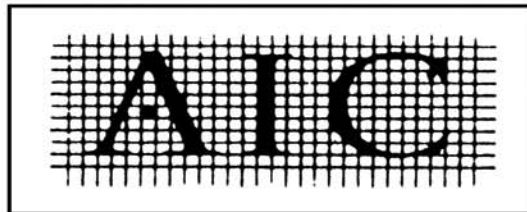

1994

AIC PAINTINGS SPECIALTY GROUP

POSTPRINTS



THE AMERICAN INSTITUTE FOR CONSERVATION
OF HISTORIC AND ARTISTIC WORKS

1994

AIC PAINTINGS SPECIALTY GROUP

POSTPRINTS

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Compiled by William A. Real

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THE PAINTINGS OF CLYFFORD STILL: WHAT WAS THE ARTIST'S INTENT?

Dee Ardrey*

J. William Shank**

One of the most controversial and unclassifiable artists in twentieth-century American painting was Clyfford Still (1904-1980). He was unusual in his ability to generate so many contradictory responses.¹

History

Still was a domineering personality who felt that painting was a deadly serious business.² His need to control situations was intense, and it spilled over into his artwork. The paintings resulted from his need to dominate the surface, to carry out his personal drama on the canvas.³ He said that, "Each painting is an episode in a personal history, an entry in a journal," and, "I paint only myself, not nature."⁴ He was meticulous about every aspect of his life. His paintings were carefully considered, composed and executed. Although the paintings exhibit vertical gestures, there was nothing spontaneous about their creation. Over 1200 works on paper exist and are now part of the artist's estate. Although they are not studies per se, many of the paintings developed from the works on paper.⁵

According to his students, his lectures at the California School of Art (now the San Francisco Art Institute) consisted more of diatribes against the art establishment than instruction in painting technique.⁶ Still was a self-taught painter.⁷ He created his own personal system of materials and paint application. He believed that his homemade paints, which began as powdered pigments in

* *The Menil Collection, Houston, TX.*

** *San Francisco Museum of Modern Art, San Francisco, CA.*

¹ Michael Auping, "Clyfford Still and New York *The Buffalo Project*" in *Clyfford Still* (Munich: Prestel-Verlag, 1992), p. 23.

² Mary Fuller McChesney, *A Period of Exploration: San Francisco 1945 - 1950* (Oakland: The Oakland Museum, 1973), p. 42, 44.

³ McChesney, p.44.

⁴ McChesney, p.43.

⁵ Conversation with Patricia Still, the artist's widow, on 6 June 1994.

⁶ Conversations with students, McChesney, p. 42.

⁷ David Anfam, *Abstract Expressionism* (New York: Thames and Hudson, 1990) p. 33.

his studio, were superior to commercially available artists' products. He was secretive about his technique, allowing only carefully chosen colleagues and students to see his studio practices.⁸

Although Still was somewhat knowledgeable about his materials, some of his choices indicate that the momentary tactile qualities of the materials, as well as monetary concerns, took precedence over their permanence. It is clear that he would have liked to control the aging process, leaving nothing to chance. He left written instructions on the care of the paintings. Because of changes in the surfaces over time, it is now up to conservators to determine what paramount qualities of the surfaces Still would have wanted to preserve.

Technique⁹

Still almost always used an unbleached, 12-oz. cotton sailcloth canvas (triple thread warp, single thread weft). He painted on canvases stretched over cedar strainers, but rolled most of them after completion, often three or four to the tube, for storage. Most of the twenty-eight paintings given by the artist to the San Francisco Museum of Modern Art arrived this way in 1978, and stretchers needed to be fabricated for them before they could be exhibited. The paintings also arrived rolled three or four to the tube at the Met for the 1979 exhibition there.

Occasionally, for his early works, he used denim and burlap as his support (e.g. SFMOMA's PH169¹⁰). In the late 1940s, he began leaving the raw canvas exposed and sometimes intentionally dirty, according to John Schueler, one of his students.¹¹ Wood splinters and other inclusions embedded in or stuck to the surface can still be detected.

The application of hot rabbit skin glue, the only canvas preparation, has become evident with time as the size has discolored, creating an unintentional design element (e.g. PH379, now at SFMOMA). The glue was applied with a rag in a circular motion and the application was inconsistent.¹² In some cases, shrinkage of the glue over time has caused the exposed canvas to crimp. (PH446, at the San Francisco Museum of Modern Art, is a good example.)

⁸ Telephone conversation with Frank Lobdell, April 1994.

⁹ This section is derived from examination of the paintings in the SFMOMA Collection, conversations with the artist's widow and daughters, and with students of Still's during the San Francisco period.

¹⁰ Throughout this paper, Still's untitled paintings are referred to by the "PH" (for "photo") number assigned to them by the artist.

¹¹ Susan Landauer, "Clyfford Still and Abstract Expressionism in San Francisco," *Clyfford Still* (Munich: Prestel-Verlag, 1992), p. 98.

¹² Conversation with Still's daughters Diane Knox and Sandra Campbell, 28 January 1991.

No traditional ground layer was applied to the canvas before painting. But on at least one occasion, on PH174, white paint was used as an underlayer for a color field.

The paints were prepared by pouring dry pigments onto a palette in a mound and creating a well at the top, into which Still poured boiled linseed oil as well as a small amount of turps and drier.¹³ He then mixed the ingredients to a buttery consistency with a palette knife. According to Hassel Smith, he mixed large quantities of paint and kept it in 10-gallon cans underneath the palette on his cart, but his widow denies this. He was not interested in experimenting with materials; his approach was direct and simple. (He considered acrylics too experimental and did not use them. Modern plastic paints were anathema to Still also because of his view of himself as heir to the Old Masters.)¹⁴ Supposedly, oil paints from the tube were used sparingly, usually in accent areas. However, in 1979, he told a conservator at the Met that he used tube colors, so he may have changed his technique in the late work.¹⁵ The method of application was by brush and palette knife in the early works and by a variety of palette knives exclusively in the middle and late paintings. Paint was trowelled onto the surface like a buttery paste. It was a sculptural approach: the paint was carved and worked in three dimensions. The black pigment used in so many of his paintings is lamp black.¹⁶ It is greasy and soft by the nature of its manufacture, and extremely slow drying.¹⁷ However, microscopic analysis points to a mixture of lamp black with charcoal black.

Still's use of varnish was erratic. Natural resin was applied to the surface overall in some instances, but this was done years after the painting was finished. Over time the artist is said to have occasionally applied varnish or oil locally to certain design areas that he considered too dry. Some of the paintings are intentionally selectively saturated, and the degree of gloss seems to have been governed by medium-to-pigment ratio. But some of the paintings are highly inconsistent in the degree of saturation due to uneven oil absorption by different pigments. (PH968 in San Francisco shows this quality clearly.)

Inherent Vice: The Aging of the Paintings

In terms of ensuring the longevity of his paintings, Still's use of boiled linseed oil as a medium is problematic. Boiled linseed oil has been treated with air or heat

¹³ Conversation with Jack Jefferson, May 1994.

¹⁴ Conversation with David Anfam, 4 April 1991.

¹⁵ Conversation with Lucy Belloli, 1 June 1994.

¹⁶ According to Jim Eakles, a former student, in telephone conversation, May 1994.

¹⁷ R.D. Harley, *Artists' Pigments c. 1600 - 1835* (London: Butterworth Scientific, 1970), p. 160.

or both in order to make it dry quickly.¹⁸ It has the highest gloss of all the oil media; it dries with a sleek, greasy sheen and easily forms a skin.¹⁹ Not intended as an artist's medium, it is manufactured for commercial purposes. According to Ralph Mayer, its use has led to a considerable deterioration of the paintings executed in it.²⁰ One Still student, Jack Jefferson, said that they all used boiled linseed oil because it is cheap. (It can be purchased at the hardware store.) According to Mrs. Still, he preferred it because it dries so fast. But the immediate greasy quality seems in keeping with the raw, almost brutal, effect of Still's paintings from the late Forties and early Fifties. The "new look" of Still's paintings started a trend at the California School of Art.²¹ Frank Lobdell's paint film is still, for instance, soft to the touch after 25 years on SFMOMA's painting April 1959.

Microscopy

The mixing of powdered pigments and linseed oil on the palette would lead to uneven absorption of the medium by the pigments over time.²² In Still's paintings, the pigment particles are not evenly distributed throughout the medium, and we see an unevenly bound paint film. In two SFMOMA paintings, one from 1951 and one from 1958, small islands of bright red pigment particles within the darker red field are visible. Examination of cross-sections at 25x magnification reveals an uneven distribution of fairly coarse particles. Additionally, the absence of a ground has led to "sinking" of the paint layer. The glue size was used to prevent saturation by the oil medium; however, it is not enough of an isolating layer to perform this role effectively. If the paint is not applied thinly on unprimed canvas, the result can be a dry pigment deposit left on the absorbent surface.²³ At the top of a cross section taken from a matte area, the uneven surface of underbound pigment particles with an absence of oil is evident. The light reflected off this surface is diffuse, resulting in a matte effect. By contrast, a sample taken from a more glossy area in the same painting shows the presence of oil right up on the surface; this surface is much more even. These samples were stained with Rhodamine B; there is no question that the medium is oil. But a thin line of oil lies right up on the surface of the sample from the glossier area. A sample taken from a red color field has bled out onto the bioplast, illustrating that it is some sort of dye or organic pigment. Two pigments commonly used by Still, lamp black and alizarin crimson, are high oil absorbers, so that the sinking effect is exacerbated in these color areas. The

¹⁸ Rutherford Gettens and George Stout, *Painting Materials; A Short Encyclopedia* (New York: Dover Publications Inc., 1942), p. 6.

¹⁹ Max Doerner, *The Materials of the Artist and their Use in Painting* (New York: Harcourt, Brace, Jovanovich, 1984), pp. 105-6.

²⁰ Ralph Mayer, *A Dictionary of Art Terms and Techniques* (New York: Thomas Crowell Co., 1969), p. 42.

²¹ Landauer, p. 98.

²² Ray Smith, *The Artist's Handbook* (New York: Alfred Knopf, 1992), p. 182.

²³ Smith, p. 189.

considerable variation in oil absorption by pigments (compensated for by manufacturers of tube colors) must be taken into account by artists who mix their own colors.²⁴ If it is not, a vast inconsistency between colors results. Still was clearly aware of this problem, advising that "application of varnish or restoration of the linseed binder by cloth or brush is advisable, especially where a matte effect was not the original intention."²⁵ But he left no guidelines as to where it was not the original intent. There is evidence of linseed oil applied later to the paint surface in some of the paintings. This effect is clearly evident on at least one painting (PH591) that went directly from the artist's studio to SFMOMA in 1976 and was not varnished or coated there. He is known to have locally applied varnish to resaturate areas that had become too dry, as he supposedly did with spar varnish prior to the 1979 exhibition at the Metropolitan Museum of Art.²⁶ The degree of gloss became a vehicle for his formal statement; this was no accident. In the paintings that were originally selectively saturated, the relationship of matte to glossy areas has changed, bringing about stronger contrasts. This change is by degrees, and does not significantly alter the intended visual statement. In the paintings that were not selectively saturated, a matte/gloss contrast has developed which adds a new dimension to the visual character of the painting. Especially in the late paintings, it is our opinion that Still wanted adequate saturation to keep the color fields right up on the surface. We do not believe that he intended the push and pull between color fields that now occurs as a result of inconsistent oil absorption. However, we are not in a position to act on this belief, nor is it appropriate. But an awareness of these changes helps us better to understand the work.

Additional effects of inherent vice in the paint layer include a chronic soft, non-drying state, cracking, and cleavage. Many of the late paintings may have dried in darkness due to studio circumstances, leading to a slow "softening" and considerable yellowing rather than the usual drying and oxidation mechanism of pigmented oil films.²⁷ Because many of the paintings never dried and hardened, canvas impressions and burnishing and flattening of impasto areas occurred when the paintings were rolled together. (We see this effect especially on SFMOMA's black painting, PH58.) Sawdust and other particulate matter, even cigarette butts, became imbedded in the paint, and dust now clings to the surfaces of many paintings. This effect was intended by Still; it textured the surface and lent an earthy quality.²⁸

Cleavage and severe cracking are widespread in certain late Still paintings. The artist laid colors of low oil absorption over those of high oil absorption. In this case, the lower layers are more flexible than the upper layers, a combination that

²⁴ Smith, p. 182.

²⁵ From written instructions left by Clyfford Still on the care of his paintings.

²⁶ Conversations with Dorothy Mahon and Chris McGlinchey, 1 June 1994.

²⁷ Gettens and Stout, p. 46.

²⁸ Laudauer, p. 98.

leads to cracking of the upper layers.²⁹ There are also occasions of Still's ignoring the fat-over-lean rule, with disastrous results. SFMOMA's large blue canvas, PH585, suffers from widespread cleavage, despite a history of decades of attempts at local consolidation. It is currently unexhibitable. Still was also in the habit of painting over paintings after they returned from exhibitions, sometimes more often than he documented.³⁰ SFMOMA's black painting (PH58) was repainted at least three times.³¹ It too suffers from chronic paint cleavage and cracking.

The Exhibition

An international retrospective exhibition organized by Dr. Thomas Kellein of the Kunsthalle, Basel, gave the paintings of Clyfford Still their first European tour in 1992-93. Given the current state of the paintings, the prospect of international travel was somewhat frightening. The works in San Francisco that had been requested for loan were surveyed, and recommendations were made to the curatorial department. Most of our restrictions--or vetoes--were honored, but, of course, some were not. We stabilized the paintings as best we could, and worked with art transporters in order to devise travel frames and crates suitable for the problematic paintings.

Still was adamantly opposed to frames on his late works; he wanted his vertical gestures to form a continuum extending beyond the bounds of the canvases.³² In keeping with this attitude, we adhered thin cotton webbing to the exposed tacking edges with Beva film. Handles were attached to the stretchers to facilitate moving and installation. Thanks to the Tate Gallery's development of the stretcher lining or "cami" lining, and to our British Getty Intern Lucy Pearce, we attached cami linings to most of the paintings prior to travel. The insertion of an extra fabric, usually a dimensionally stable polyester sailcloth, between the canvas and the stretcher crossbars, helps to avoid damages to the paint layer like stretcher bar marks. The lining also substantially minimizes the vibration of the canvas during transport.

The paintings travelled in large part safely during the course of the 1992-93 international tour, which included venues in Basel, Madrid, and Amsterdam, as well as Buffalo and San Francisco.

Acknowledgements

We are indebted to Mrs. Clyfford Still for her invaluable assistance in understanding the technique of her late husband. Thanks also to Marshall Fine

²⁹ Smith, p. 181.

³⁰ Anfam. *op. cit.*

³¹ Clyfford Still, San Francisco Museum of Modern Art exhibition catalog (Los Angeles: American Art Review Press, 1976), cat. entry #18.

³² From undated written instructions by the artist on the care of his paintings.

Arts of San Francisco; to Chris McGlinchey of the Metropolitan Museum of Art, to Elizabeth Cornu and Lesley Bone of the Fine Arts Museums of San Francisco for the use of their analytical equipment; to art historian David Anfam of the National Gallery of Art in Washington; to Conservators Lucy Belloli, Frank Zuccari, Jim Bernstein and Carol Mancusi-Ungaro and especially to Robert Lodge in Oberlin, whose research into the technique of Clyfford Still complements our own.

This paper was delivered in slightly altered form at at the annual conference of the American Institute for Conservation, Paintings Specialty Group, in Nashville, Tennessee, in June 1994.

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Still, Clyfford, undated written instructions left by the artist on the care of his paintings, collection of his family.

DECIPHERING ARTIST'S INTENT IN A LATE PORTRAIT BY FRANS HALS

Carol Christensen and Michael Palmer*

In 1990, treatment of a problematic heavily restored late work by Frans Hals was undertaken in the painting conservation department at the National Gallery of Art, Washington. Understanding the history of the painting and the reasons for its state at the time treatment began became central in determining both the artist's intent and the future course of treatment.

Although Hals was sought after as a portrait painter throughout his life, his reputation declined after his death. A taste for more "finished" portraits during the eighteenth century caused his work to be forgotten until the late 1800's. Because of the two centuries of relative obscurity before the resuscitation of his reputation, the provenance of a number of works now generally accepted to have been painted by Hals does not extend back further than the late nineteenth century, when his pictures began to fetch large sums and many reappeared on the art market.

Until Hals was rediscovered, most of his portraits remained in the hands of the descendants of the artist's sitters, where they were sometimes altered to satisfy the changing tastes and fashions of later owners. The c. 1648-50 painting (Fig. 1, before treatment) proposed for treatment was one such picture. The identity of the sitter is unknown, as is the painting's history before 1883, when it was offered for sale in Vienna. At the time of examination, its appearance was marred by the presence of clumsy repaint in the hair of the figure and throughout the background. This repaint had been in place at the time the painting came on the market in 1883.

A complicating factor in determining the course of treatment was the presence in the underpaint of a black hat, long known through infrared photographs (Fig. 2 infrared reflectogram). It was important to determine first, whether Hals or someone else overpainted the hat, and second, if Hals intended to portray the sitter wearing a hat, whether enough of this hat was intact to again reveal it.

Four cross-sectional paint samples were taken from the hair and the background above the sitter's head in order to better understand the layer structure of the painting. Examination of these samples showed that two layers of oil varnish with a thin layer of dust between them separated the black hat from the oil bound overpaint. This suggested that the painting may have left Hals' studio with the sitter hatted. Although it might be possible that Hals would have used a single layer of varnish to "oil out" the hat before deciding to paint over it, it is unlikely that he would have

*Carol Christensen is a painting conservator and Michael Palmer a conservation scientist at the National Gallery of Art, Washington, D.C.

applied one layer of varnish, then waited long enough for the varnish to acquire a layer of dust, and later applied another layer of varnish before covering up the hat. It seemed more likely that the painting left Hals' studio with the hat intact, and at a later date another artist painted over it. This later artist could have been the sitter himself, since the pose assumed, with the hand placed over the heart, is one iconographically associated with artists, and Hals did paint a number of other artists. If the sitter were an artist, he could have easily altered his own portrait a few years after it was painted.

Evidence about when this alteration occurred was provided by a drawing (Fig.3) made by Pieter Holsteyn, a Hals contemporary. This Rijksmuseum drawing was made after the painting, in preparation for an engraving. The drawing shows the sitter with short hair and without the hat. The drawing could have been made no later than 1673, when Holsteyn died. Therefore, assuming Hals painted the portrait around 1648, the hat was painted out within 25 years after it left Hals' studio.

This was especially troubling in deciding the course of treatment, because of the condition of the overpaint. The pink-brown paint used to mask out the hat did not match the surrounding original greenish brown background, and therefore the entire background had been repainted more recently to color up the mismatch. If the uppermost, easily soluble, and obviously later grey-green overpaint were removed, the earlier oil bound overpaint covering the hat would be revealed, forming an ugly pink-brown halo around the head.

Moreover the difference in color was not the major problem. The original background, estimated to be well preserved beneath the soluble repaint, was extremely thinly painted, so that the priming layer was clearly apparent beneath the thin veil of paint and between brushstrokes. The problem from a restoration viewpoint was that it would be nearly impossible to paint out the thick halo of overpaint covering the hat and at the same time match the thinness of the rest of the background. The chances of effecting a successful visual appearance for this painting were clearly greater if the overpaint could be removed. However the fact that the overpaint was applied so close in date to the original painting and was so much a part of its history made one hesitate to remove it.

The mismatch between the old overpaint covering the hat and the original background was puzzling. The artist would hardly have painted out the hat in colors that did not match the rest of the background. It seemed more likely that some component of the overpaint had faded to create a halo of discolored paint not originally present. Microchemical analysis of several pigment scrapings supported this hypothesis. Prussian blue was identified in the pink brown overpaint, though its color was not visible due to fading. The fading was likely caused by its admixture with large quantities of lead white. Without the blue colorant, the paint covering the hat no longer matched the surrounding background. Since Prussian blue was not available until a century

after this painting was overpainted for the first time, it became obvious that the present overpaint was not the original overpaint in place around 1673.

What had happened to the painting between 1648 and its appearance on the art market in 1883? It seemed likely that the painting left Hals' studio with the sitter wearing a hat, and that at some time no later than 1673 the hat was painted out. After 1650, hats of this type became less popular in Dutch portraits, so the sitter or his family might have decided to cover up this now unfashionable accoutrement. Other paintings by Hals have undergone similar changes, including one in the Hermitage, St. Petersburg, and another in the Fitzwilliam Museum, Cambridge.

Whoever painted out the hat in the National Gallery painting had done it by the time Holsteyn copied the picture in 1673. However from this point forward the painting could have existed in several states. The painting could have remained covered with overpaint for at least 100 years, until the seventeenth century overpaint was removed, perhaps during cleaning. Alternatively, the overpaint could have been removed soon after 1673 and the sitter could have again worn a hat for 100 years. In this case the oil varnish would not have been original, but would instead have been applied after 1673. This would explain why the painting was abraded in many areas beneath the oil varnish, but in this case the presence of the two layers of oil varnish in the cross-sections could no longer be seen as proof that the painting had left Hals' studio with a hat. It is possible that in the two well-preserved areas where cross-sections were taken, the oil varnish could have been original, with the paint beneath it intact. However, samples were not taken in the more abraded areas, where an oil varnish, although present and probably early, may not have been original.

The one thing that is certain is that around 1800, the early overpaint was removed and replaced by overpaint containing Prussian blue. This meant that no matter who first painted out the hat, even if it were Hals himself, this early layer of overpaint was no longer present, so there was no option of retaining this very early layer. The present layer of discolored overpaint, which contained Prussian blue, was much later than the painting, making the decision to remove it easier. Another alternative arose during these enquiries. Since there was no evidence of the earliest layer of overpaint, might it be possible that it had in fact never existed? Could the seventeenth century Holsteyn drawing have been a hatless variant of the portrait rather than a slavish copy? The amount of abrasion to the hat in some areas makes this unlikely. If the hat were never covered up early on, then there would be no reason for the abrasion present in the hat beneath the two layers of oil varnish, abrasion probably caused by the strong solvents used to clean paintings in the eighteenth century.

Another mystery to be solved was at what point the sitter acquired his long curly eighteenth century style hair. Another cross-sectional paint sample, taken through the repainted hair, helped

answer this question. The sample showed that above the pink brown overpaint covering the hat lay seven layers of varnish with a very thick layer of dust between layers 3 and 4. The repainting of the hair lay on top of these varnish layers, suggesting that after the hat had been painted out the second time (around 1800), the painting remained in this state for many years, that is, with the sitter hatless and wearing the short straight hair evident in the Holsteyn drawing. However, after some time had elapsed, perhaps 50 years, with periodic varnishing, the hair was restyled (c. 1850) in the long curly style that had been popular during the late eighteenth century.

The extreme solubility of this resinous later and longer hair suggests it was not painted in at the same time as the old Prussian blue-containing overpaint, which is oil bound and hard to dissolve. However, this long curly hair was quite similar in appearance and solubility to the top layer of overpaint on the rest of the background. Since this grey-green layer contained viridian, a pigment not available before 1825, both the longer hair and the thin background overpaint are assumed to have been painted after this date. The longer hair was clearly overpaint, since it was painted over cracks and losses in the original paint.

To sum up, then, the painting probably left the studio with the sitter wearing a hat. The hat was painted out no more than 25 years later. This early overpaint was removed some time between 1674 and c. 1790-1800. We know for certain because of the presence of Prussian blue that some time after 1790 the hat received its second layer of overpaint. The many layers of resin varnish present above this oil bound overpaint suggest the painting existed in this state until at least 1825, more likely even later. However, by some time between 1825, when viridian became available, and 1883, when the painting was offered for sale, the Prussian blue component in the overpaint had faded so much that this second later overpaint covering the hat no longer matched the rest of the background, so the entire background was repainted and the hair was changed to the long curly style popular during the last part of the previous century. This most recent campaign of overpaint could have been undertaken in preparation for an exhibition preceding the painting's sale in Vienna.

Having determined that there were two non-original and extremely discolored layers of repaint covering both the original hat and the background, the decision was made in consultation with the curatorial department to remove the later repaint. Infrared reflectograms suggested that despite abrasion on the right side, there was enough paint present to warrant the hat's reappearance. Mechanical removal was effected using dimethyl sulfoxide as a softening agent and working with the aid of a microscope. Fortunately the difference in color between the pink-brown overpaint and the black hat made the task less arduous than it might otherwise have been. The presence of a tough varnish separating overpaint from original paint provided a useful cushion during mechanical removal.

The hat-background interface proved to be the most damaged area, though the hat itself was also abraded at the right. Inpainting was not difficult or problematic once the overpaint was removed, although it was necessary to inpaint scattered areas where a thin veil of pink-brown overpaint could not be removed completely, without damaging underlying paint.

Following conservation, the spontaneous, thinly but vigorously painted background typical of Hals is once again visible, and the sitter more convincingly occupies the picture space (Fig. 4, after treatment). While the treatment chosen was not perfect in every respect, due to a few lingering questions about the painting that cannot be answered with absolute certainty, the course of treatment decided upon was seen as the best solution to a difficult problem, in which halfway measures such as overpainting the overpaint would have yielded a false and visually unsatisfying result.

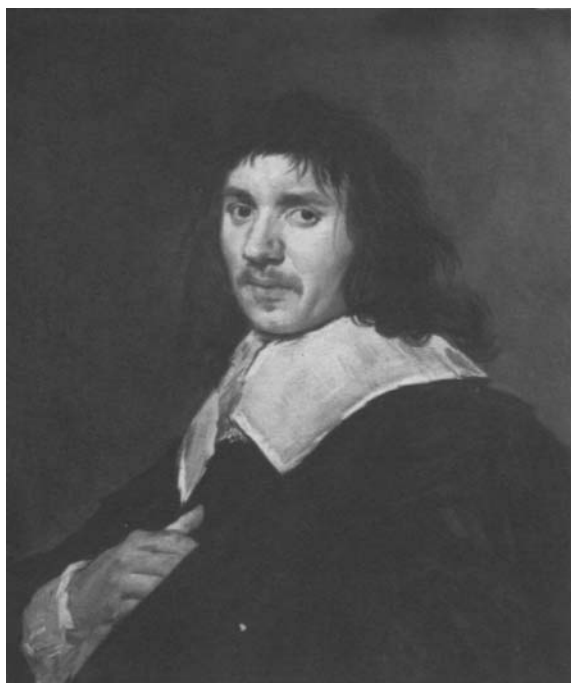


Fig. 1: Frans Hals, Portrait of a Man
1648-50, before treatment



Fig. 2: Infrared reflectogram mosaic



Fig. 3: Pieter Holsteyn II, ink drawing
after Hals, Portrait of a Man (no later
than 1673)



Fig. 4: Hals, Portrait of a Man, after
treatment

'THE BIGLIN BROTHERS TURNING THE STAKE-BOAT' BY THOMAS EAKINS: A TECHNICAL STUDY REVEALS SURPRISING TECHNIQUES

Christina Currie* and James Smith**

Thomas Eakins' great masterpiece of 1873, *The Biglin Brothers Turning the Stake-Boat* is the largest and most ambitious of his 1870's rowing series. The technical study revealed that the painting was the result of extraordinarily obsessive planning and attention to detail. From this investigation I have selected two topics for discussion, the first my own visual observations, the second, cross-sectional analysis carried out in collaboration with James Smith, senior microscopist at Cleveland State University/ NASA Lewis Research Center in Cleveland, Ohio.

PREPARATORY MARKINGS PRIOR TO PAINT APPLICATION

When I began to examine this painting closely with the stereo-binocular microscope, a complex pattern of tiny markings started to emerge. These included incised lines, incised compass arcs and tiny dark prick marks. To make sense of these observations, I laid a sheet of mylar over the painting, traced the outlines of the painted forms in black and traced all the incised markings in red.

Prior to painting the figures of John and Barney Biglin, Eakins indicated the main contours with minute prick marks. These appear slightly dark under the microscope today. Where they are completely masked by overlying paint x-radiography is the only way to visualize them. An extra line of prick marks in the water area adjacent to the right arm of John Biglin indicates that Eakins corrected the position of this arm during the registration process. This adjustment was probably made by shifting the position of an overlying sheet of transfer paper. There is a vertical carbon-based line starting at the bottom of Barney Biglin's hand and extending to the lower edge of the canvas. This is placed exactly in the center of the painting and is only visible in infra-red. In thinly painted landscapes by Eakins (for example *The Meadows, Gloucester, New Jersey* c 1882, Philadelphia Museum of Art), a central vertical line is often visible with the naked eye in what appears to be graphite.

To prove that the tiny prick marks were made before the paint layer was applied rather than after, I looked to the x-radiograph for evidence. On the computer, I annotated an scanned image of an enlarged x-radiograph of the head of John Biglin, locating the prick marks in yellow. On a scale of 1:1 with the painting, the prick marks on the x-radiograph measure only 0.2 mm in diameter and appear as regular tiny black dots. I noted a number of additional prick marks in the x-radiograph that are totally hidden under original paint proving that these markings were indeed part of Eakins' preparatory process.

Eakins marked the positions of the small but important upper left and right boats with narrow, ruled, horizontal, incised lines. These are crossed by incised compass-drawn arcs in pertinent places. As with the prick marks, these precise incisions are also only visible with the aid of a microscope or with an enlarged print of an x-radiograph and are often partially filled or concealed by paint. They are sharp in character and obviously made into a dry ground layer. Incised lines border the right tip of the upper right boat. Compass arcs and incised horizontal and vertical lines are used to delimit the splash of the lower right oar as it hits the water.

In addition to incised lines and dots, underdrawing was visible with the microscope and infra-red reflectography. A dry drawing material, probably graphite, was found on certain contours of the Biglin's boat. For the lines visible only in infra-red I found it impossible to tell whether they were applied with wet or dry mediums. Outlines follow all the major contours of the Biglin's boat including its lower shadow in the water. The

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uppermost tip of the stern is located along a ruled diagonal line drawn from the right edge of the painting to approximately the center of the right side of the boat. Fine lines also denote most of the profile and contours of the two men. Scattered hand-drawn notations are also apparent in places in the water to indicate highlights. Loose, slightly imprecise underdrawing locates the red-capped figures in the upper right.

With the naked eye it is possible to distinguish large conical pinpricks along the top, bottom and sides of the painting at approximately one inch intervals. They are probably large pinholes resulting from the adherence of transfer paper, either by Eakins, for his lost full-scale watercolor of the painting or by his pupil Alice Barber, who made an engraving after it.

The Biglin Brothers Turning the Stake-Boat, being by far the largest and most ambitious of the rowing series might well have merited unusually detailed preparation. I therefore examined other rowing and boating scenes by the artist during this period in his career. Through microscopic examination, I found that the markings on *The Biglin Brothers turning the Stake-Boat* are by no means unique. In fact, almost every boating scene in oil that I examined showed some form of incised marking as well as drawing lines made in dry and wet mediums.

One example is the Metropolitan Museum of Art's *Max Schmitt in a Single Scull*, painted in 1871. Here, in the bridges, lines of prick marks outline the rounded forms, and incised lines follow the straight elements. In the water area incised diagonal perspective guidelines locate Max Schmitt's boat. Important points near or along these guidelines are marked with pairs of incised arcs. In two places, the ends of incised lines are marked by tiny red arcs that are not incised. The position of the small upper left boat is marked with horizontal incised lines. Incised lines are also found under the contours of Max Schmitt's boat and oars and under the ripples behind it. In places a drawing material, probably graphite, possibly strengthened with a ruling pen or brush, could be discerned underneath the paint of his boat and oar. While incised prick marks around the figure of Max Schmitt were not distinguishable, this does not preclude their presence.

A similar range of incised lines, dots and drawing lines were noted on the Philadelphia Museum of Art's *Pair-Oared Shell* of 1872, *Biglin Brothers Racing* of around 1873 at the National Gallery of Art and *The Schreiber Brothers* of 1874 at Yale University Art Gallery.

PREPARATORY DRAWINGS

There are only two known extant preparatory drawings for *The Biglin Brothers Turning the Stake-Boat*, a small-scale drawing in the collection of The Cleveland Museum of Art and a scaled perspective drawing of the boat in the Hirshhorn Museum. The small-scale drawing is compositionally the same as the final painting but there are small differences in the figures. The reverse has been shaded for transfer. When my tracing of the final painting to the Hirshhorn was laid on top of the scaled perspective drawing of the boat, I noted no changes. This indicates that Eakins worked out the design and precise details of the boat to scale prior to transferring it to canvas.

Eakins concern for precision is illustrated by the following quote from his unpublished manuscript on drawing of around 1884, held in the Philadelphia Museum of Art, 'To measure small parts of an inch you should have a diagonal scale, or make one on paper by dividing an inch in 10 equal parts, drawing lines at right angles through these divisions and marking off 10 divisions on these last lines. Diagonals then drawn from the tenths on the top line to the next tenths on the last line will in traversing the whole distance gain the one tenth by regular stages of tenths of hundredths. You can thus accurately measure hundredths of an inch with your compasses, and estimated between the tenths across the scale you can estimate very closely to the thousandths of an inch.'

We know that there were more drawings for *The Biglin Brothers Turning the Stake-Boat*, based on a letter from Eakins' pupil Charles Bregler to The Cleveland Museum of Art in 1942. Bregler relates that 'Eakins made accurate drawings of the ground plan of the boat etc. But it was impossible to save them, the paper being in a state of decay.'

It is also likely that Eakins made loose, out-of-doors oil studies for this painting to establish tone and color; such studies were probably discarded or painted over. It is probable he made at least one detailed figure study for *The Biglin Brothers Turning the Stake-Boat*, either in oil or pencil or both, followed by a perspective

drawing to include the figures, as in the preparatory drawing of *John Biglin in a Single Scull* (Museum of Fine Arts, Boston), which was a study for a watercolor of 1873.

Eakins' manuscript provides clues to his method of transferring his designs to canvas but there are no explicit instructions. At one point he describes a complicated squaring-up method of transferring information from a ground plan to a perspective plan. Later on in his career, Eakins squared-up his rough oil studies and a set of corresponding squares in pencil can often be found in the final painting. In the rowing and boating canvases there are no such signs of squaring-up. Based on his writings and my observations, I think that Eakins' first mark on the canvas would probably have been the drawing of the exact vertical and horizontal centers. Next, he most likely transferred the important points of the boats from a scaled drawing to the canvas using dividers, protractor and compasses, perhaps with the set of drafting tools in the collection of the Hirshhorn museum. I think he would have transferred the figures by tracing them onto transfer paper from a detailed preliminary drawing or printed illustration of some kind and pricking through the tracing to the primed canvas with a sharp point. Later he probably joined up the dots with a drawing material and strengthened the outlines with a ruling pen or thin brush.

PAINT LAYERS

Within *The Biglin Brothers Turning the Stake-Boat*, there is a strange marriage between the delicate, almost watercolor technique in the lower half of the painting and the thick, more spontaneous paint work of the riverbank and sky. X-radiographic details illustrate the contrast sharply. In the thinly painted lower half of the painting Eakins carefully abuts his different paint areas, which explains the black outlines around the figures in the x-radiograph. In the sky, the palette knife is used to create a dense and textured surface.

Not surprisingly, the thick paint layer in the sky is marked by drying cracks. Eakins first painted the sky light blue with a thick bristle brush and then covered it with a ochreous/creamy color applied with a palette knife. Above this is a thin, broken, semi-transparent, ochreous layer which may or may not be original.

The lower central highlights in the water are not painted as such, but are reserved sections of ground, as in watercolor painting. In these highlight areas one can make out the light, pitted commercial ground surmounted by a brown/black imprimatura or toning layer. The pits appear to be burst air bubbles. The glaze-like toning layer was also noted in cross-sections of the sky. Where the pitted ground is left visible by Eakins to form in the lighter parts of the scull, this toning layer was not present. Presumably Eakins avoided toning this area in order to preserve luminosity. In *Max Schmitt in a Single Scull*, which is painted on a similarly pitted commercial ground, I observed a deep blue rather than a brown/black imprimatura. As in the Cleveland painting, this layer does not appear to be present underneath the main scull.

Other painterly techniques in *The Biglin Brothers Turning the Stake-Boat* include glazing, toning, reworking over wet paint, rubbing with a solvent-soaked cloth or brush to create thinness and using the back of the brush through wet paint to break up reflections.

CROSS-SECTIONAL ANALYSIS

I selected a cross-sectional sample from the lower left sky for this paper, shown in accompanying figure. The questions I set out to answer are as follows:

- 1) what is responsible for the sparkly fluorescence under an ultraviolet light source in layers three and six?¹ Could it be zinc oxide, which is known to cause this phenomena under certain ultraviolet excitation conditions?
- 2) what are the transparent lumps in layer three, which fluoresce under ultraviolet excitation? (filter set as above) - could they indicate resin in the media?
- 3) what is upper semi-transparent toning layer and is it authentic? I have observed this type of layer, usually partially removed by cleaning, on many landscapes by Eakins.
- 4) what is the general chemistry of the various layers?

¹filter set: ultraviolet, wide transmission filter G365, chromatic beam splitter FT 395, barrier filter LP 420

James Smith carried out scanning electron microscopy on the cross-section at the NASA Lewis Research Center². He performed elemental analyses on selected areas by energy dispersive and wavelength dispersive x-ray spectrometry. Both secondary electron and backscatter electron images were acquired on representative areas.

From his results I have selected the most relevant to my queries.

The backscatter image of the cross-section shows that the various paint layers, although quite similar under ordinary illumination, have vastly varying chemistry.

Various x-ray modulation scans, otherwise known as x-ray dot maps were carried out for different elements including oxygen, carbon, aluminum, silicon, phosphorus, sulfur, chlorine, calcium, potassium, iron, zinc and lead³. The density of white dots is proportional to the relative x-ray intensity for the element being scanned. Correlations between these maps can help to answer questions about pigment distribution.

Dot maps for zinc and lead distribution clearly show that lead rich layers alternate with zinc/lead rich bands. From the oxygen dot map, it was also clear that higher levels of oxygen correspond to higher levels of zinc, indicating zinc white. The zinc/lead rich bands correlate with the areas of green sparkling fluorescence observed with the microscope suggesting that such fluorescence is indeed attributable to significant quantities of zinc oxide. The ground layer is clearly lead-based with no zinc.

Why Eakins varied the proportions of zinc and lead in his paint layers is open to interpretation. It may have been fortuitous but he was probably aware of the differing aesthetic and mechanical properties of lead and zinc white, for example zinc white's high opacity but tendency to dry brittle and crack versus lead white's advantageous drying properties⁴.

²After dry-polishing with Micromesh[®] 12.000, the cross-section was coated with approximately 200 angstroms of evaporated carbon. The investigation was performed on a JEOL 840-A electron microscope used by the Analytical Science Branch of the Materials and Structures Division at NASA Lewis Research Center. Simultaneous with the SEM examination, elemental analyses were performed on selected areas of the section by energy dispersive x-ray spectrometry (EDX) and wavelength dispersive x-ray spectrometry (WDX). The EDX system used is the Kevex Delta V with a Quantum[®] thin window detector. EDX detects the presence of all elements in a selected area with atomic numbers greater than 11 (sodium) and in concentrations greater than a few tenths of one-percent. Carbon, oxygen and nitrogen are also detected if present in quantities greater than approximately 4-5 weight percent. The WDX system consists of a Microspec WDX-3PC equipped with a four crystal fully focusing spectrometer which covers the wavelength range for all elements with atomic numbers greater than 5 (boron). Characteristic x-ray lines were detected individually and the sensitivity was typically in the ppm range (0.001 wt%=10ppm). There was no attempt to quantify the EDX or WDX data due to the fine size of most pigment particles encountered (1.0µm or less). Individual EDX spectra were all collected at 15kv-600pA probe current. Both secondary electron and backscatter electron images were acquired from representative regions of the cross-section. EDX qualitative spectra were acquired from the individual layers to determine general compositions. Counts were obtained for 100 sec. at 600 pA from regions approximately 10 x 10µm.

³The optimum accelerating voltage for each spectral line was a compromise to reduce the adverse effects of spatial resolution losses, absorption effects, and to minimize electron beam damage. Typically, the maximum probe current was 12 nA.

⁴I am grateful to Dr. Leslie Carlyle for sending me the relevant passages of her thesis which may explain Eakins' layering of lead white layers with mixtures of lead and zinc white. During the latter part of the nineteenth century, writers on art were worried about the possible chemical changes caused by hydrogen sulphide on lead white. Various solutions were proposed such as mixing the lead white with zinc white or layering lead white layers with zinc white layers. Most of these publications appeared after *The Biglin Brothers Turning the Stake-Boat* was painted. However, the concern was known before and Eakins may well have shared it. Windsor and Newton's 'New White' appeared in their catalogue for 1849 which was a mixture of white lead and zinc white. Fuller information available in Dr. Carlyle's pH. D. thesis, Courtauld Institute of Art, University of London, submitted 1991, 'A Critical Analysis of Artists' Handbooks, Manuals and Treatises on Oil Painting Published in Britain Between 1800-1900: with reference to selected eighteenth century sources.'

For the ground layer, in addition to major lead white, there is iron in small proportions in the upper regions. One typical iron containing particle also contained aluminum and silicon suggesting the presence of an ochre or sienna pigment. In the imprimatura or toning layer there is calcium, phosphorus and oxygen suggestive of bone black. Iron and magnesium were also identified in this layer indicating an umber pigment which would have acted as a drier. In layer three, the light blue layer, the regions of unpigmented medium are characterized only by large amounts of carbon. There are no lead or zinc particles in these areas. For layers four, five and six, the ochre-colored layers, the main constituents are lead carbonate mixed with many aluminosilicate type particles. These particles have an approximately 1:1 ratio of aluminum and silicon and might be china clay, a common filler. Quartz is a frequent impurity. In layer six, in addition to lead and zinc, there are several particles rich in silicon, aluminum, magnesium, potassium and minor iron suggestive of green earth. In this layer there are also many iron oxide particles, generally with minor amounts of aluminum and silicon suggesting an ochre or sienna pigment. Calcium carbonate particles were also detected. In the uppermost 'toning' layer, layer seven, in which there are no coarse particles, zinc, sulfur, chlorine and oxygen are present. A few particles of silicon dioxide were also noted as in other layers. Unfortunately, this result does not answer my question regarding the authenticity of this layer.

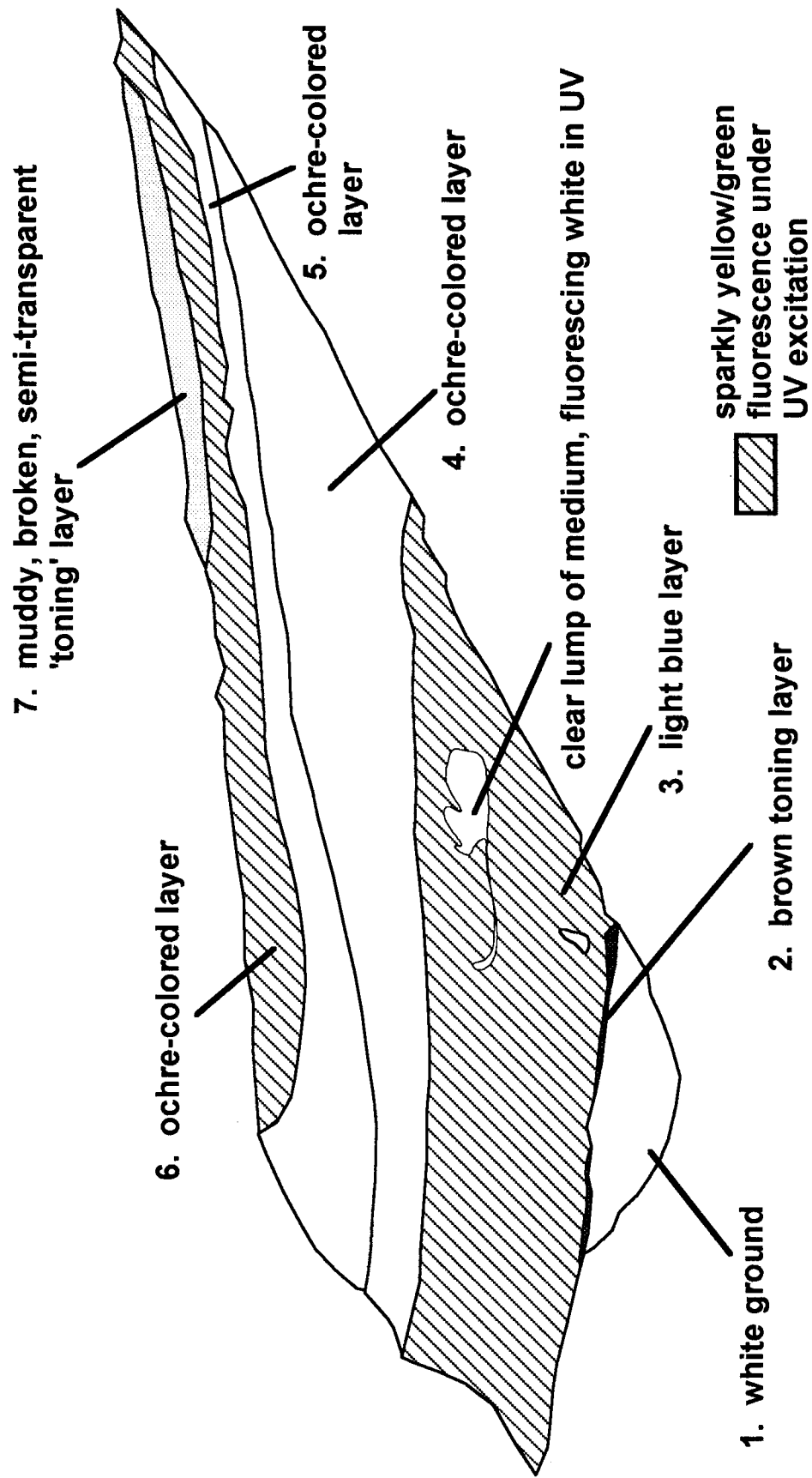
For medium analysis of the sky, a small sample of the lower light blue layer and a small sample of the upper ochre/creamy layer(s) were taken and analyzed by Fourier transform infra-red microspectrophotometry (FTIR). For the light blue layer, which contains fluorescing areas of pure medium in the cross-section, the spectra suggest the presence of a natural resin. For the upper ochre-creamy layer applied with a palette knife, the sample appears to contain a cross-linked oil, possibly linseed.

The evidence I have presented gives a fair idea of the wide range of drawing and painterly techniques used by Eakins to construct his rowing scenes. The drawings and preparatory material suggest Eakins the young but totally accomplished draftsman, a result of his rigorous training at Central High school in Philadelphia and with Gerome in Paris. The paint layers reveal Eakins as an inspired, experimental but as yet inexperienced painter.

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Thomas Eakins. *The Biglin Brothers turning the Stake-Boat*
cross-section, lower left sky



Insect Eradication of Paintings Using Ageless™ Oxygen Scavenger

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Introduction

Considerable research has been conducted with the use of modified atmospheres (MA) or controlled atmospheres (CA) to manage insect pests of stored grains and food. In most studies the lowest range of oxygen concentrations tested were 0.6-0.9%.

Marzke et al. found that as O₂ concentrations decreased from 21.0% to 0.6%, the mortality of adults and larvae of Trogoderma glabrum (Herbst) increased [1]. Mortality was also increased with increasing temperature. Three-day exposures at 0.5% O₂ at 26.7°C resulted in 100% kill of adults and larvae. Adults were more susceptible than larvae. Navarro found that exposure time was the critical factor for certain species [2], such as rice weevil Sitophilus oryzae (L.), being almost independent of O₂ concentrations below 3%. However, as O₂ concentrations decreased, the time required to kill red flour beetle Tribolium castaneum (Herbst) also decreased.

Jay et al. found that as the relative humidity decreased, the mortality of three stored product insects exposed to low O₂ atmospheres (0.8-0.97%) increased [3]. Jay and Cuff found that mortality and water loss with T. castaneum was low at 97% N₂ and 3% O₂, but high at 99% N₂ and 1% O₂, suggesting that water loss is the major cause of death at high N₂ atmospheres [4].

In studies with insect pests frequently encountered in museums, Gilberg found that 7-day exposures at 30°C and 65-70% RH to 0.421% O₂ in nitrogen killed webbing clothes moths, cigarette beetles, drugstore beetles, carpet beetles and powderpost beetles [5]. The same insects exposed for 3 weeks in plastic bags were also killed [6]. Preliminary studies by Valentin showed that exposures to 1.0% O₂ atmospheres for 20 days killed deathwatch and powderpost beetles [7]. Valentin and Preusser found that 30-hour exposures to 0.5% O₂ and 99.5% N₂ atmospheres produced 100 % mortality in fruit flies [8]. Exposure time decreased as the temperature at which the exposures were conducted increased. Exposures of 5 days to 80% CO₂ atmospheres provided complete kill of West Indian drywood termites, Cryptotermes brevis (Walker), inside pieces of infested wood [9].

Rust et al have evaluated the mortality of all life stages of pests commonly found in museums at 55% RH and 25.5°C in a nitrogen atmosphere (less than 0.1% oxygen). The insects studied were webbing clothes moths, furniture carpet beetles, firebrats, cabinet beetles, larder beetles, cigarette beetles, confused flour beetles, American cockroach, brownbanded cockroach, German cockroach, powderpost beetles and western drywood termites. The time required for 100% kill ranged from three hours for the adult firebrats to 192 hours for the eggs of the

cigarette beetle. The results are summarized in figure 1 [10].

The use of carbon dioxide for eradicating stored product insects has been widely researched and reported. The CO₂ concentration is around 60% for most of these studies. Also since stored product research is more interested in control than eradication, the exposure times reported were for 95% mortality rather than for complete mortality. The time for 100% mortality was less than 2 weeks for tested species [11,12]. Valentin et al have reported that a number of wood boring insects including *H.Bajulus*, and *A.Punctatum* are tolerant to carbon dioxide atmospheres [13].

Argon is another inert gas that is presently being studied. Preliminary results suggest a faster rate of kill than nitrogen for *Anobium Punctatum*, *Hylotrupes Bajulus*, and *Lasioderma Serricone*. Additional mortality studies need to be conducted before this can be widely used in conservation [13].

With regard to the question on insects developing tolerance to low oxygen environments, Ezra Donahaye reports that the lethal times (LT⁵⁰) for *T.Castaneum* exposed to 0.5% oxygen was 36 hours at the 2nd generation which increased to 190 hours for the 26th generation [14]. In a museum setting it is unlikely for the above to happen

It is likely that the exposure time in the low oxygen atmosphere would be dramatically decreased by increasing the temperature above 25.5°C (78°F) and lowering the relative humidity below 55%. However, the upper temperature limits and lower RH limits would depend on the nature of the object.

Low oxygen environments can be a method of microbial control as well. Valentin N. found a significant decrease of the biological activity of *Asperigillus niger*, *Aspergillius Flavus*, *Pennicilium commune*, *Actinomyces* sp, *Bacillus* sp, and *Strptomyces* sp, in a range of oxygen levels (0.1-1%) and at a RH lower than 50%. For both Bacteria and Fungi. Hence, low oxygen can be used as a method for control but not eradication [15].

The question on whether an oxygen free environment is beneficial for retarding color fading has been investigated by a number of researchers. Arney et al observed that the life expectancy of most colorants can be increased in an oxygen free environment. They also report that more than 90% of the beneficial influence of an oxygen free environment can be realized with as much as 0.2% oxygen remaining in the environment of the colorant [16].

John Burke at the Oakland Museum reports a significant reduction in color fading for pigments on paper in a less than 0.1% oxygen environment [17]. A slight color change in Cinnabar, Litharge and Sienna have been observed by Toshiko [18].

Low Oxygen Environment: Systems

It is possible to produce and maintain low oxygen atmospheres (<0.1%) with only an occasional flushing of nitrogen or any other inert gas, or the use of several packets of Ageless™ oxygen scavenger.

The procedures described below refer to a number of systems developed and published by the Getty Conservation Institute and the J. Paul Getty Museum.

The basic procedure for producing and maintaining a reduced oxygen atmosphere for treating museum objects is to replace air with an inert gas in the bag or enclosure that encapsulates the object. There are three variations in protocol: (1) *The dynamic system*. An inert gas is used to flush all air out of the bag by an initial high flow rate and then, when a low level of oxygen is reached, the flow is reduced to that required to maintain the low-oxygen atmosphere for a period required [19-21]. (2) *The dynamic-static system*. The bag is purged with an inert gas, as in the Dynamic system and after the low oxygen level is reached, a quantity of Ageless™ oxygen scavenger (described below) is quickly inserted, the gas flow stopped and the bag sealed for the required exposure period [19-21]. (3) *The static system*. This method is ideal for treating small objects (less than 150 liters). No purging of air in the bag is necessary. A calculated amount of oxygen scavenger needed to absorb the oxygen in the bag and maintain the oxygen concentration at less than 0.1% for the fumigation period is inserted.

Only the static system, which is particularly suitable for paintings will be discussed. The other methods have been published in the paper titled "Eradication of Insect Pests in Museums Using Nitrogen" by Vinod Daniel, Gordon Hanlon and Shin Maekawa, WAAC Newsletter, Vol 15 Number 3, September 1993.

The main features of this procedure includes bag construction and insertion of a calculated amount of Ageless™.

Bag Construction

Plastic films vary in their permeability to oxygen [22]. Principal criteria for selection are a low oxygen permeability, availability in convenient sizes, and heat sealability. For our treatments we have used Aclar [poly(chlorofluoroethylene)], extensively. Cryovac [Poly(vinylidene chloride)], which has a lower oxygen permeability, is another material that has been widely used by other conservators (it was not available in adequate width nor in small quantities for our application). The bags were fabricated by joining large sheets of plastic with a portable heat sealer to create a form conforming to the shape of the object.

Ageless™

Ageless™ is an oxygen scavenger patented and produced by the Mitsubishi Gas Chemical Company [23,24]. Stated by Mitsubishi to be a mixture of finely divided moist iron (ferrous) oxide and potassium chloride, it is available in several different compositions. Ageless-Z is the type suitable for application in conservation. Ageless-Z is designated as Z-100, Z-1000, etc., to indicate the milliliters of oxygen with which a single packet will react.

Treatment Procedure

The procedure for fumigating a painting (volume less than 150 liters) is as follows. Cut a

piece of the vapor barrier film sufficient to enclose the object. Heat seal three sides of the plastic film to create a bag and place the painting inside. A calculated number of Ageless™ packets (described below) are inserted and the last side of the bag is heat sealed., heat seal the last side. The bag is opened after a period of ten days.

A step wise calculation for the number of Ageless™ packets required is outlined below:

Step 1. Measure the approximate length, width, and height of the bag in cms, multiply these three dimensions together and the result will be the volume of the bag in cubic centimetres (cc).

Step 2. Since the percentage of oxygen in air is one-fifth of the volume, divide the result of step 1 by five.

Step 3. Divide the result of step 2 by the milliliter designation of the Ageless™ packet. i.e an Ageless™ Z-2000 packet has a milliliter designation of 2000.

Step 4. Multiply the result in step 3 by a factor of two.

Example:

The dimensions of a bag enclosing a 18th century panel painting were measured to be 100cms x 80cms x 10cms. It was decided to use Ageless™ Z-1000 since it was in stock.

How many packets of Ageless™ Z-1000 need to be used.

Step 1: $100 \times 80 \times 10 = 80,000\text{cc}$

Step 2: $80,000 \text{ divided by } 5 = 16000$

Step 3: $16,000 \text{ divided by } 1000 = 16$

Step 4: $16 \times 2 = 32$

In the above example one needs to use 32 packets. of Ageless™ Z-1000. Since the factor of two mentioned in step 4 is a safety factor. As one gets experienced in conducting the above treatment procedure, as well as understands the concepts illustrated in appendix 1, the safety factor can be changed to adding a few packets to what is calculated in step 3.

A couple of cautionary notes. Since the reaction of Ageless™ with oxygen is exothermic, it is important not to place the Ageless™ packets directly on the painting. Also, since the volume of the bag decreases by about 20%, as the oxygen is absorbed, it is advisable not to make a tight fitting bag.

A few other details on Ageless™. Conservators using Ageless™ during carbon dioxide fumigation need to be aware that Ageless™ absorbs carbon dioxide on an equal volume as oxygen. Also Scientists at the British Museum use a double bagging procedure for long term storage of objects using Ageless™. In a project at the Los Angeles County Museum of Art, Riter, S., Colton, S., and Daniel, V., are evaluating the feasibility of using a clamp to make reusable bags for Ageless™ application.

Conclusion

The use of an inert gas and or an oxygen scavenger to attain low oxygen atmospheres is a

feasible alternative to toxic methods for pest control. It is the wish of the authors, that the reader use the concepts illustrated in this chapter to refine, or develop new methods for the benefit of all of us involved in this valuable profession of preservation.

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AN X-RAY PUTTY COMPOSITION FOR IMPROVING RADIOGRAPHS OF CRADLED PANEL PAINTINGS

Scott A. Heffley

ABSTRACT

X-ray radiographs taken of cradled panel paintings using the traditional approach yield a radiograph where the cradle grid pattern greatly interferes with the painted image. Various materials and compositions were investigated to produce an easy to make, soft reusable putty that approximates the density of wood to X-rays. The cradle voids are simply filled with this putty, giving the cradled panel an even, homogenous density to the X-rays. The resulting primary source radiograph reveals the painting image virtually free of cradle interference, and the comparison to a "cradle free" radiograph produced through computer manipulation is favorable. This X-ray putty can also be used to neutralize complicated surface topography of three dimensional wooden objects when radiographic understanding of subtleties in the interior of a piece is desired.

INTRODUCTION

The author's conservation treatment of Bronzino's Portrait of a Young Man, oil on cradled panel painting, in 1990 initiated the search for a simple, direct method of achieving good X-ray radiographs of cradled panel paintings. Careful examination of the X-ray and infrared image revealed that Bronzino painted three completely different versions of the sitter on top of one another in this piece. Deciphering the complex X-ray radiograph required that it be free of the cradle grid distraction that a traditional radiograph yielded. The equipment to achieve this through computer manipulation was not available to the author and physically cutting and joining different exposures of the four 17" x 14" radiograph

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plates seemed excessively laborious. The alternative was to find a material that when inserted into the cradle voids would approximate the density of wood to X-rays and eliminate the cradle grid from the radiographic image. This experimentation in 1990 involved trying different materials in the cradle voids and settling on 1/16" thick Kleen Klay (a plasticine-like material) to match the X-ray density of a 7/8" thick mahogany cradle member. The resulting radiograph had a good match between the cradle void with Kleen Klay and the cradle member in the central area of the void. At the perimeter of the void, however, highlighting and shadowing continued to reveal the presence of the cradle. This highlighting and shadowing is the result of geometric distortion (known as penumbra) caused by a conical X-ray beam striking raised cradle members and recessed cradle voids with the 1/16" thick Kleen Klay wafers.

Ideally, the material used to fill the cradle voids should have the same density of wood to X-rays (as the 1/16" Kleen Klay does with 7/8" thick mahogany) but also it should occupy the same volume so that the penumbra phenomena would be eliminated. Experimentation to develop an X-ray putty that would satisfy both density criteria continued in 1993. Other important considerations included producing a putty that was soft and pliable but not sticky. Also the putty should be reusable with reproducible results – no volatile or changing materials were used in the formulation. Finally, the putty should be easy to make and easy to use (see Photo 1).

The absorption of X-rays by materials basically relates to the atomic weight of the elements involved and the density distribution of those elements within the composite material. Wood is composed of carbon, hydrogen, oxygen and some nitrogen, with a liberal distribution of air filled channels. Materials containing these elements when combined to meet the use criteria (pliability, not sticky, non-changing, etc.) were investigated in the effort to find a good putty formulation. Every wood type has a different weight density (and density to X-rays) but the types of hardwoods traditionally used in the construction of cradles fit into a single general density family.

PUTTY FORMULATION AND INSTALLATION PROCEDURE

Formulation of the putty involved trying various carbonaceous materials in differing amounts to achieve the desired use criteria and X-ray density. Glass microbubbles were added to simulate the air content of wood. Although the silica alumina glass walls of the microbubbles have a higher atomic weight than wood elements, the very low ratio of glass wall material to air volume contained within the bubbles counterbalances this problem. Formulation testing involved 3M C15/250 glass microbubbles (density averaging 0.15 g/cu. cm), but a newer product, 3M K125, has a slightly lower average density of 0.125 g/cu. cm and could be useful for future formulation. (Plastic microbubbles might be another alternative.)

X-RAY PUTTY FORMULA:

Multiwax X-835	70% (weight)
Mineral oil, heavy weight	15%
3M Scotchlite Glass Microbubbles K15	15%

MIXING PROCEDURE:

1. Melt wax and oil together in a double boiler.
2. Stir in glass microbubbles slowly (care should be taken to not breathe microbubbles because they are very fluffy and pose a silica-alumina health hazard).



PHOTO 1: X-ray putty

- Total putty volume will increase substantially, so use a particularly large container.
3. While cooling, the putty can be kneaded to further homogenize.

INSTALLATION PROCEDURE:

1. Line cradle void with fine plastic wrap to isolate putty from panel reverse (fine Handiwrap works well). Filling one void at a time is advisable (see Photo 2).
2. Push cube of putty into void with fingertips or tool (see Photo 2). After void is filled, remove putty wafer with plastic wrap and sharpen wafer corners, then reinsert and push again (see Photo 3). (If putty does not conform exactly to cradle void with sharp corners, a distorted radiograph will result. A well-formed putty wafer is shown in Photo 4.)
3. Repeat to fill all cradle voids. It should be noted that for larger panel paintings that require more than one radiographic plate, the putty wafers can often be reused by shifting between areas of the cradle reverse. This is particularly effective when precise cradle craftsmanship results in cradle voids of exactly the same size.
4. Install thin wafers of X-ray putty on top of moveable cross members that are less deep than rigid vertical members. At the top and bottom of each film plate, these wafers should be offset slightly towards the center of the film plate. The greatest amount of offset, perhaps 3/16", should be at the top and bottom of the film plane (slight rounding of both horizontal edges is helpful). The amount of offset should graduate down to zero near the center of the film plate. This will reduce the shadowing caused by the geometric distortion of the conical X-ray beam striking the thin putty wafers on top of the raised cross members.
5. This putty formulation is slightly denser than mahogany to X-rays, so consequently the cradle voids were slightly under-filled. It might be advisable to make a radiographic test after filling numerous voids so that the exact putty thickness for any given cradle could be determined.

PHOTO 2

Pushing X-ray putty
into plastic wrap-lined
cradle void



PHOTO 3

Sharpening corners as
X-ray putty wafer is
formed



PHOTO 4

Final X-ray putty
wafer with sharp edges

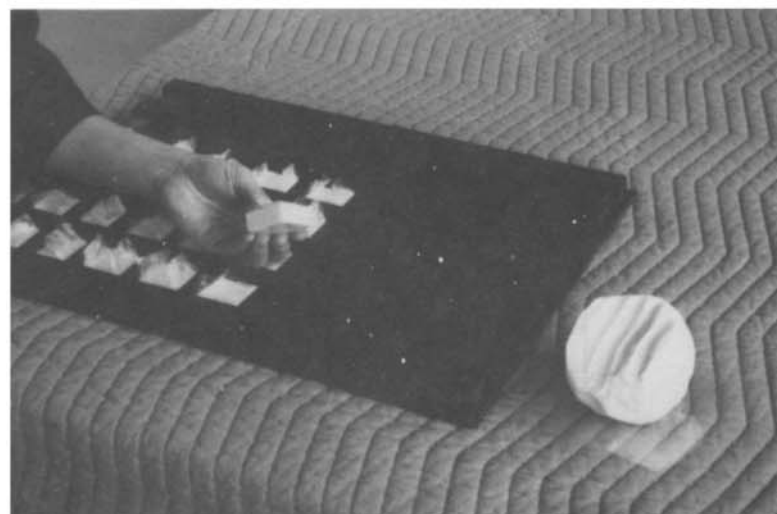
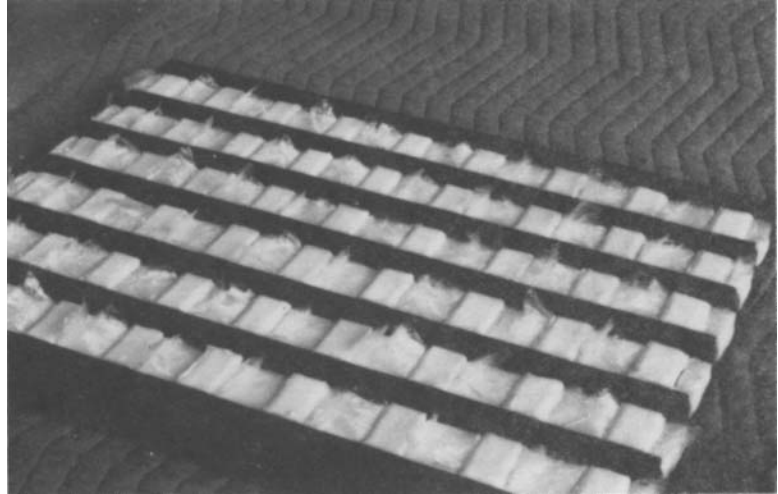


PHOTO 5

Entire cradle reverse with
X-ray putty wafer in voids
and on moveable cross-members



PANEL RADIOGRAPHIC IMAGE WITH PUTTY

After the cradle voids and cross members have been filled with X-ray putty (see Photo 5), the panel is ready to be X-rayed. The cradle grid pattern will virtually disappear, leaving the image of the paint film with any artist's changes clearly readable in this primary source radiograph.

Gerrit Dou's Self Portrait, Dutch cradled panel painting, 1663, illustrates the use of the X-ray putty (see Photo 8). A standard X-ray radiograph of the panel without X-ray putty, Photos 6 and 10, shows how the cradle grid interference renders the image of the paint film unintelligible. Photos 7 and 11 show the X-ray radiograph of the cradled panel painting with the X-ray putty filling the cradle voids. The subtle paint layering and artist changes are easily readable in this direct radiographic image of the painting. It's interesting to note that Dou originally depicted himself standing behind a window ledge that is draped with fabric. (The white disk near the center of the painting is a pigmented wax seal on the reverse of the panel.)

CRADLE ELIMINATION THROUGH COMPUTER MANIPULATION

The cradle grid can also be removed from a radiographic image through computer manipulation. This process involves first digitalizing the radiograph into computer memory. A high quality large bed scanner operating at high resolution is essential in the translation of the

complex photographic X-ray image into a digitalized representation. Large capacity data storage (like a removable optical disk with storage capacity of around 20 megabytes) and expanded capacity computer systems (such as Macintosh Quadra 650 with expanded working memory of 16 megabytes) are required to maintain the necessary clarity of subtle tone variations found in radiographs. Manipulation of the digitalized image using the Adobe software program requires the conservator to work across the surface, adjusting tone and contrast on each segment of the obscuring cradle members. This process can be very time consuming and involves considerable adjustment of the image appearance to eliminate the cradle. (Photo 9 shows this effort in progress; Photo 12 is a detail.) Once the cradle has been eliminated, a hard copy of the manipulated digital image can be made for reference or publication. Each level of intervention in the manipulation process (image digitalization, actual manipulation, hard copy production) can move the final product somewhat away from the original silver grain radiograph clarity.

A comparison of the radiographs where the cradle has been removed through computer manipulation and through the use of X-ray putty is found in Photos 7 and 9, and detail Photos 11 and 12. Both processes can successfully reveal the radiographic image of the paint layer from behind the cradle grid. The image produced with the X-ray putty is a primary source radiographic image with silver grain photographic fidelity. The computer-manipulated image has undergone successive steps of processing, but with quality equipment and careful work can also yield high fidelity. Both methods require a certain amount of time for production. Installation of the X-ray putty can be done by a technician or a well-instructed volunteer, whereas the manipulation method generally requires a conservator to make the many image appearance decisions. Another advantage to the X-ray putty is that it has almost no cost and requires no special equipment.

USE OF X-RAY PUTTY WITH OBJECTS

This X-ray putty can also be used to neutralize complicated surface topography of three-dimensional wooden objects when radiographic understanding of subtleties in the interior of a piece is desired. Wood

repairs, methods of appendage attachment, interior space definition or other subtleties found within a wooden artifact can be made more visible. Simply pack the X-ray putty onto the complicated surface of the artifact so that the resulting putty-packed object surface is even. (It is important to isolate the artifact from the putty with a fine plastic wrap because the mineral oil in the composition could stain porous surfaces.) Once the surface topography has been dimensionally neutralized with the putty, a standard X-ray radiograph will allow more internal information to be visible because the distraction of surface variation has been eliminated.

Acknowledgements

I would like to express a special thanks to Frank Zuccari, Executive Director of Conservation at the Chicago Art Institute, for his generous help with the computer manipulation component of this project. Marla Cling, Conservation Assistant at the Nelson-Atkins Museum of Art, was very helpful with many dimensions of the project, and her predecessor, Ria German, was helpful during the early phases of the project. Betse's real cool too.

Sources of Materials

Multiwax W-835

- Conservation Materials, Ltd., 1275 Kleppe Lane, #10, Sparks, NV 89431

Mineral Oil, heavy weight

- Local drug store

3M Scotchlite Glass Microbubbles K15

- Conservation Support Systems, 924 W. Pedregosa Street, Santa Barbara, CA 93101 (0.125 g/cc available here)

PHOTOS 8-12 ON FOLLOWING PAGES

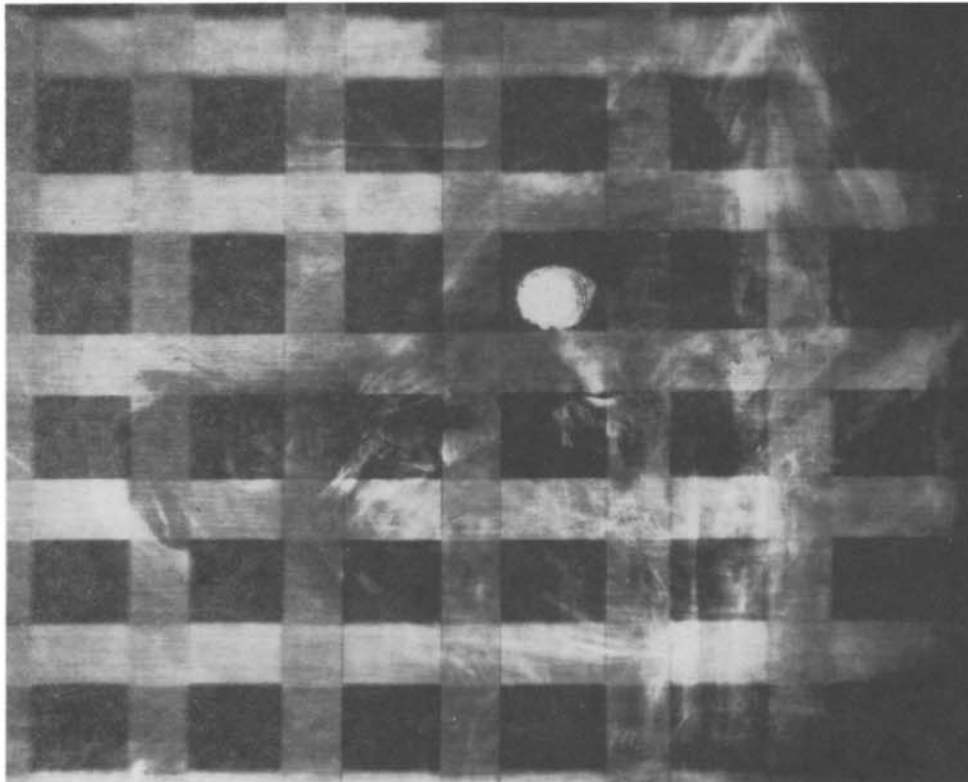


PHOTO 6 X-ray radiograph of Dou
Self-Portrait showing
cradle interference

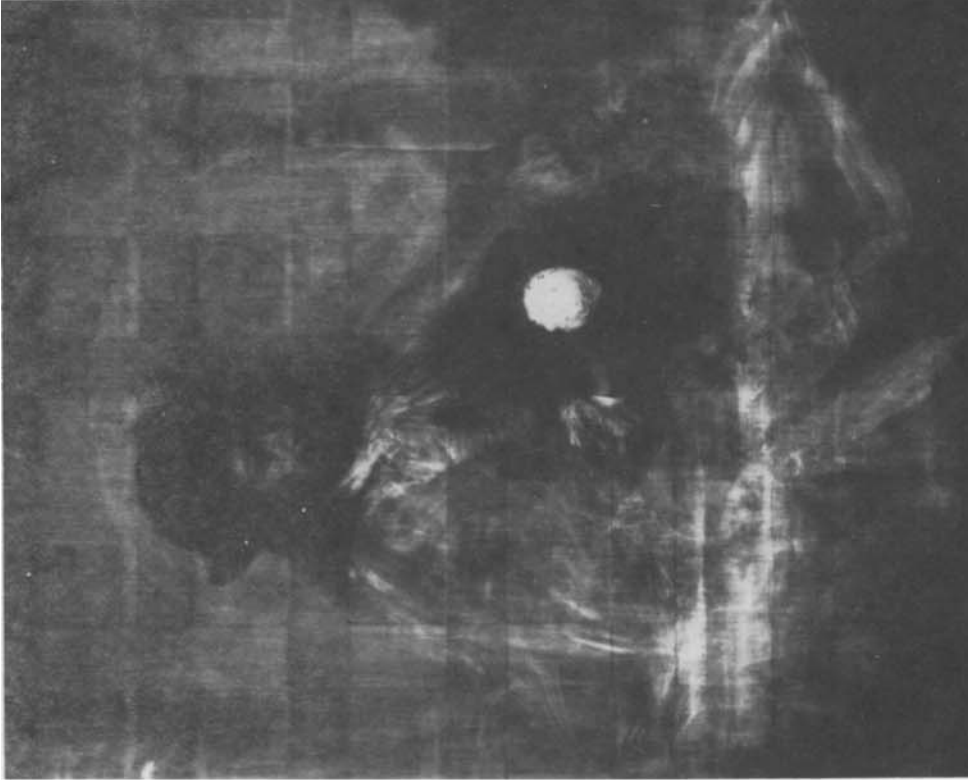


PHOTO 7 X-ray radiograph of Dou
with X-ray putty in cradle voids



PHOTO 8 Gerrit Dou's Self-Portrait, 1663,
on cradled panel painting

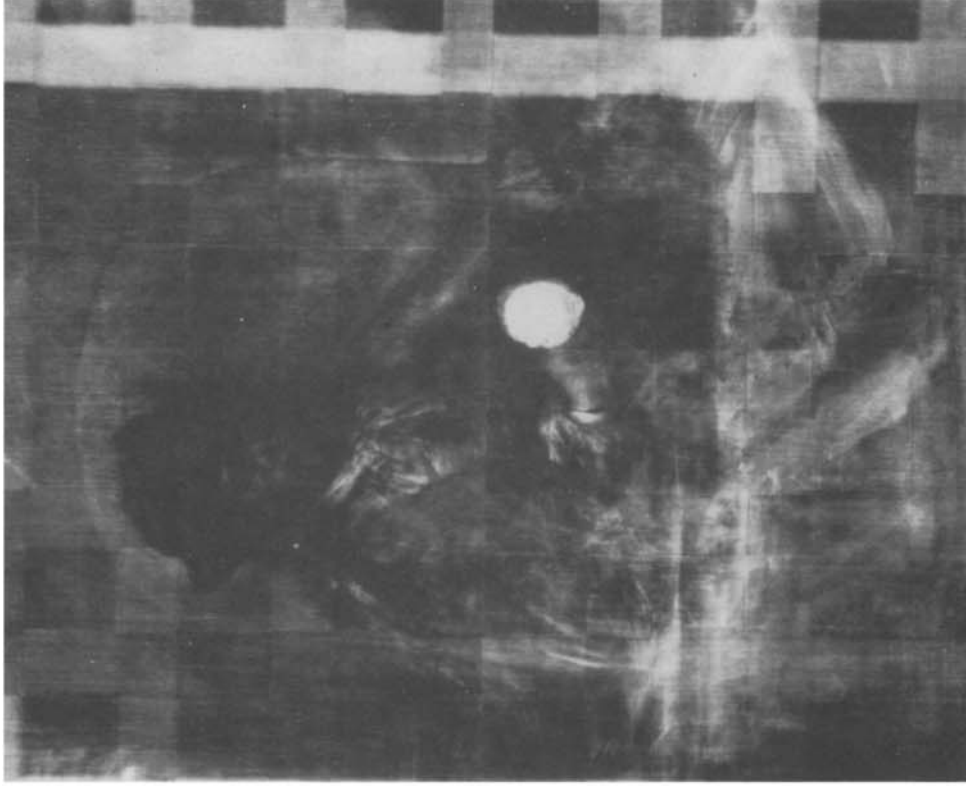


PHOTO 9 X-ray radiograph of Dou with cradle
partially removed through computer
manipulation

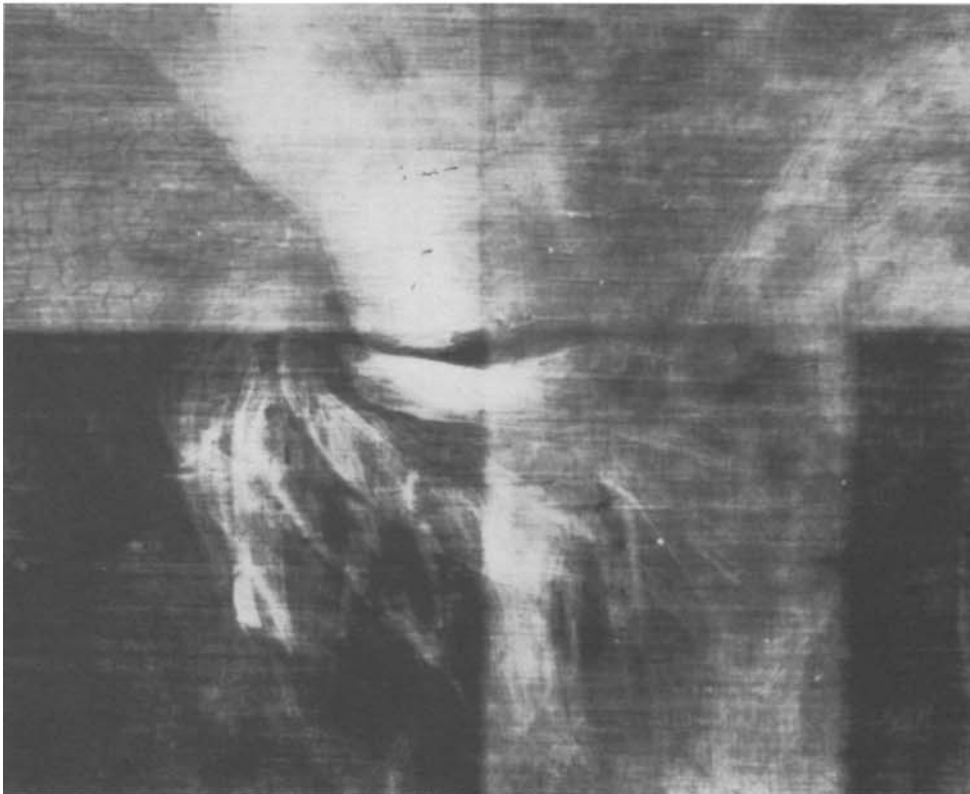


PHOTO 10 Detail of Dou radiograph (sleeve and hand) showing cradle interference

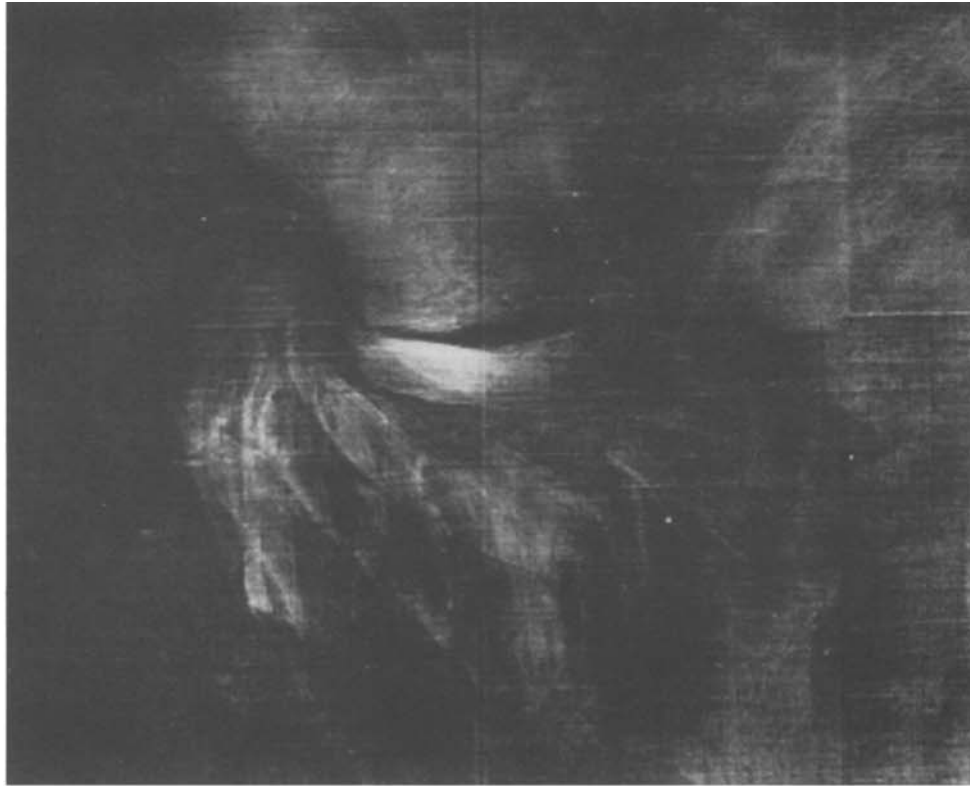


PHOTO 11 Detail of Dou radiograph with X-ray putty in cradle voids

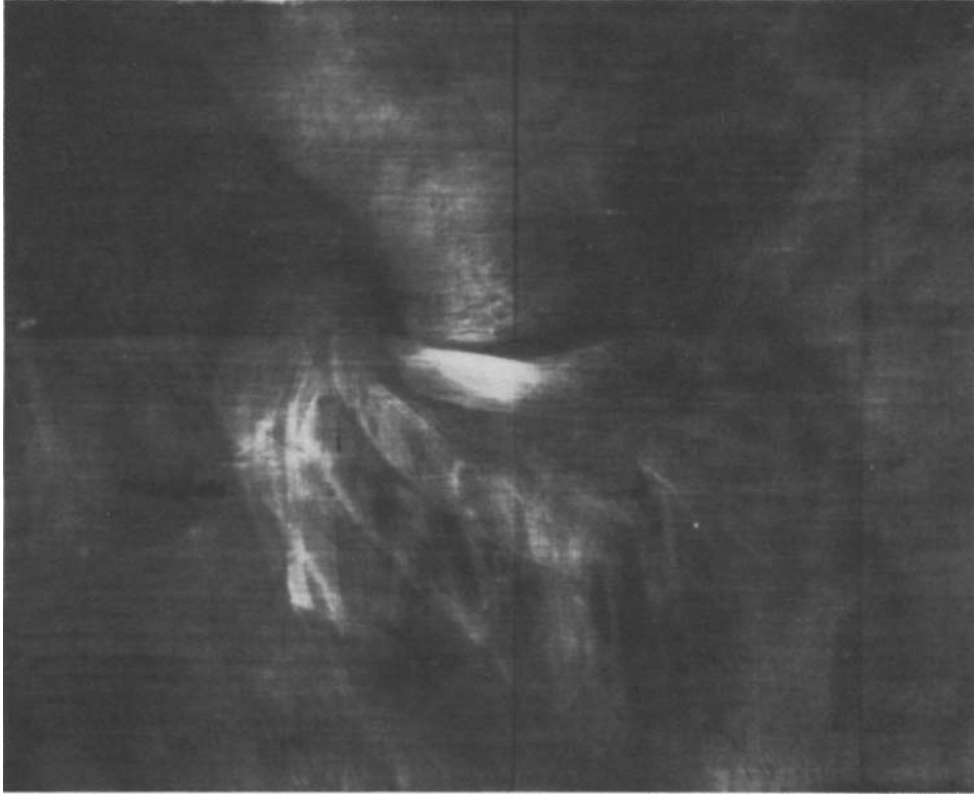


PHOTO 12 Detail of Dou radiograph with
cradle removed through computer
manipulation

CONSIDERING ARTIST'S INTENT IN THE PUBLIC ARENA

Harriet Irgang*

Publicly placed art is intricately linked to the special circumstances of its architectural setting. However, drastic alterations due to environmental conditions, vandalism or misguided past maintenance efforts can severely compromise an artwork's physical integrity and intended meaning. The examples presented here are Reginald Marsh's mural cycle at the U.S. Custom House and Charles Alston's paintings at Harlem Hospital; instances where treatment decisions attempt to integrate an understanding of the artists' original intentions with the need to protect and preserve these important publicly sited art works.

REGINALD MARSH'S *FRESCO SECCO* MURAL CYCLE

The cycle of sixteen *fresco secco* paintings by Reginald Marsh are located on the Rotunda dome of the Alexander Hamilton United States Custom House at One Bowling Green in lower Manhattan. Various aspects of the recent building-wide restoration under the auspices of the General Services Administration have been discussed elsewhere,¹ however, little attention has been given to the conservation treatment of the Marsh murals.

The Custom House, completed in 1907, was designed by noted architect, Cass Gilbert. Gilbert's plan for murals in his impressive Rotunda, however, remained unrealized until 1937, despite the fact that frame moldings were in place and names of explorers, sculpted in *bas relief*, surmounted eight of the frames.

Reginald Marsh, child of two American artists, was born in Paris in 1898. By the mid-1930s, he had achieved success with his illustrations and paintings of New York street life, painted primarily in egg tempera. Marsh held a lifelong interest in mastering new painting techniques, particularly those suited to his exceptional gifts as a draftsman. Already an accomplished painter, Marsh studied fresco technique with the Swedish specialist, Olle Nordmark, at Nordmark's well known summer school in Hopewell Junction, New York.² Marsh came to value his mentor's skills to such an extent that in 1935 he hired him to prepare the walls for his first mural commission: two *buon fresco* panels, each 13-1/2 by 7 feet, for the Post Office Department in Washington, D.C. This effort was funded by the newly created Treasury Relief Art Project (TRAP).³ Unlike the Federal Art Project of the Works Progress Administration, which granted commissions to artists already in its employ, TRAP made selections from proposals by any artist who might wish to submit one.⁴

In 1936, based on his previous success with the frescoes in the Washington, D.C. Post Office, Reginald Marsh was commissioned to paint the New York Custom House murals. The subject of the mural cycle was agreed upon by patron and artist: scenes from the busy New York Harbor would best illustrate the complexity of the Customs Department's activities. Handled by Marsh, these scenes have translated the liveliness and immediacy of his best known easel paintings to a monumental scale. Marsh made first-hand pencil sketches of these scenes, boarding the Lightship Ambrose; sailing in the Pilot Ship New York to meet an incoming freighter; and joining the press corps during an on-ship interview with Greta Garbo upon her return from Europe. For the eight smaller panels, predetermined by the *bas relief* framework, Marsh was directed to paint explorers in grisaille as if they were sculptures in shallow niches.

Marsh felt confident in using fresco for this prestigious commission rather than oil on canvas as requested by his patron. Marsh petitioned long and hard to win over Olin Dow, the Chief of TRAP, who

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Figure 1. Reginald Marsh, Incoming Ocean Liner Passing the Statue of Liberty, after treatment.



Figure 2. Reginald Marsh, Cabot, after treatment.

felt it was too costly to provide scaffolding "strong enough and heavy enough to keep fragments of plaster, etc., from falling down. It would mean chipping the whole ceiling and then replastering it." But Marsh persisted, gave cost comparisons to show that fresco would not be more expensive, offered to absorb expense overrides, and eventually won out.⁵

It is evident that the *fresco secco* technique afforded Marsh a means of achieving fluidity on a large scale just as he had in his watercolors and egg tempera paintings. Marsh painted his Rotunda murals as if they were giant watercolors, overlaying transparent washes and letting his brush skip over hillocks in the sand-textured "finish" coat just as a watercolorist might scumble over the texture of an Arches watercolor paper.

MARSH'S TECHNIQUES

In January 1938, one month after the entire Rotunda cycle had been completed, Marsh submitted a report to TRAP in which he detailed his materials and techniques, crediting Olle Nordmark as Technician.⁶ Despite the existence of this report, previous investigators have speculated about Marsh's actual medium, labeling it "distemper." While cross-sectional staining analysis by consulting conservator, Richard Wolbers, confirmed the presence of a proteinaceous binder, evidence of a glue medium has not been confirmed. Since Marsh himself never mentions glue in his official report or in the extensive archival material remaining from this period it is reasonable to trust Marsh's description of his painting media which he states was "lime water with skim milk often added."

Marsh calls his technique "*fresco al secco*" and goes on to describe his methods and materials in detail, providing notes on the quantities of the materials he used and his suppliers. Since he notes that the plastering was carried out "under the instruction of Mr. Nordmark," it has been useful to compare this report to the chapter on *secco* painting in Nordmark's 1947 book, "Fresco Painting: Modern Methods and Techniques for Painting in Fresco and Secco".⁷ Marsh's walls, applied over the existing wire lathe, consists of multiple layers of plaster made of sand and slaked lime, with cement and coconut fiber added in the initial layer, the "scratch coat." Each layer consists of ever finer sand, while becoming fatter in lime content as they progress forward from the "scratch coat" to "brown coat" to "finish coat". This last layer was kept wet prior to painting thus allowing the artist to lay in his colors on a wet surface. Marsh's complete palette consisted of the following pigments: transparent gold ochre, yellow ochre, burnt ochre, raw Italian sienna, burnt sienna, cadmium red light, raw umber, terre verte, viridian, oxide of chromium, cobalt blue, ultramarine, ivory black, Venetian red, burnt umber, and Mars red oxide.

In preparation for painting, Marsh's assistants would apply a lime wash consisting of further water applications, two coats of lime water, and overall brush applications of a mixture of ivory black, yellow ochre and venetian red for the ship panels and a mixture of raw umber and lime white for the explorers. Nordmark's book explains that pigmented lime washes such as these prevent the final colors from drying cold and hard and give an overall unity to the paintings. Marsh's report goes on to describe the grisaille paintings, detailing their highlight and shadow mixtures, "...passage & 1st shadow - black, indian red, white, viridian; ...highlight - raw umber, white, yellow ochre..."

Rather than use the traditional pounce method of transferring working drawings to the wall, Marsh projected slides of his pencil drawings onto the wall. His assistants would trace the projected outlines with burnt sienna before Marsh started painting over this underdrawing. Nordmark cautions in his book that it is difficult to hide pentimenti in the burnt sienna underdrawing because it may bleed through later on even if it has been overpainted with lime white. Numerous examples of underdrawing bleeding through can be found in Marsh's murals, including an extra skyline in the Statue of Liberty panel which seems to have been traced from a slide inadvertently placed in the projector backwards.

As previously noted, Marsh stated he used lime water and skim milk as his painting media. It is worth considering that for the Rotunda murals Marsh used *fresco secco*, consciously rejecting *buon fresco* despite his previous success with it. Again Nordmark, with whom Marsh is likely to have discussed this question, can lend some insight into Marsh's choice. Nordmark recommends *secco* painting for the artist

who wishes a more "leisurely" time frame than that afforded by *buon fresco*. This might have appealed to Marsh considering the complexity of painting on the elliptical walls of the Rotunda which curve both vertically and horizontally. In addition, the 8 large panels alone measure approximately 2500 square feet of painting and this on scaffolding rising 50 feet above the floor. Nordmark devotes an entire chapter to *secco* painting and claims it will "last as long as the wall stands and as long as water doesn't penetrate." With this in mind, it is noteworthy that the plaster layers laid down by Marsh exhibit only minor stress cracking, except where water has infiltrated in the past and caused localized damage. While broad bulges are visible in a number of the murals, no associated cracking was detected, further attesting to the flexible nature of Marsh's plaster support.

TREATMENT OF THE MARSH MURALS

Despite the relative stability of the plaster, many areas of the paintings exhibit friable paint. Even though Marsh may have added skim milk as a binder, over time that binder has weakened and in places can no longer hold the pigment particles even with the gentlest of rubbing -- a real concern if the paintings were to be cleaned. Pilot cleaning tests revealed how easily the paint is abraded by conventional cleaning methods such as rolling a cotton swab, or brushing with soft bristles, or cleaning through tissue paper. This situation is not unlike that encountered with pastel drawings or underbound modern paintings. With this in mind, the question of whether to clean the murals was considered. From the floor of the Rotunda the overall appearance of the Marsh paintings remained quite readable before treatment though they were disfigured by the horrendous state of the surrounding wall paint. The patina of dust that had settled on their surfaces was not discernible when viewed from the floor.

Though we may surmise from comparison with early black and white photographs of the murals that some loss of contrast has occurred over time, it is not evident whether this is due to either a deepening of tones as the frescoes age or the dust layer or both. To consider selective cleaning, only in areas still well bound, would certainly alter the visual balance of the murals and therefore this option was not explored further. It was similarly considered inappropriate to attempt to fix the underbound pigments with an overall varnish spray since this would saturate and darken the paint if a resin were used, or lighten it in the case of a lime water spray, thus irreversibly altering the appearance of the murals.

Complicating the cleaning question further was the presence of localized areas of interlayer cleavage primarily in areas of red and yellow ochre, though a few areas of green and blue were also found to be flaking. Cross-sectional analysis of these areas found them to be medium-rich. Perhaps cupping and lifting was occurring in these more brittle areas due to flexing in the support plaster. After testing various consolidants, cellulose ethers proved the most visually acceptable. Scattered areas of cleavage were consolidated locally with dilute sprays of Ethulose, dissolved from 1% to 1-1/2% in deionized water and ethanol, 1:1. This mixture was found to give the most satisfactory results, i.e. penetrating to a sufficient level while not leaving the paint darkened, saturated, or glossy.

It is important to note that by rejecting oil on canvas in favor of fresco, Marsh succeeded in achieving on a monumental scale the immediacy and transparency of watercolor for which he strove. The conservation team's decision not to clean or varnish the Marsh murals is firmly founded on this understanding.

CHARLES ALSTON'S HARLEM HOSPITAL MURALS

In 1936 the Federal Art Project commissioned a group of seven artists, six of whom were African American, to paint murals in various locations in Harlem Hospital, located at West 135th Street and Lenox Avenue, in northern Manhattan. Unique among the city's hospitals at that time, the staff and administration of Harlem Hospital reflected the racial mix of the surrounding community. Charles Alston, one of the African American artists selected, actively lobbied for black artists, previously excluded from major mural commissions, to participate in this particular project. As a result of these efforts, this became the first commission awarded to African American artists by the mural section of the Federal Art Project. However,

Alston was initially informed that his proposals were rejected because "Harlem Hospital as a city institution should not be singled out because of its location in the city for the special treatment indicated in the mural designs, i.e., that the subject matter deals with various phases of Negro endeavors and community life." After initiatives were taken by the FAP, the Artists Union and the Harlem Artists Guild the City's Hospital administration reversed its stance and the mural paintings by Alston and his fellow artists were completed.⁸

Charles Alston was born in Charlotte, North Carolina, in 1907. By the time of the Harlem Hospital commission, he had become a well-respected and influential artist and teacher. He chose as his theme the history of healing, both scientific and traditional, depicting superstition and magic on the east wall, and, in contrast, on the west wall, modern Western medicine. Alston described the subject of his paintings as follows, "In the science panel I have attempted to show the different races working together on the same basis with an absolute lack of discrimination, illustrating the sheer objectivity of science. I have always been interested in primitive African culture and this gives me an opportunity to concentrate on it."⁹ Alston's two arched oil on canvas paintings, mounted directly onto the plaster walls with lead white, measure each 144 inches by 109 inches.

Though Alston later claimed that he looked to muralists such as Michelangelo and Piero della Francesca in preparing for his first mural commission,¹⁰ the influence of Diego Rivera is also plainly evident. Alston's swirling figures, compressed into a two-dimensional space, radiate energy. In "Magic in Medicine", Alston depicts magical aspects of African culture: the central image of the idol is surrounded by a multitude of figures including a cult preacher, a witch doctor, conjurers and a voodoo drummer, swirling in the compressed space as if joined in dance. Evidence of continuity of this tradition of healing is still to be found in the African American culture, represented by Alston with a Southern shack and Harlem tenements.

In "Modern Medicine", Alston places the statue of Aesculapus, the Greek forefather of Western medicine at the top. Great prominence is given to the stage microscope; portrait busts of men of medicine are alongside, while animals represent the animal serum research which was on-going at the hospital. Dr. Louis Wright, the first black physician hired at Harlem Hospital, who eventually became head of surgery, instructs an integrated group of doctors. Across from Dr. Wright, Professor Alain Locke reaches for a book from his library. Locke, who was known for his writings on African culture and history, was a friend and mentor of Alston's. At the center, Alston's wife, Dr. Myra Logan, at that time interning in pediatrics at the hospital, served as model for the nurse holding the baby. At the top right, a drum paralleling the one depicted in the opposite mural lies broken and the idol has been toppled.¹¹ Taken together, these two paintings seem weighted toward celebrating the scientific and social progress to be found through modern medicine. Nonetheless, there is also a strong element of respect and perhaps nostalgia in Alston's dignified depiction of the healers of the African tradition. The complexity, and ambivalence, of this duality continues to offer resonance to contemporary viewers.

TREATMENT OF THE ALSTON MURALS

Treatment of the mural pair was privately funded by Alston's two elderly sisters, Ms. Aida Winters and Ms. Rousmaniere Wilson, through the Adopt-A-Mural program, administered jointly by the Municipal Art Society, the Art Commission of the City of New York, and the owner of the artwork, the New York City Health and Hospitals Corporation. It was learned that the murals had previously been conserved having suffered abrasion and loss of detail during their history of neglect and harsh scrubbing. During the 1979 treatment the murals were varnished with dammar resin, followed by a coat of Acryloid B-67. For inpainting water soluble photographic retouch pencils and pigments in Acryloid B-72 were used. A final coating of Acryloid B-67 was applied.¹²

In the years since the 1979 treatment, the paintings were subjected to further damage: adjacent walls were demolished, thereby compromising the integrity of the mural support walls; exposure to environmental fluctuations continued; and Plexiglas was mounted directly on the paintings' surfaces. The Adopt-A-Mural treatment project involved removal of the scratched and obscuring Plexiglas coverings;



Figure 3. Charles Alston, Modern Medicine

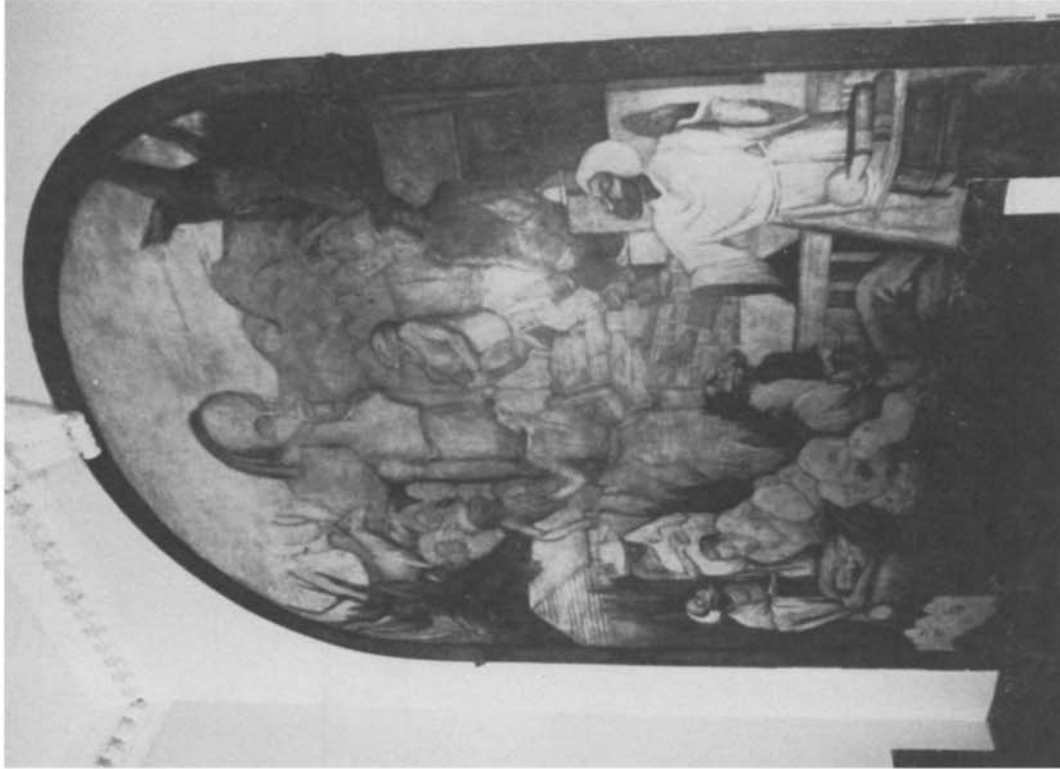


Figure 4. Charles Alston, Magic in Medicine

superficially cleaning the soot-covered murals; stabilizing voids behind the canvases which had resulted in cupping in the paint layer; and filling and inpainting losses caused by the Plexiglas mounting.

Surface grime was removed with a 2% ammonium citrate solution, followed by a water rinse. Voids behind the canvases were locally consolidated by injecting dilute Jade 403 (polyvinyl acetate emulsion) adhesive using insulin syringes. The plaster losses were filled with DAP vinyl spackling compound. Lefranc and Bourgeois Couleurs pour Restauration and Acryloid B-72 (10% in toluene) added as medium, were used to inpaint the damages.

Upon completion of these preliminary conservation efforts the paintings were secure, but still without their power to communicate the complicated narrative that Alston had intended to portray. After consultation with the Mural Conservation Advisory Committee for the Adopt-A-Mural program as well as with Gladys Pena, art administrator for the Health and Hospitals administration, the decision was made to reconstruct those details which could no longer be read as intended.

Utilizing prints of black and white photographs of the paintings taken in the artist's studio prior to their installation as well as photographs taken soon after the 1940 installation, several abraded or missing forms were reconstructed. Unfortunately, no information was discovered about the original palette, but it is likely that this oil painting had originally been more colorful than the almost monochrome muted browns and greens that have survived until now. Only hints of blues and reds were found in localized areas. There was speculation that water soluble media may have been incorporated by Alston thereby explaining the extensive damage that occurred prior to the 1979 conservation treatment; however, Alston stated in documents written at the time of the mural commission, "I chose the medium, oil on canvas, because there is a possibility that if I worked directly on the wall, the walls would not stand up. Also, the technical department [of the FAP] advised me against it."¹³

The conservators' reconstructions carried out in 1993 were restricted to contour lines and shading which could be clearly discerned in the archival photographs. A precedent for reconstruction can be found in the 1979 treatment by Farancz when some of the figural elements appear to have been restored. A conscious attempt was made during the 1993 campaign to balance the newly restored details with the evident wear of the extant original paint.

In "Magic in Medicine", ceremonial masks to the left of the idol -- the area of the painting most damaged as a result of adjacent demolition work -- were unreadable, but could be recreated with reference to the documentary photographs; the forms to the right of the idol, previously assumed to be a mountain range, on close examination of the photograph were found to be straw headdresses; and the windowless tenements behind the preacher's outstretched arm were given architectural details once again.

Some of the reconstructed elements in "Modern Medicine" include: what mistakenly read as a mound or mountain was refined to resemble the broken drum it once was; in addition, the face of the seated doctor, which had an incongruous childlike appearance, was restored to the mature visage that Alston had intended. Since the extensive inpainting and reconstruction were carried out using Acryloid B-72 as added medium, it was possible to apply a brushcoat of Liquitex Soluvar Gloss varnish, 25% in petroleum benzine, without disturbing the retouches.

Throughout the work to conserve the Alston murals staff members and patients at the Hospital commented about the meaning and importance of the murals to them as individuals, the history of the Harlem Hospital, and the community surrounding the building. Charles Alston painted these murals to celebrate his community's rich past as well as his aspiration and ambition for a better future. By conserving and selectively restoring Alston's murals, they continue to communicate within their intended social and architectural environment.

CONCLUSION

This report contrasts the treatments of two mural works, originally painted within two years of each other. In one case, minimal conservation intervention appeared to be the appropriate decision, while in the other, extensive reconstruction of damaged details was the direction taken. In both instances consideration of the artists' intentions informed these different treatment choices.

The author acknowledges the many colleagues who collaborated on these projects: at the Custom House, conservators Rustin Levenson, Perry Huston, Debra Selden, Carol Weingarten, Daisy Craddock, Travers Newton, Maura Duffy, Constance Silver, Patricia Neira, Dawne Steele Pullman, Michele Kay, Melissa Katz and Elena Raposo; interns Janet Hawkins, Ann Baldwin and Stephan Dedacek; conservation consultants Albert Albano, Frank Matero, and Richard Wolbers; and decorative painter, Jeff Greene, who brought Olle Nordmark's manuscript on fresco technique to my attention; at Harlem Hospital, Janet Hawkins, located the Alston archival materials, researched the murals' iconography and, along with Sherri Tan, assisted in their treatment and reconstruction.

NOTES

- ¹ Silver, Constance, et al., "U.S. Custom House, New York City: Overview of Analyses and Interpretations of Altered Architectural Finishes", *JAIC*, 32 (2), pp. 141-142.
- ² Thomas Garver, Reginald Marsh, Newport Harbor Art Museum, 1972.
- ³ Lloyd Goodrich, Reginald Marsh, (New York: Abrams, 1973), pp. 139 - 150.
- ⁴ Marlene Park and Gerald E. Markowitz, New Deal for Art: The Government Art Projects of the 1930s with Examples from New York City & State, The Gallery Association of New York State, 1977, p. 3.
- ⁵ Archives of American Art, Reginald Marsh Papers, Correspondance - New Deal Art Projects, 1935 - 1936, nos. 1722 - 1748.
- ⁶ Archives of American Art, Reginald Marsh Papers, Correspondence - New Deal Art Projects, 1937 - 1938, nos. 1864 - 1874.
- ⁷ Olle Nordmark, Fresco Painting: Modern Methods and Techniques for Painting in Fresco and Secco (New York: American Artists Group, Inc., 1947), pp. 3ff.
- ⁸ Greta Berman, "The Walls of Harlem," Arts Magazine, October 1977, pp. 122-126.
- ⁹ Ibid, p. 124.
- ¹⁰ Harlan Philips, "Interview with Charles Alston, " Archives of American Art, 1965.
- ¹¹ Berman, p. 124.
- ¹² Treatment Report, August 30, 1979, New York City Art Commission.
- ¹³ Berman, p. 126, note 16.

EXTREME PROBLEMS, EXTREME MEASURES:
THE AFTERMATH OF HURRICANE ANDREW

Rustin Levenson

Early in the morning on August 24, 1992, Hurricane Andrew roared through Miami, Florida. The storm, one of the strongest hurricanes to strike Florida had sustained wind speeds of more than 140 miles per hour with gusts and tornados that were clocked at 200 miles per hour. It is difficult to describe the community wide effects of Hurricane Andrew without seeming overdramatic.

As bad as hurricane Andrew was for the people of Miami and for the arts community, it could have been worse. The eye of the storm was originally pointed at downtown Miami. A storm of Andrew's magnitude hitting this area to the north would have decimated the Bass Museum on Miami Beach, the Fortress (a major art storage warehouse), the Center for the Fine Arts, the South Florida Historical Museum, the Main Public Library with its stunning Ed Ruscha Murals, the Cuban Museum and the Art Museum at Florida International University. Such are the vagaries of hurricanes that the storm veered to the south at the last minute, hitting instead several historic sites, regional libraries, and many important private collections. The Lowe Art Museum was fortunately just to the north of the fury of the hurricane.

It was at the Lowe Art Museum the I set up an Emergency Conservation Center two days after the hurricane. Because it is part of the University of Miami, the Lowe was able to run its lights and air conditioning almost immediately on the massive generator system of the university. We were given an empty back gallery to use for triage and emergency treatment of works of art. Only two trained senior conservators, myself and John Maseman, an objects conservator from Pompano, were involved. Although it would have been wonderful to have other conservators helping us, it was impossible for out of town conservators to get to or stay in Miami given the massive emergency there. Eighteen local volunteers; artists, curators, art movers, and their families worked fourteen hours a day with John and I blotting and drying works of art, removing debris, and treating the works for mold. Once stabilized, the works were put in acid free boxes and sent to the Fortress for air conditioned storage.

Our first job was ascertaining the needs of the arts community. We called all the museums and historic sites in my (wet) rolodex and asked about the status of the collections and electricity. After we advised and organized stabilization treatments for the works in public collections, we opened our doors to private collectors who lived in the eye of the storm.

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It was necessary to become instant specialists in stabilization of all types of materials. It is here that I am particularly grateful for my many years in the conservation community with the American Institute for Conservation. I was able to reach many of the colleagues and friends from various meetings over the years by phone and get recommendations for stabilizing and caring for all types of materials. After stabilization, the works could then be shipped to the proper specialists. John Maseman's studio, north of the city, became the fax and supply depot, receiving the typed recommendations of conservators and the supplies ordered by the staff in my New York City studio.

The problems were legion. The most complicated was inventory. We were lucky to have Andrea Kirsh, an art historian and friend from Chicago visiting her father in Miami. She kept an ever-growing list of what of whose went where without losing a single work of art. The final tally of works rescued reached over 5,000 pieces.

I also started a telephone hot line, supported by the National Endowment for the Arts, so that people struggling in their hot, dripping homes could do emergency drying of their treasures and try to prevent rampant mold. I staffed the hot line with students trapped at the university after the hurricane. John and I designed forms to keep track of the calls so that we could get back to those with more complicated questions. Using the instructions faxed by various specialists in the conservation of photography, objects, tapestries, paper, books and paintings, the students could give owners general advice on drying their pieces and on preventing mold and further damage. John and I were also available on site to answer more complicated questions.

In addition to the hot line, we gave several community lectures and clinics at the Lowe Art Museum, the South Florida Historical Museum, and at the meeting of the American Association of State and Local History. Mary Todd Glaser, from the Northeast Document Conservation Center, was able to come to Miami for the seminars and to look at works of art on paper in urgent need of care. Publicity and public notices in the Miami Herald alerted collectors to the hot line, the emergency center, and the lectures and clinics.

A few words are in order about what Miami was like after the hurricane. Quite understandably, little priority was given to the treatment and rescue of works of art. The Miami Herald was a compendium of services vital to hurricane victims after the storm. Pages were given over to finding lost people and pets, insurance and relief services, Red Cross and National Guard schedules, and locations of supplies. The community was in shock. There was no electricity in much of the hurricane area for over two months. Telephone service was erratic. Over 100,000 houses were destroyed or badly damaged. It rained incessantly both inside and outside houses for weeks. There was no electricity, hot water, or refrigeration. Roads were impassable because of fallen trees. Roofing nails and broken glass were the cause of frequent flat tires. Rather than traffic lights--gone with the wind--fluorescent

vests were hung at each intersection by the police. Whoever put the jacket on directed traffic until they got too hot or wet or tired. Zoo animals, including 34 baboons, roamed our neighborhoods. The National Guard instituted a curfew and patrolled the streets with rifles ready. There was little to eat. Many nights found us in line at the Red Cross with our plates out.

Nothing in emergency preparedness training can ready a conservator for such a community wide disaster. In the case of an isolated fire or storage flood, an intact community can come to the aid of a collector or museum. This was clearly not the case in post-Andrew Miami.

Another complication for the conservator can be a personal one. In my case our home was in the north wall of the eye of the storm. Our family was left with large holes in the roof of the guest house and main house, countless broken windows, randomly falling plaster, and no electricity. All our possessions were lost. A fierce black traumatized stray dog took up residence under one of our cars. We camped in the driest parts of the house wearing helmets and using flashlights. There was no school for almost three weeks. I am grateful to my husband, Randal, who took charge of the chaos at home freeing my children and I to go off to the Lowe Museum to remove works from frames, dry art objects, throw out wet mats, treat mold and field telephone calls.

I have thought a lot about what advice I would give my colleagues who may have to cope with art rescue in such community disaster situations and have the following recommendations.

1. ACT QUICKLY. By the end of the second week after the storm, many works of art that could have been saved were irretrievably damaged.

2. NETWORK. Establish a strong network in the arts community. Lecture and demonstrate so that people in the community understand and appreciate conservation work. Try to locate and work together with all types of arts professionals. Network nationally with fellow professionals. Pay your AIC dues and attend meetings, serve on committees, and introduce yourself.

3. INVENTORIES AND LISTS. We made many inventories for collectors as we pulled their objects out of swimming pools and trees. Encourage private clients, trustees, historic sites, and museums to make inventories of their works of art. Keep lists of local colleagues and arts organizations. Write down the addresses and telephone numbers of collecting institutions. Keep your AIC directory handy. If possible arrange to keep a copy of these lists outside your immediate area. Hard copies of these lists are important to have because computerized documents are impossible to retrieve without electricity.

4. MATERIALS. Keep a list of suppliers to be contacted after a disaster. John had previously ascertained where freezer trucks

could be found which was very helpful. Understand and be flexible about the materials you can use. During the emergency phase of our work, we dried pieces, removed mold mechanically, vacuumed, and treated works with ethanol or orthophenyl phenol. Once our pure and desirable supply of orthophenyl phenol from Conservation Materials was exhausted, we had to use Lysol Spray, the orthophenyl phenol that was available at our local grocery store.

POST HURRICANE TREATMENTS

After the emergency effort come long term treatments of paintings damaged by the storm. Massive problems presented themselves at the studio. People brought in ten or twelve pieces at a time, needing estimates for insurance purposes. These works were like graduate school pop quizzes. Design a treatment for punctures, tears, salt, flaking, blanching, delamination, blind cleavage, distortions, shrinkage, compound stretcher fractures, mold, grime, accretions (living and dead)....all on one painting. Often paint layers were thoroughly hydrolysed (with salt added) and many works had come into contact with substances not usually encountered in painting conservation, gobs of tar, dead fish, snails, bits of photographs, scraps of soggy insulation, building materials, leaves, etc. These grievously damaged works presented massive problems that scoffed at our usual gentle techniques. They also offered unexpected surprises at many stages of treatment. The following is a brief outline of materials used during the treatment phase after the hurricane.

MOLD

In the recovery period I saw amazing mold specimens. Mold treatments after the storm included mechanical removal, vacuuming with a micro vacuum, and finally treatments with ethanol, thymol, orthophenyl phenol, ethylene oxide, regular, ultraviolet and heat lamps. The materials used depended on whether the mold was on the front or back of the work and how the mold, support and paint layer responded to the treatments.

The mold growing between the paint and canvas on The Truants, by J. Alden Weir initially defied all chemical mixtures. Sometimes the black slimy mold, visible in areas of loss and oozing between cracks would disappear, only to return a day or two later. The mold was ultimately eradicated with a combination of light and air treatments combined with 2% thymol in ethanol. I had largely stopped using thymol in my private practice because of the possibility of damage to oil films. However, in this case, the virulent mold posed the more obvious and immediate danger.

Mold stains persisted even after mold eradication on an untitled work by Joan Brown. We were able to lift the most severe stains with 2% sodium perborate in water rinsed with distilled water.

BLANCHING

Blanching was a serious problem that affected both the paint and varnish layers of many pieces. In my 25 years of practice, I had treated blanching before, but I had never encountered the persistent severe blanching caused by Hurricane Andrew.

Materials to treat blanching were varied, again depending on the location and persistence of the blanching and the sensitivity of the painting. Simple washes of solvents were initially tried beginning with petroleum distillates and working through alcohols to the stronger solvents and gels. Various reforming techniques were also used combining solvents and varnishes. Solvents combined with heat were also effective. I had heard of a revered conservator who has used ethanol, set the surface of the painting on fire and ended with a perfect, unblanched surface. I wasn't quite up to that, but I did find in many instances that heat with solvent did work. Using the hot air blower through mylar on a surface wetted with solvent created tiny rain clouds as the water in the paint system vaporized.

ADHESIVES AND CONSOLIDANTS

During the emergency phase we used the usual range of adhesives for consolidating lifting including from gelatin size to resin mixtures. I steered away from facing paintings, not wanting to hold anything against the surface that might inhibit deep drying, and knowing that I would probably not be the person taking the facing off the painting. Instead I consolidated the pieces as much as possible and made boxes to hold the painting flat and protected. The same range of adhesives were used for long term treatments. Complicating the consolidation was almost always a stretched or shrunken (or both) support. In these cases we worked from the back to gently shrink or stretch the affected canvas, then consolidated and flattened the area. I was amazed at the amount of manipulation that was often needed and that the painting could absorb. Our macro and micro hot air blowers were our best tools in dealing with the extensive distortion and flaking we found. We also discovered, not really to our surprise, that some of the soaked canvasses had lost all their size and needed resizing to remain in plane. After flattening, these works were treated with starch solutions or with Lascaux P-550 in benzine or aerosol starches if we were concerned about the addition of water to the piece.

Sitting a sea grape tree in the rain or floating in a pool causes different kind of flaking problems than I was used to treating. In the case of a small landscape by A. Bierstadt (sea grape tree), very little of the paint layer was actually attached to the artist's board support by the time we received the painting. In this case, it was repeated gentle application of sturgeon size that finally effected the consolidation.

One consolidation we did took place with no adhesive. Four Green Pears by Donald Sultan was partially carried out with tar

solutions. Treatment of the losses on the work was done in consultation with the artist. He agreed with our technique of using our micro hot air blower and gently flattening the surface with gentle manipulation. Both he and we were pleased with the results.

A final problem I would like to discuss is insurance companies. Educating them has been a Herculean task, and just when one adjuster would understand what the painting of his client needed, he was sent back to Rhode Island and a new adjuster who normally dealt with cars came to take over the claim. Ultimately we learned to work with these varied agents, but I would be interested in connecting with their professional organization and introducing our field to them before the next emergency.

I would like to thank John Maseman, Harriet Irgang, Dawn Steele Pullman, Carol Weingarten, Travers Newton, Daisy Craddock, Marcia Steele, Toddy Glaser and her staff, Daria Keynan, Sue Nash Munro, Randal, Seth, Tamara, Moss, Cormac, and Geddes Levenson and friends and families of the arts community of Miami for their support over the last two years.

REPAIRING TEARS IN CANVAS PAINTINGS BY A RE-WEAVING PROCESS

Robert Proctor Conservator of Paintings

Historically, tears in canvas paintings were repaired by lining the painting or by applying some sort of patch to the reverse of the canvas. Both of these methods have limitations. Some argue that linings are too invasive and patches can result in either the patch or the tear "coming forward" over time. An alternative technique of repairing tears by re-weaving them can overcome these problems. The theory behind this type of repair is to return the painting to a state as close to the pre-torn confirmation as possible. The ease in which this technique can be modified to address the problem at hand makes this method a useful option to the paintings conservator.

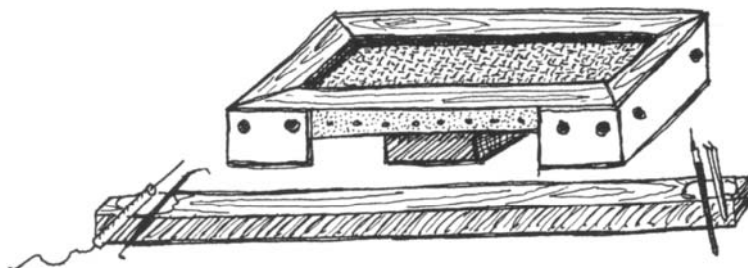
TOOLS:

Some of the tools required for this work include dental picks, small sharp scissors and at least one pair of very fine tweezers. A small brush is needed to apply tiny drops of the adhesive to the ends of the broken and the replacement threads. A soldering needle (or tacking iron adapted to hold a needle) [1] is needed to solder these thread ends together. The work must be done under magnification, so a binocular microscope is required.

SET UP:

The work can be done either horizontally on a table, or vertically on an easel. During the repair, the tear must be accessible from both the front and back of the canvas. The positioning of the painting depends mainly on the size of the painting and the location of the tear. If the painting is small and can be safely turned over repeatedly, it is often easiest to work horizontally on a table where your arms can rest on something and the tear can be supported below. Larger paintings, with the tear in an area that is difficult to reach, must be treated upright on an easel. Having a microscope set up on each side of the easel is ideal.

If the painting is to be worked on horizontally, it is helpful to maintain the same level front and back. This can be accomplished by tacking a collar of Fome-Cor® or mat board around the tacking margins so that when the painting is situated face down, the reverse of the canvas is the same level as the front of the canvas when face up. The focus of the microscope will require only minor adjustments when the painting is turned over. This also allows for the placement of the same silicone coated Mylar® covered block to be used as a support under the tear when working on the painting from either side. Leave a gap in the collar to work through. It is also helpful to have a block of wood (e.g. a piece of 2 X 4) on the table in front of the painting to rest your arms on while you work. A piece of Plasticine® or Silly Putty® on the end of the board will hold your tools in place. The board and the tools can then be moved safely aside when the painting is turned over.



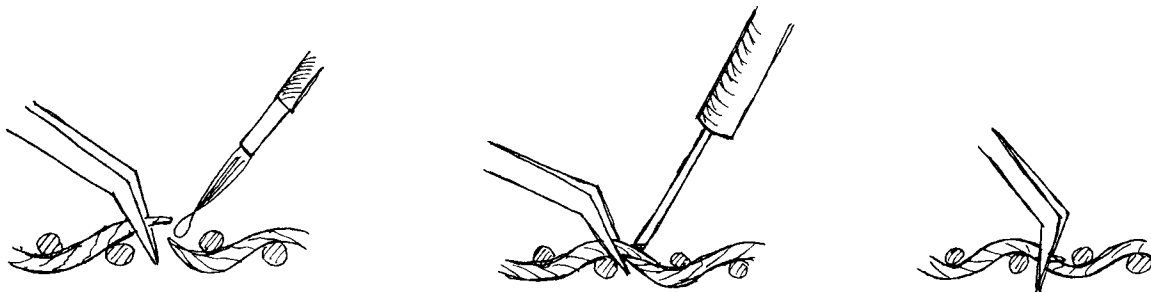
MATERIALS/PREPARATION:

In preparation for the re-weaving, any loose paint must first be consolidated. Usually, a temporary facing should be locally applied to protect the paint. The facing tissue should be applied up to the edges of the tear, leaving the tear uncovered. Like any conservation method, the treatment should be thought through to the end before proceeding. This is particularly important when choosing the adhesives for facing, consolidation of paint, and reattachment of broken threads. The adhesives used for the facing and consolidation should be compatible with those used for repairing the threads. For example, wax is not a good choice for the facing or consolidation because it can be absorbed by the loose threads and weaken or inhibit the thread bond. The adhesive residue from the facing and the consolidation must be able to be safely removed after the tear is repaired without affecting the adhesive used for bonding the threads. The adhesive used for reattaching the thread ends should be strong and flexible but not too elastic. It should have excellent heat seal properties and should not have too much bulk. A successful system is as follows. Sturgeon glue [2] is used to consolidate the loose paint. The facing is then applied with a resin mixture of 5 parts Regalrez 1094® to 1 part Kraton G 1650® [3] dissolved in enough of a low or non-aromatic hydrocarbon solvent to form a semi-viscous solution which is thin enough to brush through the facing tissue. Odorless thinner or Shell Sol 340 HT [4] are good solvent choices for the facing adhesive. Then, a water-based emulsion adhesive is used for repairing the broken threads. Jade 403® [5] is a strong yet flexible adhesive that performs well with the soldering needle and has very good aging properties. The sturgeon glue/Regalrez/Jade system incorporates fully reversible materials. It allows for the safe removal of the consolidant without affecting the tear. This is only one possibility. Other materials can be chosen which best suit the needs of a given situation. For example BEVA 371® [6] or Lascaux P 550-40TB [7] can be used for the paint consolidation instead of sturgeon glue. The Regalrez/Kraton facing can be removed with a non-aromatic hydrocarbon solvent that will not affect the BEVA or P550 or, paste can be used for the facing. Sturgeon glue and B-72 [8] have also been used successfully for reattaching the threads.

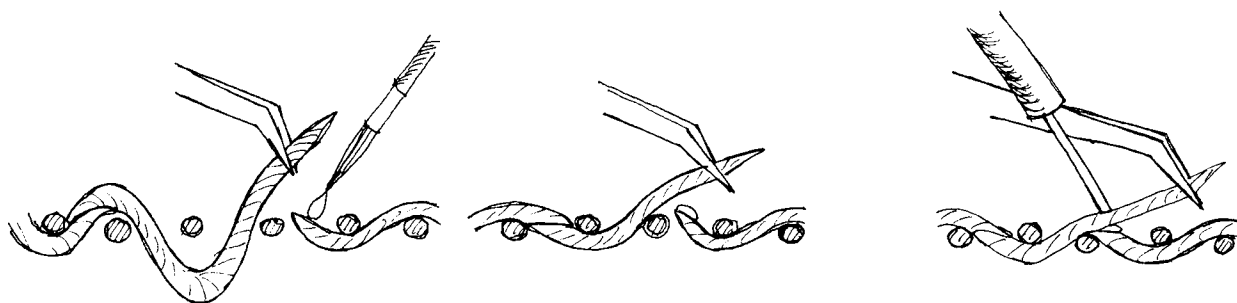
Before beginning the repair, reduce any planar distortions with moist blotters and light weights, and then temporarily re-align the tear. Next, replacement threads should be selected and prepared. These threads should be similar to those of the canvas. They can be pulled from a fabric of a similar weight, taken from the tacking margin, or from a spool. To prepare the threads, first size them by impregnating them with a fairly thin solution of the adhesive chosen for the repair such as 1 part Jade 403 to 3 parts water. Then trim them to a point with sharp scissors. The threads should be rigid enough so that they can be easily manipulated and inserted between the loose existing threads in the canvas without unraveling, yet flexible enough so that they can bend around the existing threads without creating too much stress.

GENERAL DESCRIPTION OF REPAIR:

Usually the process is begun with the painting face down starting at one end of the tear and working toward the other. Using the tweezers and dental pick, the first few existing threads are returned (re-woven) to their original position, over and under one another. All of this work is more easily performed under a microscope. If the threads are weak or brittle, they can be sized as the replacement threads are, to make them stronger and more flexible. This can be done by applying Jade or B-72 with a small brush. Sometimes the introduction of a little water helps if the threads are too stiff. The adhesive used for sizing the threads should be fairly thin and applied conservatively so as not to fill the spaces between the threads or inadvertently adhere neighboring loose threads together. This will result in the recreation of the weave rather than the construction of a fill which could act like a patch. Using the small brush, a tiny drop of adhesive is placed on the end of the first broken thread to be reattached. The adhesive used to connect the threads should be fairly thick so that it forms a small drop and does not run or bleed into the canvas. Sometimes a few small fibers from a replacement thread can be added to the drop of adhesive to bridge the newly attached broken ends and strengthen the bond. If the broken thread is long enough to meet the other broken end, use the tweezers in one hand to hold these two ends together. At the same time, take the hot needle with the other hand and solder them together. The needle should be fairly hot (approximately 80-90 degrees C) both to drive off the water and to heat seal the threads together quickly while the thread ends are held in place. The tweezers can then be used to pinch the threads together where they are joined while the adhesive cools.



If part of the broken thread is missing and it is not long enough to reach its mate, a replacement thread should be attached in the same manner. Sometimes it is helpful to attach replacement threads onto the ends of some of the existing threads temporarily to make a longer thread so they can be more easily manipulated but too many long threads make spaghetti! When a new thread is attached it should be allowed to overlap the end of the broken thread slightly for strength. The trimmed points on the ends of the replacement or temporary threads can be used as a needle to push them through the small openings between the existing threads when re-weaving. Pull the replacement thread into position over the other broken end of the original thread. After pulling the thread fairly taut, hold the thread in place with one hand and use the small brush to apply a small drop of adhesive to the point where the threads are to be joined. Use the soldering needle to secure the overlapping join.



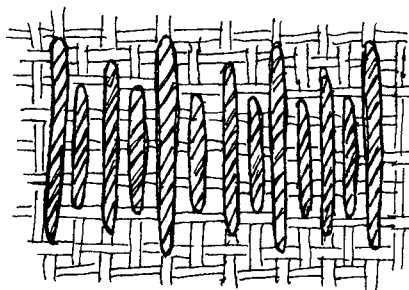
When the bond is secure, the excess replacement thread should be cut off with scissors. A small scalpel can be used to pare the join and to trim away any excess adhesive. After a few threads are re-woven and reattached in this manner, the painting should be inspected from the front. The process can be continued working alternately from front to back.



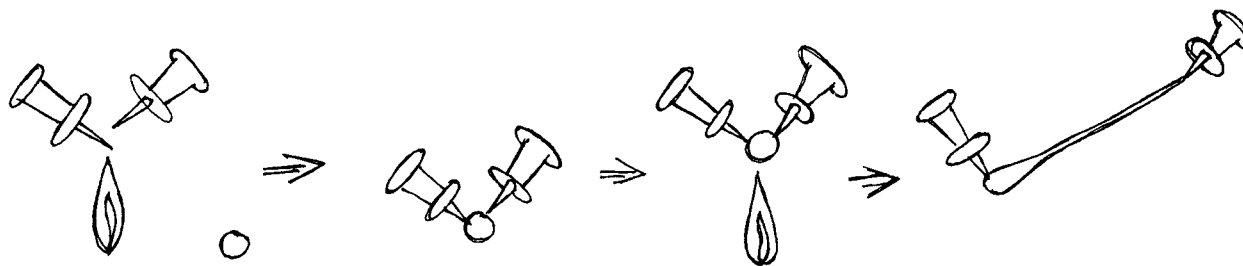
TIPS AND VARIATIONS:

Periodically during the re-weaving, after allowing the adhesive to fully set, test the bond by gently picking at the newly joined threads or by pulling on them with tweezers. If they come loose, try reattaching them and testing again. If a good bond has not been achieved, try varying the temperature of the soldering needle. If this does not work, try using more or less water, adding a little ethanol, diluting the adhesive with solvents such as xylene, or trying different adhesives altogether. Another way to increase the bond is by sizing the loose threads first.

If the bond holds somewhat, but is judged not to be quite secure enough, it can be supported in a number of fashions. Threads can be adhered on the reverse side of the canvas over the tear in intervals as bridges. Varying the length of the threads distributes the stress, so that these bridges do not form straight edges.



Hopefully, this should reduce the likelihood of the bridges coming forward. Brush a little bit of adhesive on a thread, then position them with tweezers. Next, solder them in place using the hot needle. Try picking at them to make sure they hold. The bond strength can be increased by sizing the area with a dilute adhesives such as a 5% solution of B-72 in ethanol. Bridges can also be made out of strands made from B-72. To make these strands, take two push pins and heat the points over a flame. Stick the hot points in either side of a solid bead of B-72. After the pins cool, hold the bead over the flame to soften the resin. When it is soft, remove it from the flame, and pull the two push pins away from each other drawing out a strand of resin.



These strands can then be soldered over the tear using the hot needle. The re-woven tears can also be supported by adhering a thin piece of Japanese tissue over them on the reverse of the canvas.

CONCLUSION:

Although the technique of re-weaving textiles has been used for centuries, it has only been relatively recently employed in the repair of canvas paintings. Several European conservators have been using this technique for the last two decades with great success. As with any skill, facility increases with experience. Even in instances where complete re-weaving of a tear may be impractical, aspects of this technique can be incorporated into other tear repair techniques.

ACKNOWLEDGMENTS:

I would like to thank Renate Poggendorf, paintings conservator at the Doerner Institute who introduced me to this technique in 1990 while I was an intern at the Bayerisches Nationalmuseum in Munich. I would also like to thank my colleagues Marty Radecki, David Miller and Linda Witkowski at The Indianapolis Museum of Art, and, Paul Haner, at The Saint Louis Art Museum, for their support.

END NOTES:

(1) Lascaux sells the ERSa MINOR Loetnadel which is ideal for this work. For more information on special tips made for this please see Yoder, D. 1994. "Technical Exchange" *WAAC Newsletter* Vol 16.3:(12-13). Willard has a tip for their tacking irons which is made to hold a needle. I have made my own tip by drilling a small hole in a piece of brass rod which fits in my tacking iron made by Museum Services.

(2) For instructions on the preparation of sturgeon glue as a consolidant for loose paint see: Petukhova, T., and S.D. Bonadies. 1993. "Sturgeon Glue for Painting Consolidation in Russia". *Journal of the American Institute for Conservation* 32:(23-31).

(3) Regalrez 1094® is a fully hydrogenated hydrocarbon resin manufactured by: Hercules Inc.; Wilmington, DE. Kraton G 1650® is a synthetic rubber made of a styrene-ethylene butylene-styrene block copolymers manufactured by: Shell Products; Houston, TX. For more information about these materials please see: de la Rie, E.R. 1993. "Polymer Additives for Low-Molecular-Weight-Varnishes". 1993. *ICOM Committee for Conservation* Vol 2:(566-573).

(4) Shell Sol 340 HT is a non-polar hydrocarbon solvent with less than .1% aromatic content produced by: Shell chemical Co.; Houston, TX.

(5) Jade 403® is a polyvinyl acetate based adhesive dispersed in water manufactured by: Aabbitt Adhesives Inc.; Chicago, IL. For more information about the aging properties of adhesives used in conservation please see: Down, J.L., MacDonald, M.A., Tetreault, J. and Williams, S. 1992. "Adhesive Testing at the Conservation Institute-An Evaluation of Selected Poly(vinyl acetate) and Acrylic Adhesives". *Canadian Conservation Institute Environment and Deterioration Report* No 1603.

(6) BEVA 371® is an ethylene vinyl acetate based adhesive manufactured by: Conservator's Products Co.; Chatham, NJ.

(7) Lascaux P550-40TB is a n-butyl methacrylate resin dissolved in a 30% solution of petroleum benzene manufactured by: Alois Diethelm AG; Bruettisellen, Switzerland.

(8) B-72 is an ethyl methacrylate/methyl acrylate copolymer manufactured by: Rohm and Haas; Philadelphia, PA.

GEORGIA O'KEEFFE'S CROSS WITH RED HEART: *The Alteration of the Shape of a Painting*

By Camilla J. Van Vooren, Painting Conservator

The subject of this paper is the conservation problems posed by CROSS WITH RED HEART painted by Georgia O'Keeffe during a trip in 1932 to the Gaspé peninsula in Canada. This is one of a number of depictions of crosses which the artist initiated during her first extended trip to New Mexico in 1929; an occasion which was to usher in a significant period in the artist's development.¹ The visit was made at the invitation of Mable Dodge Luhan, heiress to a large banking fortune, eccentric socialite, and writer on the arts who had a Florentine-style villa in Taos where she held salons for artists, writers, and other intellectuals.² Her invitation to O'Keeffe was welcomed by the artist; 1927-28 had been physically and emotionally demanding years. She had undergone surgery in the late summer of 1927, again in December of that year, and her recovery was slow.³ Her relationship with her husband, Alfred Stieglitz, was strained due to his infatuation with the young Dorothy Norman.⁴ Stieglitz had suffered a heart attack in the fall of 1928 and his wife faithfully and persistently saw to his convalescence.⁵ Thus, she was despondent, telling critic Henry McBride that she "...did not want to exhibit again for a long, long time...."⁶ Her doctor had even recommended that she take a break from her routine that summer.⁷

Among the first motifs which O'Keeffe adopted in the southwest were the crosses punctuating the vast, desolate landscape.⁸ Some of these crosses were erected by the Brothers of Our Father Jesus or the Penitentes, a religious society of Roman Catholics, with headquarters in Santa Fe, whose practices included cross-bearing and self-flagellation.⁹ Others were roadside crosses intended as memorials. She said, "The crosses out here are very dower and dark....Out here, to me, the Catholic Church is like a veil over the country...and you come across a cross almost in any unexpected place."¹⁰ For O'Keeffe, painting the crosses was, as she wrote, "...a way of painting the country."¹¹ "Anyone who doesn't feel the crosses, doesn't get that country."¹² Henry McBride insisted that the cross was "...a chef-d'oeuvre of mysticism..." and that "...O'Keeffe got religion...."¹³ It is more likely, however, that the use of the cross motif was simply an expression of how the artist felt about the region; its folklore and its traditions, rather than an overt religious statement.¹⁴

In August of 1932, while in Canada, she again saw roadside crosses and painted CROSS WITH RED HEART and CROSS BY THE SEA. These are thematically similar to the New Mexican crosses, but different in mood.¹⁵ O'Keeffe's comments regarding them reveal that she has been stimulated by different sentiments for the subject in the two locations. She explained, "After my summers in New Mexico where I had heard the Penitente songs and painted the dark crosses as I felt them there, the Canadian crosses seemed different. The Canadian crosses were singing in the sunlight. Sometimes there were pottery figures around them--always they had a feeling of gaiety. There was one pure stark cross in the center of a profusely blooming potato field, overlooking the water where the river was very wide. Each end of the cross was carved and there was a plaque in memory of a father who had drowned trying to save someone else who was drowning at sea...."¹⁶ O'Keeffe describes further that, "In New Mexico, the crosses interest me because they represent what the Spanish felt about Catholicism--dark, somber--and I painted them that way. On the Gaspé, the cross was Catholicism as the French saw it--gay, witty."¹⁷ O'Keeffe again sought to capture the essence of regional traditions in her painting.¹⁸

CROSS WITH RED HEART came to the studio of the Western Center for the Conservation of Fine Arts last summer with explicit instructions from the owner's representative that the painting be changed back from its current, arched-shape to the rectangular shape in which it had originally been painted, provided that the results would be satisfactory, or, in the owner's words, "perfect." I was informed, at this point, that the painting had been purchased by a private collector from a Catholic Church in New York State where it had been altered to fit into an arched niche within the church.

Once out of the dark, wood frame, it was quickly clear that the painting indeed had been first executed in a rectangular format. Both corners were folded over with staples driven through the original paint; black cloth tape covered the altered tacking margin. A secondary support consisting of a metal screen could be seen on the reverse of the painting. I later learned that the screen was added as a secondary support in lieu of a lining during a conservation treatment prior to 1966.¹⁹

A monograph on O'Keeffe published by the artist, herself, in 1976, includes a black and white photograph of CROSS WITH RED HEART in its original, rectangular shape suggesting that this reflects her intentions regarding the painting's format. To change the painting back to a rectangle with satisfactory results would be difficult, if not impossible. Moreover, pertinent to this problem are a number of questions. When did the change take place? Who dictated the change? If O'Keeffe was alive at the time, was she consulted? Did she know about it? Since the artist intended to have the painting in a rectangular shape, should the restoration be considered? If, after removing the painting from the modified stretcher, could I ethically and responsibly restretch the painting back into an arch, if the restoration to a rectangle was unsuccessful?

Answering these questions proved difficult. In fact, minimal conservation was needed. Raised cracks in the blue area near the center of the composition were disfiguring in raking light, but the stability of the paint film could be achieved with local consolidation. With correct exhibition lighting, I felt that the effect of the raised cracks could be mitigated without the intervention of a lining.

None of the labels on the Fome-Cor® backing provided information as to when the change took place. One of the labels, however, indicated that the painting had been treated in a conservation studio in New York in 1962 and that a methyl methacrylate varnish had been applied. The label did not refer to any other aspect of the treatment. Although the label gave a conservation records number, the whereabouts of the records could not be determined. There were a number of exhibition labels on the backing board as well, but conversations with curators and registrars from the exhibiting institutions did not provide any definitive information regarding the acquisition of the painting by a church or its alteration.

More important was information from the 1976 O'Keeffe monograph that identified Sacred Heart Church in Margaretville, New York, as the owner of CROSS WITH RED HEART.²⁰ Reverend Robert Purcell, the current pastor at Sacred Heart, shed light on the circumstances surrounding the acquisition of the painting.

According to Reverend Purcell (who came to Sacred Heart in 1978), the painting came to the church through the efforts of a very successful investment banker, philanthropist, and collector; Armand Erpf. Erpf had served as director of the Whitney Museum of American Art in New York city.²¹ Erpf's mother, Cornelia, converted to Catholicism in 1922.²² She was a strong supporter of Sacred Heart Parish in Arkville, New York. After her death, her son continued her legacy and became "one of the parish's principal benefactors."²³ His support was a tribute to his mother and was instrumental in the building of the new Sacred Heart Church nearby in Margaretville, New York, in 1955.²⁴ Later, in 1966, Erpf arranged for the church's acquisition of Georgia O'Keeffe's CROSS WITH RED HEART to decorate the interior of Sacred Heart Church in memory of his mother.²⁵

In spite of the abundance of information linking Erpf, the painting, and the church; the circumstances surrounding the alteration of the painting's shape before its installation in the church remain vague and uncertain. It seems unthinkable that a cultured man of Erpf's stature would have authorized an act in opposition to the artist's original intention. Moreover, a letter dated November 26, 1966 from O'Keeffe to Father Cadell (then pastor of Sacred Heart) states that she delivered the painting to a New York framer for an appropriate frame prior to its installation above the main altar of Sacred Heart.²⁶ However, since O'Keeffe wrote the letter from Abiquiu, New Mexico, her involvement in the reframing may not have been as direct as her letters suggests. Doris Bry, the artist's representative for over thirty years, introduced Armand Erpf to Georgia O'Keeffe but said that they had not discussed the change of the shape of the painting in her presence.²⁷ It seems equally doubtful that a framer would take a course of action as extreme as this without the approval of an authorized agent; but the frame company was unable to locate records regarding the CROSS WITH RED HEART. Although the motivation behind the alteration may never be identified precisely, it was not, in fact, to fit the painting in to an

arched-shaped architectural framework. This can be established from a Christmas card which shows a photograph of the interior of the church. Here one can see that the frame itself was a rectangle and only the interior liner was an arched shape.

By 1985, prices for O'Keeffe's paintings had increased to the point that the insurance coverage became prohibitive for the parish. It was required that the parish purchase an elaborate alarm system and/or provide a 24 hour guard.²⁸ To Reverend Robert Purcell, the pastor, it was clear that Sacred Heart could no longer afford to exhibit **CROSS WITH RED HEART**; the selling of the painting was considered.²⁹ Armand Erpf had died in 1971.³⁰ Others close to Erpf questioned the appropriateness of the sale.³¹ However, since the church possessed valid ownership, it was legally free to sell the painting if it wished. Furthermore, Reverend Purcell recalls a telephone conversation with O'Keeffe during which she approved of the sale.³² The proceeds of this sale went towards the building of a new parish center constructed in 1987.³³

The painting was again consigned to Doris Bry for resale.³⁴ In her opinion, the radical alteration impeded its resale.³⁵ She stated that O'Keeffe was very unhappy about the change.³⁶ Additionally, she inquired at that time into the possibility of restoring to the original, rectangular configuration.³⁷ She was advised by conservators that the crease formed by the fold along the arched shape would always be visible and that considerable inpainting would be required to mask the damage.³⁸ It was, therefore, agreed that such a treatment should not be attempted.³⁹

Similar advice was given from painting conservator, Caroline Keck (who was a close friend of O'Keeffe and worked with her for nearly forty years), when the question rose again years later at the Western Center for the Conservation of Fine Arts. In a letter, she stated that "...if any painting had been seriously abused either by intent [as seems accurate in this instance] or accident, she preferred to have it destroyed."⁴⁰ Doris Bry also commented that, "Regarding her feeling about severely damaged paintings, she wanted them destroyed, but she was not entirely consistent about carrying this out as the years went on...."⁴¹ Mrs. Keck and Ms. Bry agree that O'Keeffe approved of conservation of her paintings. O'Keeffe "...hated fingermarks, nicks, and scratches...";⁴² "...she liked her paintings to look as physically perfect as possible--no cracks, no flaking, no paint loss...no stretcher marks, no holes or dents, no yellowing...."⁴³ Bry states, in addition, that: "Insofar as the wax lining minimizes these [imperfections], she liked it. After about 1947, she liked the synthetic varnishes when sprayed on in a manner that left a thin matte surface, hardly noticeable, that barely changed the appearance of her paint film. She liked the concept that this was an almost invisible physical protection to her paint film (therefore enabling her to remove glass from her oil paintings), and the concept that all of these techniques were reversible. She also liked what some of these techniques could do to minimize changes due to uneven drying of certain colors in her early work."⁴⁴

Knowledge of O'Keeffe's favorable impression of the work of conservators, particularly her approval of lining to diminish surface irregularities, led me to reconsider my treatment of **CROSS WITH RED HEART**. Despite the fact that certain individuals, who knew O'Keeffe, confirmed the fact that the artist was angry that the painting had been changed, the evidence relating to the painting's alteration remain obscure and ill-defined.⁴⁵ In the nearly thirty years which have passed since the change took place, details of the events have been forgotten, to some degree, and many of the individuals involved (namely O'Keeffe and Erpf) are no longer alive. Existing documents leave many questions unanswered. These factors limit our ability to accurately reconstruct the past and to weigh the historical significance of the painting's alteration. They also contributed to the decision to perform only a minimal treatment to **CROSS WITH RED HEART**. The overall condition of the painting simply did not warrant additional intervention. The owner did visit our studio and we discussed the provenance of the painting. He was interested to learn about the painting's history and was very supportive of the decision not to undertake structural treatment of **CROSS WITH RED HEART**. It was agreed that the black cloth tape on the tacking edge should be removed and that the frame rabbet should be padded with felt in order to preserve the paint layer folded over the arch of the stretcher. The painting was dusted with a natural bristle brush and cracks were consolidated as necessary. Very minimal filling and inpainting were required.

The provenance of Georgia O'Keeffe's CROSS WITH RED HEART presents a situation that challenges our concept of respect for the artist's intent, the historical significance of changes made to the work of art, and the appropriateness of conservation treatment. It underlines the fact that issues of artist's intent are often unclear and that many additional factors must be considered in addition to what that intent appears to be.

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2. Jeffrey Hogrefe, O'KEEFFE THE LIFE OF AN AMERICAN LEGEND. New York: Bantam Books, 1992. p. 133.
3. Ibid. Merrill. pp. 10-11.
4. Roxana Robinson, GEORGIA O'KEEFFE: A LIFE. New York: Harper & Row, 1989. p. 318.
5. Ibid. p.309
6. Ibid. Merrill. p. 12.
7. Ibid. Hogrefe. p. 141.
8. Lisa M. Messinger, FROM THE FARAWAY NEARBY, GEORGIA O'KEEFFE AS AN ICON. Reading, Massachusetts, 1992. "*Sources for O'Keeffe's Imagery*," pp. 62-63.
9. Marta Weigle, BROTHERS OF LIGHT BROTHERS OF BLOOD, THE PENITENTES OF THE SOUTHWEST. Albuquerque: 1976. pp. xi, 159-163.
10. Perry Miller Adato (Producer and Director), GEORGIA O'KEEFFE, PORTRAIT OF AN ARTIST. USA: WNET/Thirteen Production, 1977. Transcribed from video.
11. Georgia O'Keeffe, GEORGIA O'KEEFFE. New York: Viking Press, 1976. Text opposite plate 64.
12. Ibid. Hogrefe. p. 153.
13. Ibid.
14. Mr. Jack Kunin, Appraiser of Fine Art. Denver, Colorado: helped to edit this paper and discussed the iconography of the crosses with the author.
15. Doris Bry and Lloyd Goodrich, GEORGIA O'KEEFFE. New York: Praeger Publishers for the Whitney Museum of American Art, 1970. p. 27.
16. Ibid. O'Keeffe. Text opposite plate 68.
17. Ibid. Robinson. p.376.
18. For a detailed discussion of Canadian roadside crosses, see: Paul Carpentier, LES CROIZ DE CHEMIN: AU-DELA DU SIGNE Ottawa, Canada: National Museum of Man, 1981. Canadian Centre for Folk Culture Studies Paper Number 39, A Diamond Jeness Memorial Volume.

19. Doris Bry, 1994. Personal communication. Ms. Bry related that prior to its first sales in 1966, she had taken the painting to a conservator "...to see if it should be lined or not." The screen loose lining was chosen in lieu of a lining and "...a light matte spray of synthetic varnish..." was applied.
20. Ibid. O'Keeffe. List of illustrations.
21. Ibid.
22. **THE VERY REVEREND ROBERT H. PURCELL CENTER DEDICATION BOOKLET**. Margaretville, New York: Sacred Heart Parish, May 17, 1987. p. 11.
23. Ibid.
24. Ibid. Bry.
25. Ibid.
26. Georgia O'Keeffe, letter to the pastor of Sacred Heart, Father John Caldara, confirming that the painting had been sent to a frame shop. November 26, 1966.
27. Ibid. Bry.
28. Reverend Robert Purcell, 1993. Personal communication.
29. Ibid.
30. The New York Times, January 03, 1971. Armand Erpf's obituary.
31. S. Van de Bodemcamp, 1994. Personal communication.
32. Ibid. Purcell.
33. Ibid.
34. Ibid. Bry.
35. Ibid.
36. Ibid.
37. Ibid.
38. Ibid.
39. Ibid.
40. Caroline Keck, 1993. Personal communication.
41. Ibid. Keck.
42. Ibid. Keck.
43. Ibid. Bry.

44. Ibid.

45. Ibid.

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"WALT DISNEY'S SNOW WHITE AND THE SEVEN DWARFS: AN ART IN ITS MAKING"

Linda A. Witkowski, Associate Conservator of Paintings

Abstract:

With the creation of the first full-length animated feature, "Snow White and the Seven Dwarfs" in 1937, Walt Disney took the animation medium beyond the ten-minute cartoon shorts that were comprised of a series of unrelated gags and tricks. By focusing on a complete story line and developing personalities for the characters, this film achieved far more than giving the audience a good laugh.

Composed of drawings, painted cels and backgrounds, it is estimated that over 2,500,000 works of art went into the making of "Snow White." Yet, Walt Disney's interest was in the completed film. After production, many of the painted cels were destroyed while many of the drawings were discarded or taken home by the animators as mementos of their work on this project. In 1938, only 8,000 cels were officially sold for a few dollars via Courvoisier Galleries. Only a fraction of these remain today, and their value in the auction market is astounding.

This paper outlines the many stages in the animation process with respect to their individual significance and artistic intent (e.g., the rough storyboard sketches and animation drawings vs. the clean-up drawings, painted cels and key set-ups [cel/master background] as seen in the film). Within this context the concept of archival art vs. art in its own right is considered, as well as ethical considerations for the preservation and conservation of this art form.

The source of art work for this paper is from the collection of Steve and Nancy Ison of Carmel, Indiana. Comprised of over 200 storyboard sketches, animation drawings, painted cels and master backgrounds that were used in the creation of "Snow White," the Ison collection is the largest of its kind in the world. In conjunction with this collection, the information in this paper represents one segment of the December 1994 exhibition, Walt Disney's "Snow White and the Seven Dwarfs: An Art in Its Making" held at the Indianapolis Museum of Art.

Already a well known producer of cartoon shorts, Walt Disney began the preliminary sketches on the Grimm's fairytale, "Snow White and the Seven Dwarfs," in the summer of 1934. He readapted the story and gave its characters distinct personalities, resulting in the first full-length animated feature ever made. Requiring nearly four years to complete, the production of *Snow White* necessitated the coordinated efforts of at least eight artists: storyman, layout artist, background artist, animator, assistant animator, inker, painter, and cameraman.

By 1935, the story and character development had progressed enough to begin scripting the picture, casting the voices and composing the music. The resulting script consisted of 16 major sequences, each containing any number of scenes. As part of this process, the "look" of the story and its cast was set via inspirational scene sketches and drawings of the characters. This material also provided the basis from which story sketches outlining each scene were begun. Resembling comic strip illustrations, the story sketches were usually drawn on animation paper with graphite and color pencils, and often included dialogue.

On the other hand, the first scenes for *Snow White* were created by the layout artists in early 1936.

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Meanwhile, artists in the character model department did not finalize the physical outlines of Snow White and the dwarfs until September of the that year. At that time, the December 21, 1937 premiere was approximately 62 weeks away!

Once a particular scene was approved for animation, the animator received a record of the sound track and model sheets of the characters. He also received a copy of the story sketches, a full scene description and exposure sheets for that scene. In the animation of a film, all activity—that is, character action, voices, sound effects and music—is timed and broken down into specific frames of film. At a rate of 1/24 of a second per frame of film, this information (as well as cel number and level, and notations for the camera) is recorded on the exposure sheet for a given scene.

In addition to the above-mentioned elements, the animator received a rough layout drawing of the scene indicating the character's size and action in relationship to the surroundings. The scale of the drawing—either "12 field," meaning a camera viewing area of 8¾ x 12 inches, or "16 field" with a camera viewing area of 11½ x 16 inches—was already determined by the director and layout artist. With this information in hand, the animator could begin "rough animation."

During rough animation, the animator worked through each scene, beginning to end, via a series of drawings in very rough form. As part of this process, he used the rough layout of the scene as a guide for the size and perspective of the characters, as well as a two-pronged/three-hole peg system—punched along the bottom margin of the paper—to keep all artwork registered to itself and the rough background layout. These rough drawings were drawn on animation bond paper with graphite or color pencil. The animator quickly drew only the most important points of a character's action, known as "extremes." He then numbered these animation roughs in the bottom right corner with a number indicating its order in the scene.

When the main elements of a scene worked together in rough animation, the drawings were okayed for clean-up. This was the task of the assistant animator who used the final layout for the background to accurately register the clean-up drawings he created from the animator's rough extremes. Rendered in graphite and color pencil on the same type of animation paper as the rough drawings, the clean-up drawing required a greater understanding of form, character action, and drafting skills than merely tracing a character outline from the animator's rough. In addition, the assistant animator drew many of the drawings for movement that occurred between the animator's extremes, known as "inbetweens." The few remaining drawings required for a scene were then drawn by the inbetweener, who proceeded in the same manner as the assistant animator.

At this point, the cleaned-up drawings for a scene were checked against the final layout drawing. If everything worked together properly, the animation drawings and final layout were okayed for color.

In order to finalize the character colors, artists in the Ink and Paint Department created a color model cel. This cel acted as a guide from which the director, layout artist and background painter determined the best possible colors for the characters in each scene. Once decided, a model drawing of that character on animation paper was marked with ink and color notations indicating the specific character colors and where they were to go.

Using the finalized color model cel or drawing for the characters, artists in the Ink and Paint Department transferred the hundreds of animation drawings for each scene onto clear cellulose nitrate sheets. During the production of *Snow White*, the character colors were a water soluble opaque paint and the character inks of different colors were derived by adding gray to a slightly darker version of a character color and then thinning the mixture with water to the consistency of an ink.

The process of transferring each animation drawing to the clear celluloid—or "cel"—sheets was done by hand and basically involved (1) inking the character outline on the front of the cel, and (2) painting the character colors on the back of the inked cel.

During the production of *Snow White*, the task of inking the character outline and painting the character colors was usually done by women, because experience had proven that they could do the job with a higher degree of neatness and consistency than their male counterparts. High quality drafting skills, exacting fluidity and neatness—including that of leaving the cel sheet free of grease and fingerprints—were essential, especially since, in the final projected film, the character outlines and colors were magnified many times on the movie screen.

While a character was evolving from clean-up animation to the painted cel, the background artist began working on the production background for the scene. He first created a series of thumbnail color sketches that suggested the overall mood for the scene. Then he, the director, and the layout artist selected the color key for the scene from these sketches, after which he often created a preliminary background or color study of the background in the appropriate colors. The preliminary background usually served as the model from which the production background was painted.

For *Snow White*, the production backgrounds were painted with watercolors on rough textured watercolor paper and as many as 500 different backgrounds were required, so the color schemes and overall tone had to be carefully planned and followed from background to background for there to be visual uniformity in the final film. This was accomplished in part by the fact that each background artist worked on up to five backgrounds at one time.¹ Once a background was approved, the peg hole registration system was cut out along the bottom margin. Any notations for the cameraman, such as pan moves, supplied by the animator on the final layout for that scene, were transferred to the bottom margin of the production background in graphite.

At that point, the cels, production backgrounds, and—most importantly—exposure sheets were taken to the camera room. On the exposure sheets the various departments had since recorded all the changes that occurred during the animation process, and the cameraman relied exclusively on those notations when photographing the hundreds of cels for each scene.

For those scenes requiring the illusion of depth, the multiplane camera of Disney's design was utilized. It had four to six levels stacked on top of one another, including the level carrying the camera. Each level was constructed of a heavy metal frame and glass work surface. Each also contained the two-pronged/three hole peg bar system that kept the artwork in accurate registration, was individually lit with up to eight 500-watt bulbs, and had its own exhaust vent to control the excessive heat of the lights. The camera was located at the top of the apparatus, while the work surface for the production background was usually at the bottom. Between them were layered the character movement cels and any overlays, such as trees and bushes. Photographing each character or portion of a scene at a different distance from the camera enhanced the illusion of depth.

On the other hand, where the scene did not require the illusion of depth, the standard animation camera was utilized. In this setup, the camera, located at the top of the vertical metal frame system, pointed straight down onto a single flat work surface containing the peg bar that kept the artwork registered. A large piece of glass, called a platen, placed over the background and the painted cels kept them flat during photography.

Once the photography of a scene was completed, it was then edited and the scenes were spliced together in the appropriate order. The film was combined with a synchronized sound track, complete with music, dialogue and sound effects. From this film, several prints were made and shipped to theaters for audiences to enjoy.

Premiering on December 21, 1937 and presented under the name of Walt Disney, the completed film was the final product—the work of art. Yet, from the initial story sketches and animation drawings to the production backgrounds and painted cels, over 2½ million pieces of "art" in some form were required to create the 83 minutes of *Snow White and the Seven Dwarfs*.² The coordinated efforts of the storymen, layout and background artists, animators, assistant animators, inkers, painters and cameramen—making a combined total of 750 people—were necessary to make this film possible. When viewing *Snow White*, their talents speak for themselves.

Yet the question arises: Once the film is completed, of what significance is the original artwork that made possible each production step? Are the painted cels, production backgrounds, story sketches, and animation drawings works of art in their own right? Or is their significance, after the film, merely archival?

Initially, when *Snow White* was completed, a large portion of the painted cels were washed off for re-use as blank protective cels, or destroyed. In some instances (as with the backgrounds, story sketches and many animation drawings), the painted cels were given away or taken home by the Disney artists. Many of the remaining drawings are housed in the Disney Animation Research Library for reference by the animators. However, in 1938, given the popularity of *Snow White* and the dwarfs, combined with the efforts of Guthrie Courvoisier (owner of a fine art gallery in San Francisco), Walt and brother Roy Disney were convinced that the original artwork from the film should be made available for sale through art galleries world wide.

By 1939, the production artwork from *Snow White* which eventually sold through Courvoisier Galleries consisted of 150 backgrounds, 206 story sketches, 500 animation drawings, and 8,136 painted cels.³ Since that time, selected pieces of original artwork from many of the Disney animated films have been available for sale as art.

Unfortunately, most early forms of animation art were never created with longevity in mind, and only limited information is available to the trained conservator on the specific materials and techniques used in animation art. Also, in instances of flaking paint on a cel, for example, washing off the character colors and completely repainting the cel—as a means of saving time—is currently practiced by some restorers. Usually there is no known written or photographic documentation on the condition of the artwork before and after treatment.

Since October 1994, information on animation art that includes general guidelines for its handling, display and storage has been published.⁴ However, more research is necessary to detail the traditional and current materials and techniques used in animation art so that a more appropriate approach can be outlined for its conservation and preservation. Also, with the increasing use of the computer as part of the animation process, this information will be invaluable historically. For example, with the current use of the computer by some studios in scanning the animation drawings, painted cels are not longer necessary so the "art" of inking and painting character cels by hand is becoming obsolete and forgotten. That of creating the animation drawings by hand may soon follow.

In conclusion, an increased effort to describe the wide variety of materials and techniques used in the animation process must be undertaken so that a better understanding of its historical significance and appropriate conservation measures can be achieved. Only then can the preservation of the painted cels, animation drawings, story sketches and backgrounds be implemented so that they can live happily ever after!

Endnotes

1. Maurice Noble, background, artist, interview with the author, February 21, 1994.
2. Frank Thomas and Ollie Johnston, *Disney Animation: The Illusion of Life* (New York: Abbeville Press, 1981), p. 317.
3. Cecil Munsey, *Disneyana: Walt Disney Collectibles* (New York: Hawthorn Books, Inc., 1974), p. 189.
4. Martin Krause and Linda Witkowski, *Walt Disney's "Snow White and the Seven Dwarfs:" An Art in Its Making* (New York: Hyperion/Indianapolis Museum of Art, 1994), pp. 179-181.

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TOOLS FOR INTERPRETING INTENT IN THE MURALS OF THE LIBRARY OF CONGRESS

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Introduction

The renovation and restoration of the Thomas Jefferson Building of the Library of Congress in Washington, D.C., has included the conservation of 19 cycles of murals. The project has offered numerous challenges to the Architect of the Capitol and to conservator Perry Huston and his team in making collaborative judgments about how best to determine the original intent of the artists. This paper will summarize the kinds of evidence used to determine the artists' intent and present some of the most interesting examples of conservation problems for which the various tools were relevant.

Project Background

The Congressional Library, constructed in the Beaux-Arts style, opened in 1897. The Library is a monument to the taste and values of the American Renaissance. The architects, John L. Smithmeyer and Paul Pelz, based their design for the building on a study of libraries and opera houses in Europe. The rich decoration was carried out in the finest materials and techniques, using marble, inlaid wood, gold leaf, mosaics, and carved reliefs. The goal was harmony between the architecture and the design and classical themes of the murals (*Figure 1*).

Painter Elmer Garnsey (1862–1946) coordinated the color in each area, from the ceilings to the murals to the floors, as seen in the pavilions placed in each corner of the building and in areas such as the Members' Reading Room, with its carved wood and marble, mosaics, walls covered with brocade, and ornate ceiling. Correspondence shows that the artists intentionally incorporated the colors in the walls or the mosaic ceilings in their murals.

Each important room on the first and second floors is decorated with mural cycles. The original artists were highly regarded academic painters of their day, such as Elihu Vedder, Edwin Blashfield, Kenyon Cox, and Gari Melchers. They devised uplifting and educational subjects, often classical in theme. Many of the murals were painted on canvas in the artists' studios in this country or in Europe and then shipped to Washington to be installed. A few were painted directly in oil on the plaster. To simulate the appearance of true fresco, the artists left their oil paintings unvarnished, unfortunately making them vulnerable to future surface damage.

By the 1980s, almost a century after the Library opened, the walls had become dark with grime and had been damaged by leaks. Ceilings originally white had become dark gray. Spaces were cluttered with partitions and shelves. Dropped ceilings installed for energy conservation hid the decorated ceilings and murals completely from view.

The graceful murals on walls and ceilings were also dark with grime and coatings, and in some cases they had been abraded by scrubbing or obscured by overpaint applied by in-house painters; these problems left the figures barely distinguishable. The murals varied in style, materials, technique, and condition, and they thus presented different conservation problems (*Figure 2*).

Because the mural conservation was part of an overall building restoration, the goal of the Architect of the Capitol was to return the murals as faithfully as possible to their original appearance, bringing them back into harmony with their architectural environment. This could not have been achieved by a simple stabilization or preservation treatment. The

*Curator for the Architect of the Capitol / Conservator with Perry Huston & Associates. This paper has been prepared in conjunction with Perry Huston and with assistance from Debra Selden. At present other members of the conservation team are Larry Keck, Maura Duffy, and Perry Hurt.



Figure 1. The Pavilion of the Elements (southwest pavilion, second floor, Thomas Jefferson Building of the Library of Congress), showing mural *Air* by Robert Leftwich Dodge, as completed in 1897. (Photo: *The Library of Congress*, Boston: American Architect and Building News Company, 1898.)

restoration was based on an investigation of the original appearance of the building as a whole, through study of the original construction records and early photographs, and analysis of paint layers to determine original wall colors.

The current renovation and restoration of the Thomas Jefferson Building was made possible by the opening of a third Library building, which provided a space to house temporarily the Jefferson Building's staff and collections. Congress funded the renovation in 1984; the work was divided into two phases so that only half of the building would need to be closed at a time.

The Architect of the Capitol is the agency in charge of the renovation. Work began in 1986 and will be completed this summer. The first mural was conserved in 1989. The cleaning and conservation of the over 100 individual murals by 18 different artists has been one of the most striking parts of the restoration.

Having a separate contract for the art conservation, while most of the other aspects of the renovation were under the general contractor, proved to be an advantage in making decisions and carrying out the work. The mural conservation had to be phased after or between all the different kinds of work being done in each space, which included installation of modern electrical, plumbing, heating, air-conditioning, and fire-protection systems; replacement of windows; refinishing of floors, carved panelling, historic light fixtures, and stained-glass ceilings; construction of colonnades for staff work spaces; and restoration of decorative painting. After an intensive qualification process, Perry Huston, past AIC president, was selected. Over the course of the project, 15 different conservators have worked with him. With the project now coming to a close, it is clear that the Architect's decision to have one conservation firm manage the entire project was the right one, because it allowed the needed flexibility in scheduling and provided consistency in treatment and documentation.



Figure 2. The Pavilion of the Elements with Robert Leftwich Dodge's mural *Water* before treatment, 1986. Decorative painting is in progress. (Photo: Architect of the Capitol.)

Tools for Interpreting Intent

During this project, George White, the Architect of the Capitol, and outside art historians and consultants, such as the late Sheldon Keck, worked closely with the Curator and the conservation team in making assessments about how best to understand and recover the intention of each artist. Great benefits resulted from the different viewpoints brought to bear on specific problems, with open discussions of options among the whole team leading to a course of treatment that all agreed was the best possible in the circumstances. Decisions had to take into account the intent of the architects and designers for the building as a whole and for the murals in the architectural and decorative context as well as that of each artist. Our experience showed the limits as well as the value of the various types of evidence, and it has made clear the desirability of having several types of information available in order to reach the soundest possible conclusions.

The major tools for establishing the intent of each artist included historic written documents about each mural and each artist gathered by the Office of the Curator and the Architect's archivist. Particularly important were the Library of Congress construction records (then unprocessed), which were the source of correspondence with the artists; this provided clues as to their concerns and the progress of their work. The Curator's office also searched for clues related to individual artists in the Archives of American Art and conducted research on each artist in published sources. Early guidebooks and newspaper reviews of the murals when the building first opened were among the more helpful materials, but most of the written sources found provided only hints rather than answers. A few letters from artists, however, did help solve puzzles. For example, Carl Guthrie's description of his panel showing the creation of light explained that the figure was relatively murky-looking because he was meant to be mysterious, "veiled in nebulae." Kenyon Cox's murals were suspected of having faded, because they are so much less intense than any of his others. The issue was dropped with the discovery of a letter written many years later in which Cox called the colors in these murals "pale and faded" and noted in retrospect that he would have made them brighter.

In addition to archives and libraries, human resources were tapped, including descendants of artists. Information was also solicited from the scholars working on individual American mural artists, especially Richard Murray, Curator at the National Museum of American Art (NMAA).

To supplement the written and verbal information, the Curator and the conservators gathered comparative visual material, such as images of preparatory sketches for the murals and other comparable works in the Library of Congress, various museums, and private collections. We also searched for images of murals by the same artists in other locations across the country. We examined easel paintings by the artists in the NMAA storage room and at other sites, such as Belmont, the Gari Melchers house museum. We gathered conservation reports on other murals by the same artists, and outside curators and conservators were invited to view the murals and provide the benefits of their experience. Despite our efforts, on the whole we found that the styles and techniques the artists used at the Library of Congress differed significantly from their other works.

An unusual aspect of this project was the fact that the artists copyrighted their images; in fact, they boldly inscribed or stenciled the copyright along with their names on the murals. Copyright photographs were deposited in the Library of Congress, often by publishers. These photographs were invaluable tools for determining original details and intent. Although the copyright collection is unprocessed and parts have been dispersed, the Curator's staff was able to sort them out and have copied those of the Library murals. Photographs on which the copyright date was inscribed directly on the print were particularly important. In addition, other early photographs have been gathered wherever possible from the Library's Prints and Photographs Division, from early publications, and from private collections. Exact dating of unmarked photographs found in files was not always possible, however, and publication dates were not necessarily the same as the dates on which the photographs were taken.

The rationale for this effort to gather as many early photographs as possible of each mural is that even the most securely documented archival photograph can provide only limited information about the artist's intent. Differences in lighting of the mural, in quality of focus, or in printing can produce very different appearances. In addition, the orthochromatic film used for the early photographs skews the value relationships, making the reds and warm tones look black. So, in addition to giving no information about color, these photographs left value relationships very much open to interpretation and discussion. The photographs were, however, extremely helpful in cases where paint was missing and details needed to be reconstructed. They could also give clues about areas where the canvas or pigment had darkened or possibly faded.

This historical research was balanced with various scientific tools. Techniques used included inspection under ultraviolet light to reveal overpaint and under infrared light to show preliminary drawing. Analytical testing of cross sections to provide insight into pigment and coating layers and medium and pigment identifications were conducted in particularly perplexing areas. Assistance in this was provided by Barbara Berrie at the Conservation Science Department at the National Gallery of Art and by Richard Wolbers of the University of Delaware. In addition, a dozen outside conservators have been invited to examine the work in progress, and the Washington Conservation Guild was provided a tour of the project.

Regardless of its condition, the paint on the wall provided the most important kind of evidence. In some cases, the original paint layer was intact. In others, it had clearly been badly abraded by inexperienced cleaning attempts, as seen in comparison with the copyright photos. One set of murals was completely overpainted. In every case, the remaining original material provided the firmest guide in assessing intent. The conservation was carried out with an eye to preserving the artistic harmony of each individual mural as well as its relationship with others in the cycle.

An important part of modern conservation is the careful documentation in writing and in black-and-white and color photographs of each stage of the process. Detailed reports were prepared on each mural. The reports also include photographs taken in ultraviolet light to document inpainted areas and diagrams recording different conditions. Large-format before- and after-treatment photographs are also taken by the Architect of the Capitol's photographers. Perry Huston set a high standard for the reports and developed a format carried out consistently for each mural cycle.

Application of Tools

For this presentation, we have selected a half dozen of the most interesting problems encountered on the project to demonstrate how the various types of tools have been used.

George Willoughby Maynard (1843–1923) painted four lunettes showing the progress of civilization in the southwest pavilion. He used a rough, burlap-like canvas, with the backgrounds gilded around the classically dressed figures grouped in a pyramid. Unfortunately, the sheets of gold leaf were not properly applied, the oil size and canvas darkened over time, and the pattern of rectangular patches became even more distracting once the murals were cleaned. It was clear from the copyright photographs that this patchy background was not intended. Eventually, after extensive discussions and examination by an expert gilder, new gold leaf was applied with reversible size to the background areas, with the result that the figures now stand out in proper relief.

Robert Leftwich Dodge (1872–1940) painted the Four Elements in the lunettes in the southeast pavilion. Because he painted in oil directly on the plaster, his murals were among the worst in condition. They were darkened with grime, damaged by moisture, badly flaking, and disfigured by paint loss and crude retouching. The lunette *Water*, located over a window, was the most severely damaged. A major problem was finding a way to consolidate the loose paint without complicating the cleaning system; special cleaning systems were devised with the help of Richard Wolbers (*Figure 3*).

For the Robert Dodge paintings, the copyright photographs were invaluable in inpainting and in reconstructing numerous discrete losses. After consolidating and cleaning, the time-consuming job of extensive filling and inpainting began (*Figure 4*). Fortunately, the lacunae were surrounded by almost pristine original paint film, so that, along with the copyright photographs (*Figure 5*), it was possible to reconstruct missing passages. As a result, the appearance of the murals was restored to correspond to the early photographs (*Figure 6*). The colors, hidden from view for decades, were surprising almost fluorescent pinks, oranges, blues, and yellows. They ended up harmonizing beautifully with the original yellow wall color, which had been determined through analysis of paint layers years earlier.

Henry Oliver Walker (1843–1929) painted delicate murals in watercolor-like washes in the Main Entrance Hall that were among the most praised when the Library first opened. However, they were among the most daunting for the conservators because in 1963 in-house decorative painters badly abraded them in trying to clean them with turpentine. To correct their mistake, the painters heavily overpainted the largest lunette, *Lyric Poetry*, and some of the others completely, adding their own details (such as flowers) wherever they liked, before they were stopped. Their overpaint was considerably thicker and more opaque than the original paint underneath. In the beginning, the conservator was not optimistic about being able to uncover the original, and he built a testing phase into the project. However, a multi-step cleaning procedure was devised to remove grime and overpaint without further damaging the underlying already abraded original.

Numerous early photographs of the main scene, *Lyric Poetry*, were found, but no two were exactly alike. The validity of the value relations as seen in various photographs was most heavily debated while trying to determine the original appearance of the Walker murals. The copyright photographs were very valuable in reintegrating the abraded original surface. Reintegration proceeded by first inpainting the pinpoint losses due to abrasion, then stepping back to see whether the results tallied with the copyright photos. The conservation began with the smaller lunettes (which were the least damaged) to help in assessing the artist's intent for the others and to achieve a balance among the murals. Because of the extent of the damage, the conservation treatment could not completely restore the original appearance of all of the murals, but the overall result was much more satisfactory than was first thought was possible.

Once these murals were cleaned, however, it became clear that the mosaic ceilings were completely out of key, although the pinks, greens, and yellows in the murals were without doubt meant to match those in the ceiling. When the murals were dark with grime, during the planning stages of the project, the ceilings had looked relatively clean and so had not been included in the restoration project. After inspecting the cleaned murals the Architect decided to add the cleaning of the ceilings to the project, with results that are very important not only for viewing the murals but also for the overall balance of the spaces and the retention of the harmonious aesthetic whole.

Charles Sprague Pearce (1851–1914) designed a series for the other side of the Main Entrance Hall centered upon the theme of *The Family*. His murals were almost black with grime, with the figures barely visible. The removal of grime and a heavy varnish revealed textured brushwork and brilliant hues of orange, violet, and yellow.

The primary large mural showing *The Family* posed particular problems because of a crudely brushed dark area in the ground, which seemed to fight against the location of the figures in space, and there was uncertainty about whether it was applied by the artist. Shadows at the feet of the figures confusingly appeared lighter than the ground. Construction



Figure 3. Robert Leftwich Dodge, *Water*, detail of mural during cleaning. (Photo: Perry Huston and Associates.)



Figure 4. Robert Leftwich Dodge, *Water*, detail of mural after consolidation, cleaning, and in-filling losses. (Photo: Perry Huston and Associates.)



Figure 5. Robert Leftwich Dodge, *Water*, photograph of central section copyrighted by Curtis & Cameron in 1897. (Photo: Library of Congress.)



Figure 6. Robert Leftwich Dodge, *Water*, after treatment, 1990. (Photo: Architect of the Capitol.)

correspondence revealed that the murals were not installed by the artist himself because he was ill. Cuts in the canvas showed that, because the canvas did not exactly fit the shape of the lunette, the border had been cut off and reshaped and the gap at the bottom filled in. Brushwork applied across cuts proved that some repainting occurred after the patching.

Numerous analytical tests made by the National Gallery of Art showed that this area was composed of an applied oil, which had darkened. The conclusion from the tests and the visual evidence that this discoloration would not have fit the artist's intent was bolstered by a photograph of the mural taken in the artist's studio in France and shared by a collector who had purchased the artist's estate. The cleaning of the unsightly discolored layer restored the spatial effects seen in the early photograph.

Edward Simmons' (1852–1931) cycle of nine Muses in the first-floor north corridor was left until near the end of the project because of questions about whether the original pigments might have faded. The end muses, such as Melpomene in her bright red cloak, were intense in color, while the central figure of Terpsichore looked gray and pale except for a dark green veil. A copper roof outside the windows could have reflected damaging light into the corridor. Some archival research suggested that the artist could have experimented with pigments of precipitate dyes.

One area that appeared to be disconcertingly shapeless was the swirl of red drapery behind Melpomene. The early photographs showed that there had been a funnel-shaped form. The existence of pigments which appeared to have changed color was suggested by the copyright photographs and by the appearance of the mural under ultraviolet light, in which the funnel-like form can be clearly seen in Melpomene's swirling drapery.

The original existence of this form was further confirmed by pigment analyses by Richard Wolbers, who found a top layer with red lake which is no longer visible. Therefore, in this particular area, the forms were subtly enhanced during the inpainting phase of the treatment.

During the course of treatment on the Simmons, many hypotheses were explored and the thinking of the conservation team evolved. Experiments were carried out by Michael Dunn with computer imaging manipulation based on the archival photographs and colorimetry readings in case definite evidence of unintended chemical changes was found. In the end, most of the surfaces were left as found after cleaning, but it is useful to note that computer imaging allows conservators to explore different adjustments without touching the surface of the painting.

Conclusion

The experience of the Architect of the Capitol with the murals at the Library of Congress demonstrates the importance of having several types of evidence before taking action, the need for caution and skepticism before treatment decisions are made, and the great value of the collaboration of curators and conservators in grappling with issues of intent. In the final analysis, determining an artist's intent involves interpretation; it is a kind of "knowing across," across elapsed time and from one kind of thing to another.