. Although the artist started on this painting in 2005, this particular composition originated in 1977. Photograph: Alan Phenix, Getty Conservation Institute Painting and notebooks: © Frederick Hammersley Foundation. Reproduced with permission.

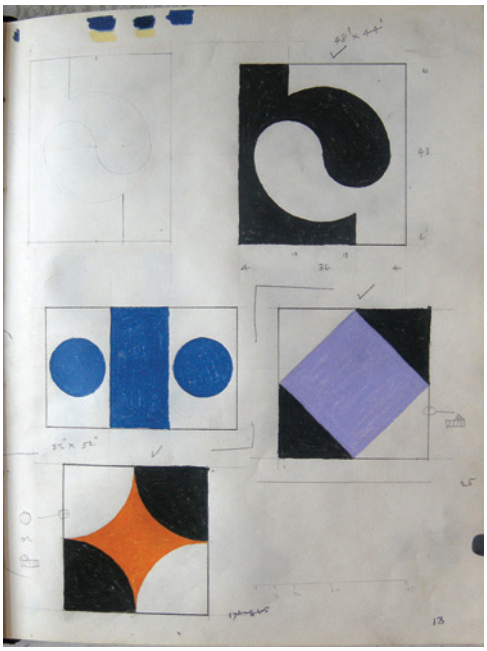

Figure 11. An early page from Hammersley *Composition book* #1: f.13*r*. The ticked composition center right becomes the finished painting, *Double duty* (#20-1965), on stretched linen canvas, which has an unusual beveled outside edge. The compositional sketch includes a small cross-section drawing of how the bevel was achieved by means of triangular bead applied to the stretcher bar. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

stuck-on pieces of paper are also used intermittently to render the shapes, alongside crayon-coloring. From f.43 (1974) of *Composition book #1* onwards, continuing right through *book #2*, the compositional schematics are mostly colored with oil paint, the medium of which often soaks through to the verso of each page, especially in areas of black. Through the latter half of *book #1* the compositions become annotated in more detail, especially with regard to specific paints used for the rendering of particular colors, and in *Composition book #2* the large majority of compositions have notes by Hammersley on paint choice (fig. 12), often being quite specific about both the paint color/pigment and the paint brand used (Winsor & Newton, Talens Rembrandt, Grumbacher, Lefebvre-Foinet, Weber, Permanent Pigments, etc.).

Some of the designs appear more than once in the *Composition books*; the most notable instances of multiple renditions are those for the red/violet/black/white compositions—highlighted earlier (fig. 8) in the discussion of Hammersley's *Notebooks*—that become the paintings *Whether vane* (#2-1980) (fig. 6) and *I agree* (#4-1980), which first appear on f.72*r* of *Composition book #1* (fig. 13) and are repeated several times thereafter.[8]

The entries in the *Composition books* naturally coincide closely with Hammersley's main periods of activity on the geometric paintings; there is an eight year gap in entries for the period between 1984 and 1992, during which time his painting output comprised predominantly organics. Entries for geometrics resume again in November 1992 (*Composition book #2,* f.21*r*) following on immediately from the compositions from the earlier period. There is another temporal break in mid-1999 (the year of Hammersley's 80th birthday), but the painted compositions start being added again in August 2004, probably connected with his return to painting that was seemingly catalyzed by renewed outside interest in his work. The last two compositions are dated 2 Nov. 2005 and include the design for the *non finito* painting already noted (fig. 10).

The *Painting books*

While the *Notebooks* and *Composition books* just discussed illustrate beautifully the creative thought processes behind Hammersley's geometric paintings, in terms of technical information regarding the painter's practice, it is the series of four books that Hammersley called his *Painting books* that

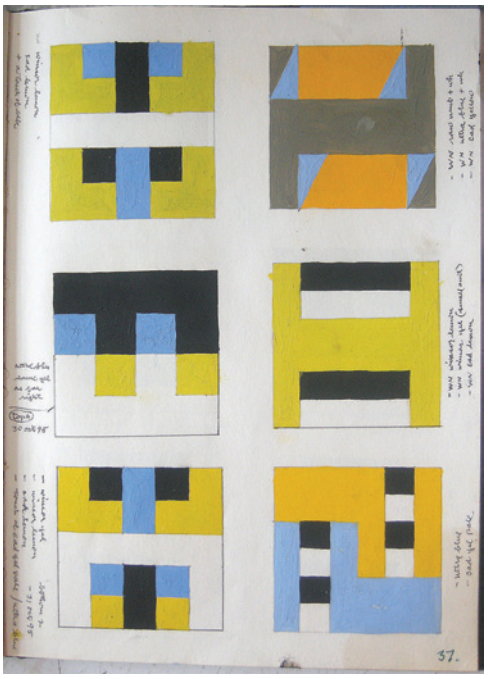

Figure 12. Hammersley *Composition book* #2, f.37*r*. The compositions are colored in oil paint and each is annotated to indicate the particular paints used. As the notes to the left composition in the bottom row suggest, particular colors may consist of a surprisingly broad mix of differently pigmented paints: here, the yellow is a mixture of four different paints—Winsor yellow, Winsor lemon, cadmium lemon, and a touch of cadmium yellow pale. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

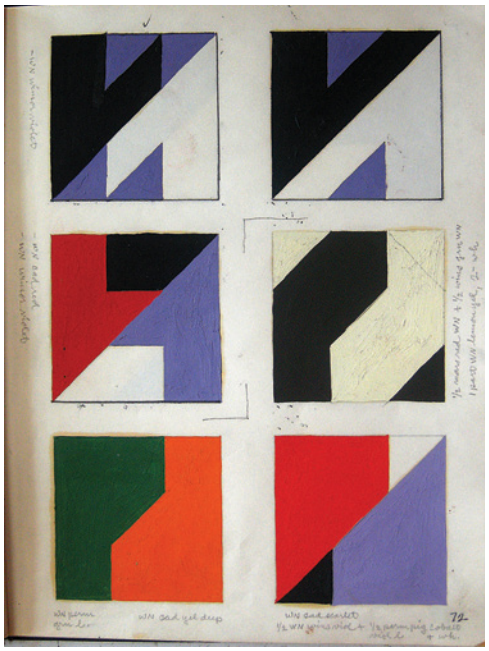

Figure 13. Hammersley *Composition book* #1, f.72*r* showing the first instances of the compositions that become the paintings *Whether vane* (#2-1980; middle row, left) and *I agree* (#4-1980; bottom row, right). These compositions each appear several other times in the composition books, with some color variations. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

represent the real mother lode. The *Painting books* are chronological lists of finished (mostly geometric) paintings that variously include details of materials and process, together with thumbnail sketches of the compositions.

Painting book #1 starts in 1959 with compositions that might considered transitional between the 'hunch' paintings and the later, purely 'geometric' works (fig. 14). The entries at this time are short consisting just of: the painting number (following the number/date system that he retained for the remainder of his working life); the dimensions; the type of support; the type of ground; [9] the title, and a schematic line-drawn sketch; sometimes also with notes on the start and finish dates, and additional facts such as sales, prize awards and so on, and occasional observations on re-use of a unfinished work as the support for a new composition. However, the *Painting Book* entries become progressively more detailed during the course of the 1960s, particularly after 1968 when Hammersley moves to Albuquerque; and by 1971 they consist of a detailed record of the specific materials and process involved in the creation of each work, even down to the number of times a canvas was wetted and pre-stretched, and the particular mixtures of tube paints that were combined for the purpose of painting specific shapes (fig. 15).

A typical example of the later *Painting book* entries: *Whether vane* (#2-1980).

The particular example illustrated in Figure 15 is the *Painting book #4* entry for *Whether vane* (#2-1980), the corresponding *Notebook* and *Composition book* entries for which we have encountered earlier. Here we see Hammersley describing all the details of materials and process involved in the making of the finished painting. The auxiliary support consists of 'extra heavy' stretcher bars[10], which the artist finishes himself by sanding the edges, sealing with shellac and polishing with wax.[11] The canvas in this instance is a Utrecht double-weave unprimed linen, which Hammersley takes the effort to wet and stretch repeatedly in order to de-crimp the fabric.[12] After sizing with rabbit skin glue,[13] the canvas is primed with three coats of acrylic gesso.[14]

Quite typically for the geometrics, the painting is done in two main stages for each color that Hammersley refers to as first and second coats, followed by one or more final 'touch up' stages;

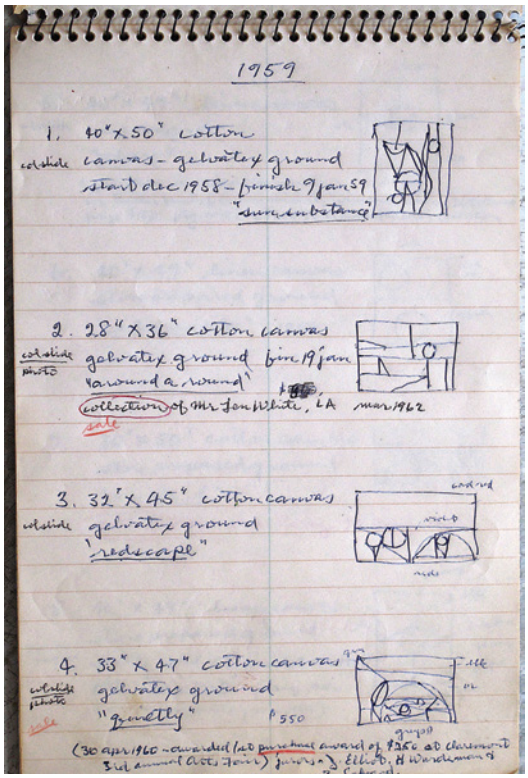

Figure 14. First page of entries in Hammersley *Painting book #1* (1959–63) showing completed paintings, listed sequentially by number, together with a line-drawn thumbnail sketch, title, and other notes on dimensions, support, ground, sales, etc. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

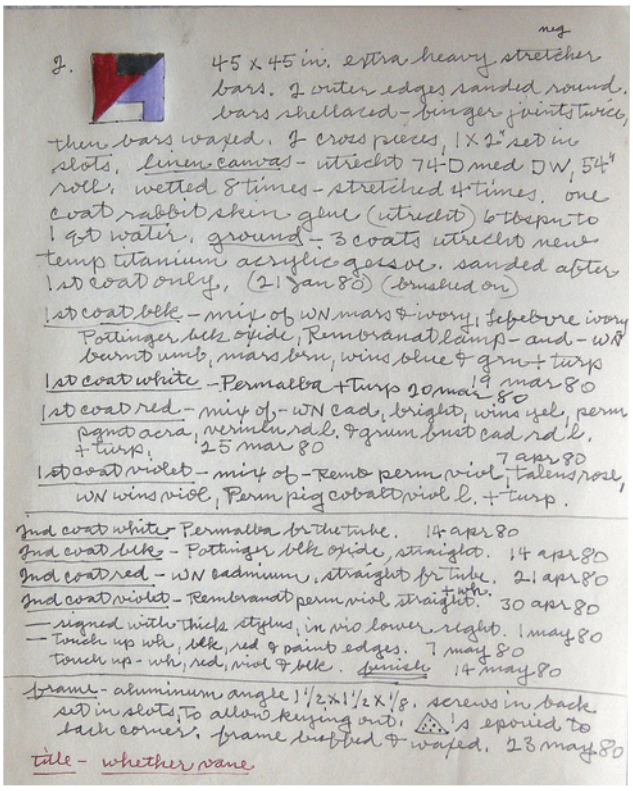

Figure 15. *Painting book #4* entry for *Whether vane* (#2-1980). The format is typical for the *Painting Book* entries from the early 1970s onwards, and includes all the details of canvas preparation, paint compositions, sequence of painting, and framing. Photograph: Thomas McClintock © Frederick Hammersley Foundation. Reproduced with permission.

though there are instances in some works of certain shapes getting three or even four coats, for one reason or another.[15] The paints used for the first and second coats of each color are mentioned by maker and shade/pigment;[16] and in this particular entry we see a distinctive feature of Hammersley's painting practice: the first coats are composed of quite complex mixtures of different paints thinned with turpentine, while the second coats are usually single paints (or at least very simple mixtures) applied straight from the tube.[17] Here, in *Whether vane* (#2-1980), the first coat of violet is a mixture of four paints: *Talens Rembrandt 'Talens rose', Talens Rembrandt* 'Permanent violet', *Winsor & Newton* 'Winsor violet' and *Permanent Pigments* 'Cobalt violet light'; the first coat of red is a mixture of six paints: *Winsor & Newton* 'Cadmium red', (possibly) *Winsor & Newton* 'Bright red', *Winsor & Newton* 'Winsor yellow', *Permanent Pigments* 'Acra red', *Permanent Pigments* '(probably cadmium) Vermilion red light', and *Grumbacher* 'Finest cadmium red light'; while the first coat black is composed from nine different tube paints: *Winsor & Newton* 'Mars Black,' *Winsor & Newton* 'Ivory Black,' *Lefebvre-Foinet* 'Ivory Black,' *Pottinger* 'Black oxide,' *Talens Rembrandt* 'Lamp black,' plus *Winsor & Newton* 'Burnt umber,' 'Mars brown,' 'Winsor blue,' and 'Winsor green.' In the second coats the violet, red and black colors are essentially just single, straight paints: respectively, *Talens Rembrandt* 'Permanent violet' (with white, presumably *Weber* 'Permalba'), *Winsor & Newton* 'Cadmium red,' and *Pottinger* 'Black oxide.'[18, 19] The painting is signed in the violet shape and then touched up in two stages a week apart, after which it is noted as "finished"; and finally it is framed by Hammersley himself using his usual method for geometrics at that time.[20] The title, developed by the free association of words and phrases described earlier (fig. 5), is then added as a last gesture.[21]

Hammersley was usually extremely rigorous in the completion of the *Painting book* entries; indeed, one of the most remarkable aspects of them is the sustained attention—devotion even—involved in their compilation over the course of five decades. However, there are very occasional instances of errors or omissions, and one such occurrence probably exists in this entry for *Whether vane* (#2-1980). The entry for this painting and others being worked on around the same time (between January and May 1980) includes no mention of varnish. Varnishing was typically the final operation by Hammersley to finish the work.

[22, 23, 24] *Whether vane* (#2-1980), which featured in the 2012 LA Louver show, seemingly still has its original varnish, so this omission of corresponding mentions of varnish in the *Painting book* entry most probably derives from a minor lapse in the artist's record keeping process.[25] It is in connection with varnishing that Hammersley most frequently records having encountered technical difficulties and being dissatisfied with results. There are not infrequent mentions of problems of getting the appearance of his varnishes right, to his satisfaction, especially with regard to evenness; and there are observations too of poor wetting of varnish on certain passages of black.[26]

The general pattern of form and content of the *Painting book* entries that we see exemplified in the case of *Whether vane* (#2-1980) occurs for virtually all of the geometric paintings by Hammersley from the early 1970s until the last entries that are dated to just a few months before his death. There are, accordingly, comprehensive descriptions of well over 160 paintings created by the artist in the period 1970–2008. To that number of 'comprehensive' entries can be added over 200 shorter entries that mostly concern paintings executed before Hammersley's move to Albuquerque in 1968. The mass of detailed information about the artist's methods and materials that is contained in the *Painting books* tends automatically to limit the broader, overall perspectives and conclusions that might be drawn from the contents just by perusing the manuscripts. It is with this tendency in mind that one of the primary tasks identified for this project is to transcribe the *Painting books* into digital text form, and edit the transcriptions [27], so that they are amenable to specific searching; with a longer term goal conceived that the information can be entered into a custom-designed database.

As well as all the factual information about materials and process Hammersley recorded in the *Painting book* entries, there is much to inform also a more general understanding of the artist's attitude to his creations, his craft and his materials. We have encountered already a few of the numerous observations by Hammersley about occasional technical difficulties, about the qualities and properties of particular canvases, grounds, paints, and varnishes, but there are also lovely asides about the color effects and relationships he was trying to achieve[28]; and in one instance a written sigh of relief at actually having finished a particular painting.[29]

In addition to the technical details of materials and process for new paintings, also recorded in the *Painting Books* are quite a number of instances of him repainting passages of earlier works, because of damage, perceived change, or some other personal dissatisfaction. While a good proportion of these occurrences are simply Hammersley 'restoring' his own works, several of his re-visitations to earlier works extend to them being completely 're-done'.[30] The issue of the artist re-rendering paintings from several years earlier, of which there are a handful of mentions in the *Painting books*, presents some intriguing questions about Hammersley's notions of authenticity and his perceptions of how the artistic essence of his geometric compositions is physically embodied. This topic will be explored more deeply in later phases of this study. But in connection with this issue, the observations of Peter Walch, made in his introductory essay in the catalogue of the 1999 Santa Fe show *Visual Puns and Hard-Edge Poems . . .* (Traugott, 1999: 15–16), become pertinent:

> *"After working with drawings* [in the notebooks] *Hammersley would transfer miniature oil paintings to the notebook* [*Composition book*, according to our nomenclature], *six to a page. . . . Hammersley considers these small works* [i.e., the *Composition book* entries] *to be the original paintings, not studies or maquettes. . . . Over the years his notebooks of geometric paintings clarify his artmaking process, serve as the sources for new ideas, and finally catalogue the evolution of Hammersley's best ideas."*
>
> *"This approach contradicts the conventional wisdom which empowers "finished" oil paintings that hang on the wall as the ultimate artistic expression. Instead, Hammersley conceives his oil paintings on notebook pages as finished works that he sometimes enlarges and reworks on canvas in larger format."*

It is evident, both from the finished paintings themselves and from Hammersley's personal testimony to the care he invested in their creation, that he was technically very proficient; highly skilled in the craft, as well as the art, of making paintings. He was clearly very concerned about the longevity of his artistic creations, to which he was attached as if they were personifications that each had individual characters. His *Painting Books* offer wonderful insights into the relationships between his materials, technique and creative intent. His paintings are typically well made, mostly from high quality materials, and they should in the longer term present few unusual conservation problems that are beyond the typical norms for the particular media he adopted.[31] Nevertheless, Hammersley's *Painting Books* are an important reference source for conservators who may, for one reason or another, encounter his work at first hand. It is hoped that this paper provides an appetizing first introduction for conservators to the wealth of information contained in Hammersley's notebooks and memoranda. The work continues of transcribing, editing and interpreting his *Painting Books,* and of making the contents more accessible to conservators, researchers, curators and, especially, the Frederick Hammersley Foundation. We are pleased and grateful that we have had the opportunity to present this work in Albuquerque, where the Foundation is based and where Frederick spent so many productive years; where *"the light is marvelous, and the sky is enormous, and the air is fresh*" (Wechsler 2006).

The artist's *Notebooks*, *Composition books*, and *Painting books*, as well as other archive materials, were kindly donated by the Frederick Hammersley Foundation to the Getty Research Institute, Los Angeles, in November 2013.

ACKNOWLEDGEMENTS

The director of the Frederick Hammersley Foundation, Kathleen Shields, has generously assisted the project by allowing close access to the archive material and to the artist's works that remain in its collection. Help with the project has also been provided by the *LA Louve*r gallery in Venice, California. The gallery kindly allowed Phenix and McClintock to examine paintings that were featured in its Frederick Hammersley show March–May 2102; Elizabeth East and Peter Goulds of *LA Louver* provided helpful advice on content and context. Thanks are also given to our colleagues Andrew Perchuk and Rani Singh in the Getty Research Institute for catalyzing the first encounter with the archive material at the Hammersley Foundation and to Tom Learner for support and guidance.

ENDNOTES

1. See: http://hammersleyfoundation.org/where selected works by the artist are presented.
2. See: http://www.amy-nyc.com/artists/frederick-hammersley/ditto.
3. See: http://www.lalouver.com/html/hammersley_bio_60s.html ditto.
4. Regarding the process involved in the 'hunch' paintings, in her essay Elizabeth East notes: *"In their development, he was not beholden to rules, formal structure, or a pre-meditated plan; rather he began with shape and color and from there the paintings grew, each element inspiring the one that followed."*
5. In the conference presentation itself, a digital reconstruction (done by Tom McClintock in Adobe Photoshop) was offered of the sequence in which the various clusters of shapes were added by Hammersley, according to his own notes on the reverse.
6. On Hammersley's view of titles, Elizabeth East has observed: *"The title offers an aspect of the character of the painting, and alludes to Hammersley's consideration of his paintings in terms of personifications."*
7. A fifth unnumbered spiral-bound notebook contains miscellaneous jottings by Hammersley on pages that were filled in separately from each end of the book, meeting at blank pages near the middle. One cover of the notebook carries the title *windfall* (also the title of a painting by Hammersley retained by the Foundation); the other is titled *no is yes.* The *windfall / no is yes* notebook is filled with all kinds of notes (on European history, color, definitions of words), musings, sketches (of geometric and organic compositions), and quotations; but from the technical point of view, perhaps the most interesting are a series of drawings of frame designs, with schematics of applied decorations and molding cross-sections.
8. The composition of *Whether vane* appears another four times (*book #1* f.73*r,* f.75*r*, f.79*r* and f.82*r*) in the red/violet/black/white color scheme and once where the violet is changed to pale blue (*book #2* f.3*r*); *I agree* appears twice again (*book #1* f.75*r,* f.83*r*) in the red/violet/black/white color scheme and once in a red/pale blue/black/white color combination (*book #1* f.80*r*).
9. Perhaps the main technical feature recorded in the *Painting book* entries up to 1964 is Hammersley's routine use of a ground he refers to as *Gelvatex* (sometimes extended to *Gelvatex Exterior White*), which probably equates with the product of that name manufactured by Shawinigan: one of the few vinyl-based (i.e., PVA) latex/emulsion architectural paints to have been commercialized in the United States. Gelvatex Coatings Corp. had a base in Los Angeles going back at least to the mid-1950s. Hammersley ceases using Gelvatex for his grounds after the move to Albuquerque.
10. There are very few mentions in Hammersley's *Painting books* to the source(s) of his stretchers. Two entries from the early 1990s allude to one supplier being 'Craftcut—Santa Fe', which can be identified as the colorman and stretcher maker *Craft Cut Products* which operated in Santa Fe until 2013.
11. In other entries, as in the case of painting *Sacred and pro fame* (#2-1978), Hammersley goes further to explain his reasons for doing this, which will be familiar to conservators: *"sanded round & bars waxed so as not to cut canvas—& waxing to allow canvas to move easily & to make wood waterproof."* Observations such as this, which occur especially in the later *Painting book* entries, give the strong impression that the artist is writing for posterity and a third party, as much as for his own records.
12. Repeated stretching and wetting is typical of Hammersely's initial treatment of unprimed canvas; instances are recorded where canvas is stretched as many as six times and wetted nine. There are many instances (e.g., the paintings *Black for more* (#3-1972); *You're just like your mother* (#6-1972); *Verb* (#8-1972); and many other examples from early 1970s) where he records further re-stretching of the canvas *after* application of the ground to unprimed canvas. In connection with stretching of pre-primed linen, he notes in his entry for painting *Extra vert* (#2-1975) *"prepared linen is always stretched after painting has first coat of paint."* Quite a broad range of canvases, both primed and unprimed, are mentioned in the *Painting books.* Utrecht and Fredrix are the main suppliers mentioned by name, and the canvases are often evidently obtained by mail order.
13. Mentions in the *Painting books* of size layers being applied—even where the canvas is obviously unprimed, and stretched and grounded by Hammersley himself—are

surprisingly quite few and far between. Where size is mentioned it is usually rabbit skin glue, hide glue or, in an isolated case, gelatin. Hide glue appears mostly in just a small group of paintings done in 1962 most of which have lead white grounds applied by the artist.

14. Utrecht New Temp (titanium white) Acrylic Gesso is Hammersley's preferred ground for unprimed canvases from about 1974 onwards, and he remained attached to that product for the latter part of his working life. Another artist quality primer recorded is Liquitex Acrylic Gesso, which appears a few times 1977–1980. As already noted, in the period before Hammersley's move to Albuquerque in 1968, his preferred ground was Gelvatex vinyl latex architectural paint. Perhaps because of poor availability of the Gelvatex product in New Mexico, after his relocation Hammersley tries an alternative house paint as ground: Sears Best Exterior Acrylic Latex is mentioned in the entries for several paintings from 1970-71: *Versa* (#9-1970); *Scape* (#1-1971); *Back & white* (#2-1971); and *Stronghold* (#5-1971). However, the artist's preference for ground product seemingly shifts quite quickly to an artist's grade product, Vanguard I acrylic polymer (gesso), which was obtained from a 'Duncan Vail Co. LA' (Duncan-Vail Artists Supply still exists in Orange, CA). Several paintings from 1971–72 have the Vanguard I acrylic polymer gesso ground. However, Hammersley notes that *"this ground very absorbent—more so than prepared grounds. . ."*, and excess absorbency is probably the reason for his switch shortly afterwards to the Utrecht product; in the entry for painting *Double talk* (#7-1973) he says of Utrecht acrylic gesso that is *"good—better than Vanguard, not as absorbent"*. As mentioned in the preceding note, lead white grounds are recorded in a small group of paintings done in 1962, but otherwise such grounds are rare: there is also an isolated mention of a lead white ground in one painting from 1969.

15. Hammersley typically signed and dated his paintings by inscribing into the still wet paint with a stylus. Quite a number of instances are recorded in the *Painting books* of him having difficulties with the signature mainly because of the paint being unexpectedly quick in drying; such occurrences are sometimes dealt with by a further application of paint to the area in which the signature was applied, or else signature elsewhere on the painting.

16. Hammersley was seemingly entirely reliant on ready-made artist's tube paints: there are no instances where the artist records making his own paint from scratch, though there are frequent mentions of additions of 'medium' (linseed oil, stand oil, dammar varnish and/or combinations thereof) to the tube paints. The tube paints are mostly premier quality grades from established artists' colormen: Winsor & Newton predominates (over 45 different paint shades are recorded), with fewer instances of paints from Grumbacher, Rowney, Permanent Pigments, Talens Rembrandt, Utrecht, and Lefebvre-Foinet. Weber 'Permalba white' and Pottinger 'black oxide' seem to have been long-serving special favorites of the artist.

17. The palette knife was as much a part of Hammersley's paint application method as the brush, and the thicker consistency implied by "straight from the tube" and lack of thinning with turpentine may at least in part be related to application by palette knife. It should be noted also that Hammersley is renowned for not using masking tape to delineate edges of shapes in his geometric painting: everything is reputedly done "up to the line".

18. The rationale for such complex mixtures in the first coats, especially of black shapes, is not given in the entry for *Whether vane* (#2-1980), but Hammersley does offer an explanation in entries for other paintings. For example, in the entry for *To plus two* (#3-1973) he notes *"should after this use black mix of thalos + umber + blacks for 1st coat only – to give a tough skin. topcoat should be one black to make it easier to match when touching up)";* and in the very last *Painting book* entry for the unfinished work (fig. 10) he notes for the first black coat: *"added colors to give more substance to the black."*

19. Hammersley's paint mixtures from the 1st coats could be considerably more complex than occurs in the case of *Whether vane* (#2-1980). For example, the entry for painting *Beside myself* (#5-1980) describes [characters in italic are editorial extensions]:

    "1st coat black - mix of - perm*anent* p*i*gme*n*ts acra red, grum*bacher* finest viridian, French ultra*marine* blue, WN (*Winsor & Newton*) burnt umb*er,* van dyke bro*w*n, wins*or* blue + (*winsor*) gr*ee*n, Rembrandt ivory (*black*) + lamp bl*a*ck, Pottinger bl*a*ck oxide, Lefebvre ivory bl*a*ck, WN (*Winsor & Newton*) ivory (*black*) + mars (*black*) + turp*entine.* 25 mar 80

    1st coat blue - mix of WN (*Winsor & Newton*) ultra*marine,* wins*or blue,* cerulian (*cerulean*), viridian + grumb*acher* finest ultra*marine,* viridian + wh*ite* + turp*entine.* 31 mar 80"

    Thus, the first black coat is actually a mixture of 13 different tube paints, thinned with turpentine; the first blue is a mixture of seven paints.

20. For Hammersley, both with his geometrics and organic paintings, the frame was an integral part of the presentation of the painting over which he devoted a great deal of care and attention. Frames were made by hand seemingly without much assistance from power tools. Wood frames, more commonly used with the organic works, were often custom-designed, finished and patinated to suit each individual composition. For the geometrics, simple frames made from L-section aluminum were the norm; Hammersley fabricated them

himself from scratch, joining and reinforcing the corners with aluminum triangles (sometimes perforated to increase adhesion, as indicated here in his schematic diagram) glued with epoxy. Keying out of the stretcher is accommodated by the mounting of the painting in the frame by means of slots; among the miscellaneous papers in the archive materials at the Hammersley Foundation are a set of instructions by the artist for keying out canvases mounted in frames of this type.

21. Sometimes the title entries are dated, and often there is a substantial time period between completion of the painting and the assigning of the title to the painting, or at least the entry of the title into the *Painting book*.

22. Following good technical practice, Hammersley typically left several months between finishing the painting and final varnishing. In similar fashion to his paints, the artist seemingly relied just on ready-made proprietary varnishes, of which several types are mentioned. Grumbacher dammar varnish occurs occasionally, especially with paintings made in the mid-1960s, but Hammersley's varnish preference is more usually towards Winsor & Newton products: 'Winton Picture Varnish' (regular and matte) and 'Retouching Varnish,' often in mixture. Occasionally, he adds beeswax himself as matting agent, in which case varnish is sometimes described as "brushed on warm." Both brush and spray application are noted in *Painting book* entries.

23. Given the ubiquity of varnish in Hammersley's painting practice, and his general preference for Winsor & Newton 'Winton' varnishes that were based on polycyclohexanone varnishes (Ketone Resin N; Laropal K80)—known to be relatively vulnerable to photo-oxidation, with all its attendant effects of discoloration, loss of gloss, micro-fracturing, opacity—it seems inevitable that varnish-related issues will be one of the primary deterioration phenomena to manifest itself in (geometric) paintings by the artist. Change in solubility/removability of the 'Winton' polycyclohexanone resin varnishes is to be expected.

24. It is clear from the *Painting books* that Hammersley typically worked on a batch of paintings at the same time, often doing similar things to them (priming, painting, framing) in groups. Varnishing was no exception, and the *Painting books* provide indirect record of Hammersley's 'varnishing' days; for example on 13 October 1977 he varnished at least 15 different paintings, all with *"Winton + beeswax brushed on warm."*

25. Features occur very occasionally in the *Painting Books* to suggest Hammersley had a separate method of tracking the details of materials and process with each painting, which served as the primary source of information for the full entries and which were retrospectively transcribed *en bloc* from the primary source. We suspect that the primary tracking method might have been something akin to labels attached temporarily to works in progress. Some works in progress at the time of the artist's death, which are retained by the Hammersley Foundation, still have annotated labels attached to them that describe technical information.

26. Three such instances are:

    Seem same (#1-1978): "varnish - WN Winton + 1/3 retouch (bl*a*ck resisted varnish like grease. brushed several times. when dry, apply 2nd coat) 9 July 78."

    Cross reference (#10-1980): "varnish - WN Winton brushed on, bl*a*ck rejected varnish, beaded. wipe off & varnish wh*i*te*s* & blues - 3 mar 81. - again, on bl*a*ck only, 27 mar 81 some rejection."

    Pre prayed (#1-1981): "varnish - WN Winton + little WN retouch, brushed on. (note - Rembrandt ivory bl*a*ck from tube gives a shiny surface which resists, puddles the varnish - Winton full maybe?-had to go over many times)."

    In all of them the final black paints are, or contain a substantial proportion of, *Rembrandt* 'Ivory black.'

27. The main editorial operations include extension and clarification of the abundant abbreviations—somewhat inconsistently applied—that Hammersley used when compiling the *Painting book* entries, which are necessary to allow reliable searching of the content for specific words and phrases.

28. Hammersley's desire to achieve particularly nuanced color relationships is perhaps best reflected in the entry for the beautiful small painting *Cool de sac* (#29-1977), which features just three color fields (pink, red and dark grey), two of which required multiple paint coats before the artist was satisfied with the result:

    "<u>4th coat grey</u> - Remb*randt* Tit*anium* wh*ite* & WN *(Winsor & Newton)* mars bl*a*ck + stand oil, dam*m*ar & med*ium* 10 apr 78. (made lighter. interesting in that as I finally got right value the coolness, lavenderish of the grey tied into, or echoed, to the pink)"

    Here we see also an instance of Hammersley adding medium (stand oil, dammar) to his tube paints. *Cool de sac* (#29-1977) features a great deal of palette knife work and the added medium may have been to aid handling properties by that application method. Whatever the cause, this work has an especially attractive surface quality.

29. The entry for Hammersley's painting *Fox trot* (#7-1980) finishes:

    "<u>touch up</u> - wh*ite,* + paint edges - + bl*a*ck. 13 aug 80

    bl*a*ck, wh*ite* + blue - + thank god, <u>finish</u> 22 oct 80"

30. The period between 1966 and 1970/1—which corresponds to his last two years or so in California and the first couple of years at the University of New Mexico—is the time during which Hammersley seems to have had

greatest impulse to re-visit, in one way or another, paintings made earlier. By his own admission, in the years leading up to his move to Albuquerque he had experienced a serious creative block: his own work *"had kind of come to a stillness"* (Wechsler 2006). This "stillness" is reflected in output of finished paintings which diminishes markedly during these years: 25 finished paintings are recorded in 1965, but 1966 features just nine; 1967 three; 1968 none at all; and only one in 1969. The period around the transition from California to New Mexico seems to have been a reflective time for the artist, and this reflective mood might be sensed in his inclination to re-visit works made some years before. Between 1966 and 1971 he had cause to completely re-paint at least seven paintings from 1965 and earlier, though for reasons that are not usually mentioned in the *Painting book*. (One of these 're-done' paintings even gets re-painted a second time a few years later because of damage to the second version.) The reflective, transitional mood might also be detected in *Painting book* entries from 1970 that feature atypical technical experimentations (not always successful), and the adoption of new materials. By the end of 1971 he had re-discovered his creative energy to the extent that he could later reflect on the relocation to Albuquerque (and, by implication, his decision to leave the University of New Mexico to focus on his painting) that *"It was the best move I ever made, because the decade of the seventies was the best, most productive decade I've ever had"* (Wechsler 2006).

31. We do, however, know of one unusual response of an early Hammersley painting to a conservation treatment: during aqueous surface cleaning, swabs acquired a bright yellowish color possibly because of extraction of some soluble component. The cause of this phenomenon has not been investigated, but a connection with Gelvatex PVA (?) as ground cannot be discounted.

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THIS PAPER HAS NOT UNDERGONE A FORMAL PROCESS OF PEER REVIEW.

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Relating Artist Technique and Materials to Condition in Richard Diebenkorn's Ocean Park Series

ABSTRACT

*This paper is the continuation of an earlier two-year research project where four of Richard Diebenkorn's Ocean Park paintings were compared based on their current condition and materials used. The four paintings chosen included two with severe cracking, (*Ocean Park No. 111, *Hirshhorn Museum and Sculpture Garden, and* Ocean Park No. 96, *Guggenheim Museum, NY) and two that exhibit minimal cracking, (*Ocean Park No. 115, *Museum of Modern Art, and* Ocean Park No. 125, *The Whitney Museum of Art). Materials analysis was completed for all four paintings, and the two paintings that exhibit cracking were found to contain an acrylic preparatory layer.*

In continuing this in-depth look at Diebenkorn's Ocean Park series, about 40 additional paintings were examined and 14 paintings were sampled for analysis. Ground and paint samples were analyzed using Fourier transform infrared (FTIR) and pyrolysis-gas chromatography–mass spectrometry (Py-GC-MS) to determine medium. Alkyd and oil paints were identified throughout the series. Cross-sectional analysis and SEM-EDS were completed to determine the layering structure and the elemental composition of the paints.

The analytical work revealed changes in the artist's materials during the time span of the series. For example, analysis of paintings from 1974 to1979 suggests that Diebenkorn started incorporating clear synthetic preparatory layers in addition to pigmented gessos. This clear layer was confirmed to be Rhoplex AC-33, which was readily available during the time in which the paintings were executed. Cross- sectional and microscopic examination of the paintings also indicated that Diebenkorn prepared a few of his own grounds by mixing clear acrylics with white pigments. Furthermore, by 1979 through the end of the series, analysis suggests that he favored pigmented commercial acrylic gessos almost exclusively.

Condition issues in this series were also documented, and a database was created to chronologically track material changes in the paintings and visible areas of instability. Correlations between his choice of painting materials and the general condition of the paintings were noted. In general, paintings that contain layers of brittle alkyd and oil paints over clear synthetic preparatory layers exhibit more severe cracking than those that do not exhibit this layering structure. This observation is illustrated in the database. Pre-1974 paintings tend to be in better condition than some of the mid-series paintings, where unconventional layering structure is observed. Also, when the artist started using commercial pigmented acrylic grounds around 1979, the number of paintings effected by surface cracks diminishes. Painted areas that consist of multiple layers also generally fare worse than areas without heavy layering and reworking.

The author also worked with the Richard Diebenkorn Foundation to establish travel histories for individual paintings and referred to historical photographs to verify analytical data and visualize previous incarnations of paintings that had gone through multiple stages of reworking. Studio assistants and fellow artists were also consulted to help understand Diebenkorn's studio techniques and philosophies.

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BARBARA A. RAMSAY

Challenges and Choices in Conserving an Early Abstract Expressionist Painting by Clyfford Still

ABSTRACT

The responsibility for conserving paintings in the Clyfford Still collection over many years brought with it a range of condition issues and conservation challenges that have necessitated not only technical expertise but a sensitive approach to interpretation and serious ethical consideration. Clyfford Still's painting, 1943 (PH-286), *provides an important early example in the artist's development as one of the first Abstract Expressionist painters. In this painting, Still takes the leap from his abstracted, but still recognizable, human forms to the fully abstract paintings that have become associated with his name. Structurally, this painting was found to be relatively sound, apart from some localized cracking, minor lifting of paint, and minimal paint loss. Aesthetically, there were condition issues that could be seen to compromise the original intent of the artist. Pronounced drying craquelure had developed over large sections of the fields of black paint, exposing white underlayers. In addition, a coating applied at an unknown date had reticulated and discolored to a dark brown color. It was not entirely clear whether the variable degree of gloss observed across the painted surface was intentional or the result of changes in the painting materials. The high degree of sensitivity of Still's paints to water and organic solvents further complicated decisions that were to be made regarding conservation of the painting. The conservator responsible initiated a dialogue regarding this painting—its materials and techniques, the causes of changes in its appearance, options for its conservation, and pros and cons of potential approaches to treatment—which continued over several years and involved conservators from the ARTEX Conservation Laboratory, several conservators from museums and the private sector, and conservation scientists. The family of the artist, the museum director, and scholars also expressed their opinions with respect to what the artist would have intended, what the work* should *look like, and how the work would represent the artist to a public that had never before seen his paintings. Scientific analysis was carried out in order to identify some of the materials employed by Still in this painting. Archival materials were also studied in an attempt to better understand the artist's intentions. A recurring question arose during these deliberations: "Should we hold the artist accountable for the materials and techniques that he has used, or should we attempt to re-introduce aspects of his original intent as we perceive them?" This presentation will describe some of the conservation issues raised by the study of this Clyfford Still painting, the treatment options considered, the ethical concerns, and the eventual conservation work undertaken in preparation for installation in the inaugural exhibition of the Clyfford Still Museum that opened in Denver in November of 2011.*

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ANNE GRADY AND JENNIFER HICKEY

Treatment of Izhar Patkin's *The Black Paintings*—Collaboration and Compromise

ABSTRACT

This paper presents the year-long treatment of Israeli-American artist Izhar Patkin's 1986 installation, The Black Paintings*, undertaken collaboratively by The Museum of Modern Art's Sculpture and Paintings Conservation Departments. The circumstances and rationale that shaped the course of treatment are addressed.*

The complications and practical limitations of treating such a work are discussed and placed in the broader context of the conservation of modern and contemporary art. In the case of The Black Paintings*, size, material construction, and current state of preservation all posed challenges to the development of a suitable treatment time frame, workspace, and budget. Beyond treatment, proper housing and handling also required reassessment. Finally, as is common in contemporary art conservation, consultation with the artist served as a valuable resource. The advantages and complexities arising from access to a first-hand articulation of artist's technique and intent is explored.*

This treatment encapsulates some of the common challenges facing the conservator of contemporary large-scale, mixed-media artwork. Adaptability and compromise are essential to achieving balance between artist's intent, realistic limitations, and the object's preservation.

INTRODUCTION

The treatment of Izhar Patkin's installation, *The Black Paintings*, highlights complexities commonly encountered in conserving contemporary art. In undertaking stabilization of this piece, the realistic limitations of the treatment prompted debate and reevaluation of textbook conservation practice and priorities. Collaboration—working across traditional conservation specializations, with professionals outside the field, and with the artist—was key to building consensus for a workable treatment strategy and for adjusting that strategy as needed. As fine art practice has become increasingly broadly defined, the conservator has responded in turn, resolving new preservation challenges through collaborative ingenuity and problem solving.

The Black Paintings

The Black Paintings is the sole work by artist Izhar Patkin in the Museum of Modern Art's collection. Patkin works as a painter and sculptor, experimenting with a range of materials, from rubber and metal in early work to more recent installations using tulle. Born in Haifa, Israel in 1955, Patkin attended the Corcoran School of Art in Washington, D.C. He moved to New York City in 1979, exhibiting under the representation of Holly Solomon. Mr. Patkin currently lives and works in New York.

The Black Paintings was a significant undertaking for Patkin, produced, beginning in 1985, over the course of two years. The piece is comprised of twenty-two pleated neoprene panels, each just over fourteen feet in height, installed directly adjacent to each other. Together, the panels cover the entire wall space of a twenty-two by twenty-eight foot room. The installation combines traditional painting and sculpture techniques with unconventional materials to create a distinct environment in which the viewer experiences the work.

The work derives its pictorial content from a 1958 play by French author Jean Genet entitled *The Blacks: A Clown Show*. Genet's play, which directly confronts issues of racial inequality and stereotyping, enjoyed significant off-Broadway success during the early 1960s and featured such prominent actors as James Earl Jones and Maya Angelou. In Patkin's work, each of the four walls depicts a tableau based on a scene from the play. The baroque, politically charged imagery of *The Black Paintings*, along with the work's overwhelming scale and presence, was

well-received when it appeared in the 1987 Whitney Biennial, and the Museum of Modern Art acquired the work soon after.

Materials and Construction

The Black Paintings represents a pivotal moment in Patkin's career. After years of comparatively modest experimentation with rubber as a medium, the artist, here, expanded to large-scale installation. In materials, construction and imagery, the panels simultaneously recall mural paintings, tapestries and theater. A dense, lively pictorial narrative surrounds the viewer. The materials and monumental scale create an intense visual and atmospheric impact. However, these very factors also proved to be obstacles to straightforward preservation.

The panels are constructed in a largely uniform way (fig. 1). Each panel is composed of neoprene rubber of two different weights. Patkin arranged the neoprene sheets in pleats,

Figure 1. Detail of one of 22 panels. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1 in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art.

Figure 2. Detail of wood bracket. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art.

alternating between the two thicknesses and sometimes layering two or three folds of the neoprene on top of one another. The top edge of each pleated panel is sandwiched between two plywood slats and secured with threaded screws and nails. These wooden brackets both hold the pleated rubber in place and serve as the point at which the panels were mounted to the wall (fig. 2).

When installed, each panel is mounted at fourteen feet and one inch, with the bottom of the panel just brushing the floor. In past installations, the panels were secured by screwing each wood bracket into the wall in an orientation that allowed the pleated neoprene to drape over the bracket. The panels are hung in ordered succession, abutting to create an uninterrupted panorama around the entire room. The loaded imagery, the distinct neoprene odor and the elevated temperatures naturally resulting from the insulating rubber produce a stifling and oppressive environment integral to the viewing experience.

Patkin used stencils extensively in *The Black Paintings*. The paint layers appear to have been primarily spray-applied, though several instances of brushwork are evident as well. Meticulous in considering his materials, Patkin chose to use two different types of paint: an acrylic aerosol, similar to Krylon®, and a vinyl furniture restoration paint, now discontinued, called FabSpray.

According to its patent, FabSpray was registered in 1954 as a "plastic base mineral pigment spray coating for textiles."[1] The artist selected FabSpray paint for its purported resilience and durability, as it was intended for use on supports that endure significant flexing. He envisioned the vinyl paint retaining elasticity over time, moving with the rubber support. In contrast, the comparatively stiff acrylic aerosol spray paint, he predicted, would crack and chip over the years to achieve a patina of sorts as the work aged, a weathered-looking surface.

Figure 3. Detail of the intentional scratching of the painted surface by the artist. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art.

Figure 4. Detail of tears, staples, and artist repairs. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art.

[2] In addition, the artist intentionally scratched areas of the aerosol paint with long primarily vertical swipes, to remove paint and destabilize those areas in order to encourage the development of this aged surface (fig 3). [3] These elements of instability were purposely built into the work to achieve a dynamic visual experience over time.

History of Condition Issues

The materials and the ways in which the artist chose to use them complicated treatment of the work. Patkin's initial conception of the aged patina was not realized in the way he had envisioned, and the interactions between the media proved to be different than what was anticipated. When *The Black Paintings* entered MoMA's collection, the piece already showed marked signs of fragility and instability. In the roughly two years between its creation and acquisition, the vinyl paint, intended by the artist to flex with the neoprene support, instead exhibited stretching, poor adhesion to the substrate and active flaking in the areas of its densest application. The artist was consulted about the condition at the time, and expressed satisfaction with the "fresco quality" achieved through the flaking and loss, and the instability was therefore accepted as part of the work. [4]

Handling an artwork of this, weight and flexibility is cumbersome, and appears to have exacerbated losses to the fragile paint layer. The first consolidation campaign on this work was undertaken in the early 1990s after exhibition on loan.[5] Triage stabilization was undertaken due to time restrictions, and the piece was packed and returned to MoMA, where the panels remained rolled and in storage.

When the black paintings were unpacked for condition assessment in 2011, the work was found to be in unexhibitable condition. The panels were visibly dirty. Chalky degradation products had accumulated across the neoprene surface, especially inside the folds. Loose and gritty, these products were also observed to be stuck to the paint layer. Additionally, the piece exhibited scattered tears—vestiges of the artist's use of staples during early installations—and artist's repairs on many of the panels (fig. 4). Patkin often adjusted the drape of the panels for exhibition by stapling through the rubber directly to the gallery walls. Small tears were not patched, but the artist used commercial rubber repair kits to stabilize larger tears.

Areas that had been previously consolidated remained stable, but other areas of paint were poorly attached to the substrate. There were significant losses, which, if left unaddressed, threatened to irretrievably compromise the legibility of the imagery. Each time the work was handled, more loss occurred.

While Patkin had intentionally incorporated a degree of instability into the work, the actual level of deterioration proved to be more extensive than the artist had anticipated. The panels required immediate attention, but it was first necessary to arrive at an appropriate balance between stability and intended decay. The resulting treatment sought to maintain the intrinsic dynamic nature of *The Black Paintings* while addressing unacceptable change.

Collaboration and Compromise

The work required the expertise of both paintings and sculpture conservators, therefore the two departments collaborated from the outset. An additional, invaluable contributing voice, the artist generously discussed the work and it's preservation with the conservation team. These conversations with Mr. Patkin were essential to the development of a workable treatment strategy. A resource unique to contemporary conservation, the living artist provides insight into an artwork's aged appearance as well as the techniques and thought

processes behind its creation. In this instance, Patkin related his memories of his process in making *The Black Paintings.* He distinguished between areas of intentional flaking, part of the work's manufacture, and areas of unanticipated loss. The artist also maintained a meticulous archive of his materials and working methods. From this, he shared samples of the paints and rubber he used in the 1980s, useful for reference and for making mock-ups.

Working with the artist, however, can also be a delicate negotiation. Typical conservation approaches to repair can be incongruent with the artist's preferences, and differences in terminology can lead to misunderstanding. In initial communications with the Mr. Patkin, for example, conservators failed to understand that in discussing the work's "craquelure," the artist was referring to the intentional losses achieved by his scratching of the paint surface. This is a distinctly different phenomenon than the fine pattern of drying cracks observed in a paint layer that conservators typically associate with the term "craquelure."

Decision-making required reconciling the artist's approval of the flaking paint and losses with his desire to preserve the legibility of the visual narrative. His suggestions regarding storage, while attractive options, were unfortunately infeasible solutions given the limitations of MoMA's facilities. Compromise was necessary to balance the priorities of the artist and the priorities of the museum while honoring the responsibilities of the conservator.

State of Preservation

The artist chose neoprene rubber as his painting substrate for the heavy, oppressive feel it creates when hung in the enclosed space of the installation. Neoprene, or polychloroprene, was released commercially by DuPont™ in 1932. Commonly used for wetsuits and gaskets, this type of synthetic rubber is polymerized by zinc or magnesium oxide rather than sulfur. It is not as prone to rapid degradation from heat and light exposure as is natural rubber.[6]

The current state of the rubber substrate in *The Black Paintings* reflects this robustness. The panels are still supple; the chalky degradation products were primarily confined to the interior folds of the pleats where microclimates accelerate deterioration. The panels, in short, retain their structural integrity.

Despite its relative longevity, neoprene remains a problematic substrate for paint, and stability of the Patkin piece was further complicated by the presence of a release agent on the rubber's surface. As part of the manufacturing process of neoprene, the extruded rubber is coated with a release agent, often talc, in order to prevent the rubber from sticking to itself when rolled. The artist ordered neoprene wholesale from multiple producers; it arrived in large rolls, coated with talc that rendered the rubber surface a hazy gray. Pleased with that surface quality, the artist chose to paint on the neoprene as delivered. He did not prepare the surface with any additional coating, nor did he remove the talc. The presence of this layer has likely undermined the adhesion between the neoprene and the paint.

Contrary to the artist's expectations, the aerosol paint appears to be much better adhered to the rubber than does the vinyl paint. The vinyl paint's flexibility seems to diminish, rather than contribute to, adhesion, resulting in delamination and stretching of those paint layers. The extension of the paint's surface area renders it impossible to consolidate the paint in a way that restores the intended surface quality. The once smooth vinyl surface becomes creased and crumpled like a deflated balloon.

Thick applications of the acrylic spray paint have cured to a brittle film with pronounced craquelure and cupping at the edges. This paint tends to break when encouraged to relax back toward the substrate (fig. 5). In contrast, the areas of thinly sprayed acrylic were largely well adhered and stable.

In addition to the paint's insecurity, the scale of the work and its unrestrained substrate posed handling challenges. The absence of a systematic procedure for safe handling appears to have contributed to paint loss in the past. Extraneous creasing of the neoprene and stress to the paint layer can be readily caused due to the free movement of the panels. During previous installations each panel was hung by screwing the wooden bracket into the wall with the panel was draped over to cover it. This approach required two installers to hold the panel at the left and right, while a third installer stood on a ladder positioned between the panel and the wall and secured the wooden bracket into the wall. This method proved to be

Figure 5. Detail of foreground with stretched vinyl paint and background with brittle spray paint. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art.

cumbersome, time-consuming, and required significant manipulation of each panel. Finally, in order to store the work, each panel was wrapped, paint surface inward, around a Sonotube®. The panels were rolled beginning at the bottom, which required at least 3 people to properly align and roll each of the 22 panels. By rolling from the loose bottom to the bracketed top of the panel, the pleats were more likely to shift out of alignment during rolling. An alternate strategy for movement and installation, intended to streamline the process and mitigate future damage, was necessary.

Treatment

It was evident upon examination of *The Black Paintings* that stabilizing this artwork would be a time- and labor-intensive task. The conservation team developed an intervention strategy that would balance access to the work and its longer-term preservation. However, given the constraints of time, budget and manpower, the scope of treatment was limited, with an emphasis on stabilization.

At the onset of the project, the record of each panel's current condition was outdated and incomplete. As it would have taken several weeks and caused additional paint loss to unroll and assess the condition of every panel, general condition of the work had to be estimated. Therefore the broader treatment plan required re-evaluation as work proceeded panel by panel. Priority was placed on establishing a uniform workflow, one focused on re-treatability rather than reversibility. The panels will continue to require maintenance each time they are installed. Other museum professionals at MoMA, particularly the preparators, were instrumental in developing a new installation and storage program that reduces handling, better serves the long-term stability of the work, and fits realistically within the institution's budget, space, and staffing constraints.

The monumental scale of the panels required a large space dedicated to the project. Space was reserved at the museum's off-site storage facility for two panels to be unpacked and treated at a time. One was hung for pre-treatment photography, condition assessment, and dusting, while the second panel was laid flat on tables for consolidation and repacking (fig. 6). Cleaning and consolidation tests were conducted using a variety of methods and materials before settling on an initial system. Solvent-based adhesives were problematic due to paint sensitivity, and heat -set adhesives appeared to be incompatible with the rubber. Therefore an acrylic emulsion adhesive was chosen to consolidate and patch tears. This adhesive provided a strong bond between the paint and the substrate and is intended to retain a degree of flexibility over time. The aim was to achieve effective adhesion even as the panels are handled and rolled. As treatment progressed, the treatment strategy continuously adapted to increase the efficiency and efficacy of the intervention.

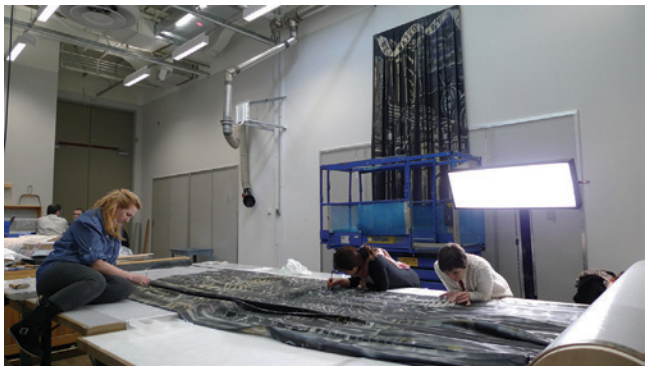

Figure 6. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art. Workflow setup.

Our treatment included realignment of the panel pleats, dry cleaning, stabilization of torn neoprene and consolidation of the paint layer. Areas of imagery that were especially pertinent to the narrative, as discussed with the artist, were prioritized. First, the panels were hung to loosen unwanted creases and to more easily remove dust and rubber degradation. Next, each panel was lowered to the table for realignment and consolidation. Having decided against wholesale consolidation approaches in favor of local stabilization of the paint, this step was the most time-consuming aspect of the treatment. *The Black Paintings* comprises over 1300 ft.^{2} of painted surface.

Several ambitious alternative re-housing strategies were considered, but it was not possible to develop a hanging system that fit realistically within budget and space constraints. In the end, rolling each panel around a tube proved to be the most workable solution. However, the interleaving material, a roughly woven cotton, was replaced. Not large enough to cover each panel, the original interleaf grabbed at the loose paint, pulling flakes away. In its stead, a similar, but finely woven and un-dyed cotton was selected and cut to sufficiently cover each panel.

A detailed, illustrated instruction manual was developed. This manual is integral to the long-term preservation of this work, carefully delineating the necessary staffing and equipment, as well as proper handling procedure. The manual also incorporates clear installation instructions developed with the preparators. The installation procedure was streamlined to minimize handling. Rather than drilling directly into each bracket from beneath the panel, cleats are now secured to the back of each bracket. The panels can now be hoisted and slotted into place without a third person in between the wall and the panel. Mock installation of two panels was useful in testing and refining the new method (fig. 7).

Figure 7. Izhar Patkin, *The Black Paintings,* 1986, Ink and vinyl paint on neoprene, 22 panels, Overall 14 ft. 1in. × 22 ft. × 28 ft. (426.7 × 670.6 × 853.3 cm), Museum of Modern Art. Testing installation procedures with MoMA preparators.

After treatment documentation was completed, the panels were placed in rolled storage. While hanging the panels would have been ideal, space restrictions made this impossible. The move to rolled storage, however, provides better overall support than the crate in which they were previously housed.

Conclusion

Patkin's *The Black Paintings* will continue to pose conservation challenges. The unstable, incompatible materials will require periodic reassessment and intervention. The conservator must prioritize, adapt, and compromise to arrive at a workable preservation strategy. The artist is a valuable resource; discussion and collaboration will continue to be essential to arriving at a balance between material preservation and intended decay.

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JOSEPH G. BARABE

Discriminating Palettes: The Painting Materials of Clementine Hunter and Her Imitator

ABSTRACT

The paintings of Clementine Hunter (~1887–1988), an illiterate and self-taught folk artist from Natchitoches Parish, Louisiana, once sold for pennies but now command prices in the tens of thousands of dollars. Recently, a number of works attributed to her have been suspected to be forgeries. In the course of the criminal investigation into the forgeries, McCrone was contracted to examine a number of works purchased directly from the artist, and thus of known authenticity, and compare their material constituents and visual characteristics with works suspected to be imitations. The comparative analyses proved useful to the investigators, as both the authentic and the suspect groups had distinctive palettes and a number of visual characteristics as well. This paper will summarize McCrone's findings and show the efficacy of the comparative approach, which can be enormously effective in generating data of evidentiary value.

The analytical methods performed on the paint samples included polarized light microscopy (PLM), energy dispersive x-ray spectrometry in the scanning electron microscope (SEM/EDS), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. The results were summarized in tabular form, and charts were created showing the distribution of painting materials and comparing visual characteristics between the known Hunters and the five questioned paintings. Significant differences were found between the known authentic paintings and those of questioned authenticity. This paper describes the analytical methods used, the data generated during the chemical and visual analyses, the conclusions the analyses permitted to be drawn, and the forensic result.

This material was also presented at *Divine Disorder, Conserving the Chaos: Conference on the Conservation of Folk and Outsider Art*, held at the National Council for Preservation Technology and Training in Natchitoches LA on February 15 and 16, 2012, and will be published in a Postprint generated from that conference. It is being published here with permission of the editor.

Authenticity Studies

Assessing the possible authenticity of a work of art generally involves three approaches:

1. Style and aesthetics. Does it look like it was done by the master? Is it in the master's style? Is it good enough?
2. Provenance. What is its paper trail? Where was it throughout its history?
3. Material constituents. Were they available to the artist? Do they fit her palette?

McCrone's assignment was to characterize and analyze the material constituents of the works, which we performed in great detail, but we were also requested to examine and compare any notable visible characteristics, including the signatures on the paintings. We played no role in assessing the provenance of the works; that was undertaken by the law enforcement officers in assembling the paintings for study.

McCrone Background

Fakes of many kinds are frequently encountered in the collectibles marketplace, and, for many years, McCrone has played an active role in bringing them to light, or, when the evidence supports authenticity, acknowledging that possibility. Dr. McCrone's analyses of the Shroud of Turin and the Vinland Map are two of the more famous examples; more recently, we have examined the ink on the *Gospel of Judas* codex for the National Geographic Society and found it to be consistent with published analyses in the scientific literature, and the *Archaic Mark* manuscript at the University of Chicago Library, a probable turn-of-the-20th-century forgery.

Protocols for Studies in Authenticity

Over the years, we have developed a number of logical protocols that help us discriminate between items of possible

authenticity and probable fakes. The most straightforward protocol is based on the material constituents: Does the item contain materials not historically available when the item was supposedly created? If so, we can be quite certain that the item is not authentic. Of course, it must be ascertained that the anachronistic materials are not due to recent restorations or other forms of contamination.

While obvious, this is not the only protocol we are able to employ. Less absolute than the 'material availability' protocol, but useful nevertheless, is the fact that we are able to compare the working methods and especially the materials of the artist (the artist's "palette") and compare those with the ones present in the questioned piece or pieces. This is based on the fact that many working artists develop consistent working habits including materials' usage, in order to develop a predictable 'voice.' Material usage for a painter would include choice of substrates, ways of producing a workable ground, choice of binding medium, and selection of a group of paints with which the artist is able to generate the pictures gestating in her brain.

Of the paint colors, by far the most important is the white; not only is it used to create white areas and neutral grounds, but it is mixed with all of the other paints to alter their tone. In similar fashion, the next most important color for many artists is black, for the same reasons.

In order to identify an artist's palette, the following criteria should obtain:

1. Sufficient exemplars. A palette is a compilation of statistical data; the more data, the better.
2. Comparable exemplars. All of the works were oil paintings on board, of approximately the same size.
3. Contemporaneous exemplars. An artist's palette may change or undergo modification over time. In this case, all of the paintings were created, or alleged to have been created, around 1970, plus/minus about five years. Figure 1a is a timeline showing the evolution of signatures throughout Hunter's career. All of the works chosen have signatures similar to that in figure 1b.

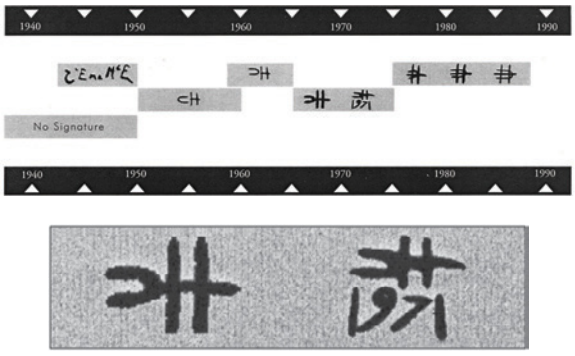
The works selected by the prosecutorial team proved to be appropriate for comparative examination.

Objects of Study

The paintings included in the study were in three groups of five:

1. Five paintings provided by Mr. Thomas Whitehead, all of which had been personally purchased directly from the artist by the collector and were thus of the best possible provenance. These were to be examined, photographed, sampled, and analyzed; they were designated A–E. Figures 2a–2d are photographs of four of Mr. Whitehead's paintings.
2. Five paintings purchased from the dealer, Mr. Robert Lucky, who was suspected of having sold forgeries created by Mr. and Mrs. Toye, the accused forgers. These suspected forgeries had all been confiscated by the FBI. These were also to be examined, photographed, sampled and analyzed, and the findings compared with those from the known authentic paintings. These were designated F–J; four of the paintings are included as figures 3a–3d.
3. Five paintings provided by J. O. Brittain; these too had been personally purchased directly from the artist by the collector, and were thus of the best possible provenance. These were to be examined and photographed only; they were designated K–O. Four of them are included as figures 4a–4d.
4. We later received paint samples from one of Hunter's plywood palettes, also of good provenance. However, it may not have been produced during the same time period as the ten paintings of known authenticity. We included these materials in our study, but did not consider them as contemporaneous with materials from the painting. This was designated P (fig. 5a).
5. We also received later a large number of paint samples confiscated from artists suspected to have created imitations of Hunter's works. These received only limited analysis. Representative samples are shown in figure 5b.

The five Whitehead paintings, the five Brittain paintings, and the palette were designated "CH Paintings", or simply "CH;" and the five suspected imitations as "Q_CH Paintings" or "Q_CH". The "Q" signifies the questioned status of these five paintings.



Figures 1a–b. (a) top, timeline of Clementine Hunter's signatures, and (b) bottom, showing forms from about 1970. From Gilley, Shelby R., *Painting By Heart: The Life and Art of Clementine Hunter, Louisiana Folk Artist*, (2000), p. 70.

Figures 2a–d. Four of the CH Whitehead paintings purchased directly from the artist: (a) upper left, Painting A, *The Hospital*; (b) upper right, Painting B, *First Communion;* (c) lower left, Painting C, *Washday*; (d) lower right, Painting E, *The African House.*

Planning: Examination, Photography and Sampling

Upon arriving in Natchitoches, I met with the law enforcement and forensic evidence gathering team assembled by Assistant District Attorney Alexander Van Hook and FBI Special Agent Randolph Deaton IV. The team also included Assistant Attorney Cytheria Jernigan, Dr. Mary Striegel, Mr. Jason Church, and Mr. Kirk Cordell, Executive Director of the National Center for Preservation Technology and Training (NCPTT), in whose laboratory the examinations, photography, and sampling were performed. Before beginning the work, we discussed goals and working methods, although much of these had been discussed in earlier communications. Our final plan of execution was to examine, photograph and sample the paintings at the NCPTT laboratory, and to analyze the samples at our own Westmont, IL facility. This plan was accomplished as follows:

Examination

Each of the paintings was examined in white, ambient light, both with and without higher magnifications using a stereomicroscope, and with long-wave (365 nm) ultraviolet illumination to ascertain the paintings' fluorescence characteristics.

Photography

During the examination sessions, each of the paintings was photographed, front and back, using a copy stand in the NCPTT conservation laboratory; this was performed by Mr. Church, under my direction. Furthermore, photomacrographs of each of the signatures on the paintings were made at low magnification using the stereomicroscope. Photomacrographs of the eyes of the subjects in the paintings were generally made at both low and moderate magnifications.

Sampling

Small samples of each of the main colors were taken with an extremely fine-tipped tungsten needle under the stereomicroscope. Each sample was stored on a microscope slide, under a coverglass. The number of samples varied with the complexity of the palette of each painting.

Analysis

The samples were analyzed using a number of analytical methods, each of which provided important information:

1. Polarized light microscopy (PLM). PLM is performed by taking a small amount of the sample supply, dispersing it

Figures 3a–d. Four of the Q_CH paintings purchased through Mr. Lucky: (a) upper left, Painting F, *Wedding Day*; (b) upper right, Painting G, *Uncle Tom's Cabin (1)*; (c) lower left, Painting H, *Uncle Tom's Cabin (2)*; (d) lower right, Painting I, *Washday.*

in a thermoplastic resin of known refractive index (Cargille Meltmount™, n_D = 1.662), covering it with a coverglass, and examining the preparation with a polarized light microscope. The amount of information provided by this method can be very large indeed, and was of singular importance in this project. Particle size, color, shape, and crystal class can be readily determined, and even trace amounts of material, if visually distinctive, can be easily noted.

2. Energy dispersive X-ray spectrometry in the scanning electron microscope (SEM/EDS). While the scanning electron microscope provides some morphological information, the primary use of EDS is to provide information about the elemental composition of very small portions of the sample. For example, if we identify the element titanium in a sample, we can be assured that one of the titanium–containing pigments is present. The morphological information is often useful as well, allowing us to clearly distinguish between, for example, barytes and blanc fixe, the ground mineral and precipitated forms of barium sulfate.
3. Fourier transform infrared spectroscopy (FTIR) provides chemical compound identification of many materials, especially organic binding media and pigments.
4. Raman spectroscopy (Raman) also provides chemical bond information, thus helping identify many important materials, including distinguishing the crystal phases of many materials.

Figures 4a–d. Four of the CH paintings purchased from Hunter by Brittain: (a) upper left, Painting K, *Uncle Tom and Little Eva*; (b) upper right, Painting L, *Uncle Tom with Little Eliza and Zinnias and Pole*; (c) lower left, Painting N, *Watermelon Eating*; (d) lower right, Painting O, *Card Playing.*

The analyses of the painting materials proceeded more or less routinely. We were hoping to identify materials in the Q_CH palette that weren't available in the mid-1970s; this would have shown conclusively that the Q_CH paintings were not authentic. However, as we accumulated data on the individual paintings, we found no anachronistic materials. There was one pleasant surprise. We had been told, during our meeting in Natchitoches before the sampling session, that Hunter would often accept painting materials in exchange for her paintings. Thus, we were expecting her palette to be a mish-mash of materials from multiple sources. We were struck by the relative consistency of her materials usage: she clearly had some favorite paints, and there were a few popular ones that she seemed to deliberately avoid. She had the working habits of a professional painter.

In the same vein, we found the Q_CH palette internally consistent as well, although the palette was distinctly different from the CH palette.

Table 1 summarizes our findings as to the significant materials identified in both the CH and the Q_CH paintings, and Chart 1 further refines those distinctions. A few comments as to the significance of our findings are in order:

- The painting substrates are very different. The CH paintings are all on Upson board, while the Q_CH paintings are all on tempered hardboard, (Masonite™ or a similar material).
- The relative lack of filler pigments in the CH paintings versus the ubiquitous presence of ground dolomite in the Q_CH paints. The dolomite renders the Q_CH paints much more transparent and is an indication that the Q_CH paints are inexpensive, student grade materials.
- High zinc versus high titanium whites. The differences may seem slight, but many artists choose their whites carefully, often brand specific, since white is mixed with virtually every other color. The Q_CH actually need the extra opacity offered by the high titanium white, because

Figures 5a–b. Photographs of Hunter's palette, left (a) and a selection of paints confiscated from suspects' home, right (b).

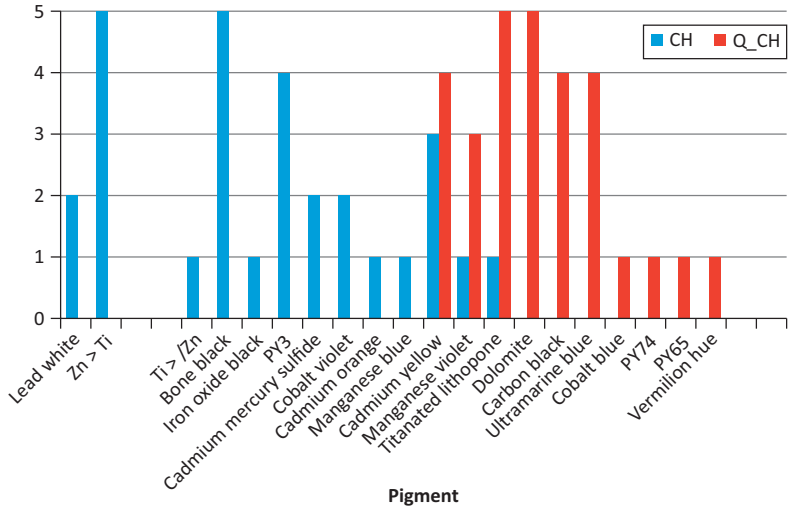


Chart 1: Significant Materials Identified in Paintings A through J and P

Known Authentic Clementine Hunter (CH) Paintings Containing Identified Material	**Materials Identified in Paintings A through J**	**Questioned Clementine Hunter (Q_CH) Paintings Containing Identified Material**
A, B	Lead white	–
A, B, D, E (Zn:Ti 1:3) C (Zn:Ti ~2:1) P (Zn:Ti 1:0 and 6:1)	Titanium and zinc white	F, G, H, I, J (Ti:Zn ~2:1)
A	Titanated lithopone	F, G, H, I, J
P (1 sample)	Dolomite	F, G, H, I, J (in 20 different paint samples)
A, B, C, D, E, P	Bone black	–
P	Iron oxide/manganese black	–
–	Carbon black	F, G, H, I
A, B, D, P	PY3	–
B	Cadmium orange	–
D, P	Cadmium mercury sulfide	–
B, C	Cobalt violet	–
B	Manganese blue	–
C, D, E	Cadmium yellow	F, G, I, J
C	Manganese violet	H, I, J
–	Ultramarine blue	F, G, I, J
–	Cobalt blue	H
–	PY74	H
–	PY65	J
–	Vermilion hue (Naphthol AS + Arylide yellow)	I
Drying oil	Binding medium	Drying oil
Upson board	Substrates	Tempered hardboard

Table 1: Significant Materials Identified in Paintings A through J and P

the colored paints tend towards much greater transparency than the CH colors, especially as they were filled by the highly transparent ground dolomite.

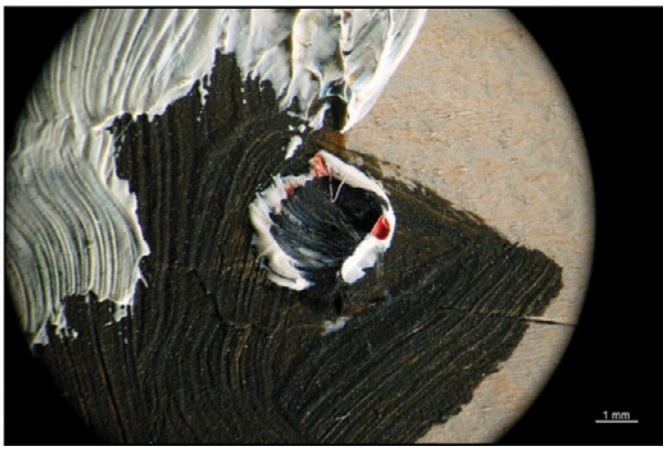
- The Q_CH paintings all contain significant amounts of titanated lithopone, a relatively inexpensive opaque pigment. Just one CH contains this material.
- CH prefers bone black, whereas Q_CH prefers carbon black. Again, CH has chosen the more expensive pigment, Q_CH the cheaper. One of the more noticeable characteristics of the Q_CH paintings is their weak blacks. Interestingly, the one non-bone-black black paint found in CH's repertoire is the iron oxide black found on the plywood palette, most likely a later item than the paintings, and another expensive, highly opaque black.
- CH had a strong preference for PY3 (Hansa Yellow 10G), whereas none was found in the Q_CH paintings. This is not so much a matter of quality as of the artists' preferences.
- Conversely, ultramarine blue is totally lacking in the CH paintings, while it is the primary blue in the Q_CH works. This is of some significance, as ultramarine blue is extremely popular, being both inexpensive and of very high quality.
- Varnish: CH never, Q_CH often.

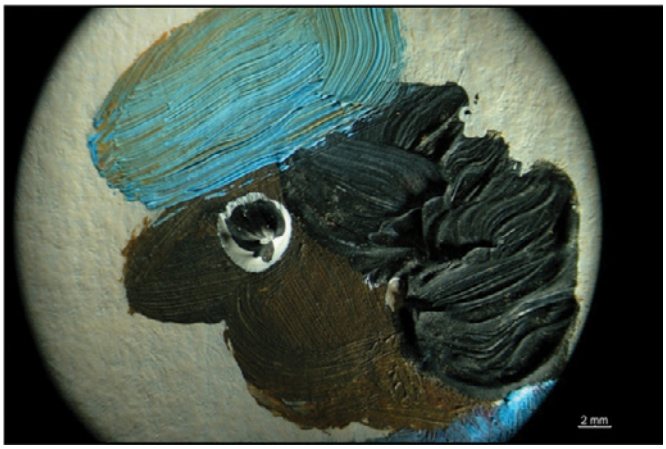
Figure 6. Examination, photography and sampling were performed at the NPCTT laboratory in Natchitoches LA. Left to right, the author examines a painting, FBI agent Randolph Deaton IV confers with Director Kirk Cordell, while Dr. Mary Striegel documents findings. Photograph by Mr. Jason Church.

Visual Information

In addition to distinct paint palettes, the paintings differ in several visual characteristics as well.

- Background paint: CH backgrounds are usually flat and with little texture (figs. 7a, 7b and figs. 9a–9d), whereas the Q_CH backgrounds are usually streaked (fig. 8a and 10b–10d) or have the mottled texture of possible use of a paint roller (figs. 8b and 10a).
- Underdrawings: The CH paintings include an underdrawing in what appears to be graphite pencil, even under the signature, whereas none was observed in the Q_CH paintings.
- Opacity: the CH paints are generally opaque, the Q_CH tend towards transparent. This is especially noticeable in the skin tones. Compare figures 7a and 7b with figures 8a and 8b.
- Paint stroke economy: CH tends to use just a few quick strokes, perfectly placed, whereas Q_CH tends toward a series of short jabs. This is especially noticeable in the depictions of the eyes of the subjects. Compare figures 7a and 8a.
- Dirt: The CH paintings were generally clean, with very little surface dirt, as would be expected in a valued and well treated work of art. In contrast, four of the Q_CH paintings had large amounts of soil rubbed into the crevices. The dirt was also accompanied by bits of coarse paper fiber, suggesting that the paintings had been covered with soil and then mostly wiped clean, probably with a paper towel. Applying dirt to a painting is a well-known technique to make a painting appear older than it actually is. Figure 8a provides a notable example.





Figures 7a–b. (a) upper right, photomacrograph of grandmother from CH painting, *Hospital*. Note smooth background and high opacity of the paints and precision in creating the eye, including bloodshot from weeping. (b) photomacrograph of washwoman's face in CH painting *Washday.*

Signatures

When comparing authentic to questioned objects of a specific class, it is always best to compare those created during as narrow a time frame as possible. In this regard, we were fortunate, as Hunter's signatures evolved in significant ways over time. Figure 1a is a timeline of her signatures from the beginning of her career until the end. This study is specific to paintings created (or supposedly created) about 1970 (fig. 1b).

While the signatures might be considered as yet another visual characteristic, they also constitute important forensic evidence in and of themselves. While a more detailed analysis must await the scrutiny of a handwriting expert, certain characteristics can be seen by the interested observer:

- As noted above, in many cases, even the signature rests above a penciled sketch line in the CH paintings. In

Figures 8a–b. (a) upper left, photomacrograph of preacher's eye in Q_CH painting *Wedding Day*. Note low opacity of flesh tones, streaked background, and dirt in crevices; (b) upper right, photomacrograph of washwoman's face in *Washday*. Note textured background, low opacity and mottled textures.

Figures 9a–d. Signatures from CH paintings. The background paint is smooth, the ratios of width to length are roughly 1:1.4, and signature elements exhibit a relative lack of symmetry. Note also penciled underdrawings in figures 9a and 9b.

Figures 10a–d. Signatures from Q_CH paintings. The background paint is more highly textured, including the possible use of a paint roller in figure 10a. The backwards Cs are roughly equal in width to length (a ratio of 1:1.1) and they exhibit greater symmetry.

those cases where no underdrawing was found, it was suspected that the underdrawing was originally present but was painted over. In the Q_CH paintings, none of the signatures included an underdrawing.

- Most noticeably, when compared side by side, we find the CH signatures almost uniformly awkward, often poorly executed, whereas, in contrast, the Q_CH signatures are universally consistently well-formed, even fluid. The adjectives "drawn" as opposed to "written" come to mind.
- The ratios of width-to-length in the backward Cs were found to be different as well, about 1:1.4 in the CH paintings, and closer to 1:1.1 in the Q_CH paintings.

The Palette and the Confiscated Paints

The primary focus for this study is the comparison between the known and authentic paintings. Data from the palette was included, but its lack of a clear date of creation diminished its usefulness. However, most of the materials from that object also fit in well.

The 231 paints and other artists' materials confiscated from the suspects' home were also examined. Ninety-two of the items were oil paints of the Winsor Newton™ brand; of these, eighty-six were from the Winton™ series; these are student grade paints.

CONCLUSIONS

In the course of our examinations, we found significant differences between the ten paintings purchased directly from the artist and the five of questioned authenticity. While our most detailed analyses were of the paintings' material constituents, we also noted significant differences in how the paintings were constructed, and in the graphic characteristics of the signatures on the paintings. Each type of evidence carries its own weight, but in each case, the preponderance of the evidence supports the conclusion that the five questioned

Known Authentic Clementine Hunter (CH) Paintings Exhibit These Characteristics	**Materials or Characteristics**	**Questioned Clementine Hunter (Q_CH) Paintings Exhibit These Characteristics**
Professional grade (more opaque)	Paint quality	Student grade (more transparent)
Smooth: all Light streaks: A, E (partial) Textured: none	Brush strokes (background)	Smooth: none Moderate streaks: G, I, J Textured: F, H
Long, smooth wide strokes Balanced impasto	Brush strokes (general)	Short strokes, mottled texture Exaggerated impasto
B, D, E, K, L, M, N, O (not seen on A, C, D)	Graphite pencil underdrawings	–
Awkward, often poorly executed	Signature consistency	Fluid, consistently well-formed
Mean: 1:1.4 Mode: 1:1.4	Signature ratios of width-to-length in backward Cs	Mean: 1:1.1 Mode: 1:1.0
1, 1	Brush strokes: eyes # white strokes, # black	2+, 2
–	Surface dirt on painting (none on back)	F, G, I, J
C, D, E	Stacking damage (flattening of impasto)	–
–	Varnish on surface	G, H, J

Table 2: Visual Characteristics Seen in Paintings A through O

paintings are not authentic. When taken in combination, one could raise one's level of confidence a full step, from "There is evidence supporting the conclusion that the five questioned paintings are not authentic" to "There is strong evidence supporting the conclusion that the five questioned paintings are not authentic."

As a result of our analyses, and the summation of evidence from other sources, including other forensic laboratories, the dealer Robert Lucky and the forgers Beryl and William Toye were successfully prosecuted.

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MÓNICA PÉREZ AND JUAN MANUEL MARTÍNEZ

Comparison between Two Identical Portraits of Fray Camilo Henríquez

ABSTRACT

In the summer of 2011, a panel painting was sent to the Paintings Conservation Laboratory of the Centro Nacional de Conservación y Restauración (National Center for Conservation and Restoration) in Santiago, Chile. It was the portrait of Fray Camilo Henríquez, a priest who actively participated in Chile's Independence, between 1810 and 1823. This portrait is a very well-known image, and it appears in many books, especially those related to Chilean history and art. It's the iconographic source for most of the portraits and drawings that were later made with the image of this priest, whose work spread among different areas of knowledge and of Chilean history.

Fray Camilo Henríquez played a very important role during Chile's Independence. After taking his religious vows in Lima, Peru, to the "order of the good death," he was imprisoned by the Inquisition for reading philosophers whose books were forbidden on the territories dominated by the Spanish crown, because they promoted liberty and ideas related to the rights of man. After being released from prison he was sent to Quito, Ecuador, where the revolution for the Independence was starting, as it was in other Latin-American countries. There Fray Camilo kept on developing the ideas of freedom that he would spread when going back to Chile in 1811. A few days after his arrival he wrote a famous proclamation where he attacked the absolutist regime and called to vote for men who promoted independence ideas during the elections to form the first national congress. Once this was constituted, he was elected alternate representative and then senator, and from these positions he promoted several reforms to the public education system, such as the use of the Lancaster System, in which the more advanced students passed on the knowledge to the rest. He was also one of the founders of the Instituto Nacional, the oldest educational institution in the country and bastion of public education in Chile, dating from 1813.

He wrote plays related to independence topics. He was the creator and editor of the first Chilean newspaper, La Aurora de Chile, in 1812, and for this he is considered the father of journalism in our country and founder of the Chilean press. When this newspaper was cancelled for being too revolutionary, he founded another paper, the Monitor Araucano, which was a little more moderate. During the process of the Spanish Reconquest, from 1814 to 1817, a period in which many patriots were imprisoned or sent to exile, Camilo Henríquez exiled himself in Buenos Aires, Argentina, where he also participated in the editing of newspapers and kept on working for the region's Independence process. He returned to Chile in 1822 and was hired as librarian and then second director of the newly created National Library. He died in 1825 (Encina 1956; Frias 1994; Hernández 2012; Dibam-Museo Histórico Nacional, 2009).

For all these activities, his image as well as his name are widely known and are associated with different areas of knowledge, social matters and history of Chile. Within the country there is a wide variety of institutions and works that carry his name: several schools in different cities and towns, libraries, one of the rooms of the National Library, a theater, streets and monuments, among them one commissioned by the Journalists Association.

The peculiar portrait that was studied represents Fray Camilo Henríquez wearing a black cassock, lying on a red couch, with a quill on his right hand. In front of him there is a table with a blue tablecloth, a book, sheets of paper and a paper roll over it. Behind him to the right side, there's a bookshelf, and in the lower area there is a text: "El Padre Camilo Henrique," (Father Camilo Henríquez) (fig. 1). This painting is considered peculiar because priests are not usually portrayed this way, lying on a couch, but some intellectuals have indeed been portrayed with a melancholic gesture. Maybe the artist tried to represent his religious vocation as well as his intellectual side, that of a man with passion for reading and writing about the subjects that were vital to him.

Figure 1. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca. 1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum (592). Photograph: Archive CNCR.

This portrait has been the iconographical source for most of the paintings and images from Fray Camilo Henríquez, and probably it will also be in the future. Among the portraits and drawings that are based on this image there is the engraving made by Narciso Desmadryl (fig. 2), a French artist who made the drawings for a catalog of outstanding men in Chilean history, in 1854, and it is known that he based his work on existing portraits. Also, artist Carlos Alegría made his version in 1925 (fig. 3), representing basically the person, not the room. In both cases, even the decoration of the cassock's collar is similar to the one in this painting, although Desmadryl's drawing has more detail in the decoration of the arm of the couch.

The Painting Conservation Laboratory received this painting from the Director's office of the Dirección de Bibliotecas, Archivos y Museos - DIBAM (Libraries, Archives and Museums Direction), located inside the National Library. As most people had seen it on exhibition for many years at the National Historic Museum, it was thought it belonged

Figure 2. Narciso Desmadryl. *Portrait of Fray Camilo Henríquez*, 1854. Engraving, 35 × 30 cm. Museo Regional de Rancagua, (475).

Figure 3. Carlos Alegría. *Portrait of Fray Camilo Henríquez*, 1925. Oil on panel, 29.3 × 20 cm. National Historic Museum (379).

to them and was on loan at the formerly mentioned office. However, when it was being restored the Lab staff realized that it was actually a second portrait, belonging to the National Library, and the one owned by the museum was still on exhibit in its usual place.

At the National Historic Museum, the portrait of Camilo Henríquez is part of the permanent exhibition and is seen daily by hundreds of people. On the other hand, the portrait belonging to the National Library is only seen by a few persons every day, although it also has an outstanding place for his role as the first librarian of that institution.

Both paintings are made on wood and are attributed to Swiss artist José Guth, although none of them are signed or dated. There were some people in both institutions who knew about the existence of the two portraits, but they all believed they had the original.

In 2010 the Paintings Conservation Lab already had the experience of having two identical paintings by the same author, when two identical portraits of another patriot who struggled for Chile's independence, Luis de la Cruz y Goyeneche, were restored and studied (fig. 4). Both of them were made (and signed) by a very well known Peruvian artist, José Gil de Castro, who carried out most of his work in Peru, Chile, and Argentina at the beginning of the XIX Century, and whose work is being studied by experts from these three countries.

Similar to that occasion, the National Historic Museum lent its painting to study it, take samples and compare both portraits, in regard to iconography, manufacture technique, pigments and materials. Additionally, one of the goals was to try to confirm or dismiss the attribution made to José Guth, through analyses and historic research.

According to the information obtained, the portrait belonging to the Museum was received in 1920 from the National Library, together with many other works of art, as the Library, an already consolidated entity, was the institution that received and concentrated most of the painting heritage at that time. When the museums were later created, the National Library gave them a great amount of its works of art to form the collections of these new institutions.

When trying to clarify if both portraits had been painted by the same artist, some information was found regarding a loan requirement made by the National Library to the Museum in 1968. At that time, the painting was temporarily moved to the National Library for one month. Although no document has been found that mentions the objective of this loan for such a small period of time, it is believed it is possible that during that month the painting could have been copied, and some reasons for doing that are suggested: maybe the director admired Fray Camilo Henríquez and wanted to have him back in his old institution, perhaps regretting the time when the portrait was given to the National Historic Museum, or maybe a member of the staff or the same director wanted to celebrate his work as the first librarian.

Figure 4. José Gil de Castro. *Two Portraits of Don Luis de la Cruz y Goyeneche*, ca. 1823. Left: Oil on canvas, 107.9 × 84.3 cm. National Historic Museum (752); Right: Oil on canvas, 107.5 × 82.3 cm. Museo O'Higginiano y de Bellas Artes de Talca (131). Photograph: Archive CNCR.

Why speaking of a copy? First of all, because of what one was able to observe with the naked eye and also with the help of non-destructive analyses. At first sight, both paintings look exactly the same, but upon closer examination it was possible to see some differences. When comparing both paintings it was noticed the one from the Library was smaller (49.3 × 71 cm. vs. 53.3 × 74.4 cm), and that it seems to have been painted having the Museum portrait as a model but without taking out the frame, because it was the same size and shows the same

image one can see when that painting is framed. The portrait from the Museum shows a piece of wall after the bookshelf, which is hardly visible when framed, and the painting from the Library ends just after the bookshelf (fig. 5).

Another different aspect is the text written in the lower part of both paintings: on the one belonging to the Museum, the letters are made with gold leaf, while the text on the portrait from the Library is made apparently with paint or darkened metallic powder. On the other hand, there was a difference in execution that was clear: while the portrait from the Museum has a clean execution, with smooth and fine surfaces, and much attention to detail, like the decoration on the cassock's collar; the portrait from the Library shows rough and thick brushstrokes and little attention to detail, for instance, the same collar area is almost just sketched (figs. 6, 7).

With Infrared Reflectography, one was able to see these same differences between both paintings: in the portrait belonging to the Museum it was possible to see a better technique in the face, and the decoration on the collar is clearly observed, but the light blue ground over which these motifs are painted turns transparent and it is possible to see that the collar was painted after the face and the cassock. On the portrait belonging to the Library, the face looks rougher and the decorative motifs on the cassock's collar disappear when observed with this method, showing only an opaque surface (Pérez 2011-1) (figs. 8, 9).

Figure 5. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*. Both paintings together: it is possible to see the difference in size and border details. Photograph: Archive CNCR.

Figure 6. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca. 1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum (592). Detail of cassock's collar. Photograph: Archive CNCR.

Another difference was that on the portrait from the Museum it was possible to see the whole table, with the objects painted over it, while on the portrait from the Library, these objects seem to have been painted first, and then surrounded with the blue color of the tablecloth.

With the naked eye it was possible to see, in both portraits, some drawing lines on the floor to correct the perspective of the tiles, apparently made in pencil, that are visible under the paint layer. When analyzed with Infrared Reflectography it was

Figure 7. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca. 1968 (?). Oil on panel, 49.3 × 71 cm. National Library. Detail of cassock's collar. Photograph: Archive CNCR.

Figure 8. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum. (592). Detail of the face, Infrared reflectography. Photograph: Archive CNCR.

possible to see that on the portrait belonging to the National Library these lines were clear, a slight change of the original drawing in one leg of the table, and some lines between the fingers of the left hand.

In the portrait belonging to the Museum it was possible to see many perspective lines, forming a smaller grid on the floor. There were other pentimenti like the legs of the

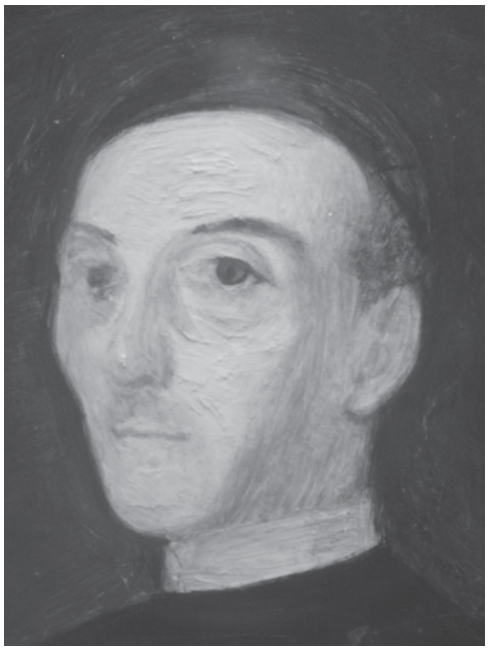

Figure 9. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca.1968 (?). Oil on panel, 49.3 × 71 cm. National Library. Detail of the face, Infrared digital photograph. Photograph: Archive CNCR.

furniture that had been initially drawn in other place and were longer, in the table as well as the couch. The shadows of these legs were also changed from the initial drawing. Other pentimenti was seen on the arm of the couch that had been initially painted lower; there were vertical and horizontal lines on the tablecloth, probably to form the folds. And the most interesting aspect, that would confirm the idea about which one was the original and which one the copy, was what one was able to see on the bookshelf and the books on the portrait from the Museum. With the naked eye, they are seen painted in a downward perspective from left to right, but with Infra Red Reflectography it was noticed they had been initially painted the other way round, in an upward perspective from left to right. There were also changes on the size of the bookshelf that was smaller in the beginning and some of the books (Pérez 2011-2) (figs. 10, 11).

With UV fluorescence photographs defined darker areas were observed on the portrait from the Library, which were previous interventions, on every border and on two horizontal lines that coincide with support separations, all of them already restored.

Using the same technique to study the portrait from the Museum, a darker area was seen in the center of the painting, near the priest's image and the objects over the table, probably due to an excessive cleaning. No overpaint was observed.

Figure 10. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca.1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum. (592) Detail of the bookshelf, Infrared reflectography. Photograph: Archive CNCR.

Figure 11. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca.1968 (?). Oil on panel, 49.3 × 71 cm. National Library. Detail of the bookshelf, Infrared reflectography. Photograph: Archive CNCR.

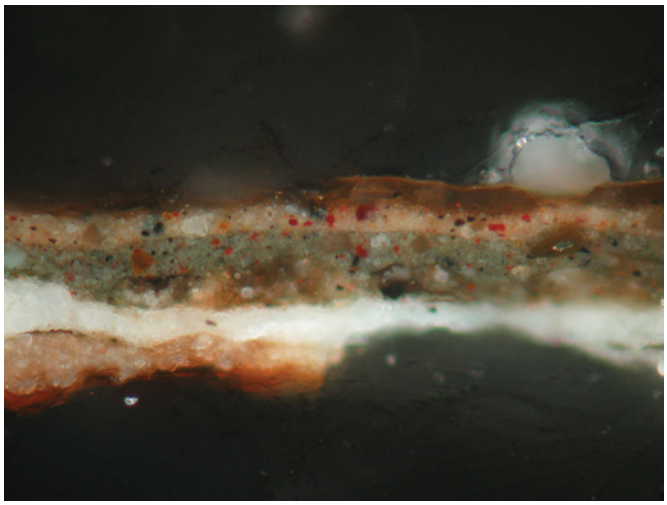

Figure 12. José Guth (attrib.), *Portrait of Fray Camilo Henríquez*, ca.1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum. (592). The cross-section shows a structure similar to those found on canvas paintings. Photograph: Archive CNCR.

The Scientific Analyses Laboratory took some samples from both paintings to make cross-sections to assess the paint layers and to identify pigments. The varnish on the Museum portrait was also analyzed, but not that of the Library portrait, because it had been previously restored in 2000 and it was known they had applied Dammar varnish at that time (Maturana 2000).

With FTIR spectroscopy it was possible to identify the varnish on the Museum portrait as one made out of triterpenic resins, probably Mastic. With Raman spectroscopy, the red from the couch was identified as vermillion, and the white from the paper roll over the table showed lead white and Prussian blue. That confirms that the objects were painted once the tablecloth was already completed. Cross sections showed very thin layers, including the ground, similar to the ones found on canvas paintings (Aguayo 2011-2) (fig. 12). The text was observed with a binocular magnifier, and the letters were made out of gold leaf with red bole under it, both of them applied over the paint layer (fig. 13).

Similar analyses were made to the portrait from the Library. The red sample was also identified as vermillion, while the white sample, taken from the sheets of paper, only showed the signs that are characteristic of calcium carbonate. This could

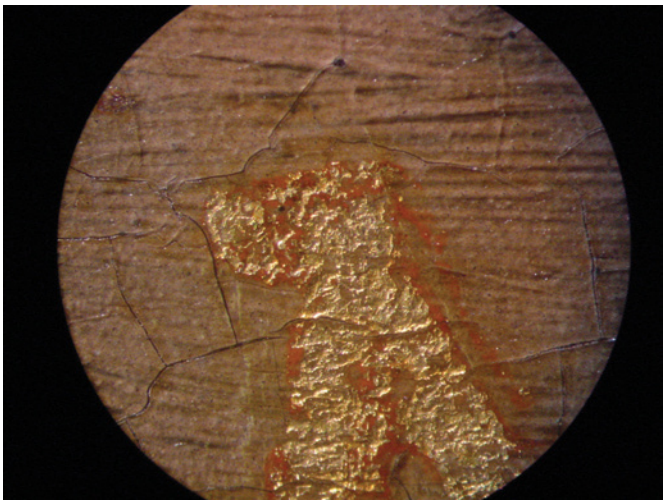

Figure 13. José Guth (attrib.), *Portrait of Fray Camilo Henríquez,* ca. 1820. Oil on panel, 53.3 × 74.4 cm. National Historic Museum. (592) Detail of gold leaf in text, microphotography. Photo: Archive CNCR.

indicate that these objects were not painted over the blue tablecloth, but were instead painted first or that the areas were left as empty spaces showing the ground, and the blue was applied later, around these spaces. This would also indicate a difference in the execution of both portraits. In this case, the cross section showed thicker layers, with an unusually thick ground (Aguayo 2011–1) (fig. 14).

While the pigment identification results were not conclusive regarding a specific period, some aspects of these analyses together with non-destructive, plain visual observation and

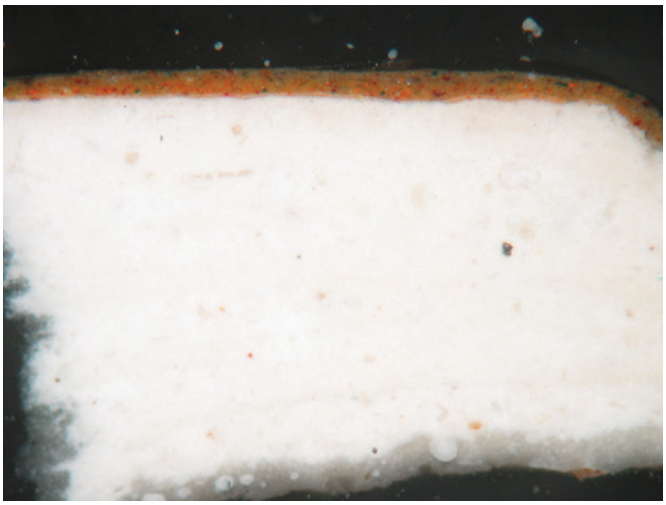

Figure 14. José Guth (attrib.), *Portrait of Fray Camilo Henríquez,* ca.1968?. Oil on panel, 49.3 × 71 cm. National Library. The cross-section shows an unusually thick ground layer. Photo: Archive CNCR.

historic research gave some information that would permit to conclude, with some degree of certainty that the portrait belonging to the National Library is likely a copy of the one belonging to the Museum.

Restoration

The portrait belonging to the National Library, which had already been restored in 2000, and that had other intervention prior to that, accidentally fell in 2010, and suffered some losses that included the ground in some cases. The wooden support, that had been reinforced with two wooden battens in the past because it was separated into three parts, showed a separation between these in the back, which were filled to avoid an increase in their size. The losses were filled and chromatic reintegration was carried out.

There were not many damages on the painting from the Museum, and while the main goal when it was taken to the CNCR was its study, there were two small cracks on the lower right corner that were consolidated; a varnish cleaning was carried out, because it was notoriously yellow on the lighter colors; some abrasions were filled and chromatic reintegration was carried out on these and on small paint film losses. A final varnish was applied. The portrait was framed and glazed with glass, which the Museum asked to remove, because of its high reflectance. Together with the reflectance of the other glass protecting the area in which the piece was exhibited, it had made the aesthetic reading of the painting difficult. The frame had a small loss on the right molding, where a dyed, varnished wooden insert was attached.

CONCLUSION

After all the scientific and visual analyses and historic research, more questions appeared.

It was very hard to find reliable information, or even to find any information, especially regarding the origin and moving or transfer of these portraits between institutions. Sources do not always coincide in the information they give, nor do the institutions have all documentation tidy and accessible.

The aim to confirm or dismiss the attribution to José Guth is still in process. The attribution was made around 1990 with the method of visual comparison with other paintings created by him, but it is being strongly questioned at present. Now, with more technical and information resources, a renewed interest and the help of parallel projects, we hope to be able to solve the matter of the attribution of these portraits, or at least the original one, based on the research about a network of local artists, probably apprentices of José Gil de Castro. A study about one of these artists is being carried out, whose paintings have more similarities with these portraits than the

Figure 15. M. Guerra V. "Camilo Henríquez revisa el primer Número de "la Aurora de Chile". 13 de febrero 1812". National Library.

rest of the work by José Guth, so there is still work to do on this matter.

In fact, this project has also been useful for stimulating the interest of other people, apart from the initially involved staff, for getting reliable information about the portraits. After asking many questions of the National Library staff, and they themselves of other people, a researcher, who was studying the history of the Library, is now researching about the history of these two portraits as well. Another painting was "rediscovered" (fig. 15), one that portraits Fray Camilo checking the first edition of La Aurora de Chile, a painting that was printed in an old book, that was unknown for most of the staff.

In the beginning, each institution that owns a portrait thought they had the original. Now knowing which one is the original and which one the copy, both of them are still in an outstanding place inside each institution. That makes us think that the copy is not always a forgery, especially in this case where there is no economic interest or aim to deceive, but rather to highlight the image of a man who did great works for the benefit of his country.

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CYNTHIA SCHWARZ

A Chastened Splendor: The Study and Treatment of Works by H. Siddons Mowbray

ABSTRACT

Nine large-scale decorative lunettes painted by the Gilded Age American artist Harry Siddons Mowbray (1858-1928) were studied and treated. The paintings, from the 1892 home of Collis Huntington, are put into context stylistically and technically with writings by mural painters of the time. A technical study revealed an absorbent ground and unusual decomposition of cadmium yellow pigment. Interesting aspects of the treatment, including the use of adhesive strips for the removal of lead white paint from the verso, is discussed. The treatment took four years and the paintings are now hung at Yale University Art Gallery.

Background

In the fall of 2008, the conservation department at Yale University Art Gallery (YUAG) began the process of planning for the conservation of a collection of over 30 works known as the Huntington Collection. A major renovation of the reinstallation of the museum, completed in December of 2012, prompted the re-examination of hundreds of works of art. YUAG's Curator of American Painting and Sculpture, Helen Cooper, used the occasion to initiate a project that had been on her agenda for decades—the conservation of the Huntington Paintings. Nine of these works, 40 × 80 inch lunettes by the artist H. Siddons Mowbray (1858-1928) (fig. 1), prompted a closer look at his aesthetic goals and aspirations.

Figure 1. Mowbray's large lunettes before treatment. H. Siddons Mowbray, *Nine Allegorical Female Figures*, 1892. Oil on canvas, 39 1/2 × 78 ¾ in. (100.3 × 200 cm) each lunette. Yale University Art Gallery. 1926.100-1926.108

The Huntington paintings were produced in 1892 for the railroad magnate Collis Huntington's mansion at 57th Street and 5th Avenue in Manhattan. In 1884, Collis Huntington, head of the Central Pacific railroad, married Arabella Huntington. Though Collis held his money close, Arabella was a lover of the arts and society, and it was she who steered their art patronage. The Huntington's collection of European paintings exhibited on 5th Ave. included four Rembrandts, now in the collection of the Metropolitan Museum, as well as Flemish and British masterpieces. The Huntingtons rarely used the home, but it was an ideal spot for entertaining in New York society, located on the same corner as the Vanderbilts and the Joneses. The home's architect, George Post, commissioned four painters—Elihu Vedder, Edwin Blashfield, Francis Lathrop, and H. Siddons Mowbray—to decorate the mansion. The home was demolished in 1926 to make room for new commercial buildings; today the lot is occupied by Tiffany's. Among the rooms decorated with paintings were the front entry hall, the

dining room, and the "White Room," or women's parlor.[1] All of these architectural paintings were willed to Yale University Art Gallery in 1926, when they were hastily removed from the walls, rolled around lumber, and put into storage for almost 80 years. Mowbray was hired to paint the lunettes in the entry and those above the doors in the hall, as well as to supervise the painting of the stairways (Post). The Huntington commission came at a pivotal moment in Mowbray's development as a painter and the study of his works at this time is critical to understanding him as an artist.

Harry Siddons Mowbray was born in 1858 in Egypt to British parents. After being orphaned at a young age, Mowbray moved to North Adams, Massachusetts and was raised by an uncle and aunt. His uncle, George Mowbray, was a chemist who had a critical part in the development of nitrate compounds, both as a substrate for photographic images and as an explosive. Harry idolized him and inherited a sense of innovation and experimentation from his adopted father. After turning down a prestigious place at West Point in favor of the pursuit of an art career, Mowbray studied in France under Leon Bonnat alongside peers Kenyon Cox, William Merritt Chase, and others. Around 1886, he moved to New York, joined the forward-thinking Society of American Artists, and took up a studio at the Sherwood Studio building, just a few blocks from the future Huntington Mansion. During his years in Paris and his initial stay in New York, Mowbray became well regarded for his intimate, jewel-like harem scenes (fig. 2). These sensual pictures were extremely marketable; the collector Thomas Clarke bought at least 15 of them. Despite this success, however, Mowbray soon became intent upon concentrating on mural decoration, inspired by Renaissance art and following John Le Farge's lead. He would later reflect on his dissatisfaction around this time with the French Academic school of his training, with its reliance on idealized realism:

> It is not uncommon for artists to come sharply up to moments of this kind and seek a new method of expression for the one they have worn out. I was tired of the photographic realism of the school in which I had been educated, and its blighting dependence on the model for everything. A fondness for the Italian art of the Renaissance came over me. I wanted above all things to do mural work… [but] opportunities were very remote. (Mowbray 1928: 56)

Figure 2. H. Siddons Mowbray, *Idle Hours*, 1895. Oil on canvas, 12 × 16 in. (30.4 × 40.6 cm). Smithsonian American Art Museum. 1910.9.12

His first decorative commission, offered to him in 1888, was for the New York Athletic Club (NYAC). It was one panel for their clubhouse, a piece that we might consider more of an easel painting than a wall painting today. This piece, subsequently destroyed in a fire, only exists in a rough sketch from the NYAC's archives. Mowbray describes the panel as "amateurish" (Mowbray 1928, 56), but it left him with a desire to do more mural work. It was not until 1892 that he would receive another mural commission, when Augustus Saint-Gaudens introduced him to the architect George Post, who was looking for muralists for Collis Huntington's mansion. Mowbray writes that he was beyond words, and could hardly get home quickly enough to share the good news with his wife (Mowbray 1928). Mowbray was paid $7,000 for the paintings and occupied him for two-years. They were by far the largest paintings that Mowbray had tackled.

When Mowbray's career is examined as a whole, the Huntington paintings emerge as a transitional work from his easel painting to mature mural paintings, both aesthetically and technically. From the 1880s to Mowbray's final works in the early 20th century, he progressed from his colorist Orientalist compositions to the staid, flat, geometric murals of his late works in Connecticut's Litchfield County. For the Huntington mansion, he created two cycles of lunettes that straddle this line between easel and mural paintings. The smaller paintings represent the myth of Persephone (fig. 3). They recall Mowbray's easel paintings in their attention to detail and depth, as well as their intrinsic delicate color balances. The second cycle, and the focus of this study, is a series of nine lunettes representing reclining allegorical female figures. Mowbray veers from traditional iconography with the addition of the muses of electricity and agriculture to a group of seven classical muses. Formally, Mowbray's strong women recall the statuesque figures of Michelangelo's Sistine Chapel more than the idealized figures of the French Academy. The lunettes, devoid of their original context, may strike some of us today as almost gaudy in their bright colors, laid out in broad fields. In fact, our perception is now new; upon seeing the younger artist's paintings in 1892, Elihu Vedder called them "dangerously close to illustrations on expensive boxes of candy" (Jaffe 1992, 110).

Figure 3. H. Siddons Mowbray, *Proserpine and Ceres Reunited*, 1892. Oil on canvas, 23 ¾ × 42 in. (60.3 × 106.7 cm). Yale University Art Gallery. 1926.95

However, his reaction may have been more generally to a changing aesthetic in mural painting, one that we note even today when the paintings are out of context. In 1917, Kenyon Cox would reflect on the beginnings of the mural movement in 1892 and wrote, "A modern American decoration is more likely to look overcolored and violent when strayed among other pictures, and to need the subduing influence of shadow and distance to transform its vividness into a chastened splendor" (Cox 1917, 16).

Despite Cox's observation, Vedder's reticence to accept Mowbray's aesthetic, certainly reflects the younger artist's fine-tuning of this delicate balance of color, and the progression of his career suggests that eventually Mowbray would temper his palette. His next commission, in 1897, was for the living room at the Vanderbilt mansion at Hyde Park (fig. 4).

Figure 4. Conservation Intern Sarah Gowen examines a fragment of Mowbray's ceiling at the Vanderbilt Mansion in Hyde Park, New York. This fragment is all that remains from a ceiling painting in the home's living room.

Upon completing this decoration, Mowbray, on the train ride home, wrote of his elation at their favorable reception by Vanderbilt. However, just two years later, he was called back to Hyde Park to tone down the murals, to make them appear older and more in line with French paintings that decorated Mrs. Vanderbilt's bedroom, as is evidenced in a letter from Frederick Vanderbilt to Stanford White:

> Mowbray has agreed to tone down his paintings to make them look old, more on the style of the two that are now up in Mrs. V's bedroom and boudoir (as to tone, I mean) which were painted in Paris for Duveen. Please bear in mind my paintings are going to be hung in that room in [sic] a large Bougereau, a de Neufville [sic] a Villegas, a Shreyer, etc. Etc. The walls will be quite filled in with them. (Albee 2008, 122)

However, a careful examination of the remaining fragment of this mural showed no obvious evidence of reworking, having been painted quite thinly and directly and having no surface coatings, either toned or otherwise. This apparent refusal to repaint the mural may explain why it was removed from the house by 1906, with only the fragment illustrated here remaining. After this commission, Mowbray's career as a muralist began to pick up, with the University Club library completed in 1904, the Morgan Library in 1905, and the Larz Anderson House in 1910. Later in his life, he retired to Washington, Connecticut, where he would continue to paint murals for the Gunn Memorial Library and several local congregations.

The intent of the technical study of these paintings, both through instrumental analysis and archival research, was to gain insight into the materials and techniques used to produce them and to better understand their damages. The American Mural painters wrote frequently of their idealization of fresco as a technique, and much of their technical writing centers around three topics: how to simulate fresco in an American interior, including methods for maintaining matteness, the importance of respecting the flatness of the wall in composing murals, and how to adhere these paintings to the wall. Mowbray created his paintings, as did many of the nineteenth century mural artists, at his off-site studio on loose pieces of linen tacked to a board. These artists frequently wrote about the modern necessity of choosing canvas over traditional fresco. Mowbray points to purely practical considerations: "In most cases, in the present day, a decorator must paint his canvases while the building is in the process of construction. For the fresco, at least a year would be required for the walls to season before any work could be undertaken" (Mowbray 1916, 8). Alternatively, Will Low, in his "Modern Possibilities of an Ancient Art," cites preservation as the motivation: "today we think that for our climate and for the houses which we build, it is safer to paint on canvas with oil color" (Low 1902, 175).

We can see evidence of the original configuration in the ten small lunettes, which along one edge still have an unpainted tacking margin with original nail holes (fig. 3). The larger canvases were cut out of their moldings when they were removed from the walls, and these original edges no longer exist. After transporting the murals to the home, the muralists would adhere them to the wall with lead white paint, a careful process colorfully described by Elihu Vedder when he wrote,

> The night before, the space for the picture was coated as thickly as possible with white lead, and early the next morning the canvas was taken up on the scaffolding. You see, the back of the canvas also had to be painted thickly, which was done as they went along. … you can imagine that the least difference in matching would have resulted in a disastrous misfit.… and to my horror this happened. … I instinctively felt in my pocket for a flask, but alas! … prohibition was against it! (Vedder 1910, 492)

Technical Study

Mowbray's choice of a priming layer quickly became one of the main focal points of this study. The priming is an off-white, evenly applied ground. It may have been commercially prepared, but the possibility that Mowbray had a voice in the character of this ground should be considered. For these first murals, he used an absorbent ground in order to achieve the matte affect that he desired. In his 1916 treatise, "Suggestions for a Beginner undertaking a decorative ensemble," Mowbray writes, "there are… prepared colors and mediums whereby a dry, flat surface may be obtained as well as by the use of absorbent canvas. These all have their drawbacks and are, moreover, very difficult to modify once on the wall." (Mowbray 1916, 8)

He goes on to suggest, rather, that the painter works freely without gloss in his mind, and goes back to apply surface coatings to affect the gloss after the painting is complete. Was the suggestion that absorbent grounds may give difficulty learned by experience in his early mural pieces; particularly, this commission? The ground is observably absorbent; in areas of loss, one can see that it has taken on the color of the paint layered on top. Nineteenth century absorbent grounds on easel painting have been beautifully researched and well documented, such as in the American impressionism and pre-Raphaelite schools. These grounds generally are composed of a proteinaceous binder and a calcium-based filler, much like a traditional gesso.[2]

Under low magnification, Mowbray's ground has a crystalline appearance uncharacteristic of a lead ground. Samples of the ground were analyzed with a variety of techniques[3] at the YUAG facilities and with scientists from the Winterthur Museum Scientific Research and Analysis Laboratory. It was found that the ground contains large amounts of zinc and also lead, both common pigments in nineteenth century grounds, and it is bound in a drying oil. However, a major third component was observed at appeared to be an alumino-silicate. Upon further analysis with FTIR (fig. 5), this alumino-silicate has been characterized as kaolin, a highly absorbent clay. This

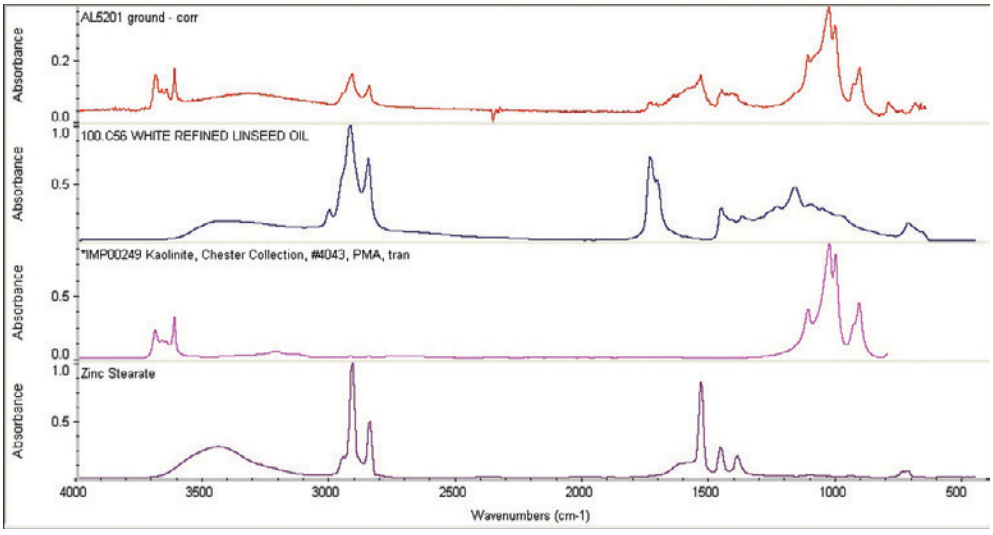

Figure 5. FTIR spectrum with potential matches of a sample of Mowbray's ground used in the lunettes. Note the possible match with kaolin, characterized by a peak in the 3600–3700 range. Analysis carried out at Winterthur Scientific Research and Analysis Laboratory.

analysis has led to a hypothesis that Mowbray attempted to formulate a ground that would be both absorbent and, critically, flexible, enabling it to be rolled and transported across town without cracking. In their present state, it is apparent that there has been a serious adhesion failure between ground and the leanly bound paint layers, especially in the background green color (figs. 1, 6). When Mowbray later refers to problems with absorbent grounds, one can hypothesize that he may have witnessed these issues first hand. A closer look at the surface of the paints reveal more about the adhesion issues. FTIR analysis of the paint layers revealed a drying oil binder, and elemental analysis revealed a modern palette including viridian, cadmium yellow, cobalt violet, and zinc white. In ultraviolet light, the majority of the fluorescence that is due to the properties of the pigments used (fig. 6). Cross-section results revealed no overall varnish coating, and a saturating varnish would have been antithetical to the imitation of fresco. There are several characteristic fluorescence colors of pigments; for example, a pink characteristic of organic red lakes and the cool bright fluorescence of zinc white. However, It is quite unusual to see a mossy green fluoresce so brightly orange. In cross-section this fluorescence appears more brightly at the top of the sample. There does not appear to be a clear coat applied after the paint dried, but a gradual transitory interface between the fluorescing section and the rest of the paint. Furthermore, the fluorescence did not appear in every cross-section taken. The reasons for this reaction has not been definitively determined, but two likely explanations follow:

- One possible explanation is that the difference is fluorescence is due to a dilute consolidant applied before the paint was fully dry, resulting in the hazy interface between layers. The inconsistent presence of the coating in cross-sections suggests that it was applied in a non-uniform layer, perhaps quickly by brush. Although a distinct material could not be characterized with instrumental analysis, this layer could be a shellac-based consolidant used by Mowbray to adhere a very leanly bound paint to this absorbent ground.

Figure 6. Ultraviolet light. H. Siddons Mowbray, *Allegorical Figure Representing Science*, 1892. Courtesy of Meaghan Monaghan.

- SEM-EDS data acquired from a sample of the background suggest that the pigment mixture in this area is viridian and cadmium. Research into the degradation of cadmium sulfide pigments suggests that when a specific deterioration product, cadmium sulfate, is formed, the bright orange ultraviolet fluorescence begins to appear. In a study in *Analytical Chemistry* (Van der Snickt 2009), this change is only seen in the upper 5μm of the paint surface, which is consistent with the cross-section of green paint on the Mowbray paintings. There have also been studies (Leone 2005) that found lack of adhesion in early CdS-containing oil paints. X-Ray Diffraction analysis of the green paint would aid in determining whether this is occurring on the Mowbray paintings.

In his later career, Mowbray used lantern slides to transfer his studies to canvas, a practice that would become widespread among the American muralists. He wrote extensively of the importance of studies in his treatise:

> The more time you give towards making your working sketch complete in all respects, the better you will be equipped for doing the actual work of the ceiling, and the greater your grasp of it as a unity, Your sketch should be, in all points but size, the embodiment of what you want your ceiling to be, and should possess tones and colors that you have simply to match in doing the large work later on. (Mowbray 1916, 7)

He followed his own advice strictly for his Gunn Library murals, as can be seen from studies that mimics exactly the final product. For the Huntington murals, however, Mowbray appears to use a general template for the figures and is largely improvising the details of each picture as he works. With infrared imaging a grid is visible which he used for sizing up his drawings, but one also sees fairly extensive changes made to patterns in the dresses as well as the backgrounds, both in infrared and in pentimenti. This improvisational approach to his painted designs recalls his easel paintings, which are full of playful additions, as in the turtles added in the lower corner of *Idle Hours*, clearly added later in the composition, but which end up stealing the scene. The palette and brushwork on the lunettes is playful and inventive in his use of color, much like the Orientalist palette of his early works.

Conservation Treatment

Conservation treatment was carried out with two major concerns never far from our minds: the preservation of the untouched matte surfaces of the paintings and the strict time limitations for an insurmountable amount of work. The paintings came to us rather damaged. They had been stored at

Yale rolled around the disassembled stretcher of a ceiling painting from the same collection, where they had laid since their acquisition in 1926. Extensive structural and cosmetic work was needed for all nine of the paintings. A photographic record shows their condition changes over time (fig. 7). Images taken before the home's demolition show paint surfaces that were fairly intact while the paintings were in situ. At that time of the paintings' acquisition by Yale, most of the paint losses to the surface had occurred. The muralists may have chosen lead white paste to adhere their paintings to the walls for permanence reasons, but this same material created harsh conditions for their removal. One can see from the overall pattern of the losses (fig. 6) that they appear to be formed when a worker made an arching movement with his arm while slipping a knife or other tool behind the paintings. The vertical splits and tears more likely result from their rolled storage. Before any structural treatment could begin, the paintings were consolidated using mixtures, in various proportions, of funori and Aquazol 200. Funori is a seaweed consolidant that has a remarkable ability to leave no saturating gloss on a matte surface. Aquazol was added when additional strength was needed.

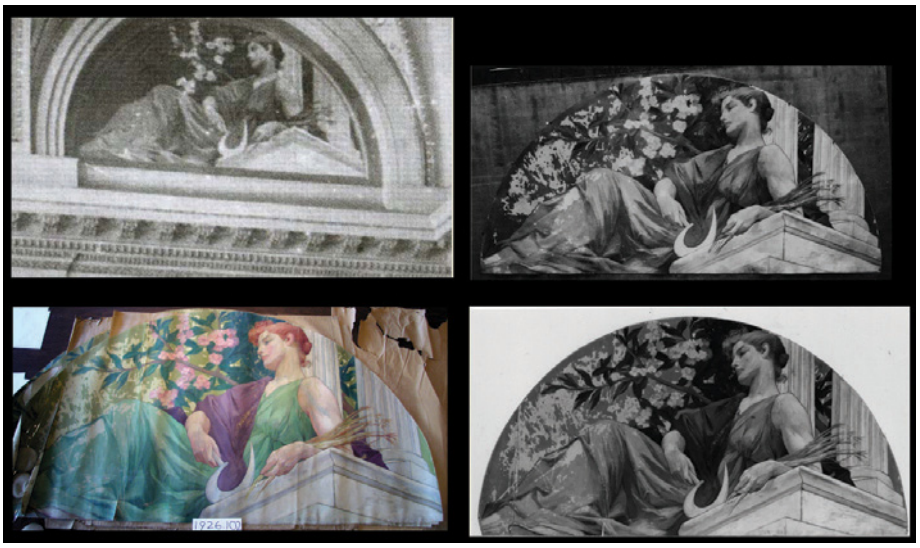

Figure 7. Clockwise from upper left: Mowbray's allegorical figure of agriculture as it hung in the Huntington mansion c. 1915, at its accession into the Yale collection in 1926, from an undated mid-20th century photograph, and as it was unrolled from storage in 2003.

Figure 8. The verso of Mowbray's *Allegorical Figure of Music*. In this image, the painting has been loomed onto a working stretcher and temporary tear mends are in place. The lead white paste adhesive residue is still present.

The greatest and most time-consuming challenge of this project came with the removal of lead white adhesive from the versos of the canvases (fig. 8). The amount of surface area to be cleaned, combined with the health concerns of working with lead paint, suggested that traditional mechanical systems for lead removal would not be appropriate. An effective chelating gel was formulated, but acted slowly and left the surface texture slick rather than restoring the rough texture of the original canvas. A method was developed to mechanically remove the lead from the verso that uses adhesive strips and draws from traditional strappo methods. Conservators used two layers of fabric—one thin polyester gauze that conforms to the surface and a thicker cotton canvas that stiffens the strip, applied one at a time. The adhesive used is BEVA film. The great advantages of this technique are that it kept the lead dust relatively contained, and it is easily trainable so that virtually anyone can safely perform this operation. Conservators decided to line and mount the paintings onto aluminum honeycomb with a sacrificial interlayer of four-ply museum board to ease reversal if needed. The decision to line onto a rigid support was driven by the desire to restore the artist's intention of a flat, rigid surface for these fresco-like murals. Lining was done by hand with minimal pressure, maintaining Mowbray's impastoed brushwork. BEVA gesso was used for filling. The sharp peaks and valleys of Mowbray's bristle brushes would have been time-consuming to imitate by

Figure 9. Mowbray's lunettes after treatment, hanging in the renovated American paintings gallery in Street Hall at Yale University Art Gallery. Courtesy of Yale University Art Gallery.

carving gesso or other hard fills. BEVA gesso is easily shaped with warm Willard tacking tools and, when used with Golden PVA paints, can even be shaped after inpainting. The texturing step was especially important in this case as the paintings are now displayed 16-feet away, lit by skylight. At this distance, color perception is less critical than texture, which is exaggerated by the raking light of the skylight. As the paintings were not varnished and are of reach of regular maintenance, a housekeeping schedule has been developed with the facilities and exhibitions departments.

The paintings are now on view in Yale's newly renovated Street Hall, an 1864 building. They are hung looking over great masterpieces of 19th century America, including works by Thomas Eakins, Edwin Austin Abbey, and Winslow Homer (fig. 9). In this hanging sympathetic to their original space, they will be able to be appreciated in a setting similar to their original home, and perhaps Mowbray's intended chastened splendor will be restored.

ENDNOTES

1. For more on the history of the Huntingtons' architectural paintings, see the recently published "The Huntington Murals at the Yale University Art Gallery," by Sally Webster. *The Magazine Antiques*, November/ December 2012 and the Bulletin of the Yale University Art Gallery, New Haven: 1926.
2. For more information about 19th-century American absorbent grounds, see: Mayer, L and Myers, G. 2004. American Impressionism, matteness, and varnishing *Journal of the American Institute for Conservation* 43(3): 237–254.
3. Fourier Transform Infrared Spectroscopy (FTIR), Scanning electron microscopy with electron dispersive spectroscopy (SEM-EDS), Raman spectroscopy, cross-section microscopy, and polarized light microscopy (PLM).
4. The author was one member of a team responsible for the conservation treatment that included Ian McClure, Patricia Garland, Meaghan Monaghan, Carlos Moya, Laura Hartman, Sarah Gowen, Victoria Schussler, Katie Fitzpatrick, Dina Anchin, Shan Kuang, and Jeremy Bell. The conservation project was funded by the Horowitz Foundation and the Samuel H Kress Foundation.

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Lightning Round on Outreach: Conservation at the Lunder Conservation Center: Reflecting on Our Past, Present and Future

The Lunder Conservation Center opened in 2006. The Center was the first conservation space designed to have glass walls so that much of the work done in the conservation departments of the Smithsonian American Art Museum and National Portrait Gallery would be made visible to the museum visitor. The Lunder Conservation Center was designed so that visitors would be able to see into the conservation spaces while also being able to access interpretive content through different forms of media including kiosks with touch screens in front of each conservation space, an interactive media wall, and paper brochures.

One of the most important decisions made in establishing the Lunder Conservation Center was to create a staff position titled Program Coordinator. The Program Coordinator helps organize and administer a range of programs which fall under both public and professional outreach activities. These include tours, annual programs with school groups (high school, college and graduate schools), lectures, workshops, study days and conferences. The Program Coordinator is a member of museum staff who gives tours to the museum audiences by passing by the different conservation spaces and speaking about the work carried out. The Program Coordinator interprets the space and activities for the visitor. In order to do this effectively, the Program Coordinator works closely with the conservation staff in order to provide updated information on tours. This process is now enhanced by the use of an iPad to present microphotographs or technical images. The role of the Program Coordinator helps establish the fact that the work is best done in a controlled environment and done can't be done in open gallery space at all times, open to the interruption of visitors.

At the November 2011 conference "Playing to the Galleries and Engaging New Audiences: the Public Face of Conservation" held at Colonial Williamsburg, a theme that emerged was that the most successful outreach programs had staff dedicated to developing the content and message presented about conservation to the museum audience. Public outreach requires time and effort. Conservators are increasingly expected to dedicate time to this activity which means that they have less time for conservation treatment and research. It is important to recognize that outreach in the field of education can benefit from the participation of individuals with educational training and expertise. In our own profession of art conservation, some conservators are developing this skill and work on a contract basis for museums who wish to develop conservation-themed programs for students.

Challenges and Future Directions

Over time, the conservators working in the Lunder Conservation Center have often heard comments from colleagues that they did not see conservation in action when they visited the museum. The expectation that conservators will always be seen working in the Lunder Conservation Center is something that is not communicated effectively. In reality, work is carried out throughout various museum sites. For the conservators working at the Smithsonian American Art Museum the collections are presented and stored at the Donald W. Reynolds Center, which is the museum building shared with the National Portrait Gallery, as well as at the Renwick Collection which is in a historic building located near the White House. The majority of the collection is stored at off-site facilities. In addition to the museum collections displayed indoors, the conservation department is also responsible for a small collection of outdoor sculpture on display in the city. Examination of objects in storage, photo documentation, preventive conservation activities, and meetings with museum colleagues all take place in closed spaces.

Going forward we hope to be able to present more information to our visitors about the work we do in order to broaden their understanding of the role of a conservator working in a museum. This can be done by providing more content on the kiosks and website that highlight even more "behind the scenes" activities that take place out of view.

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Lightning Round on Outreach: Looking Out from the Walters 'Window into Conservation'

ABSTRACT

More than 70 years after establishing the Conservation Department, the Walters Art Museum created a space where museum visitors could interact directly with conservators. The Walters' "Window into Conservation" differs dramatically in operation and scale from other visible-conservation arrangements, giving visitors an up-close, intimate look at conservation in action and the ability to ask questions of conservators. The resulting discussions make for a unique museum experience and leave lasting impressions on both visitors and conservators.

The Walters Art Museum of Baltimore, Maryland, has an active, long-standing commitment to collections care and public outreach. Visitors who want to learn more about the history of conservation at the museum, which dates back to 1935, can now visit the Walters' "Window into Conservation."

Before the Window into Conservation was open, visitors to the Walters were able to connect with conservation only intermittently. In 1993, a Tiepolo painting that required treatment was too large to fit into the paintings conservation studio, and a temporary space was built in the galleries to accommodate it. From 1993 to 1996, visitors could watch the treatment through glass portholes in adjoining gallery spaces, but could not engage with the conservators. Infrequently, conservators led tours and gallery talks pertaining to the conservation of individual objects. This still takes place when the fourth floor of the museum is periodically closed for extensive gallery reinstallation.

The Walters' Window into Conservation was opened in 2009, on the fourth floor of the Center Street building, adjacent to the 19th century galleries. The window was dedicated to Elizabeth G. Packard, late conservator of the Walters Art Museum, with a generous donation from Ms. Eleanor McMillan. Public engagement through conservation is guided by Terry Drayman-Weisser, Director of Conservation and Technical Research.

A visitor approaching the Window into Conservation sees a large picture frame on the wall of the fourth-floor gallery; a sliding-glass window within it reveals a small room connected to the conservation laboratories. The window is open when a conservator is at work inside, often at a workbench just beneath the glass. In addition to the particular treatment in which the conservator is engaged, the carefully curated room provides a variety of didactics to prompt visitor questions. These didactics display the raw materials used to create fine art or the types of deterioration that require treatment before exhibition. Materials include three-dimensional objects, reconstructions, mold-making materials, paintings on canvas or panel, and two paintings in treatment stasis.

The entire conservation department—including preprogram and graduate interns, post-graduate fellows, and Walters staff—takes turns working in the window, which is staffed by a conservator on Fridays, Saturdays, and Sundays from 12:30 p.m. to 4 p.m. These are the hours of peak museum attendance. The window is closed and locked at other times, but visitors are still able to look into the room and to learn about conservation at a nearby video terminal, which was installed in early 2012.

The Walters Window is different from other dedicated visible conservation spaces because its primary goal is to provide direct contact with museum visitors. While the conservator staffing the window has an ongoing treatment on display, and works on the project between visitors, it is understood that the treatment is included mainly as a point of discussion. Public engagement, rather than visible treatment, is the goal for the entire period the window is open.

People from all demographics visit the window, including scholars, students of art history, artists, school groups, and

docent-led tours. A conservator may have a few prepared statements to summarize his or her treatment or to gauge a visitor's level of interest, but the open environment and didactic materials encourage an astonishing variety and number of questions. In general, visitors are inquisitive, enthusiastic, and eager to learn more about conservation and the objects being treated.

The small size of the window does create some challenges unique to the Walters: for example, large groups may find it hard to see or hear the conservator. Other challenges are common to conservators in all museums who seek to raise public awareness about conservation. Visitors may know only a little about restoration and conservation, or be misled due to inaccurate representations of the profession in the media. Often museum-goers simply want to watch a conservator at work rather than to discuss the treatment process or learn about conservation practices. Even if visitors are curious, certain aspects of treatment and conservation ethics may be difficult to sum up in the few minutes of an average visit.

In the fall of 2011, a survey was administered to 117 museum guests after they had visited the Walters Art Museum Window into Conservation. The results showed that an overwhelming majority had discovered conservation for the first time, and they considered the window to be educational, informative, and fun. A whopping 99% of the visitors surveyed would recommend the window to others. Only one person described the window as uninteresting.

From the conservator's point of view, working in the window is often refreshing. The average museum visitor is generally curious, and seeing someone handle or work on an object is often a new experience. The visitors' enthusiasm and interest in learning more about objects, artists, and the conservation profession can invigorate conservators' own passion for the discipline. Working directly with the public also prepares conservators to participate in a broad range of outreach activities that seek to increase awareness of conservation.

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MICHAEL O'MALLEY

Bridging a Divide–Conversing with Allied Professionals

ABSTRACT

Conservators are very good at sharing knowledge and networking among themselves, but reaching out to allied professionals such as art historians is another thing altogether. The conservation treatment of a seventeenth century portrait of a venerated Augustine nun not only led to a renewed appreciation of its formal qualities, but also became an occasion to bridge a divide between Québec conservators and art historians. Ten years after the treatment, in the absence of any serious scholarly interest in the painting, the conservator published an article about it in a Canadian art history journal and reopened the discussion around the attribution of the painting.

The portrait of Mère Catherine de Saint-Augustin (1632–1668) is a precious object for the Augustine nuns of Québec. Oral tradition relates that the portrait was made at her deathbed. Mère Catherine first served the community as a nurse, then as keeper and director general of the hospital. Her leadership, devotion, and spiritual fervor made a lasting impression on the young French colony. Beatified by the Vatican in 1989, Mère Catherine is considered to be one of the founders of the Catholic Church in Canada.

Before treatment, the portrait was covered by successive layers of overpaint. In the 1950s, it was finally rendered unrecognizable by a nun who tried to "rejuvenate" the sitter by giving her a younger, more cheerful appearance. The removal of the overpaint uncovered details and characteristics of the original surface that had not been seen in decades. The painting is neither signed nor dated, but the quality of its execution points to an artist of European training, as opposed to the work of an amateur or a self-taught painter.

The eminent Québec art historian, Gérard Morisset (1898–1970), had seen the painting before its last transformation in the 1950s. As early as 1936, he noticed a resemblance between it and female figures in two works by French painter Claude François (1614–1685), also known as Frère Luc, who sojourned in New France in 1670. However, Morisset stopped short of definitively attributing the portrait to Frère Luc, perhaps because François came to Québec two years after the death of the sitter. The portrait has generally been attributed to Hughes Pommier (1636–1686), a priest and artist associated with the Québec Seminary.

While many questions remain open and unanswered, the article refocused attention on this enigmatic portrait and on the work of conservators. Stylistic and scientific evidence was presented that argue in favor of an attribution to Frère Luc, which seems to have been well received by some art historians in Quebéc.

AUTHOR'S NOTE

The article is published in French, but a substantial English summary can be found at the end of the article.

REFERENCE

O'Malley, Michael. *Un nouveau regard sur le portrait de Mère Catherine de Saint-Augustin*. The Journal of Canadian Art History, Vol. 30, 2010, pp. 8–27

Link to the article on Academia.edu: <http://www.academia.edu/9467532/Un_nouveau_regard_sur_le_portrait_de_M%C3%A8re_Catherine_de_Saint-Augustin>

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WILLIAM WEI

Conservation, Engineering and Materials—Reinventing the Wheel?

ABSTRACT

The scientific side of the world of the conservation of cultural heritage is primarily a world of chemistry. This is not surprising since a majority of issues dealing with the conservation and restoration of objects are chemistry-based issues such as aging, artist's materials, cleaning, corrosion, effects of climate and indoor pollution, identification, pigment analysis, etc. Conservation training programs thus include a considerable amount of chemistry in their syllabi. As a result of this and years of experience, a certain trust in, and acceptance of, what chemists in conservation scientist have to say has developed in the conservation world, no matter how complicated the measurement. On the other hand, when it comes to issues involving the mechanical and physical behavior of objects and materials, this level of trust and acceptance is not nearly as strong. There is still much discussion over issues such as vibrations, the cracking of panel paintings, the strength of adhesives, etc., although similar issues have been solved in the industrial world, using principles and methods long accepted in engineering and physical sciences.

Yet, while most conservators would board their flight to the next AIC conference without batting an eyelash, they have serious concerns and can be quite skeptical when those same principles and methods which are used to protect their lives in an aircraft, are used for protecting valuable objects. Why is this? It is the age-old need for three things:

- *Better education in the areas of the mechanical and physical behavior of materials and objects;*
- *A willingness by conservators and other end-users to learn and better understand such new engineering information, and not just look for the quick, "non-academic" fix; and*
- *A willingness by engineers and physical scientists to better and more simply explain the concepts and solutions that are already there, and not lose their clients in a sea of jargon and complexity, and unnecessarily reinventing the wheel.*

Over the past decade, the conservation research department of the Rijksdienst voor het Cultureel Erfgoed, as an applied research organization, has built up considerable experience in bringing engineering principles to conservation science. Examples of work being conducted to improve an understanding of mechanical and physical behavior of objects include:

- *Simple methods for teaching the principles of the mechanical testing of materials developed together within the former conservation training program of The Netherlands Institute for Cultural Heritage (program now operated by the University of Amsterdam);*
- *Work conducted in close cooperation with museum professionals to help understand the difference in the effects of shock and vibrations on sensitive objects;*
- *Specific case studies on the combined chemical and mechanical effects of climate on outdoor sculpture;*
- *Introduction of simple methods for monitoring the cleaning of objects and the accumulation of dust.*

It is shown that, as in all walks of life, a willingness to communicate in another "language" always leads to better communication, understanding, and solutions of the issues involved.

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MATT CUSHMAN, RITA ALBERTSON, AND PHILIP KLAUSMEYER

A Case Study in the Removal of a Lead Lining Using a Q-Switched Nd:YAG Laser

ABSTRACT

Portrait of a Woman, *a circa-1830 oil-on-canvas attributed to John Samuel Blunt in the collection of the Worcester Art Museum, exhibited numerous structural and aesthetic issues that necessitated treatment. Of major concern were several complex, unmended tears that a previous lining failed to secure in plane. This previous lining was attached using a lead-containing adhesive paste that had to be removed in order to affect a successful treatment. Traditional aqueous and solvent-based methods proved to be ineffective at removing the lining adhesive. Ultimately, a Q-switched Nd:YAG laser with an emission wavelength of 1064 nm was used to remove the adhesive.*

1. INTRODUCTION

In 2010, a portrait attributed to John Samuel Blunt (American, 1798–1835), a somewhat itinerant painter active in New England between 1816 and 1835, [1] was given to the Worcester Art Museum (fig. 1). The portrait of the unidentified woman matches several technical and stylistic characteristics identified by Robert Bishop in his critical analysis of the oeuvre of The Borden Limner, whom Bishop identifies as Blunt. [2] Out of curatorial interest, the painting was selected for treatment.

Figure 1. John Samuel Blunt, *Portrait of a Woman*, ca. 1830. Oil on canvas, 33 × 27 7/8 in. (83.8 × 70.8 cm). Before treatment.

2. PAINTING CONDITION

There were several cosmetic issues preventing the painting from being considered exhibitable, including heavy surface soiling, multiple discolored varnish coatings both natural and synthetic in origin, and crudely matched overpaint covering the entirety of the background and much of the sitter's costume. From a long-term preservation standpoint, structural concerns needed to be addressed. A failing lining could no longer hold the painting's several complex, unmended tears in plane, yet the stiffness of the lining adhesive held distortions in the original canvas support in a static state (fig. 2). To complicate treatment planning, the original canvas was found to be very brittle and multiple localized infusions of an unknown adhesive were evident on the lining verso (fig. 3). It is suspected that the combination of the brittleness of the original support, the stiff lining adhesive and the failing bond between the lining canvas and the adhesive film contributed to propagation of canvas breakage extending beyond the initial tears, which may have resulted in the decision to apply adhesives locally from the lining verso.

Figure 2. *Portrait of a Woman*, before treatment, raking light.

Figure 3. *Portrait of a Woman*, before treatment, verso. Note the several darkened areas where adhesives have been infused into the lining canvas in an attempt to maintain proper adhesion between the lining canvas and the original support.

3. LINING ADHESIVE ANALYSIS

Efforts were made to characterize the lining adhesive, knowing that the lining would need to be reversed in order to achieve a satisfactory structural and aesthetic treatment. Microchemical spot testing, Fourier transform infrared microscopy (FTIR), cross-section fluorescence microscopy, and scanning electron

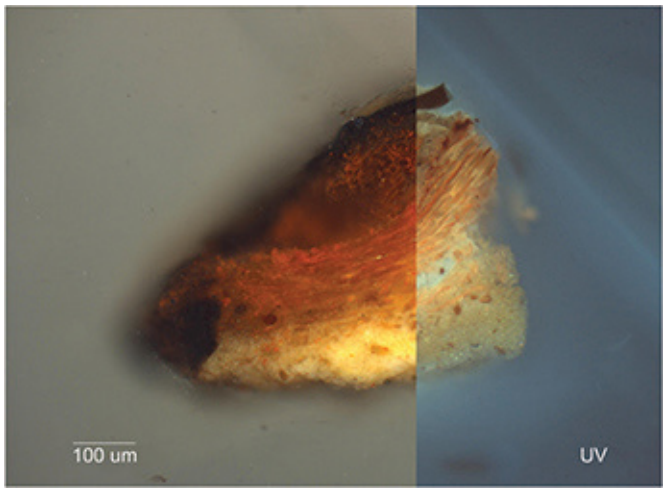

Figure 4. Micrograph of a cross-sectioned sample from *Portrait of a Woman*, showing the thick adhesive paste application, canvas threads, red-colored ground absorbed into the canvas, ground, paint, and varnish applications.

microscopy with energy-dispersive X-ray microanalysis (SEM-EDS) were employed to characterize the film and inform treatment options.

Previous damages at the edges of the painting and small delaminations between the lining canvas and lining adhesive provided convenient locations from which to collect samples. The lining adhesive was a hard, yellow opaque coating not unlike a stiff oil paint. Microchemical spot testing suggested the presence of lead. [3] In addition, the bright lemony yellow fluorescence of zinc white particles was observed using cross-section fluorescence microscopy (fig. 4), which also showed that a red ground application had been at least fractionally absorbed into the canvas support by capillary action. It is possible that this fractional absorption of the ground application has contributed to the brittleness of the canvas support. The thickness of the lining adhesive, comparable to the thickness of a canvas thread, should be apparent. The presence of both lead and zinc in appreciable amounts was confirmed using SEM-EDS as were small amounts of iron, silicon, and aluminum, all of which were probably present as a clay-containing yellow earth pigment that imparted the yellow coloration to the lining adhesive. [4]

FTIR produced a complex spectrum for the adhesive film that was unable to be adequately resolved; however, analysis suggested the presence of lead white in linseed oil with possible additions of a polysaccharide-based material and a natural resin. [5] While having a good approximation of the components of the adhesive paste's binding medium would have been useful, it is not surprising that additives would have been used to modify

the working properties of an oil paint for this purpose; indeed, it is possible to find recipes for complex, oil-based lining adhesives published in 19th-century popular magazines:

> To line old oil-paintings take a piece of grey or unbleached calico, strain it upon a frame, and size it with weak size. When dry, take ¼ oz. spirits of turpentine, 1 drachm camphor, dissolve it in 4 oz. cold-drawn linseed oil, 2 oz. white lead, stiff ground, do. umber, 4 oz. finely-washed and dried whiting. Mix all together; apply to the calico well, rubbing it in; after the second coat, pumice to erase the lumps. Give the picture a coat, and pumice that; then coat both, and put them together upon a level board face down upon a piece of brown paper well sized. Well press, and rub the air out, so as to bring them in perfect contact, and in a few days it may be tacked upon a frame and be stronger than ever – JACK OF ALL TRADES. [6]

3.1 VISUAL OBSERVATIONS

After the painting was faced with Japanese tissue, the lining canvas was removed mechanically while not requiring applied heat, moisture or solvents. Removal of the lining canvas revealed a thick, uneven and locally discontinuous adhesive paste coating (fig. 5). As noted from the recto, the tears in the canvas were not properly mended, and it appeared as though the tears continued to propagate after lining, leaving small angular breakages in the canvas support and extending through the adhesive, ground and paint films. Extruded fill materials were visible at the edges of the tears, and localized areas of adhesive residues could be found where infusions had been applied through the lining verso (fig. 6).

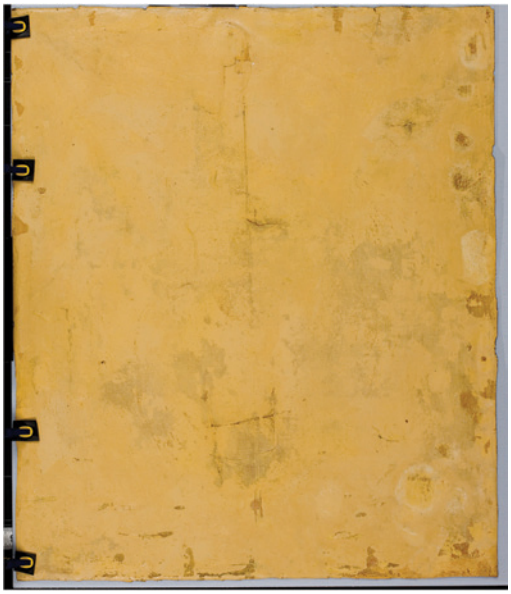

Figure 5. *Portrait of a Woman*, verso after lining removal.

Figure 6. *Portrait of a Woman*, verso after lining removal (detail). Note the unmended tears, adhesive residues, extruded fill materials, distortions out of plane, and small voids in the lining adhesive film.

Given the brittleness of the canvas support, along with the complicating factors of stiff distortions and multiple tears, the decision was made to avoid mechanical removal of the adhesive film if at all possible.

4. EVALUATION OF CLEANING SYSTEMS

A range of formulations was prepared in an attempt to identify an effective means to efficiently swell or solubilize the adhesive film. Neat solvents, binary and ternary solvent mixtures, and solvent gels thereof were tested, but none provided an acceptable level of cleaning.

Aqueous preparations were also tested. Those with pH between 9.0 and 9.5, strong chelators such as EDTA, high ionic content, thickeners and suspension agents allowing for both greater dwell time and dispersion of swollen materials, and added polar solvents were effective but left much to be desired. These preparations required dwell times on the order of 15–20 minutes and repeated agitation with a brush to remove material from a 3/4 in. × 3/4 in. area, and while the bulk of the adhesive paste film was able to be removed, the elevated pH and long dwell time left behind a slick surface with considerable adhesive paste residue in the recesses of the canvas weave (fig. 7). It is suspected that available cellulosic material at the surface of the canvas was hydrolyzed during the long dwell time, beginning to compromise canvas integrity.

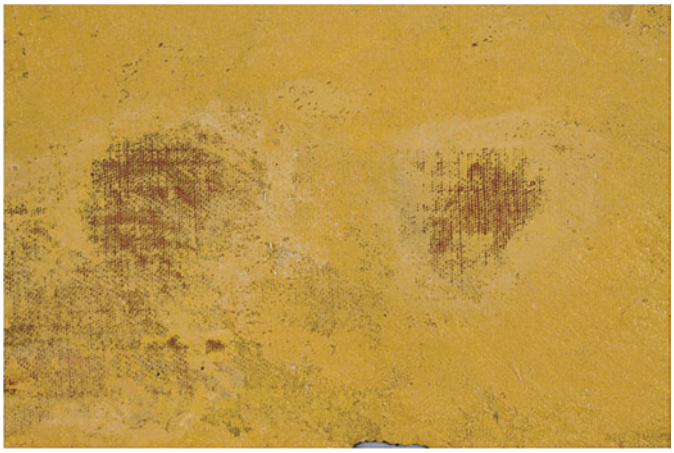

Figure 7. Detail of most successful aqueous cleaning tests.

4.1 LASER CLEANING

After unsatisfactory results from both traditional and leading-edge approaches and before settling for mechanical removal of the lining paste with scalpels, a Q-switched Nd:YAG laser from Lynton Lasers Limited (fig. 8), which the conservation department had rented for use in the cleaning of several stone and ceramic pieces and surfaces in the Museum's collection, was considered for this particular application. Although lasers have become widely accepted tools in objects and architectural conservation, paintings conservators as a whole have been wary of their use for the cleaning of painted surfaces. However, because of the offending material's presence on the verso of the painting rather than the recto, coupled with recent conservation literature suggesting that laser cleaning may be appropriate for the removal of lining adhesives, [7] surface soiling from textiles, and lead-containing overpaint on objects, a small initial cleaning test was performed.

Figure 8. Lynton Laser's Compact PHOENIX™ at the Worcester Art Museum, with laser handpiece inset.

The Compact PHOENIX™ laser used for cleaning is capable of producing laser pulses at both 1064 nm and 532 nm, with output energy between 60–100 mJ and pulse duration of 10 ns. Repetition rate can be selected between 1–25 Hz. Focal spot size is approximately 1–2 mm. [8] The amount of control afforded by these specifications make lasers attractive tools for cleaning when applicable. It is worth noting that one can expect these values to vary slightly in practice, especially at higher energies and higher repetition rates. While one of the touted benefits of Nd:YAG lasers is a "self-limiting" quality to the cleaning, in the present application, this concept was ignored because localized heating of the canvas verso could have damaging effects throughout the painting's layered structure if not carefully controlled.

5. HEALTH AND SAFETY CONSIDERATIONS

The primary pathological effects to be avoided in the use of laser light in the visible and near-IR range are photochemical damage to the retina and retinal burns to the operator or an observer in the area of operation. [9] As such, all operators and observers were required to wear appropriate protective eyewear, and measures were taken to enclose the operating area in order to prevent accidental exposure of passersby. Also, the Compact PHOENIX™ unit features an emergency shut-off for use in the event of an emergency.

The mechanisms by which a surface is cleaned using a laser–photothermal, photochemical, and/or photomechanical processes–all result in the ejection of the removed material into the immediate vicinity. In the present study, the removal of a lead-containing film required special considerations for personal protective equipment, containment, and disposal.

The operator wore disposable Tyvek® coveralls, a half-mask respirator with particulate filter attachment, and black nitrile gloves were chosen to offer protection while providing a quick-glance empirical sense of how much particulate material was escaping the variable-suction HEPA vacuum held adjacent to the surface to be cleaned (fig. 9).

For optimal containment, an enclosure was constructed inside the conservation department's spray booth, wherein all surfaces were covered with polyethylene sheeting held in place with

Figure 9. The primary author modeling personal protective equipment.

rare-earth magnets (fig. 10). All seams were sealed with multiple offset layers of packing tape, and the entrance and exit of the space was designed with redundancy in containment in mind.

Once work was completed, all surfaces were wiped with damp cloths, and all materials were collected, sealed, and properly disposed of according to lead and heavy metal regulations.

Figure 10. Inside lead containment space, with rare earth magnets securing polyethylene sheeting (inset).

6. PRACTICAL OBSERVATIONS

For the initial cleaning tests, two adjacent, unattached fragments from the proper right edge of the painting were used. Both fragments measured approximately 1/8 in. × 5/8 in. Although these fragments were located at the edge of the painting, the thick, uneven application of the lead-containing adhesive paste appeared to be representative of the arrangement of materials found elsewhere on the canvas verso.

Cleaning tests were successful and informative. Even using a very low repetition rate, cleaning was relatively quick, easy to monitor and control, and resulted in the recovery of the canvas weave even though removal was not perfect. A two-step mechanism for cleaning was observed, with an initial photochemical darkening of the film followed by the expected photomechanical ablation. A side-by-side comparison between cleaned and uncleaned fragments illustrates the cleaning efficacy (fig. 11). A sample from a cleaned fragment was examined using cross-section fluorescence microscopy, showing that the bulk of the adhesive paste was able to be removed with no apparent disruption of the substrate, ground, or paint layers (fig. 12).

After these successful tests on fragments from the painting, a larger test was undertaken on the canvas verso to gain a better sense of how much time would be required to complete the cleaning. An area measuring approximately three inches squared was selected, and the test represented an eightfold improvement in efficiency with respect to the most effective of the traditional cleaning tests. Satisfied with these results, cleaning continued until removal of the lining adhesive was complete overall (fig. 13).

Figure 11. Painting fragments before (top) and after (bottom) laser cleaning, in raking light.

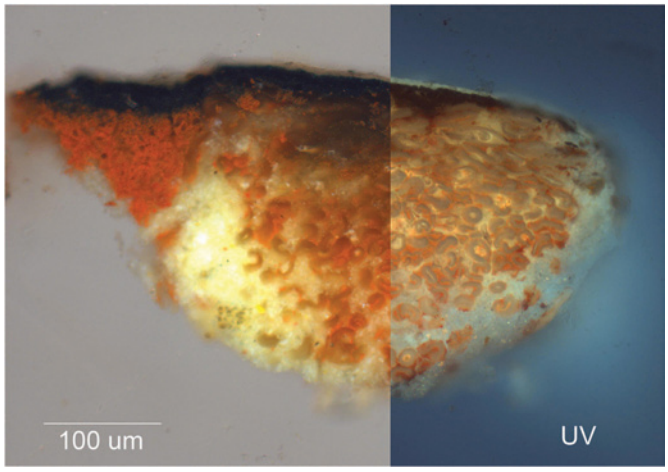

Figure 12. Micrograph of a cross-sectioned sample from *Portrait of a Woman* after laser cleaning, showing marked reduction of the lead-containing adhesive paste layer.

Figure 13. *Portrait of a Woman*, verso after laser cleaning.

Of note is the selective nature of the cleaning; the lead-containing paste was removed while fill materials that had extruded through unmended tears were left unaffected. However, it is this same selectivity that contributed to an overall imperfect and mottled appearance due to the presence of large inclusions within the adhesive paste that served to partially mask the adhesive paste from the incident laser radiation (fig. 14). These remaining materials required some mechanical removal prior to subsequent humidification or lining; continued laser application would risk overheating the area.

Figure 14. Detail, verso after cleaning showing an overall mottled appearance with isolated spots requiring mechanical removal.

In general, the laser was found to be a satisfying tool to use for this purpose, as nearly every change in movement or instrument settings had a discernable effect on cleaning efficiency. On the macroscale, satisfying observations included the subtle relaxation of the canvas as larger areas of the verso were exposed as well as the removal of the adhesive paste at the tears in the canvas without requiring traditional mechanical action.

Removing the lining adhesive allowed for conventional treatment and documentation of the painting to proceed, including a complete computed x-radiograph, which would have been much more difficult to interpret if an uneven, radiopaque coating were present on the verso. [10]

Upon removal of the facing, small, localized areas of microscopic disruptions in the surface were visible; however, observations made during and after varnish and overpaint removal suggested that these disruptions were limited to those uppermost layers (fig. 15). It is possible that these disruptions may relate to the lower glass transition temperatures of those materials relative to the oil paint film, and the interface between the surface and voids in the facing may have contributed to this phenomenon as well. While a relief that there was no apparent damage to the original paint film, methods of safeguarding against localized heating need to be considered if this technique is to find wider applications in paintings conservation.

7. RESEARCH-IN-PROGRESS

It would be beneficial to assemble something similar to a heat sink on the surface of a painting to draw heat away from the ground and paint films and dissipate it across the surface. An attempt to build a facing material with these characteristics is described below.

Figure 15. Details, recto after laser cleaning, before (top) and after (bottom) varnish removal. Note the surface disruptions in the sitter's hair before varnish removal.

7.1 THERMAL CONDUCTIVITY OF POLYMERS

Generally speaking, the greatest factor driving heat-sink-type behavior is thermal conductivity, which, for amorphous solids like polymers, can be described using one of Debye's equations:

$$\lambda = {}^{1}/_{3}(C_p \bullet v \bullet l)$$

Where λ is thermal conductivity, C_p is the specific heat capacity of the material, v is the phonon velocity, and l is the phonon mean free path. For our purposes, the most important term is l, the phonon mean free path, which can be described as the average distance a quantized packet of heat or vibration can travel in one step in a given medium at a given temperature. For polymers, this mean free path is on the scale of angstroms, greatly limiting their thermal conductivities. [11] Given the desire to work with familiar materials for the sake of comfort and knowledge of reversibility, this is quite a challenge to overcome.

7.2 BUILDING A COMPOSITE FACING

It is possible to impart advantageous properties to our familiar coating materials by creating a composite including conductive materials like carbon nanotubes or graphenes, both allotropes of carbon made of a continuous network of sp^2-hybridized carbon atoms capable of conducting both heat and electricity while remaining chemically inert. A drawback of these materials is that they can be prohibitively expensive, and, especially in the case of carbon nanotubes, safety must be a top priority when handling. [12]

Ideally, these materials would be able to transmit heat over long distances, but the reality of the situation is that this will probably be impossible within the constraints of the usual conservation treatment, given that one would have to use less-expensive grades of these materials with lesser conductive properties. Also of note is the fact that there is a nonzero resistance for conducting heat at every interface within the composite. As such, a relatively inexpensive grade of powdered graphene was selected.

For the facing material itself, one could consider replacing the usual Japanese tissue with a material such as Buckypaper, a sheet of nanotubes or graphenes cast from a suspension; however, cost is a concern here as well. An inexpensive, albeit less conductive, option is to use a thin, carbon fiber veil as a facing material. Thus, a final facing system of carbon fiber veil adhered with 5% (w:v) graphene nanopowder suspended in 30% MS2A in Shellsol D-38 was proposed for testing. This system combines materials of known inertness and reversibility, a polymer with a relatively high glass transition temperature, composite materials with high thermal conductivity, and a reasonable cost per surface area.

7.3 REVERSIBILITY TESTING

An empirical test for reversibility was performed by coating small canvas-board panels overall with the graphene/MS2A suspension, with most of the panel also being covered with two layers of the carbon fiber veil. After several days of drying, the facing was removed using Shellsol D-38, leaving behind a section of the graphene/MS2A coating. The system provided very good reversibility, but it was imperfect; small agglomerated specks of graphene were visible in the recesses of the canvas weave.

7.4 THERMAL DISSIPATION EXPERIMENTS

Fragments of a 19th-century oil-on-canvas painting were prepared for testing in the following manner: an uncleaned surface; a surface-cleaned sample; a surface-cleaned sample with two applications of MS2A varnish; a surface-cleaned sample with two applications of the graphene/MS2A suspension; a surface-cleaned sample with two applications of MS2A varnish and carbon fiber veil; and a surface-cleaned sample with two applications of graphene/MS2A suspension and carbon fiber veil. A Lynton Compact PHOENIX™ laser was aimed at the recto for 120 seconds at 20 Hz repetition rate. Efforts were made to hold the geometry consistent from sample to sample. Thermographic data were captured using a thermal camera at three frames per second, and the data were then analyzed using IR Cameras Thermography Suite, providing measurements for solid-state temperature and heated spot size over time.

7.5 RESULTS AND DISCUSSION

After plotting maximum temperature over time, each sample can be seen to follow roughly the same pattern of an initial

steep increase in temperature followed by a leveling off. The sample reaching the highest temperature was one that was cleaned and then coated with MS2A only. A trend was noticed where samples with the surface coating soaked through cracks or losses, saturating the verso, reached higher temperatures.

The general trend observed is that the spot size increases over time, but the differences between facing arrangements did not produce a statistically significant difference in spot size for this particular arrangement of materials.

If only curves representing those samples where there was no noticeable saturation on the verso are compared, it is interesting to note that the two samples using the carbon fiber tissue as a facing exhibited the lowest maximum temperatures, hovering between 50 and 55 °C, between 10–15 degrees lower than that for other samples (fig. 16).

The presence of the graphene nanopowder in the composite appeared to have no statistically significant effect, at least at this level of loading. This might not be the case for composite coatings with a much higher graphene load; however, reversibility might be more difficult at higher load levels.

It must be stressed that the data collected reflect only the solid-state conditions of the samples. Investigations on the temperatures and forces applied to a painting sample on the femtosecond scale under such conditions would be useful for better describing the kinetics at play.

8. CONCLUSIONS AND FUTURE RESEARCH

The use of a Q-switched Nd:YAG laser proved to be successful for the removal of a lead-containing adhesive paste from the verso of John Samuel Blunt's *Portrait of a Woman* in the collection of the Worcester Art Museum. However, there remain avenues for future research: Is it possible to optimize the laser ablation of lead-containing films by manipulating laser wavelength, pulse duration, and energy while controlling the heating of the painting's layered structure? Would this technique be useful for the removal of lead white fills?

Ultimately, the first attempt at engineering a thermally conductive composite facing material was not altogether successful as presented above. While one can imagine beneficial uses of such a coating, especially where heat must be controlled, directed, or normalized across a surface, there is much work to be done toward the selection and arrangement of materials, testing, and practical use.

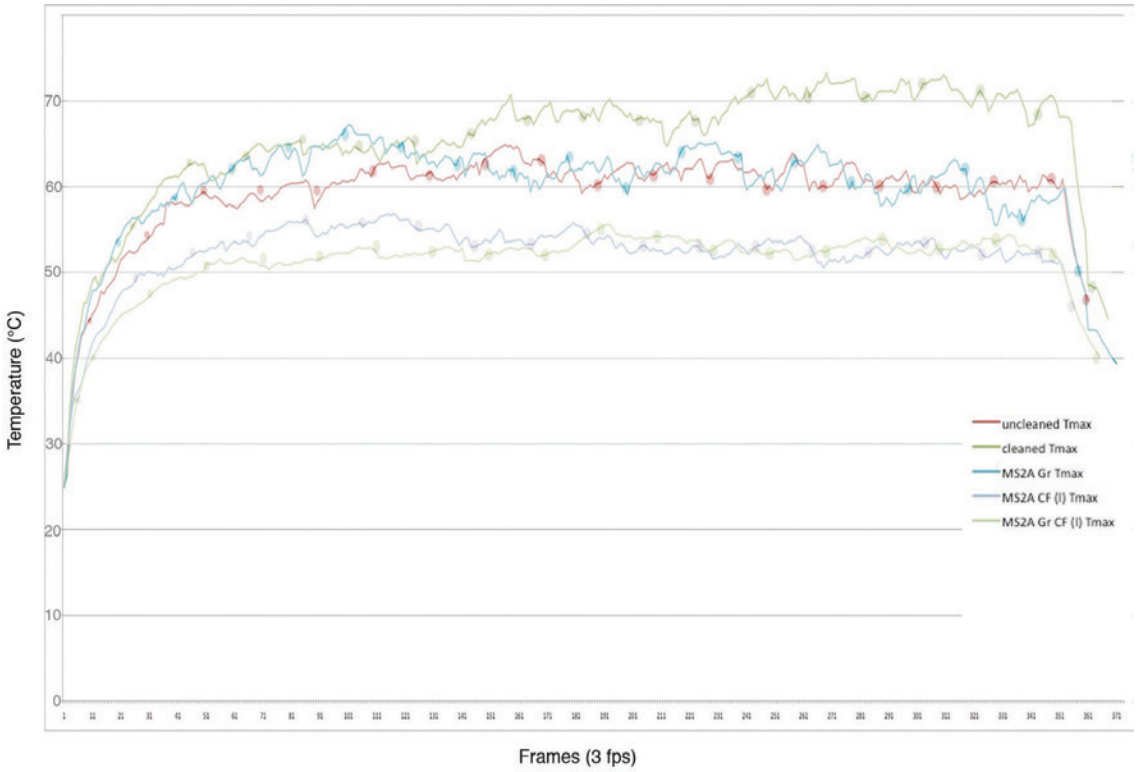

Figure 16. Chart showing maximum temperature over time for non-darkened 19th-century painting samples.

ACKNOWLEDGMENTS

The authors would like to thank Gianfranco Pocobene, Valentine Talland, Holly Salmon, and Jess Chloros of the Isabella Stewart Gardner Museum, Elliott Rittenberg of IRCameras, LLC., Lynton Lasers, and Barbara and David Krashes. The authors also wish to thank the Andrew W. Mellon Foundation for its continued support of the Worcester Art Museum Art Conservation Department.

ENDNOTES

1. A timeline of Blunt's life can be found in Child, p. 106.
2. For a discussion of technical characteristics of Blunt's work and an identification of Blunt as the Borden Limner, see Bishop.
3. For complete discussion of microchemical spot testing, including the procedure for testing for lead using potassium iodide, see Odegaard, et al.
4. Unpublished analytical report by Philip Klausmeyer. Analyses of coatings, overpaint and ground and paint layers were also undertaken, but because they are out of the scope of this paper, they are not be presented here.
5. Ibid.
6. Reply to an October 7, 1870 query about how to line oil paintings, *English Mechanic and World of Science*, October 21, 1870. It is not suggested that this is the exact recipe used for the lining of *Portrait of a Woman*; rather, it is used as an illustration of the complex restoration recipes available in 19th-century popular literature.
7. Batischche, et al. discuss the potential use of lasers for the removal of beeswax and animal glue lining adhesives.
8. Values from Lynton Lasers promotional material. Colleagues at the Isabella Stewart Gardner Museum are working to establish practical output for this model.
9. For regulations regarding laser safety, visit www.osha.gov/SLTC/laserhazards/
10. It is hoped that a selective ground application seen in the x-radiograph, along with the overall, red-colored ground application soaked into the canvas support may be found to be characteristic of Blunt through comparative study of other known works by the artist.
11. Much of the scientific background for this experimental section can be found in Han and Fina, as well as in the references cited therein.
12. NIOSH has published several bulletins concerning nanoparticle safety, especially that of carbon nanotubes, which have been suggested to have asbestos-like effects when inhaled.

SUPPLIERS

Nd:YAG laser: Lynton Lasers Ltd. www.conservationlasers.com

Thermal imaging camera: IRCameras, LLC., www.ircameras.com

Graphene nanopowder: www.graphene-supermarket.com

Coated carbon fiber veil: www.fibreglast.com

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ROBERT PROCTOR AND JILL WHITTEN

On Picture Varnishes and their Solvents for the 21st Century

ABSTRACT

No book is more important to painting conservators than On Picture Varnishes and Their Solvents *by Feller, Stolow and Jones (1985). Several varnishes have been introduced to the field since this book was published more than a half century ago. This paper will discuss the unique solubility parameters of several of the varnishes commonly used by painting conservators and how different solvents can affect their appearance and allow them to be applied in distinct layers that can be applied and removed without disturbing the layers of varnish or inpainting below.*

The title of this paper is borrowed from the seminal publication by Feller, Stolow and Jones. Less than an addendum, it is an acknowledgement of the foundation they laid. *On Picture Varnishes and Their Solvents* [1] was originally published in 1959 and revised in 1971. The information within is still some of the best available today. The book served as the first in-depth study into picture varnishes and as an introduction to the use of synthetic resins to the field of conservation. It may be argued that very little advancement had been made on these topics until the publication of the IIC Brussels Congress Preprints. [2] In this publication, two articles co-authored by R. de la Rie and C. McGlinchey and a third by M. Leonard, introduced a new class of synthetic low molecular weight resins (LMW) that offered conservators the promise of varnishes that were both stable and aesthetically appealing.

Soon after this publication, Jill Whitten joined Dr. de la Rie at the National Gallery in Washington to study the handling properties of these materials. Over the past 20 years the authors (Whitten and Proctor) and Dr. de la Rie have presented a number of workshops in both the US and Europe aimed at helping practicing conservators and students of conservation understand the properties of these resins so that they might use these materials with both confidence and success. Most of the information in this paper comes from this collaboration and through using these varnishes in everyday practice.

None of the general concepts of solubility parameters, empirical qualities of solvents, or polymer chemistry are new, and the credit for them belongs to others who have contributed on this subject. The authors' own contributions come from informal experiments and through deciphering technical data both published and on the web. This paper will discuss four resins used for varnishing, three LWW resins (Regalrez® 1094, MS2A® and Laropal® A 81) and one polymer (Paraloid® B-72). These were all chosen because of their stability. Of these four resins, three will be covered more thoroughly due to their differing solubility characteristics that allow them to be used together in reversible layering systems. The fourth, MS2A®, will only be discussed briefly, due to the unique and complex solubility characteristics of the resin and, because it is the least stable of the four resins. Polyvinyl acetate polymers (PVA, e.g. Mowolith 20) were omitted not because of any failing of the resin stability, but because of the authors' lack of experience with PVA. The continued manufacture of these resins is also uncertain.

Problems with Nomenclature and the use of Proprietary Varnishes and Solvents

Both the generic terms used by industry, and the names conservators have adopted for varnish components are often non-specific and often lead to confusion. For example, in Europe, Paraloid® B-72 is often simply called "Paraloid." Paraloid is the parent name of dozens of acrylic resins, all having different characteristics, including solubility and stability differences (e.g. B-67, F-10, B-44). In the US and Europe, both Laropal® K 80 and, more recently, Laropal® A 81, are often referred to only as "Laropal."

Similarly, names given to solvents such as mineral spirits, naphtha, white spirits, petroleum benzine, ligroin, petroleum

ether, Stoddard solvent, and Shellsol are all non-specific. Each one of these names can describe a range of products with varying properties. These are all hydrocarbon mixtures. While most of these terms have ASTM specifications that basically group them according to their boiling points, for example, as a group mineral spirits have higher boiling points than naphthas, there can be considerable overlap. A fast evaporating mineral spirit may have a lower boiling point than a slow evaporating naphtha. Furthermore, they all come in different grades and qualities. Many are simple fractions, meaning they contain much of what distills out of crude oil between a certain range of temperatures. Better quality solvents are blended from desired fractions and treated to remove things like sulfur and benzene. The best are hydrogenated to make them more stable. To make things even more confusing, many solvents that have been used reliably by conservators for years have recently been dearomatized, dramatically reducing their strength without undergoing any name change. Fisher Petroleum Benzine 264 [3] is probably the most familiar example.

Choosing good solvents is as critical as choosing stable resins. [4] In order to make a good choice it is important to learn solvent properties. In general, solvents sold at art and hardware stores are unreliable since their formulas can change without notice and they often tend to be of poor quality. It is best to purchase solvents from a reliable distributer of laboratory chemicals or one specializing in conservation products. Either of these sources should be able to provide technical data sheets for their products upon request.

Describing formulations and the problem of percentages

Many conservators use the term percentage to describe a varnish mixture. Unfortunately, several different methods for representing a percentage are used and some of the most common used by conservators are not actually percentages at all. For example, 25 grams of resin in 100 mL of solvent is often called a 25% wt/vol solution. The true way to make a 25% wt/vol solution is to place 25 grams of resin in a volumetric container (e.g. an Erlenmeyer flask or graduated cylinder) and then fill it up with solvent to the 100 mL mark. A 25% wt/wt solution is made by adding 25 grams of resin to 75 grams of solvent. While both of these can be called a 25% solution, due to the varying density of these materials the wt/wt solution will usually be considerably more dilute than a wt/vol solution. Therefore, it is best to avoid the term percentage and label and refer to "mixtures" by the way in which they are made. For example, when making a varnish with 25 grams of resin in 100 mL of solvent, simply label the jar "25 grams (resin x) in 100 mL (of solvent x) thus avoiding any confusion. It is also good practice to put the date and the initials of the person who made the mixture.

Proprietary Varnishes

While proficient and talented conservators work in all different ways and choose materials for many reasons, using proprietary varnishes should be avoided for several reasons. The most important being that their exact contents are usually unknown. While there may be a considerable amount of information obtained through publications like MSDS, technical data sheets, conservation journals and websites, they are not always accurate or up to date. The components in proprietary products often change without notice. Furthermore, the proportions and reasons for the inclusion of each ingredient are rarely divulged.

The following are examples are found in the AIC-PSG Paintings Conservation Catalog, Volume 1, Varnishes and Surface Coatings. [5] (These are included, not to single out any product or manufacturer, but to illustrate the confusion that can arise when trying to evaluate the performance of any proprietary varnish.)

CPC Finishing and Matte Varnishes aka Beva UVS Finishing Varnishes

"…Conservators Products Company used Escorez® 5380…in the early 1990s. However…a switch was made to Regalrez® 1094…in February 1996. …There are no batch numbers or other indicators to distinguish between the two base resins…." When the Chapter was published, these varnishes were said to contain a "proprietary EVA plasticizer dissolved in a low aromatic petroleum solvent" and that the Matte Varnish contained two different kinds of wax. [6] Things like the evaporation rate and the amount of aromatics in the solvent as well as the proportion of the waxes were not divulged. Note that aromatics are not necessary to dissolve Regalrez® 1094. Presently, neither the manufacturer's nor distributer's websites mention anything about plasticizers.

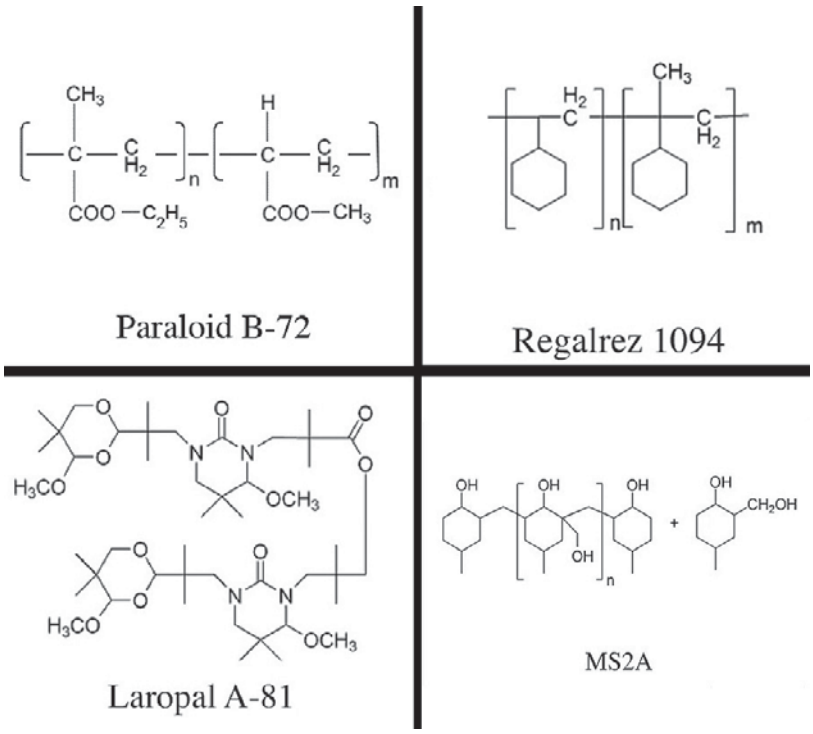
Talens Rembrandt Matte, Gloss, Retouch, Spray Matte and Spray Gloss Varnishes

Each one of these products is said to contain different combinations of solvents, some of which have changed over the years. Questionable contents include turpentine and castor oil. The standard Matte Varnish contains beeswax while the Matte Spray includes fumed silica. [7]

Winsor & Newton Conserv-Art

This varnish includes unknown amounts of three stabilizers: a UV absorber Tinuvin® 328, a phenolic heat absorber Irganox® 1010, and Carstab® DLTDP. The last is presumably added to stabilize the other two stabilizers. The ethical implications of applying a varnish that contains a UV absorber that will inhibit the detection of retouching make the use of this varnish by conservators problematic. [8]

Introduction to four different resins



MS2A®
MS2A® is a reduced ketone (polycyclohexanone).

MS2A® is one of the few materials produced specifically for conservation and has an illustrious history.[9] The process, and in particular the base materials used for making this varnish, have changed over the years. These differences have resulted in variations in solubility and physical properties. Degrees of yellowness, odor and brittleness have all been noted. Sadly, Vincent Routledge, who has been the sole manufacturer of the resin for the past 15 years, has recently passed away leaving the future of MS2A® uncertain.

Experimentally, MS2A® has been shown to be the least stable of the resins presented here but these shortcomings are greatly improved by the addition of Tinuvin® 292 (2% to the weight of the resin). Anecdotal reports commend the ease in which MS2A® can be safely removed after decades of gallery life. Because of strong hydrogen bonding between the alcohol groups, the varnish is known to be brittle, prone to scratching and subject to blanching when exposed to high RH. These problems have been mitigated by the increased number of substituted methyl groups present in the more recent batches and by the addition of wax to varnish solutions.

An odd property of this resin is that when MS2A® is dissolved in a non-polar solvent, the resulting solution will be more polar than the solvent alone. This can lead to potential problems when trying to brush MS2A® over other varnishes or inpainting. On a positive note, MS2A® is the most forgiving resin when it comes to "editing". With care, matte or lean areas in a dry coat of varnish can be touched up with more varnish without disrupting the original coat. The final appearance is a soft gloss. It does not saturate as well as Regalrez® 1094 or Laropal® A 81.

Paraloid® B-72
Paraloid® B-72 is a copolymer of ethyl-methacrylate and methyl-acrylate.

Paraloid® B-72 is the only true polymer of the four resins being discussed (the other three being made of smaller molecules are more accurately described as low molecular weight resins). Formerly known in the US as Acryloid® B-72 (now known in the US and EU as Paraloid® B-72) it was introduced to the field as early as 1950. The proportions of the two co-polymers were changed in 1975 resulting in a slight increase in polarity. This explains why results originally reported by Feller differ slightly from the properties of the resin we know today.

While some experiments have shown slight changes in chemical make-up after prolonged ageing, [10] this does not appear to affect the aesthetic, physical or solubility properties of the resin. Anecdotal reports of poor ageing are almost always centered on artworks treated after the Florence floods where an atmosphere of confusion dominated. Most of these reports mistake problems with the solubility of the underlying paint with changes in the resin. The resin may also have been confused with Paraloid® B-67 that has been shown to cross-link in the presence of UV light. [11] It is not an overstatement to describe Paraloid® B-72 as the most trusted resin in our field. As a polymer, Paraloid® B-72 is by far the toughest and the best varnish for evening out surfaces prone to "sinking in" as well as protecting paintings from minor abrasions or things like food splatters. This makes it an ideal "isolating coat" or base for other varnishes in many instances or for use on paintings exhibited in more vulnerable areas.

Regalrez® 1094
Regalrez® 1094 is a produced by the polymerization and hydrogenation of pure styrene and alpha-methylstyrene feedstocks (hydrogenated hydrocarbon resin).

The introduction of a new class of LMW resins in 1990 by René de la Rie and Chris McGlinchey opened up new

possibilities for varnishes that combined greater stability, improved aesthetics and lower solubility parameters than the polymer and natural resin varnishes being used by conservators.

Out of all the resins introduced, Regalrez® 1094 has become the most widely adopted. This is not only due to the optical properties, that allow it to mimic the look of natural resins and its superlative ability to saturate colors, but also because it can be safely applied to many solvent sensitive paintings. Regalrez® 1094 is made through the hydrogenation of oligomers produced from pure monomer feedstocks (primarily styrene and alpha-methylstyrene). The result is a more stable, uniform resin than the other hydrogenated hydrocarbons introduced which are made from less refined feedstocks. [12]

When stabilized with small amounts of Tinuvin® 292 (as little as 0.5%, but 2% to the weight of the resin is recommended) Regalrez® 1094 has been shown to compete with Paraloid® B-72 in stability and can be considered a class A resin using Fellers criteria. [13] For over 20 years Regalrez® 1094 has been used at many of the most respected museums in the US including The Getty, the Art institute of Chicago and Museum of Modern Art as well as by many private conservators.

Over the years criticisms of stickiness have been brought to the authors' attention. All have been traced either to the use of mineral spirits containing a very slow evaporating fraction, or to the presence of a soft wax used as either a matting agent or as residue from a lining adhesive unintentionally left on the surface of a painting.

Regalrez® 1094 has the lowest molecular weight of the resins discussed here and therefore saturates extremely well. Molecular weight is directly linked to saturation and distinctness of image. [14] Since saturation and high gloss are related, an overly shiny or flinty look can result when Regalrez® is applied in a thick layer. This can be mitigated by the inclusion of a hard wax like Cosmoloid 80H (5-10% to the weight of the resin), spraying thin layers of the resin dissolved in faster evaporating solvents or applying Regalrez® 1094 in a thin layer over Paraloid® B-72 or Laropal® A 81.

Regalrez® 1094 is an excellent finishing varnish. The low viscosity allows for very thin applications that still saturate as well as any varnish.

Laropal® A 81

Laropal® A 81 is produced by the polymerization of urea and aliphatic aldehyde (urea-aldehyde resin).

Several other resins were introduced with Regalrez® 1094 in the Brussels Postprints including a one-off production of an experimental urea-aldehyde resin produced by BASF (aka: "the experimental aldehyde resin" [15]). While this resin proved promising as a varnish, early investigations mainly focused on using it as an inpainting medium. Since the manufacture of this resin was never put into full production, the research switched to a similar resin widely produced by BASF, Laropal® A 81. While the resulting Gamblin Conservation Colors have been rapidly accepted by conservators, the use of Laropal® A 81 as a varnish has evolved more slowly.

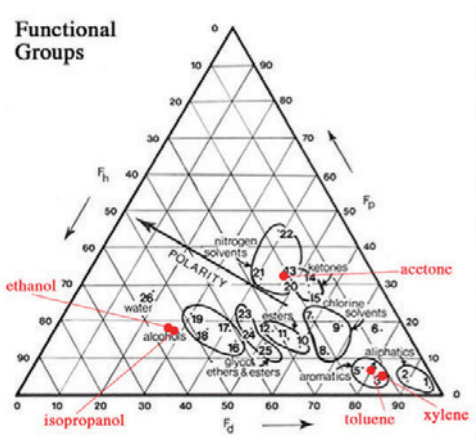
In the paint and coating industry Laropal® A 81 has replaced Laropal® K 80 for making pigments pastes and increasing gloss. Note that the "A" stands for aldehyde while the "K" is for Ketone. The chemistry of Laropal® A 81 is more complex than the other resins discussed in this paper therefore the formula presented in diagram 1 is only an approximation.

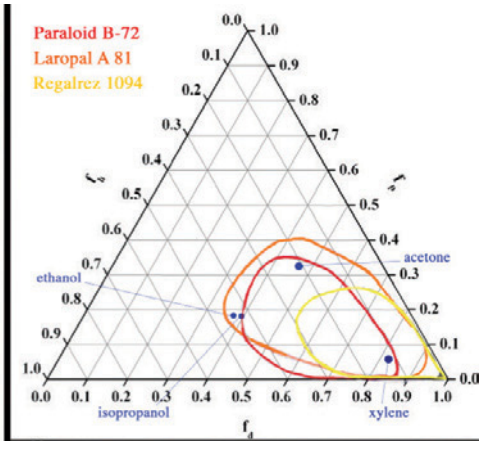
The addition of Tinuvin® 292 (2% to the weight of the resin) results in increased stability of Laropal® A 81 and makes it a class A resin by Feller's standards. The gloss and saturation falls between that of MS2A® and Regalrez® 1094 comparing favorably with Dammar. One might imagine that it will eventually replace Laropal® K 80 in many proprietary varnishes.

Solubility of Three Resins

Although flawed, the Teas Chart is an indispensible tool for illustrating the solubility of resins.

To orient the reader Diagram 2 shows five classes of solvents plotted on the Teas Chart. [16] Several common solvents are highlighted spanning the range of the chart. Diagram 3 shows



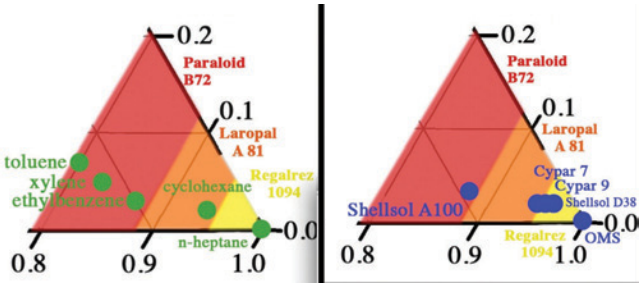


these solvents surrounded by the areas representing the solubility (solubility domain) of each of the four resins discussed in this paper. [17]

Diagram 3 should help the conservator visualize what solvent can be used to apply each resin in a discreet layer without it intermingling with another layer and predict how each layer may be removed sequentially without disrupting the layer below. With the exception of MS2A®, [18] any solvent or solvent mixture falling within the solubility domain of one resin, that does not fall in the solubility domain of another, will allow for the safe application/removal of the first resin on/from the second. How these solubility domains overlap can limit how certain resins can be used. For example, the rather narrow solubility domain of Paraloid® B-72 falls almost entirely within the rather broad solubility area of Laropal® A 81. This means that certain solvents can be used with Laropal® A 81 that will not affect Paraloid® B-72. On the contrary, there are virtually no solvents for Paraloid® B-72 that will not affect Laropal® A 81.

MS2A® has a broad solubility range®; it is soluble in polar and non-polar solvents. The solubility of Regalrez® 1094 falls entirely within the solubility range of MS2A® however, Regalrez® 1094 is insoluble in polar solvents. While in theory MS2A® could be applied over Regalrez® 1094, the solvents or solvent combinations necessary would make this impractical in most cases. For example MS2A® could be dissolved in 1-methoxy-2-propanol or even a mixture of isopropanol and mineral spirits and not effect an underlying layer of Regalrez® 1094. Most conservators would agree that applying a varnish in such solvent combinations would be unnecessarily risky to the paint film. [19] Trying to predict how MS2A® could be applied over Laropal® A 81 is complicated. Even when MS2A® is mixed in a solvent that will not affect Laropal® A 81, the MS2A® will increase the polarity of the mixture. Therefore the more MS2A® in the mixture, the more likely it will intermingle with the underlying Laropal® A 81. [20]

While the differences in these resins seen in the polar regions of the Teas Chart may have some useful applications for inpainting or consolidating, it is the non-polar region, in the bottom right corner, which is the most useful for varnishes.



In Diagram 4, red represents the range of hydrocarbon solvents that will dissolve all three resins. Solvents in the orange area will dissolve Laropal® A 81 and Regalrez® 1094 but not Paraloid® B-72. Solvents in the yellow will only dissolve Regalrez® 1094.

By carefully selecting solvents, certain varnishes can be applied in discreet layers one on top of another. This can be done either by brush or spray. Furthermore, each layer can subsequently be removed one layer at a time. This will also work for inpainting if the proper resins and solvent combinations are chosen. This method is designed to help a conservator during a future treatment. For example, if the painting is vandalized or scratched, the top varnish can be removed without removing any inpainting, or if the final varnish is less than perfect it can be removed and redone without detriment to the artwork or any inpainting.

This system allows for the best attributes of each resin to be employed. For example, Paraloid® B-72 is good for "evening out" a surface or where "sinking in" is a problem. Laropal® A 81 and Regalrez® 1094 can be spray or brush applied over Paraloid® B-72 to add saturation. Laropal® A 81 stands between the two, in terms of solubility and appearance. While not as good at evening out absorbent surfaces as Paraloid® B-72, it provides an even gloss that is a bit softer than Regalrez® 1094 but still adds saturation. Laropal® A 81 as an inpainting media (e.g. Gamblin Conservation Colors) works well within this system. It is not necessary to use all three resins in a treatment. However, these three very stable resins offer a wide range of solubilities, different aesthetic and physical properties, and provide the versatility to design a number of successful varnishing strategies.

Solvent Selection

Choosing high-grade solvents is not only important because they are more stable and reliable, but because there is usually detailed technical information available. Unfortunately, the glossy brochures with helpful colored tables and graphs have been replaced by technical data sheets found only on the internet. While these "tech sheets" are meant to be accurate, one should be aware that even these tech sheets often give only the target values for these solvents and the solvent produced can differ slightly; they also sometimes contain mistakes.

When considering solvents for varnishing the three most important criteria are solubility parameter (referred to as strength for lack of a better term), evaporation rate, and safety.

Solvent Strength

The strength of a solvent can be measured in several different ways and there are many good papers that outline these methods describing how they are determined and the differences between them. [21], [22], [23], [24] Five of the most common are Kauri-Butanol Value, Aniline Cloud Point, Hildebrand, Hansen and Teas.

Kauri Butanol and Aniline cloud point are determined experimentally using titrations of the sample solvent, while Hildebrand and Hansen are determined mathematically by measuring intermolecular bond strengths. Teas modified Hansen's values so they could be plotted on a two- dimensional graph. Each of these methods will show incongruences when actual resins are tested with actual solvents particularly in the borderline regions.

Solvent Evaporation
The evaporation characteristics of a solvent are important as they will influence the handling properties and, to a lesser degree, the appearance of a varnish.

There are three common ways that evaporation rates are evaluated: the n-butylacetate rate (nBuAc), seconds to evaporation and boiling points (BP):

NBuAc rate: The ratio of the time it takes a given amount of solvent to evaporate compared to an equal amount of n-Butyl acetate. Slower evaporating solvents have lower NBuAc rates.

Seconds to Evaporation: (often listed as seconds to 90% evaporation). A given amount of solvent is kept in an open container and the number of seconds are counted until 90% has evaporated. Slower evaporating solvents have higher seconds to evaporation rates.

Boiling Point (BP): The BP is almost always available from the distributor. Although the BP is closely related to the evaporation rate it is not an exact measurement. Problems can arise when comparing the BP of solvents from different classes. For example, an aromatic solvent having the same BP as an isoparaffin will evaporate more slowly than the isoparaffin (an alcohol with this same BP will be a much slower evaporator). Slower evaporating solvents (of the same class) have higher boiling points.

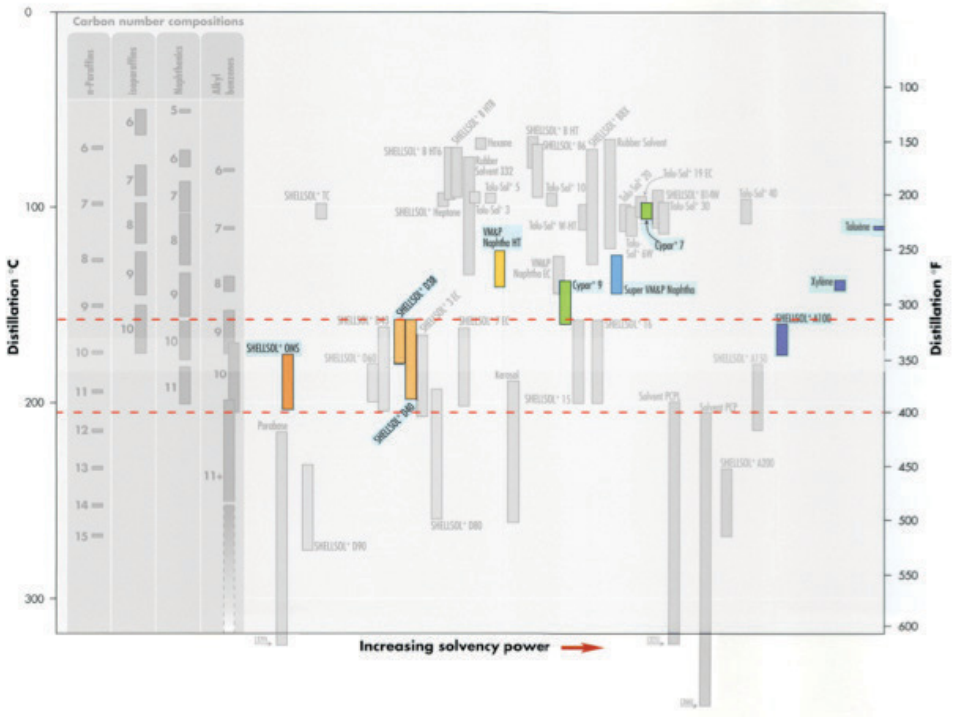
The difference between the Initial Boiling Point and Dry Point is referred to as the "cut". Solvents are said to have a "broad cut" if there is a big difference between the initial boiling point and dry point. A "narrow cut" has the initial and dry points closer together. Solvents with a broad cut give more control when brushing because the brush will begin to drag a little bit before the varnish becomes tacky. Actively brushing the varnish as it dries will reduce gloss and can keep the varnish from "sinking in" to more porous areas of the painting. Narrow cut solvents will tack up suddenly when brushing. Overly glossy areas or "hot spots" cannot be buffed out as easily with a narrow cut solvent. A narrow cut may help achieve a more matte spray surface.

The evaporation rate will determine how much time there is to apply a varnish and how long the varnish will stay tacky upon drying. How the solvent evaporates will affect the way a varnish feels when brushing. In general, a varnish that is sprayed will be more matte and less saturated than a brushed varnish. Mixing the varnish in a faster evaporating solvent will increase this effect (matt surface) as will increasing the amount of air and pressure in the spray, as well as the distance between the painting and the spray gun.

In general, the most satisfactory solvents used for brush varnishing have:
nBuAc value between 0.15–0.2
BP dry point around 325 degrees F–350 degrees F
90% evaporation rate of 2000–3000 seconds

For brush varnishing large paintings like murals:
nBuAc of between 0.05–0.1
BP dry point around 400 degrees F
90% evaporation rate of 9,000–12,000 seconds

Distillation range and solvency power of Hydrocarbon Solvents[25]



Shell Solvent Chart
Diagram 4 shows a range of hydrocarbon solvents produced by Shell Chemical with some specific solvents highlighted. Each is placed on a graph where the "x" axis represents solvency power and the "y" axis, boiling points.

Toluene, to the far right, is the solvent with the greatest strength followed by xylene found slightly to the left. Toluene is a faster evaporator, and being a single isomer is shown with a very narrow distillation range or narrow cut. Xylene has 3 isomers with slightly different boiling points and is shown with a broader cut. While xylene is considered 100% aromatic having three aliphatic methyl groups make xylene act more like an aliphatic solvent than toluene that only has one methyl group. Thus, xylene is weaker than toluene and shown lower on the graph.

Similarly, the cyclic structures of cycloparaffins will mimic aromatics to a degree. Therefore, the strength of an aliphatic solvent will increase with the concentration of cycloparaffins without the addition of aromatics. For example Cypar 7, which is 99% cycloparaffins, is stronger than Shell Super VM&P Naphtha, which is a mixture of 46% linear and branched aliphatics, 42% cycloparaffins and 12% aromatics. [26]

Of the three Shell solvents that have the desired evaporation rates, only Regalrez® 1094 will dissolve in Shellsol D-38 and Shellsol OMS. Laropal® A 81 needs a mixture of about equal parts of Shellsol A-100 and Shellsol D-38 to dissolve. Paraloid® B-72 will only dissolve in Shellsol A-100.

By using each of these resin/solvent combinations subsequent layers can be applied and removed without threat of undermining the layers below. It is recommended that the least polar solvent mixture that will dissolve any given resin be selected for the safety of the paint layers.

Future work
While aromatic solvents pose little risk to most aged paint films, they do pose a considerable health risk. Therefore, the search continues to find a safer substitute for the aromatic component of these mixtures.

To avoid using aromatics, solvents from other classes containing polar functional groups will have to be employed. Unfortunately, as of yet, no safer solvents have been found that are stable and have the desired evaporation characteristics. [27] With mixtures of solvents with differing evaporation rates, the ratio of each solvent changes as evaporation occurs. If the slower evaporating solvent is a poor or non-solvent for the resin, the varnish can become hard to work with and often results in incomplete and uneven films. If the stronger solvent is the slower evaporator, as the varnish dries the solution will become more and more polar, and eventually end up as gel where the polar solvent no longer leaves the varnish through evaporation but by the very slow process of diffusion where it is more likely to have interaction with the paint film. A further problem is the potential formation of an azeotrope. When the azeotropic proportion of a mixture is reached, evaporation rates will usually increase radically. The further apart on the Teas chart that solvents in a mixture are from each other, the more likely it is that these effects will increase. Furthermore, the mixing of solvents from different classes will often have a synergistic effect resulting in mixtures that could pose an unpredictable risk to the painting.

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27. Several solvents have been investigated: turpentine, α-Terpinene, phellandrene, decaline, acetates and lactates. Many of those with lower health risks prove to be less stable materials. For others, accurate and reliable information on both the health risks and action on paint films still needs to be determined (e.g. 1-methoxy-2-propanol is often suggested as a substitute for aromatics, but is not recommended for use in a varnish due to the potential for swelling paint films). Both Turpentine and 1-methoxy-2-propanol have seen a dramatic lowering of their toxicity ratings recently. Turpentine has gone from 300 ppm to 100 ppm and 1-methoxy-2 propanol from 100 ppm to 50 ppm.

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Research into Anti-Graffiti Coatings for Acrylic Murals: Preliminary Testing and Evaluation

ABSTRACT

In the past 40 years, outdoor murals have become a familiar feature in cities in America and around the world. Murals are a valuable expression of modern society, and must be preserved for current and future generations to benefit from their cultural import. However, in recent years, outdoor public murals have become targets for graffiti. Anti-graffiti coatings have been developed to protect murals from this type of vandalism. The Getty Conservation Institute has been researching anti-graffiti coatings since 2008, beginning with a literature review and search for products currently on the market and used by artists, conservators, and cities for this purpose. Over the past year, practical testing of a selection of these products has been carried out on mural test walls. The focus of the project was testing the performance of 11 anti-graffiti coatings designed for exterior surfaces, including six permanent coatings and five sacrificial coatings currently being used by conservators on murals or referred to in the literature. The coatings tested were fluorinated acrylics, waterborne polyurethane, acrylic, silicone, polysaccharides, and wax.

To assess the performance and effectiveness of the anti-graffiti coatings, five types of graffiti materials were applied over the anti-graffiti coatings, and graffiti was subsequently removed using methods recommended by the coating manufacturers. Graffiti materials tested were: Krylon metallic and Krylon gloss spray paint, Sharpie paint and permanent markers, and Rust-O-Leum latex house paint. To test the change in coating performance over time, graffiti was removed one day after application, repeated for ten successive rounds, and then after one month, six months, and one year. Following manufacturers suggestions, high pressure hot water was used to remove graffiti, followed with solvent-based graffiti removal using proprietary removers made by the manufacturers as part of their anti-graffiti coatings systems. The coatings were evaluated according to several criteria: appearance (color, clarity, and sheen), performance (ease of application, ease and efficiency of graffiti removal, and durability of the coatings), and stability (color change and ageing). Preliminary results show that in general, sacrificial coatings perform fairly well: they are easy to apply, sufficiently durable, allow for easy and efficient graffiti removal, and are more resistant than permanent coatings to common graffiti materials. Sacrificial coatings also have drawbacks: they tend to be less aesthetically pleasing than permanent coatings, the coatings must be reapplied after every graffiti removal, and maintenance is an issue for some which discolor and attract dirt, requiring removal and reapplication. Benefits of permanent coatings included: easy application, generally an aesthetically pleasing appearance, low maintenance, and no reapplication of the coating after graffiti removal. Drawbacks of permanent coatings were: adhesion failure with high pressure hot water spray, deformation and dissolution when using solvent-based graffiti removers, surface damage due to the mechanical action required to remove graffiti, and the irreversibility of the coatings. This project provided valuable information about specific characteristics and behavior of a variety of anti-graffiti coatings currently being used in conservation. None of the coatings tested have all the characteristics of a desirable anti-graffiti coating, and other products and methods should be investigated.

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Development of Portable Hyperspectral Imaging Cameras for Identification and Mapping of Organic Artist's Materials Such As Paint Binders and Textile Fibers

ABSTRACT

Near-infrared (750–2500 nm) reflectance imaging spectroscopy has been recently shown to be a useful tool to map and identify various artists' pigments. This approach has utilized both electronic transitions (color) and vibrational overtones from hydroxyl (-OH) and carbonate groups (-CO3). [1] *Here we report on efforts to extend this methodology to map and identify non-pigment artist materials such as paint binders and textile fibers in situ. Imaging spectroscopy, the collection of hundreds of contiguous narrow-band images, offers an improvement over site-specific fiber optic reflectance measurements by combining both spatial and spectral information. Currently new portable high sensitivity hyperspectral cameras are being developed that will operate under the low light levels conditions necessary to examine paintings, drawings, illuminated manuscripts as well as textiles. These cameras will have both high spectral (2.4 to 4 nm) and high spatial resolution (< 0.1 mm per pixel) capabilities. Identification and mapping of these organic materials will be done using the higher harmonics of the vibrational features found in the mid-IR which are routinely used to identify these materials using FTIR spectrometers. These chemical signatures include overtone and combination vibrational features associated with amide bonds, -CH2 -OH, and -CO3 groups. The cameras utilize transmission-grating spectrometers and state-of-the-art infrared detectors, such as InGaAs and InSb arrays of 640 × 512 pixels and 1024 × 1280 pixels, to obtain the required sensitivity. The instrument's performance is being verified using test panels and paintings in the National Gallery's collection whose composition is known by GC-MS and FTIR analysis. To date we have demonstrated (1) the ability to separate and map test panels painted using drying oils versus whole egg tempera; (2) have mapped an egg yolk binder in a 15th-century illuminated manuscript; and (3) have separated wool and silk fibers within a ca. 1500 tapestry. The knowledge gleaned from this instrument will help art historians to better understand, and conservators to better preserve, important works of art.*

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Studio Tips: A Useful Varnish Tip

Small defects or pits in the varnish of a 19th century painting were filled by dotting a 30% Paraloid B-72 (in xylenes) solution into the ding/dent/dimple and passing a cloth-wrapped wood block over the area. The cloth was a cotton jersey t-shirt fabric scrap. The wood block was about 2 × 5 in. The painting was supported from beneath with a smooth flat surface.

The technique mentioned worked extremely well at "repairing" small defects in an overall glossy varnish. What looked like tiny pits in the surface in raking light disappeared after being treated locally in this way. The painting was large with a complex and difficult varnish history–it was extremely gratifying to be rid of the small blemishes without interfering with the overall varnish.

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Studio Tips: Use Sugru® to Modify Tool Handles

Sugru® is an air-curing silicone rubber that is gaining widespread use with online tinkerer communities. It has many favorable working properties, including hand-formability (preferably with gloved hands), good thermal stability, good resistance to polar solvents including water, and it comes in many colors and is relatively inexpensive.

Along with technical specifications and an MSDS, an online community can be found on Sugru's website, where users are actively sharing ideas and images. Of interest to conservators may be the use of Sugru to create custom padding on tool handles to increase comfort and/or control.

Images:www.sugru.com/gallery

SUPPLIER

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Studio Tips: Modify your Tabouret or Cart with Quick-Grip Clamps

When trying to maintain an organized workspace, consider attaching Quick-Grip clamps to one's cart. Doing so can provide quick access for tools, easy resting spots for items that are repeatedly picked up and put down, and "crowd control" when switching between projects.

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Studio Tips: PANTONE® Lighting Indicator Stickers

PANTONE® has recently released lighting indicator stickers to aid in at-a-glance determination of whether viewing conditions are optimal for evaluation of color accuracy. The stickers meet D50 (5000k) or D65 (6500k) lighting specifications and can be purchased in individual sheets of 40 stickers.

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