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AIC PAINTINGS  
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POSTPRINTS

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San Diego, California • June 13-14, 1997



The American Institute for Conservation of Historic and Artistic Works

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**Papers Presented at the Twenty-Fifth Annual Meeting  
of The American Institute for Conservation of Historic and Artistic Works  
San Diego, California  
June 13-14, 1997**

**Compiled by Robert G. Proctor**

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## TABLE OF CONTENTS

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Karen French <i>A Method for X-Raying Oversized Paintings with Multi-plate Exposures</i>	1
Lance Mayer and Gay Myers <i>American Painters and “Old Master” Recipes: 1920s to 1940s</i>	11
Antoni Mathias, Chris Stavroudis and Aneta Zebala <i>The Design, Construction and Use of an Inexpensive, Multipurpose, Heated Suction Table</i>	12
Alina Remba, Pilar Sedano Espín and Rocío Bruquetas Galán <i>Loss Compensation in Spain: Criteria for Paintings and Polychromed Sculpture</i>	19
Elizabeth Mention <i>A Case Study of Orazio Gentileschi’s <u>Madonna and Child</u>: A Victim of Revolution</i>	32
Jay Krueger <i>Considerations in the Treatment of Jackson Pollock’s <u>Number 7</u>, 1951</i>	43
Eric Gordon, Karen French, Peter Nelsen and Catherine Rogers <i>A Local Treatment for Setting Down Severely Tented, Water-Damaged Paint on a Transferred and Lined Painting by Giambattista Tiepolo</i>	51
James Hamm <i>Alex Jean Fournier: Murals at the Roycroft Inn</i>	59
Niccolo Caldaro, Thorton Rockwell and Anne Rosenthal <i>Conservation of a Heavyweight: <u>The Rose</u> by Jay DeFeo</i>	68
Patricia Sherwin Garland and Stephen Kornhauser <i>Understanding a Picture Through its Conservation History: The Crucifixion by Nicolas Poussin</i>	79
Helen Mar Parkin and James S. Horns <i>A Technical Study of Paintings by Grant Wood</i>	85
Teresa A. Lignelli <i>Use of <u>Rigatino</u> Inpainting Technique for Compensation of Losses in Panel Paintings: A Case Study</i>	96
Mark V. Lewis <i>Filling in the Gaps; The Conservation of a 17C English Panel Painting</i>	106

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# A METHOD FOR X-RAYING OVERSIZE PAINTINGS WITH MULTI-PLATE EXPOSURES

Karen French\*

## INTRODUCTION

This paper explains a method to take a complete X-ray of an oversize painting at the Walters Art Gallery. The painting was undergoing a full conservation treatment, and it was hoped that an X-ray image would help clarify certain areas for inpainting as well as explain numerous *pentimenti*.

The project was interesting because it posed many challenges. The foremost question of how to X-ray something 16 x 9 feet (in a non-specific lead-lined room); secondly, the concern that the radiography would be affected by a past transfer of the paint and ground and subsequent re-lining to canvas with a zinc-white glue paste, and thirdly, the restrictions resulting from our equipment and facilities.

## THE PROBLEM

*Scipio Africanus Freeing Massiva* by Giovanni Battista Tiepolo is the largest painting in the Walters collection. As a result it could not fit into the painting conservation lab and was being treated in a temporary studio built within gallery space. Situated with artwork and people above, below and around it, this studio posed problems for X-raying purposes. The public and staff not only had access to the surrounding areas, but two windows were present in the studio walls to allow visitors to view conservation in progress.

Catherine Rogers<sup>1</sup>, who worked with Walters staff on the conservation of this painting, tried to find a company who would take the X-ray; however, due to changes in Maryland state regulations, the search was fruitless. The only possible way to take an X-ray was to shoot it ourselves in the temporary treatment studio. A portable X-ray unit<sup>2</sup> was borrowed for this purpose.

## SAFETY FACTORS

Safety issues were a high priority, the X-ray unit was certified for use in our museum by the Maryland Department of the Environment's Radiological Health Program. In addition to the Walters normal radiography training, all potential operators undertook a 2-hour radiographer training seminar, covering items specifically related to X-raying outside of a fixed lab setting. The fundamentals of radiological safety were reviewed: including working time; working distance and shielding; personal and area exposure reduction; the posting of signs and control of the area (with guards and stanchions); specific equipment procedures; Walters emergency procedures; use of film badges; dosimeters, a survey meter and recordkeeping.

During conservation treatment the painting was oriented vertically, fixed to an exterior wall allowing for working space behind the canvas. Radiology safety experts deemed that this wall was thick enough to protect

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\*Karen French, The Walters Art Gallery

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<sup>1</sup>Private Conservator, Charleston, South Carolina.

<sup>2</sup>The radiographic unit used was a portable industrial "Hot spot" with a 0.5mm focal spot. This unit was lent by the Corcoran Gallery of Art, Washington, D.C.

anyone passing through the alleyway outside from the emitted X-rays.

Gallery areas around the studio were tested for X-ray scatter using different exposures to ascertain kilovoltage (kV) safety limits. The windows, the steps and the well area near the studio door were blocked off with X-ray caution signs and stanchions, security officers were cautioned not to allow visitors too close.

A protocol of procedures was drawn up for each day of use (including tests and warm-ups), a radiography log was kept recording operating conditions, machine checks and usage and people present. All exposures with kV and milliamperes (mA) were noted down, and operators wore personalized X-ray film badges and dosimeters. Daily checks were conducted of the surrounding studio areas, as well as survey checks during and after each machine exposure. The key to the machine was removed between exposures and the unit kept in a restricted area when not in use.

X-raying near the door end of the studio was managed with the operator and control unit outside the studio doors as an extra shield. For exposures at the furthest end of the painting, the control unit was placed in the studio approximately 4 feet from the door. The operator, wearing a lead apron, would set the unit to expose then move outside the studio.

## PLANNING

Very little published literature on X-raying oversize paintings could be found<sup>1,2,3</sup>. During the early stages of planning, the idea of trying to X-ray the Tiepolo horizontally (our normal manner) was dismissed. This would have required extra movement of the painting during its treatment, and was impractical due to its size. Keeping the painting upright, afforded easy access to both the front and back, and provided the alley outside to shoot X-rays away from the galleries. In order to work vertically some type of special mounting system was required to hold the film to the upright canvas<sup>4</sup>.

The approximately 2 inch thickness of the painting's stretcher allowed enough space to slide X-ray film behind the stretcher bars for direct contact with the back of the canvas. By shooting from front to back, stretcher interference in the X-ray image was eliminated.

Using the 14 x 17 inch size of the X-ray film sheets, the painting was divided up into rectangles. It was calculated that around 120 film sheets would be needed to cover the entire painting. As well as the time involved in placing and shooting the numerous exposures, there was a concern about uniformity of all the plates and the problems of fluctuations in kV and current through numerous exposures.

## MOUNTING SYSTEM

During the conservation treatment of the painting we had employed a Mitka™ plate mounted vertically to a lockable wheeled camera tripod. It was decided to use this tripod to hold a mounting board that would support many sheets of X-ray film together. Gatorfoam provided a lightweight, strong and durable flat surface for the mounting.

A special bracket was produced consisting of a hollow 6 inch brass pole. At one end this locked into the tripod mount, and at the other end attached via screwed brackets to a wooden board approximately 10 x 15 inches. Velcro™ attached to the perimeter of the wood board, and in a corresponding placement on the center of the mounting panel, held the two together (Figure 1). Two mounting panels were constructed so that film could be laid out on one while exposing the other. For some parts of the painting the stretcher bars precluded entry of the tripod mount when centrally placed behind the gatorfoam. One gatorfoam panel was therefore prepared with Velcro™ in a variety of positions, allowing placement around the stretcher bars.

Film sheets were attached to the gatorfoam using 3M double-sided tape. For each exposure, the mounting board with film was manoeuvred into position by two people at the back of the canvas, the tripod with the mounting block was then moved in behind this to meet the corresponding Velcro™. The panel was locked into position on the tripod with the film in good contact with the canvas (Figure 2).

At the edges of the painting, where the gatorfoam panel was too thick to pass under the stretcher, film was mounted projecting beyond the panel. This enabled the film to slide easily up to the painting's edges behind the stretcher to produce a complete X-ray.

### FILM TYPE AND PROCESSING

While working on the mounting system, the type of X-ray film and its development were also considered. Usually at the Walters, X-ray film is processed by hand in the darkroom, where a maximum of three sheets can be developed, fixed and washed together at one time; each processing session requiring a total of 1 hour and 15 minutes. Given the number of plates involved in this project, this time frame was impractical. There were also concerns for the consistent development quality of so many images<sup>5</sup>, therefore an alternative was looked for.

The costs of hiring or buying a hospital-type rapid processor were prohibitive. A nearby local hospital agreed to our use of one of their machines. This processor took only 1-1½ minutes to develop, fix, wash and dry each plate, not only reducing developing time, but ensuring a standardized uniform processing<sup>6</sup>. The only drawback with this system was that it required a special rapid processing film: Kodak™ X-Omat RP. Several tests were run with the rapid processing film on the fixed-distance lab X-ray unit to determine any differences in exposure time and settings between it and the regular X-ray film types.

### THE METHOD

The aim was to achieve the best quality radiograph of the entire painting by minimizing the number of exposures and maximizing the number of film sheets exposed at one time. Tests determined the film focus distance and the diameter of the circle of exposure.

On the portable X-ray unit the mA was not manually adjustable, it altered according to the kV setting. Safety inspectors had advised us, when working in the temporary studio in gallery space, to keep the unit below 50 kV and to shoot within the 30 kV range. The X-ray tube was placed in front of the painting with the X-ray beam orientated horizontally. Tests for an optimum exposure were conducted on single sheets of film with different variables. A remarkably clear and strong exposure was achieved with a film focus/X-ray tube distance of 8 feet, a setting of 20 kV, 4.1 mA and an 8-minute exposure.

The painting was divided into three horizontal and three vertical rows forming nine rectangles, each containing twelve 14 x 17 inch plates (an extra section at the right side could be exposed with another three shots). A diagram was labeled with each rectangle of 12 being assigned a number 1 - 9, and each plate within it given a letter A - L (Figure 3). The extra sections at the far right were given corresponding numbers and continued with the letters M, N and O.

A gatorfoam panel was assembled with 12 sheets of X-ray film placed with a ½ inch overlap in all dimensions. After exposure and developing it was found that the whole area of film had not been exposed. Contained within the 12 plates was a circle of exposure, in which the central 6 plates were fully exposed. To still achieve 12 exposures at once would have required moving the X-ray unit further back from the painting, changing the exposure parameters and leaving less room available for maneuvering the equipment. Since the 8 foot setting had given such a good radiograph it was decided to shoot multiple exposures of 6 not 12. The film sheet overlap was increased to 1½ inches to ensure that no information was lost.

Movement of the X-ray unit and its delicate tube had been minimized by setting just three heights. To achieve each multiple exposure, the axis of the radiographic beam was aimed at the center of the six plates, perpendicular to their surface. For each height level, the X-ray unit was placed on a mobile scaffold or cart.

To help maintain a constant distance from the painting while moving the X-ray unit along its length, a line was taped on the floor, parallel with, and 8 feet from, the painting's surface. Plumb lines at either end of the X-ray unit's base were set to the tape line to indicate parallel alignment (Figure 4). A central plumb line, from below the unit, was used to ensure that the tube was centered accurately with a constant film distance/beam focus for

each six plate exposure (Figure 5).

Before mounting and exposing, each film sheet was labeled 1A, 1B, etc. in relation to the diagram, to aid identification for developing and montage of the film plates later. X-raying began at the top left corner, proceeded horizontally across to the top right before moving down a level to start again at the left. After each exposure, the placement of the film was marked in chalk on the back of the canvas, to ensure correct overlap of the next panel of film. All film was processed the day of exposure.

### RADIOGRAPH ASSEMBLY

To achieve a clear picture (without overlaps) of such a large radiographic image, it was necessary to cut and paste the film sheets into a sectioned montage. After processing, each full sheet of film was documented photographically prior to cutting. Each of the nine sections of the radiograph was cut, assembled and photographed with a 4 x 5 inch camera. The nine 8 x 10 inch black and white prints produced from these photographed sections were in turn overlapped, cut and assembled to produce one overall (although greatly reduced) image of the entire radiograph (Figure 6).

### RESULTS

The fear that the radiographic image would have been compromised by the painting's transfer and lining processes turned out to be unfounded; instead a strong, sculptural and rather beautiful image was produced. For a radiograph of this scale there was very little distortion created by the differences in the beam angle, which made assembling of the montage fairly easy.

The radiograph revealed how Tiepolo worked and reworked his image, altering his composition directly on the canvas (Figure 7). Details were brought out in the radiograph that are no longer distinct in the painting. Perhaps most exciting of all was how the radiograph revealed complete character changes that link the Walters painting more definitely to a sketch in a private collection in Milan.

In the Milan sketch the third figure on the left is a seated Roman soldier with his back to the viewer. The third figure on the left in the Walters painting is a seated African boy, beneath whom the radiograph revealed a similar Roman soldier. Another major change revealed was that of a young man seen in profile in the Walters painting, who was originally painted as an older bearded man looking out of the painting.

### CONCLUSION

In the end, this method for undertaking large scale radiography was fairly simple and worked well. Not only was much time saved by dramatically reducing the number of individual exposures but the uniformity of the resultant radiograph was increased. Subject to the availability of large scale X-ray film and processing methods as is being experimented with in Florence, Italy<sup>7</sup>, a multi-plate technique such as this has its advantages.

As a coda, if it wasn't enough that this large painting was X-rayed once, it was X-rayed twice. In searching for different types of film and a hospital processor, contact was made with Fuji Medical Systems and people involved with their direct digital Computed Radiography techniques. These techniques give a greater dynamic range with the possibility of digitally enhancing an image, and easy electronic transmission of first generation digital information, all potentially useful for conservation purposes.

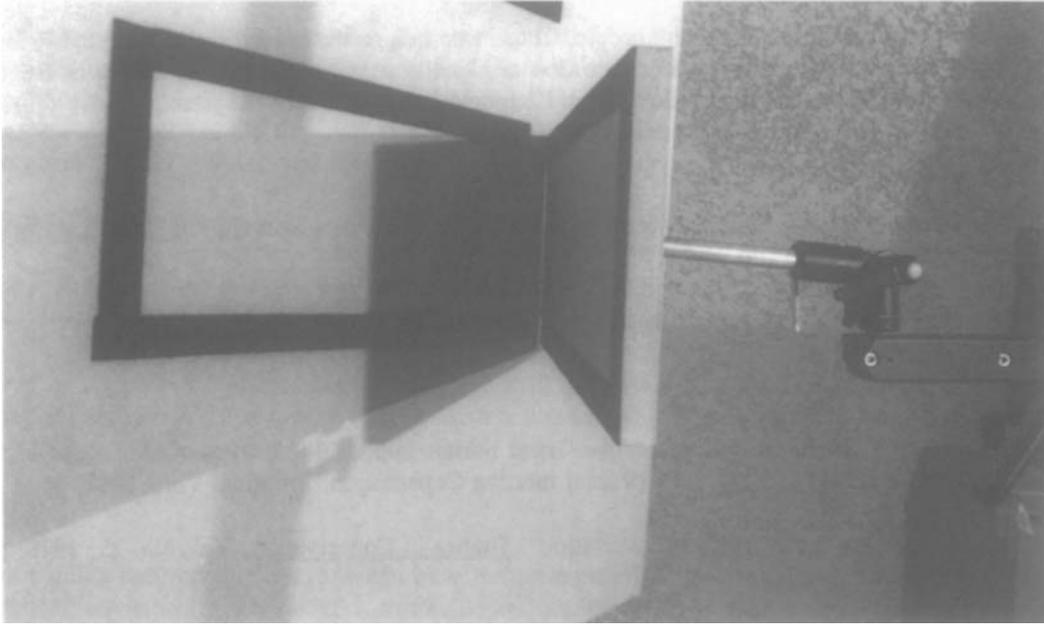
As an experiment, a complete digital computed radiograph of the Tiepolo was taken. This involved using phosphor-coated imaging plates instead of film, and required each exposure to be undertaken separately, therefore a genie lift was used to move the X-ray unit to the nine different heights required. The Computed Radiographic technique reduced the exposure time dramatically to 8 seconds at 20 kV with 2 mA at a distance of 5 feet. These results are currently being compared to the conventional radiograph, while further tests are made on this as an another X-ray technique for artwork.

## ACKNOWLEDGEMENTS

Working on something oversize involves many people. Those who helped me most directly were the fellow conservators treating the painting: project leader Eric Gordon, special contract conservator Catherine Rogers, contract conservator Peter Nelsen, Mellon fellow Elyse Klein and intern Kimberly Royster.

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**Fig. 1.** The alignment of the Velcro® on the back of the mounting panel and the tripod attachment system for holding the film to the canvas.



**Fig. 2.** Locking the film on the mounting board in place using the tripod mount.

1A	1B	1C	1D	2A	2B	2C	2D	3A	3B	3C	3D	3M
1E	1F	1G	1H	2E	2F	2G	2H	3E	3F	3G	3H	3N
1I	1J	1K	1L	2I	2J	2K	2L	3I	3J	3K	3L	3O
4A	4B	4C	4D	5A	5B	5C	5D	6A	6B	6C	6D	6M
4E	4F	4G	4H	5E	5F	5G	5H	6E	6F	6G	6H	6N
4I	4J	4K	4L	5I	5J	5K	5L	6I	6J	6K	6L	6O
7A	7B	7C	7D	8A	8B	8C	8D	9A	9B	9C	9D	9M
7E	7F	7G	7H	8E	8F	8G	8H	9E	9F	9G	9H	9N
7I	7J	7K	7L	8I	8J	8K	8L	9I	9J	9K	9L	9O

Fig. 3. Diagram for placement of X-ray plates and location numbering system. Actual size of plates 17 x 14 inches



Fig. 4. X-ray set up with distance markings on the floor.



**Fig. 5.X-ray unit set up on movable cart with plumb lines for accurate centering.**



**Fig. 6.** Overall radiographic image of *Scipio Africanus freeing Massiva* by Giovanni Battista Tiepolo.



**Fig. 7. A detail from the radiograph illustrating how the head of Massiva was moved up about 6 inches in the composition.**

## AMERICAN PAINTERS AND "OLD MASTER" RECIPES: 1920S TO 1940S

Lance Mayer and Gay Myers  
Lyman Allyn Art Museum

(The authors are preparing for submission to the AIC Journal a version of their talk which will include some additional research and a number of illustrations. For this reason they are publishing here only an abstract of the talk that was presented in San Diego.)

During the first half of the twentieth century, many American painters were fascinated by historic painting techniques, an interest fueled by and reflected in the writings of Max Doerner, Jacques Maroger, and many others. This interest led some artists to revive the use of such traditional techniques as egg tempera and gesso grounds, and it also resulted in the popularity of pseudo-historic recipes purported to have been used by the Old Masters, including gum Arabic and egg/oil emulsions, oil-resin glazes, special drying oils, jellies, wax, and other media. An interesting outgrowth of this experimentation was that some artists embraced commercially-produced house paints, early synthetic media, and new types of varnishes as they searched for modern materials which would rival traditional ones in handling and permanence.

Among the artists whose papers are preserved in the Archives of American Art, Reginald Marsh and John Stuart Curry stand out as having had especially well-documented interest in technical experiments and innovations. For example, Curry experimented with Doerner's "mixed technique" before and after Max Doerner's The Materials of the Artist and their Use in Painting was published in English in 1934. Marsh was an avid collector of recipes from a wide variety of sources, and his notebooks record the structure of many of his paintings in diagrams showing extremely complex layering, offering insight into why some of these paintings are difficult for conservators to treat. The correspondence between Marsh and Curry, in which Marsh enthusiastically advocated the methods of Jacques Maroger and Curry responded with interest but skepticism, is especially interesting. Curry corresponded with other artists, exchanged many letters with chemists and manufacturers of artists' materials about both traditional and modern materials, and kept a notebook which describes the materials used in many of his paintings as well as comments on their handling and drying.

An important part of the authors' intent is to try to understand how artists' experimentation with different materials has affected the stability and appearance of their paintings. The authors have examined and treated many paintings by Marsh and by Curry, including paintings still owned by Curry's widow, many of which have never before been treated by conservators. They have also interviewed William McCloy, Curry's studio assistant, who shared Marsh's and Curry's enthusiasm for a wide variety of techniques. Looking with McCloy at both McCloy's and Curry's paintings from the 1930s and 1940s offered insights into how these and other paintings have stood the test of time.

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Authors' address: Lyman Allyn Art Museum, 625 Williams Street, New London, CT 06320

## THE DESIGN, CONSTRUCTION AND USE OF AN INEXPENSIVE MULTIPURPOSE, HEATED SUCTION TABLE.

Aneta Zebala, Paintings Conservator<sup>1</sup>  
Chris Stavroudis, Paintings Conservator<sup>2</sup>  
Antoni Mathias, Technical Support<sup>1</sup>

The mural, "The Evening Outlook", was painted in 1954 by Hugo Ballin, a writer, stage designer, movie producer, and director in addition to being a painter. The painting was commissioned by the Evening Outlook, a Santa Monica newspaper, and depicts a vista of Santa Monica Bay and Pacific Coast Highway as seen from atop the California Avenue incline. At left, St. Monica stands flanked by two hemispheres and silhouetted against a Douglas aircraft. The date, 1875, in the center of the banner signifies the date of the founding of the city of Santa Monica and the Outlook newspaper. The mural was relocated once in 1978 and it was to be taken down again in preparation for the reconstruction of the building's lobby. In January of 1995 we agreed to treat the painting which measures 15 feet x 12 feet.

The mural is painted on a shaped canvas in the form of a vertical oval with irregularly shaped elements extending beyond its oval edge. Although the mural was painted on fabric and marouflaged to the wall, Hugo Ballin successfully conveyed the feeling of a painting executed directly on the wall. His use of a light palette and washes of color on a thin cotton fabric, virtually devoid of a ground layer, as well as the absence of any framing device contribute to this illusion. The mural's support is a single piece of light weight cotton. The off-white ground layer is thinly applied and the paint is matte in appearance and slightly underbound.

The whole composition is rendered in a somewhat sketchy technique over a preliminary pencil drawing. It is only in some sections of foreground and foliage that the brush strokes are visible and the paint layer is thicker. In the foliage Ballin made extensive use of white chalk lines, possibly meant as a quick means to intensify the effect of light vibration. Considering the 1978 dismounting and reinstallation as well as our removal of the painting from the wall in 1995, the mural's paint layer probably owes its fairly sound state of preservation to a relatively straightforward technique and the use of a conventional paint medium. We had noted paint loss along the heavier painted passages and along the intricate edge, as well as small and large scratches, abrasions and cuts throughout the surface.

Upon removal from the wall we found a number of small and large tears in the thin cotton support. The integrity of the fabric support was compromised by numerous cuts from both the previous and our removal of the painting. Only then did we realize that the large and fragile canvas could not support its own weight. The two banner ends that extend beyond the main body of canvas by 9" each are particularly at risk. They were found to have been torn, almost severed from the rest of the mural. After the painting had been detached from the wall we belatedly realized that it required a lining. The lining was judged to be necessary. We also felt that the unlined painting would not be able to safely sustain another installation/deinstallation cycle. In addition, the extreme moisture responsiveness of the fabric would require overall humidification to relax it, and suction to allow the canvas to dry. This argued for a suction table.

And so this suction table came into being to fit a very specific need – to treat the Ballin mural. It was built as a simple and functional apparatus, for a fraction of a cost of a commercial table – its nuts and ugly bolts very much in evidence. We are delighted to report that it works very well and we see no reason that this design cannot be the inspiration for a general purpose heating suction table for paintings conservators.

The innovative feature of this table is its simple design based on hot water circulating through an air conditioner condenser coil. The radiator transfers heat via conduction to the perforated metal plate that is the working surface. The condenser coil allows even and free passage of air through it and provides the significant structural support necessary to allow suction to be used without deforming the perforated plate.

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<sup>1</sup> Aneta Zebala Paintings Conservation, 2122 Ocean Park Boulevard, Suite 9, Santa Monica, CA 90405

<sup>2</sup> Chris Stavroudis, Paintings Conservator, 1272 North Flores Street, Los Angeles, CA 90069

## Construction

Before the full scale table was constructed, a prototype suction table was built from a smaller condenser and perforated plate. When tested, it demonstrated that the heat distribution was satisfactory and could be accurately controlled, that heat transfer to the perforated plate was good, and that the airflow through the table would not cool the perforated plate and yet it supplied adequate suction necessary for treatment. The water temperature could be raised to a maximum of 200° F, which was the equivalent of 190° F on the surface of the plate.

The prototype allowed certain design details to be worked out. The expansion of the water overwhelmed every attempt to design a simple closed circuit heating system and the final design uses an open circuit with a large hot water reservoir. Also, we realized that vapor lock caused by water boiling within the cartridge heaters could be avoided by mounting the heaters at an angle.

This heated suction table is constructed from commercial air conditioner condenser coils, a perforated aluminum plate, an immersion heater and a circulating pump, a radiator and a fan for cooling, and a vacuum cleaner to provide suction. Two identical used condenser coils are mounted into a wooden framework that supplies structural support for the table, allows for thermal expansion of the coils and provides an air plenum below to distribute the suction across the table's surface. A perforated aluminum plate placed directly on top of the coils provides the working surface.

Each condenser coil provides a heating surface of 30" by 80". Each coil is 3 1/2" thick with copper tubes arranged in three rows. Since it required considerable effort to obtain the two used AC condenser coils, the size of the table frame was dictated by the size of the available coils. They were positioned side by side to provide a total heating surface of 60" by 80".

The table frame was built using 4"x 4" pine struts joined with mortise & tenon. The plenum chamber was built from plywood and reinforced with wooden ribs to give support for the coils which weigh 100 lbs each. (See Suction Table Plans.) The plenum chamber was double coated with white heat resistant epoxy paint to create a sealed and a heat reflecting surface.

A perforated aluminum plate placed directly on top of the coils provides the table's working surface. Heat transfer from the condenser fins to the aluminum plate is by conduction. The plate is 1/16" thick aluminum with staggered 3/32" diameter holes on 5/32" centers, which results in a 33% open area. Initially a single perforated sheet was custom manufactured, but it was unacceptably out of plane. In the present design, we use two 40"x 60" plates. The table design must allow for thermal expansion of all components. The aluminum plates expand by 1/8" during heating of the table top. If this expansion is not allowed for in the design, the table poses a risk to the artwork and operators.

The water is heated with two 4.5 kW water heating elements drawing 30 Amps at 240 volts. (See Electrical Schematic.) The higher efficiency of the heat transfer to and from the water flowing through the heating circuit allows for lower power consumption. Where power availability is minimal, a gas water heater, with proper ventilation, could be used instead of an electric heater. The table is cooled by switching the water circuit from the water heater to a cooling radiator.

The water is circulated with a 1/4 hp, 2 gallon per minute circulating pump. All fittings are copper tube joined with solder. A shut off valve was built in so that one coil could be deactivated if a smaller heating surface is desired. The open two gallon hot water reservoir allows for thermal expansion of the water and keeps the water pressure in the coils at an absolute minimum. (See Water Flow and Control diagram.)

The application of heat and pressure to a painting must be kept to a minimum. This table has the capacity of adjustable temperature from cold to 190° F measured at the surface although the maximum temperature is not likely to be required for any conservation treatment. The required surface temperature can be set by adjusting the temperature controller that controls the water heater. The thermostat's sensor is inserted in between the fins inside one of the coils. When the predetermined temperature is reached the water heater automatically shuts off but the hot water continues to circulate through the coils. The surface temperature can be controlled to within 3° F.

## **Treatment**

Tests were carried out to assess the adhesion of canvas to the wall. In the 1978 move the mural was mounted to the plastered drywall with a thin layer of adhesive in a water soluble binder. The attachment seemed good throughout, with the exception of a few isolated air pockets which detached easily. After surface vacuuming, the paint's adhesion to the substrate was improved with an overall consolidation with two brush applications of hydroxypropylcellulose, Klucel GF.

We considered applying a facing layer prior to removal of painting from the wall but ultimately decided against it. The consolidant proved sufficient to protect the underbound passages of paint and chalk lines. In addition we felt that we would have more control during removal of the painting from the wall without the interference of another non transparent and obscuring layer.

With the use of a scissor lift we installed a pulley system to lift a sonotube for the removal. The painting was rolled and hoisted upward onto the tube while we detached the canvas from the wall mechanically using sharpened large pastry spatulas. The adhesion of canvas to the drywall varied from poor to good to tenacious.

Needless to say its removal was not as clean as our preliminary tests indicated. Approximately 50% of the canvas was detached free of additional layers, and the remaining half was detached with a thick layer of wall paint and, in some sections, the paper skin of the drywall.

The safest way to remove the residual latex paint and paper from the reverse proved to be mechanical scraping with chisels and scalpels. Gwynne Barney, who was assisting at the time, excelled at this thankless task that busied her over a period of four months.

Further local consolidation of powdery paint and flattening were performed in the studio. This proved difficult to control because the canvas was extremely responsive to moisture. The aqueous consolidation resulted in rapid distortions of the canvas. We needed a large flat surface with the capacity to restrain the canvas during consolidation and drying.

The choice of lining fabric was dictated by a variety of considerations: total weight after lining, risk of texture transference into a very fine canvas, and the availability of a suitably wide lining material. The width requirement of 144" was not met by any fabric we considered. Tetco PCap - polyester monofilament fabric was chosen for its dimensional stability, strength, and light weight. The 126" wide PCap 70-260 was the widest fabric available. It provided enough stability to this structurally compromised canvas. Beva® 371 met the requirements for a non-aqueous adhesive that could be flocked onto prestretched PCap. The flocking method guaranteed an even application without the impregnation of the original canvas. In a mock-up we determined the best dilution and the necessary coverage of flocked adhesive. One gallon of Beva diluted with 1 gallon of Naphtha was heated and sprayed warm onto a 12' x 18' sheet of PCap, stretched over a working frame.

The table was first used as a suction device to assist in relaxing and flattening of the distorted support. A sheet of a heavy, tightly woven, acrylic fabric was laid down directly on the perforated plates as a cushioning interleaf and to block the central joint of the perforated plates from making an impression into the canvas. Humidification and relaxation treatment had to be performed in sections with the secondary fabric precisely aligned underneath and ready for lining. The lining procedure proved a challenging task of coordination. The painting had to be slowly unrolled from a tube suspended from the wall, and simultaneously aligned with the flocked PCap being unrolled from another tube suspended below the painting. In addition the suction table had to be rolled from side to side to provide a lining surface for each section since it was not large enough to line an entire width of the mural. As the flocked surface was very "nappy", we had to minimize relative movement between the painting and lining fabric.

After aligning the two fabrics on the table, we smoothed out the main distortions with the suction turned on. The restrained painting and lining fabric was lightly misted with water. The section was covered with Hollytex and then a Dartek membrane. Upon completion of flattening and drying (approximately one hour) the heat was turned on and the flattened section was adhered to the PCap. It took approximately 45 minutes to reach the desired temperature of 155° F. Total treatment consisted of five separate lining sessions, the last three performed with the painting face down to assure that there were no wrinkles in the PCap.

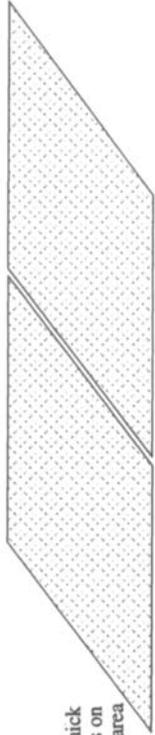
This technique and the choice of lining materials proved appropriate and the results were satisfactory. A sufficiently strong bond was achieved, the canvas was structurally reinforced yet it retained its original flexibility, and the light color palette of the mural was not changed, no adhesive penetration through the canvas occurred. The painting, thus reinforced, the losses filled and repainted was rolled onto a sonotube for long term storage.

**Problem of presentation**

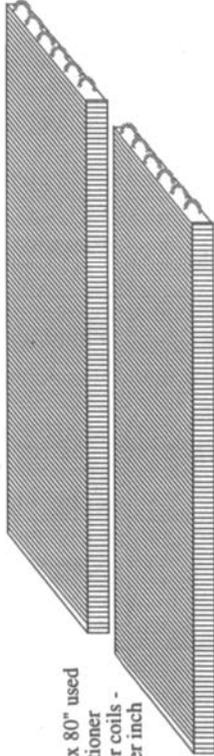
When the painting is installed in its future location, a new method of attachment to the wall will be required. Ideally the painting should not have any visible framing device installed in order to retain its "mural like" appearance. At the same time it would be judicious not to adhere the lined canvas directly to the wall in view of past damages and its structural fragility.

**MATERIALS LIST**

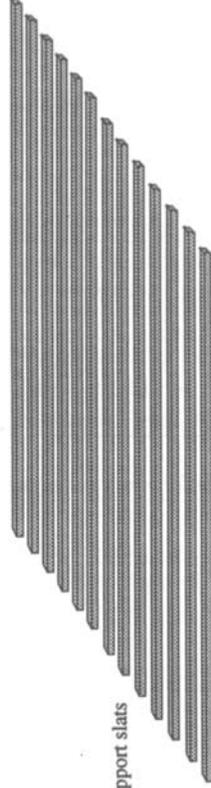
MATERIAL	MANUFACTURER	SUPPLIER
2 PERFORATED ALUMINUM PANELS, 40" x 60" each. 1/16" thick aluminum with staggered 3/32" diameter holes on 5/32" centers which results in a 33% open area.		Accurate Alloys, Inc. Irwindale, CA 1-800-842-2222
2 COMMERCIAL AIR CONDITIONING CONDENSER COILS, 30" x 80" x 3 1/2" each. 3/8" copper tubes arranged in three rows; 14 fins per inch. Copper headers with 3/4" MPT supply & return connections.		Metal Recycling Facility
2 IMMERSION HEATERS, 4.5kW each combined to create a circulation heater.		Electrical Supplies
CIRCULATING PUMP provides 2 gallons of water per minute.		Plumbing Accessories
RADIATOR for cooling. A used car radiator.		Metal Recycling Facility
COPPER TUBING; 3/4" SOLENOIDS, etc.		Plumbing Accessories
TEMPERATURE SENSORS, RELAYS, THERMOCOUPLES, TEMPERATURE CONTROLLER, CONTACTOR, etc.		Electrical Supplies
SURFACE THERMOMETERS COOLING FAN. A used, 18" Diameter Fan.	Pacific Transducer Corp.	TRIESS Scientific
PCAP 70-260. A plain weave polyester monofilament fabric, 126" wide.	TETCO	TALAS
BEVA® 371.	Conservator's Products Company	
BURKE SONOTUBE. A 12" diameter x 14' long tube for long term storage.		Building Supplies



Two 40" x 60" perforated aluminum plates - 1/16" thick with staggered 3/32" holes on 5/32" centers - 33% open area

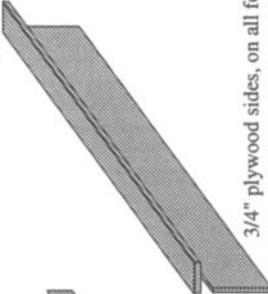


Two 30" x 80" used air conditioner condenser coils - 14 fins per inch

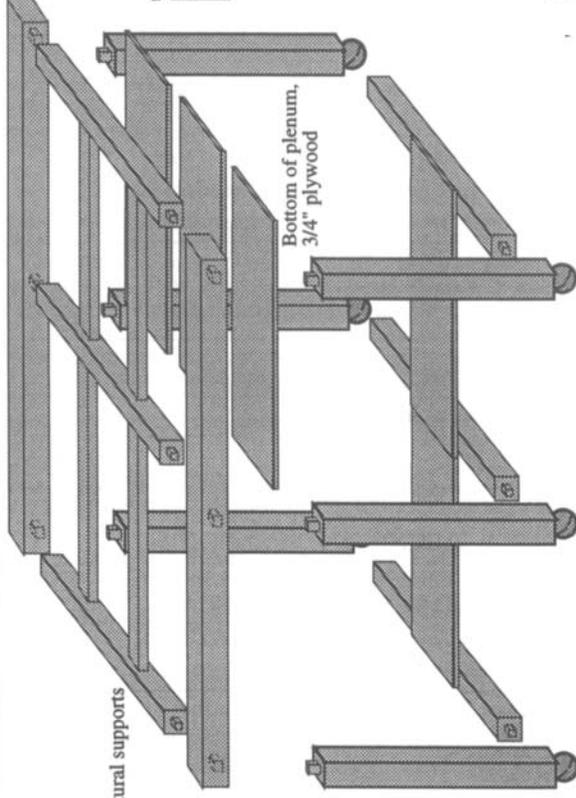


1x1 support slats

1x4 fir edging, on all four sides



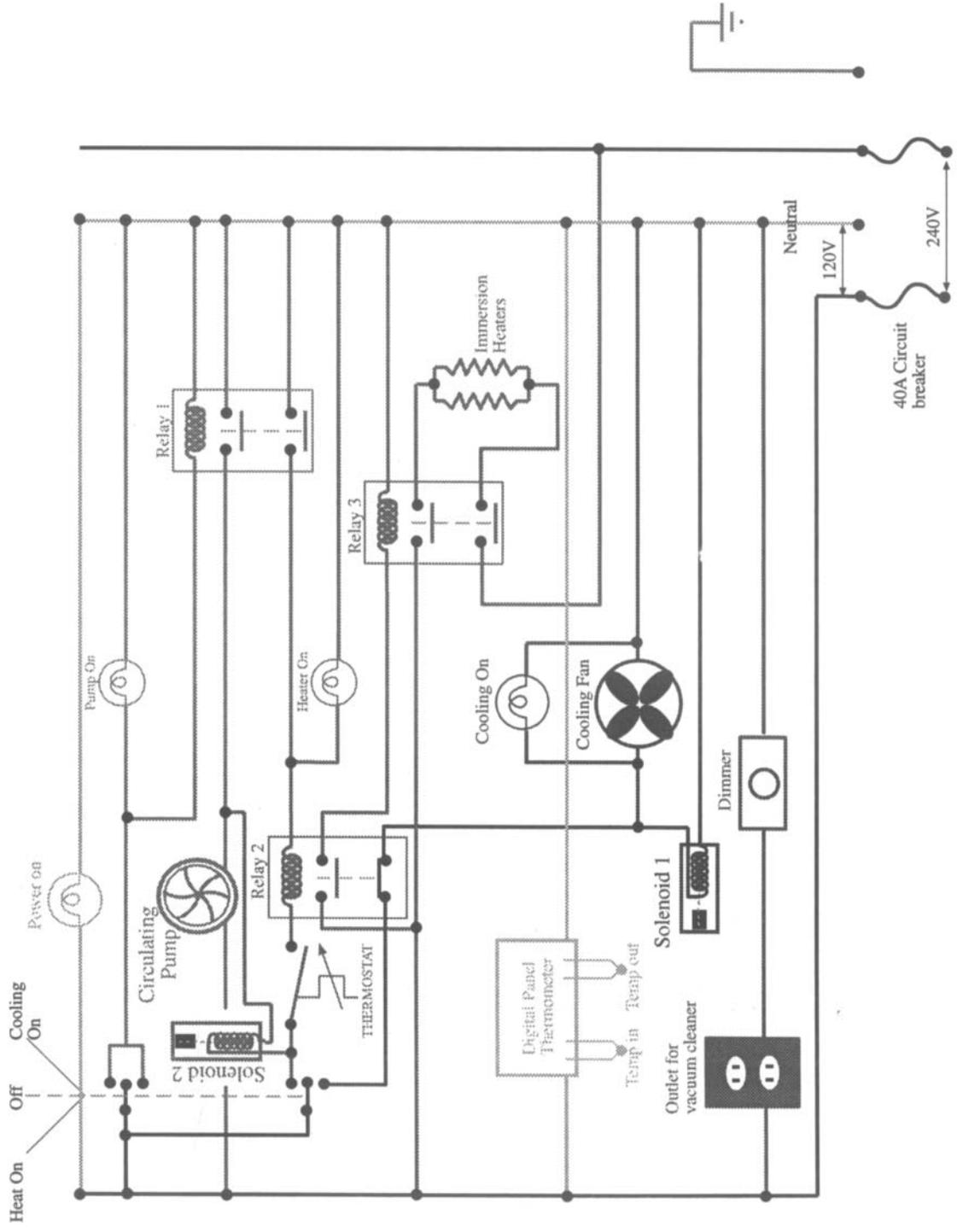
3/4" plywood sides, on all four edges



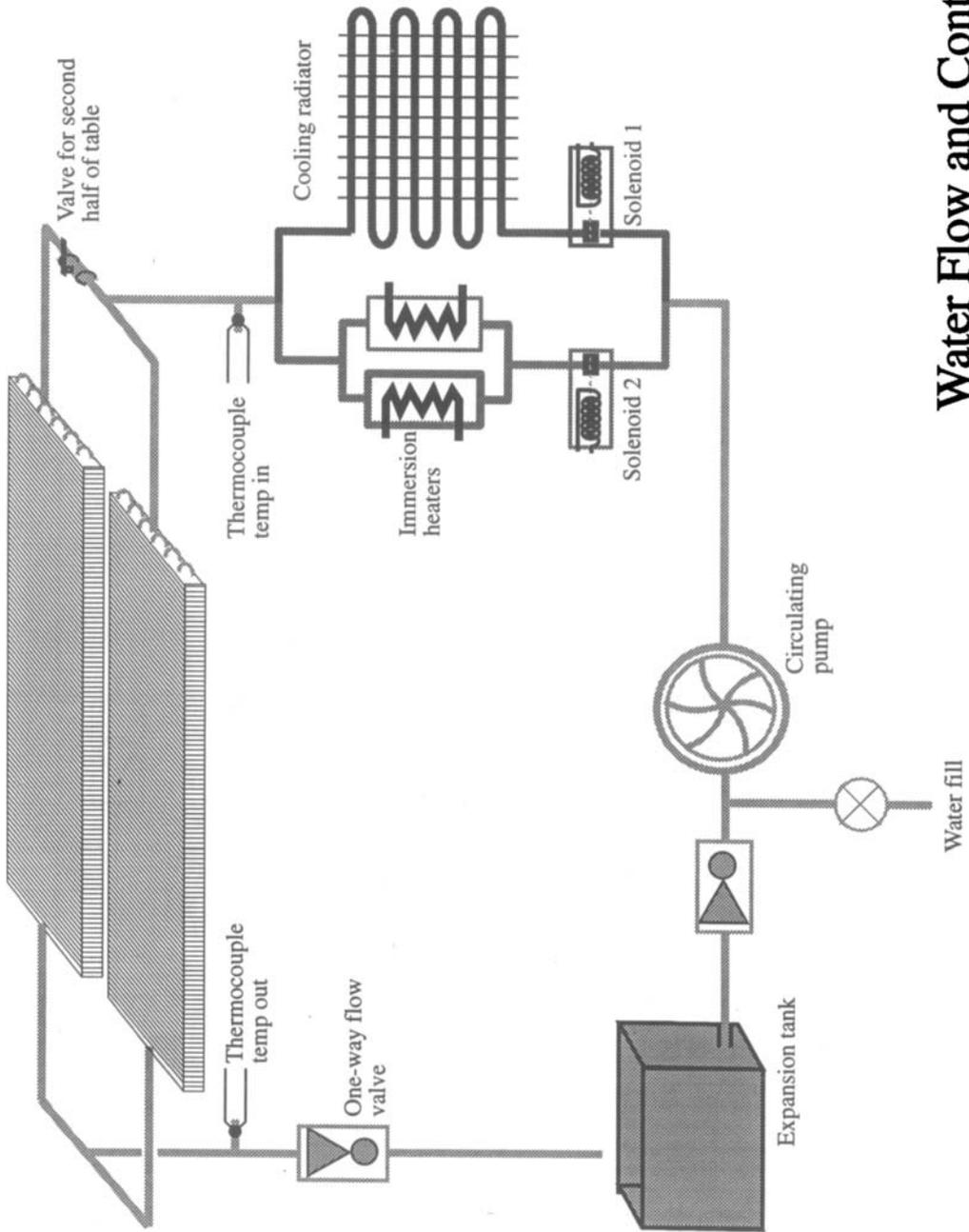
4x4 structural supports

Bottom of plenum, 3/4" plywood

## Suction Table Plans



**Electrical Schematic**



## Water Flow and Control

## LOSS COMPENSATION IN SPAIN: CRITERIA FOR PAINTINGS AND POLYCHROMED SCULPTURE

Alina Remba, Paintings Conservator\*  
Pilar Sedano Espín, Chief Conservator\*  
Rocío Bruquetas Galán, Paintings Conservator\*\*

### Historical Introduction

Compensation and retouching of artworks has been practiced in Spain since early times. Traditionally, it was understood either as a “repair” of the object with exclusively utilitarian goals or for bringing the image up to date for religious or purely aesthetic reasons.

Since the end of the Middle Ages we find many written documents referring to painters’ commissions for repairing or “dressing” paintings and sculptures. The main intentions were to accommodate the prevailing stylistic trends, or change the iconography of a figure. A classic example in the history of Spanish restoration is the *Retablo Mayor* by Pedro Berruguete in the church of Santa Eulalia de Paredes de Nava in Palencia. Originally, the background was gilded in a typical Gothic style. This was substituted in the middle of the 16<sup>th</sup> century to conform to the Renaissance taste for oil painted landscapes (see figures 1 & 2). A case of change in iconography is found in the Retable of the Convent of San Pablo in Toledo, painted in the 15<sup>th</sup> century. Here the figure of the donor, a Hieronymian friar, is transformed into Saint Paula. This change probably took place in the 16<sup>th</sup> century when the female order of St. Jerome was founded in Toledo.

Images were also modified for reasons of decorum. To this respect, the Council of Trent, convened in 1546 by Pope Paul IV, was to become a key event in the decision to remodel numerous Spanish paintings and retables. King Charles V, loyal to the church, favored a systematic revision of the images and harshly condemned the “excess” into which several religious representations had fallen<sup>1</sup>.

The reign of Philip II, from 1556 to 1598, supposed an inevitably busy restoration period due to the intensive artistic activity promoted by this monarch, a great art-lover and discerning collector. One of the duties of the various painters who worked for him was to repair deteriorated paintings. Here the criteria were always based on the personal interest and taste of the king, who would select the specific areas to be retouched and overpainted. The following are indications Philip II made in 1596 about the changes that had to be carried out on Federico Zuccaro’s High Altarpiece at the Basilica of the Monastery of El Escorial:

*Saint Jerome, located in the inner part of the retable, should be redone, all of him should be well worked; and the woman that is by the other panel door should be removed. The angels, the children and the Christ from the inner part should remain. Where the woman is, something else should be placed - whatever the priest wants.*

*A mantle should be placed on the head of Our Lady of the Assumption and another more beautiful face should be made.*

*He should redo the face on the Christ of the Resurrection. The one he has painted is not right because it is not pleasing<sup>2</sup>.*

Sometimes it was the monarch’s special sense of decorum which prevailed. It is well-known that in the painting by Vecellio Titian, Philip II ordered Saint Margaret’s left thigh to be covered, because he considered it immodest<sup>3</sup>. On other occasions, however, he would show great sensitivity for the original value of the artworks and would recommend retouching them as little as possible. In a note to his secretary, Pedro de Hoyo in July 1566, he wrote about the *Descent from the Cross* by Roger van der Weyden:

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\* Museo Nacional Centro de Arte Reina Sofía, Santa Isabel, 52, 28012 Madrid, Spain

\*\* Instituto del Patrimonio Histórico Español, El Greco, 4, Ciudad Universitaria, 28040 Madrid, Spain

*The summer being over and given that the chapel will no longer be open, the Mute [Navarrete el Mudo] should beautify the colors that have fallen off the painting, in the garments and the background. But neither Our Lady's gesture nor her headdress should be touched nor anything that is not a garment nor the background as I indicate today*<sup>4</sup>.

Art restoration, inside as well as outside the court, was in the hands of professional painters until the 17<sup>th</sup> century. During the 18<sup>th</sup> century, it would gradually acquire more autonomy as an independent occupation. The disastrous fire of the *Alcázar* of Madrid in 1734 considerably affected the picture art collection of the royal residence. With the aim of repairing the damaged works, several painters of the court were hired as “restorers” and, at this point, art restoration became an independent activity. At that time, the restorers were developing a greater sense of respect for the artwork in its original conception; nevertheless, they frequently carried out arbitrary retouchings, and changes of formats. An example of these practices is *Las Hilanderas* by Diego Rodríguez de Silva y Velázquez, which was enlarged during its restoration.

By the end of the 18<sup>th</sup> century, the need to stop these abuses was felt by many art lovers. Among them was Francisco de Goya y Lucientes, who harshly criticized sundry restoration work done by his contemporaries. On January 2nd, 1801 Goya wrote to Pedro Cevallos, Director of the Royal Academy of Fine Arts in Madrid:

*...Your excellency, I am unable to speak highly of the disharmony which the comparison of the retouched parts with the ones that were not caused me, because in the former the sparkle and the strength of the brushstroke, the mastery of the delicate and wise touches conserved in the latter have disappeared and are entirely destroyed: with my natural frankness, encouraged by feeling, I did not conceal how bad it appeared to me. Afterwards they showed me other paintings and all of them were equally deteriorated and corrupted in the eyes of the teachers and of the truly intelligent, the more paintings are touched with the excuse of conserving them, the more they are destroyed, and even if the artists themselves could resuscitate, now they could not retouch their paintings perfectly owing to the dingy tonality of the colors given by time, which is something that also paints...*<sup>5</sup>

then, on July 28, 1801 he complained again

*...my opinion is based on what time makes us see in retouched paintings, and time is not as destructive as the repairers, and time points out every day more where they interfere: I am not saying that some of the works should not be lined and repaired, but only the tears, without extending the brushwork and by those who know and respect them...*<sup>6</sup>

In the 19<sup>th</sup> century the restorer's profession became linked to public institutions such as the fine arts academies and museums. It is in this century when we find the first publications on art conservation and restoration techniques. One of the most important is *Arte de la Restauración* by Vicente Poleró y Toledo which dates from 1853. Poleró y Toledo provided a clear description on how to retouch paintings. He recommended the use of pigments and mastic resin as retouching materials<sup>7</sup> and condemned oil-based paints for their pertinacious resistance when they had to be removed, and their pitiful discord once dried<sup>8</sup>.

At the turn of the 20<sup>th</sup> century, the profile of the restorer started to be defined in Spain, with the introduction of posts at the Prado and the Archaeological museums. In addition, the new international awareness over cultural property began to emerge in the 1930s. This culminated in Spain in 1933 with the law of Historical Patrimony. With the start of the Civil War in 1936, all efforts were curtailed. This was specially deplorable if we consider the vast amount of artistic works which were damaged. Shortly after the war, politics dictated the course of treatment. The criteria followed were mainly the recovery of the original appearance of the art works, by making mimetic retouchings and erasing every possible vestige of the effects of the war. This situation continued well into the first two decades of the Francoist government, due to the isolation of the country from the rest of the world<sup>9</sup>.

1961 marked the beginning of the modern age of restoration and conservation in Spain, with the opening of the Instituto Central de Restauración y Conservación de Obras y Objetos de Arte (ICROA) in Madrid - now the Instituto del Patrimonio Histórico Español (IPHE)<sup>10</sup>. This national center was initially based on guidelines from the Institut

Royal du Patrimoine Artistique in Brussels. Later, a group of conservators from the Institute trained in Italy and brought techniques borrowed from the Istituto Centrale del Restauro in Rome. One of the Institute's missions was to bring together different ideas and methodology which were extremely diverse in origin.

With the advent of democracy in 1977 and the creation of a quasi-federal system in Spain, cultural policies were implemented by the regional governments, and new regional centers and schools of conservation were created in various autonomous communities. These centers became economically independent from Madrid and organized their own programs, promoting a diversification of opinions.

## Survey

The main aim of this paper was to obtain an accurate representation of the current loss compensation and retouching criteria used in paintings and polychromed sculpture by means of the results of a survey of opinion. Questionnaires were sent to conservators from leading public and private institutions, museums and universities. The questionnaire contained twenty questions and its purpose was to assess the factors -whether historical, political, economical or aesthetic- that influence the reasons for the application of criteria, and to determine whether a consensus of principles and methodologies involved in loss compensation and retouching exists, as well as defining the major tendencies and patterns. The responses amounted to 33 out of 52 questionnaires sent. For the purpose of this paper we will only discuss five questions which we feel will be of interest to the reader.

### 1. Do you think there is consensus in the treatment of lacunae in Spain?

Most Spanish conservators could not agree on whether there was a unified criterion employed in the treatment of lacunae. 22 conservators believe that there was no unity while the other 10 acknowledged that there was one and 1 did not know. From this, and the answer to more specific, follow-up questions, we conclude that there is only unanimity at the theoretical level. Teaching of loss compensation in schools and universities is quite uniform throughout Spain, and based on the philosophy of Cesare Brandi, who stressed the importance of reconciling the aesthetic and historical factors when compensating for loss.

In terms of reversibility and materials employed, there was almost unanimous agreement. The materials commonly used as filling materials are the traditional rabbit skin glue and calcium sulfate, although others are used as well (see graph 1). Watercolors, maireri paints and pigments and resin are principal retouching materials (see graph 2). However, in practical terms, there is disagreement on the selection of specific reintegration techniques. In addition, the finish of the lacunae may vary from restorer to restorer, so that a discernible technique becomes almost illusionistic in some hands, while others may stress the presence of the loss.

### 2. Which factors play a role when compensating for loss within your institution?

Within the museum and university environment, aesthetic and historical factors play an important role. Regional centers are in charge of on-site works, and usually take care of church-owned property. For these, as expressed by the centers from Andalucía, Castellón, Madrid and the Basque Country, the important factors are first aesthetic, then religious and, to a lesser extent, historical. Economic and political factors do not seem to play an important role for the respondents (see graph 3).

The priority of factors varies considerably from the secular institutions to the religious ones. In Spain, two thirds of Cultural Property is Ecclesiastical Patrimony. For the Catholic church the main factor is religious, as stated on a recent interview with Monsignor Jose María Cabrera, Delegate of Cultural Patrimony from the Archdiocese of Toledo. For Monsignor Cabrera, economic factors also come into play. The Archdiocese of Toledo is one of the richest in religious patrimony in Spain. They have approximately 2500 buildings in which hundreds of retables and thousands of paintings and images are found. When conserving their retables, they like to carry out full treatments right up to the compensation level, something that is hard to achieve on a limited budget. They receive \$1.25 million annually from the state and regional governments. However, of this 1.25 million, 90% goes to real estate property and only the remaining 10% to movable property. Conservation for the latter is possible due to fundraising in the parishes and by means of agreements with conservation schools<sup>11</sup>

### 3. Do you think that the choice of retouching technique depends on the period when the artwork was made?

Half the conservators asked agreed that the choice of retouching technique does depend on the period of the artwork. This half includes educators and conservators who work with traditional art, except for three who work with contemporary art. The other half believed that the same retouching techniques can be applied to a medieval painting, as to a Baroque or a 20th-century painting. They further note that the period is not as important as the technique used by the artist. Of these 16, 8 work with 20th-century art. This means that 8 out of 11 conservators working with contemporary art would use discernible techniques when compensating. To illustrate this point better, we would like to discuss the following case study:

The painting *Paisaje de Cadaqués* painted by Salvador Dalí in 1923, became part of the Reina Sofia Museum Collection in 1990 after Dalí's death. The painting had been heavily restored, and more than one third was unsympathetically overpainted (see figure 3). Before starting the treatment, the studio contacted Dalí's close friend, the leading art historian Mr. Santos Torroella, who uncovered the origins of the damages, and revealed why the painting had been so heavily restored in the past. He explained that in the 1960s, Dalí became infuriated when reading his father's will, and, in his rage, intentionally stepped on the painting. Mr. Santos also pointed out that Dalí never finished an area in the bottom right quadrant of the work.

Figure 4 illustrates the condition of the painting after the damage, as it appeared in 1980 in the catalog of the exhibition *La Vie Publique de Salvador Dalí* at the Georges Pompidou Museum<sup>12</sup>. Mr. Santos further explained that the horizontal dark marks were drips of paint which fell on the painting while it was in storage. Most likely the painting underwent some unfortunate restoration in 1982, since it appeared with the paint losses, drip marks and unfinished areas covered in a 1983 catalogue<sup>13</sup>.

Conservators at the Reina Sofia Museum, together with Mr. Santos, decided to eliminate the 1982 retouchings because in addition to covering the original paint, they did not closely follow the artwork's intent. *Paisaje de Cadaqués* was not a finished painting and the retouchings were attempting to do exactly this. The placing of the curve on the road was an arbitrary choice, since there was not enough information to justify its placement from this or any other point of perspective.

Conservators were faced with choosing the correct method of treating the lacunae of this severely damaged, unfinished painting. The principle that was followed for compensation was to accept the work as an unfinished painting with irreversible damage and mutilations. The conservators then decided to use the *tratteggio* and to a lesser extent pointillism techniques for the retouching<sup>14</sup>. On the unfinished areas the goal was to improve the reading of the artwork by creating areas of flat colors based on the tonality and color of the paint residues without drawing or inscribing a precise contour because of the lack of information (see figure 5). Although the *tratteggio* technique is normally used for traditional paintings, it was found to be the best choice for this painting: a technique that is visible to the naked eye close up, but allows for a better reading of the artwork from a distance.

### 4. Do you believe that the complete reconstruction of lacunae is justified in objects of devotion?

First, we would like to clarify that not all religious artworks are considered objects of devotion. By objects of devotion we mean images that are venerated, and prayed to. A retable, although found inside a church, has traditionally had a didactic purpose and therefore, is not considered an object of devotion. In Spain, objects of devotion are for the most part treated differently from other artworks. For example, some images of Christ can only be restored by men and special skirts are made so that they do not remain undressed in the conservation studio while undergoing treatment; similarly certain female saints have to be treated by women only.

The main factors that influence the restoration of objects of devotion are religious and aesthetic. These objects have religious value but their aesthetic quality may not be as important. When compensating for loss in objects of devotion, 24 of the responses advocated the complete reconstruction of the losses, although 10 of these 24 said that the extent of treatment would depend on the aesthetic value of the image, and many advocated reconstruction that was visible to the naked eye.

Very often, objects of devotion are over-restored, but sometimes the amount of work is controlled by the possible response of the faithful. An example of this is the 14<sup>th</sup> century *Virgen del Pilar* in the Cathedral of Zaragoza, one of the most venerated images of Spain (see figure 6). When the image showed some flaking, Conservator Ana Carrassón of the IPHE in Madrid was contacted and she, together with the cathedral chapter, came to the following conclusions: the image is known and venerated as a black virgin by the faithful. This characteristic appearance is the result of the accumulation of surface dirt, candle soot and discolored varnishes. This appearance is the personality of the image and fundamental for her recognition by the faithful, and although aesthetically she would benefit from cleaning, the removal of the black surface -exposing its original gilded surface- would erase every trace of her primary function as an object of devotion. The fact that the sacred image had been touched by a conservator could cause apprehension among the faithful and, thus, it was decided not to fill or retouch it. A preventive care approach was followed where the image only received local consolidation. The image was examined, X-rayed and treated at dawn behind closed doors to avoid TV, radio, and newspaper coverage.

5. How do you approach the compensation of a large loss when you have enough information from the artwork itself, when you have information from an outside source, or when you do not have enough information?

28 answered that a large loss would be retouched when there is enough information from the artwork itself. 21 would carry out a reconstruction when the information is provided from an additional source such as a preparatory drawing, sketch, copy of the artwork, etc. 15 would color-compensate the loss when there is no information at all. Those who oppose any kind of compensation in the three cases based their judgment on ethical values and preferred to follow a purist approach, leaving the bare support exposed.

When compensating large losses, Spanish conservators prefer the retouching technique to be discernible from the original technique. When there is enough information within the artwork, 24 out of 28 conservators would retouch using discernible techniques, and when the information comes from an outside source 20 out of 21 conservators would make the reconstruction visible. The ones that are opposed in both cases use invisible and illusionistic techniques. When there is not enough information, neither inside or outside the artwork, all 15 thought that compensation should be discernible (see graph 4).

When the source of information is more reliable, there is a clear tendency to use techniques that allow a formal and chromatic retouching. *Tratteggio* and pointillism appear to be the most prevalent techniques, yet others are also used, such as chromatic selection, chromatic abstraction, neutral tints, and visible glazes. On the other hand, when there is no information at all, or information of a less reliable kind, conservators do not aim to reconstruct the lacunae, but to integrate the whole, through of making the loss recede. The technique normally used is the neutral tint, where the tone most frequently found within the artwork is selected. Neutral tones can also be obtained through the techniques mentioned before. However these techniques, except for chromatic abstraction are seldom used in this case (see graph 5).

When conserving monumental works several compensation techniques may be applied within a single artwork. Such was the case of the *Retablo de San Eutropio de El Espinar* built in the second half of the 16<sup>th</sup> century (see figure 7) and located in the parish church of a small town near Segovia. As is common in the retables of this period, it is composed of a solid structure occupying the whole apse, on which the architectonic elements, the paintings, and the polychromed sculptures are distributed according to an iconographic scheme. The architecture and sculptures were executed by Francisco Giralte and the royal painter Alonso Sánchez Coello was in charge of the paintings, gilding, and polychromy. Still conserved is a distemper grisaille painting which hangs from the ceiling to conceal the images of the retable during Holy Week (see figure 8).

The conservation problems which this retable presented were the usual ones: discolored varnishes, numerous paint and gilding losses, instability of certain pieces, accumulation of dust, etc. The monumentality of the works -some of the images are life size- and the fact that they are still in the same surroundings for which they were originally made, were key factors in determining which guidelines should be followed when compensating the losses. On the one hand, the specific character of the retable -which was conceived as a unity- conditions the conservator not to treat each image or painting as isolated cases, but as elements belonging to a whole. On the other hand, the goal for which

they were created and the context of the works have remained unaltered for the last four hundred years. One should not erase the footprints that have impressed the passage of time on the work nor on its environment.

Then, when compensating for loss, the conservators aimed to follow a criterion that was coherent with these premises and that would reconcile the respect for the “advanced age” of the retable and the need to reconstruct certain losses that were hampering the vision of the whole. There were several categories of losses: a large amount of losses would reveal the bare wood through a thick layer of filth; others would exhibit the red bole that was left and some exposed residues of the white ground. Also, there were support and paint losses from the distemper painting. A solution, always focused on avoiding excessive intervention, was found for each of the cases described above.

For the first type of losses, the bare wood was respected; once cleaned and consolidated it would harmonize with the whole. The same occurred with the color of the bole which was respected since it blended perfectly with the gilding. Leaving the bare materials as a background -bole or wood- was the only truly neutral approach, since psychologically they would be accepted for what they were, a logical alteration in a work that is 400 years old, but whose own tonality makes them optically withdraw from the general chromatism. This is not the same with the losses in which the white ground was conserved because this color produces the opposite effect. It imposes itself like a mark on the whole, making its reading more difficult. It was thus decided to retouch the white ground with the *tratteggio* system. The same occurred with the case of the distemper painting. The size and location of the losses allowed for an easy reintegration. Once the insets were attached, they were retouched with the *tratteggio* system.

### **Conclusions**

As deduced from the survey, there appears to be a consensus of criteria at a theoretical level, but less agreement in practice, with different methods being used as far as selecting retouching techniques is concerned. Thus, some conservators would restrict usage of discernible techniques on artworks from certain periods, while others would implement them casually if the technique of manufacture allowed it. Illusionistic techniques in addition to a variety of discernible techniques may be implemented in the treatment of large losses, although discernible techniques are more likely to be employed. On most occasions, loss compensation is defined by museum values which are primarily aesthetic and historical. For conservators working outside the museum environment, religious and economic factors also come into play, since two thirds of all cultural property in Spain is Church patrimony, with most artworks still being located on-site, many doubling up as objects of devotion.

Because of the vast amount of cultural property and the limited budget available for treatment, Spaniards have recently begun to stress the importance of preventive care methods. For them loss compensation does not seem to be the most important step during treatment. Since retouching is reversible, it can be easily applied or removed and, most important, is understood as mutable in response to the prevailing conservation trends.

### **Acknowledgments**

The authors wish to thank all the conservators in Spain who kindly answered the survey for their insight. Our gratitude especially goes to Ana Carrassón and Juan Antonio Sánchez Pérez for sharing their treatments with us. Also, we would like to express our appreciation to the staff of the Conservation Department at the Reina Sofia Museum for their support throughout this project and also to Jennifer Beach and José Loren. Alina Remba would also like to acknowledge the Samuel H. Kress Foundation for its continuous support during her two years of advanced studies in Spain.

## Endnotes

<sup>1</sup> Ana M.<sup>a</sup> Macarrón Miguel, *Historia de la Conservación y la Restauración*. Madrid: Editorial Tecnos S.A., 1995, p. 64.

<sup>2</sup> J. Zarco Cuevas, *Los Pintores Españoles en San Lorenzo el Real de El Escorial, 1566-1613*. Madrid: Instituto de Valencia de Don Juan, 1931, pp. 108-109.

<sup>3</sup> Macarrón, *op. cit.*, p. 68.

<sup>4</sup> Autographic note of Philip II to his secretary Pedro de Hoyo dated July 1566. Zarco, *op. cit.*, p. 30.

<sup>5</sup> Letters of Francisco de Goya to Pedro Cevallos, Director of the Real Academia de Bellas Artes. Archivo de la Real Academia de Bellas Artes de San Fernando, Madrid. Published in J. Gállego, "Una carta inédita sobre la restauración de pinturas", *Boletín de la Real Academia de San Fernando*, 1993, nº 76, pp.171-178.

<sup>6</sup>*ibid.*

<sup>7</sup> Vicente Poleró y Toledo, *Arte de la Restauración*. Madrid: M. A. Gil, 1853, p. 66.

<sup>8</sup> *ibid.*, p. XI.

<sup>9</sup> Alfredo J. Morales, *Patrimonio Histórico-Artístico*. Spain: Historia 16, 1966, pp. 99-100.

<sup>10</sup> The Instituto Central de Restauración y Conservación de Obras y Objetos de Arte (ICROA) changed to Instituto de Conservación y Restauración de Bienes Culturales (ICRBC) in 1985 and then again to Instituto del Patrimonio Histórico Español (IPHE) in 1996.

<sup>11</sup> Personal interview between the authors and Monsignor Jose María Cabrera, March 1996.

<sup>12</sup> Abadie et al., *La Vie Publique de Salvador Dalí*. Paris: Centre Georges Pompidou, Musée National d'Art Moderne, 1980, p.11.

<sup>13</sup> Catalog of Ferrara, 1983, p. 108.

<sup>14</sup> The pointillism technique was used to cover residues of the horizontal drip marks. The *tratteggio* technique was carried out with Winsor and Newton Watercolors and the pointillism technique with Maimeri Restoration Colors.



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



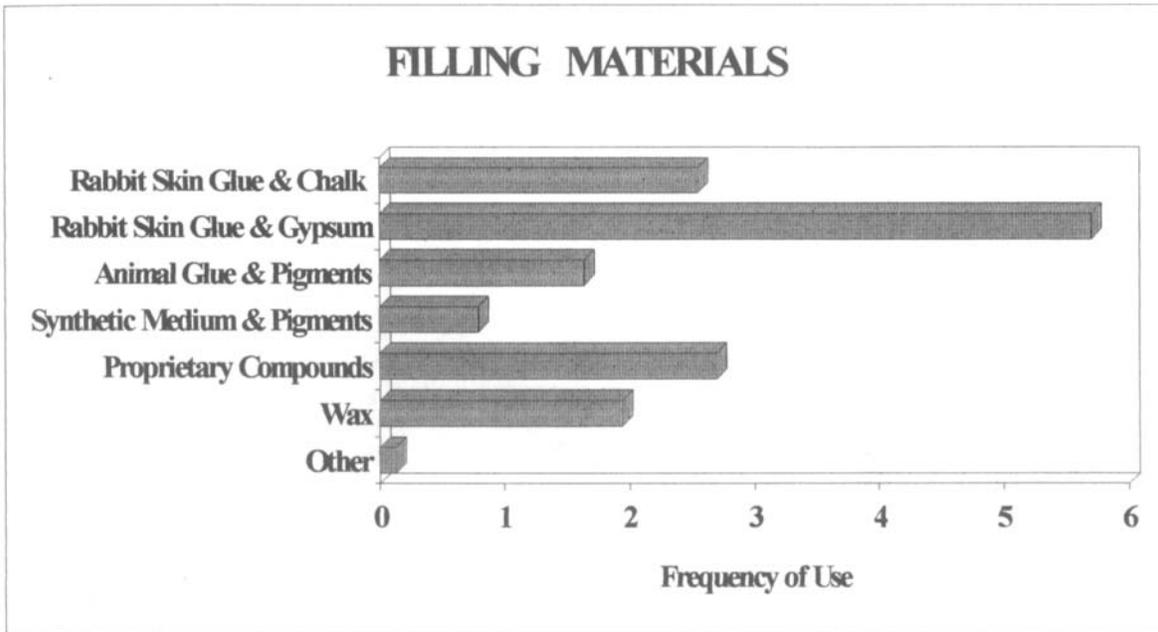
Figure 7



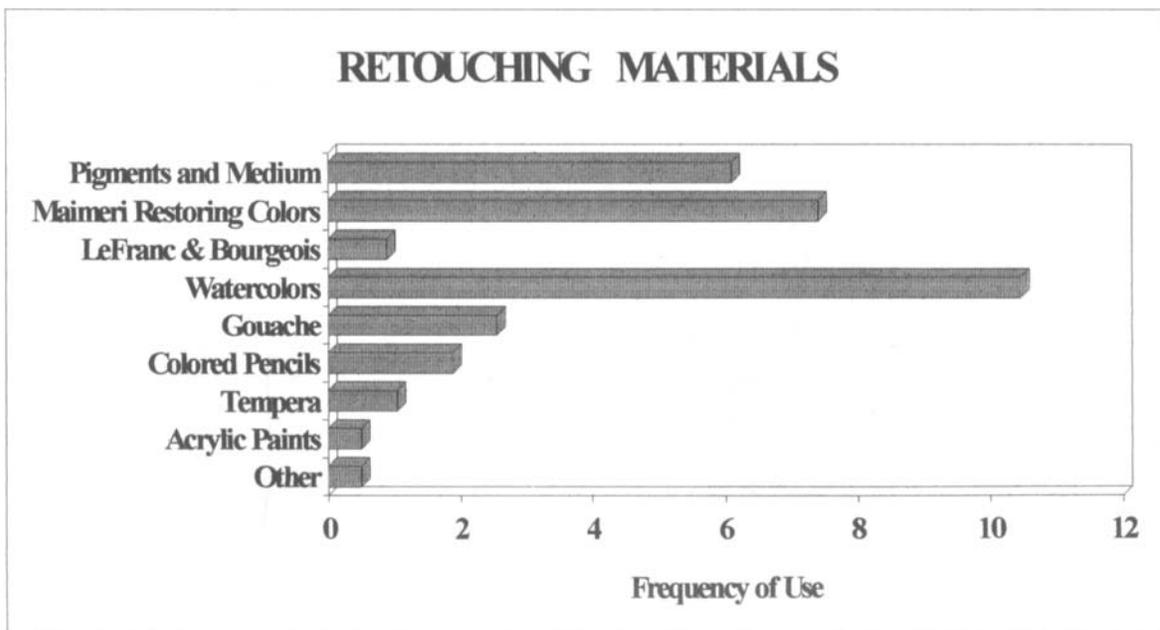
Figure 8



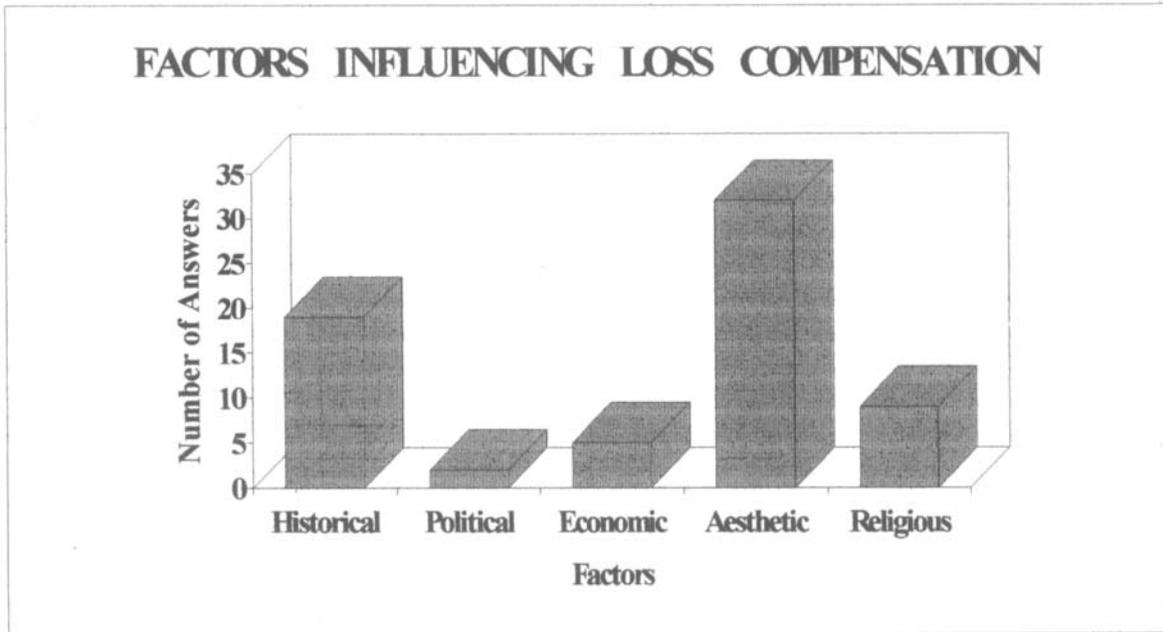
**GRAPH 1**



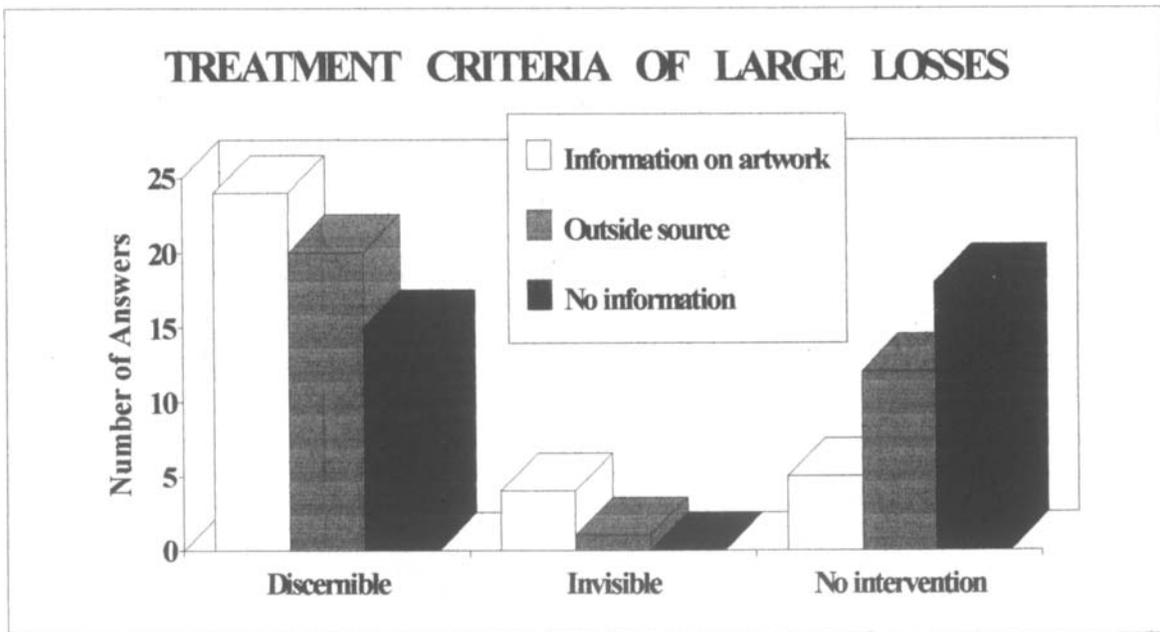
**GRAPH 2**



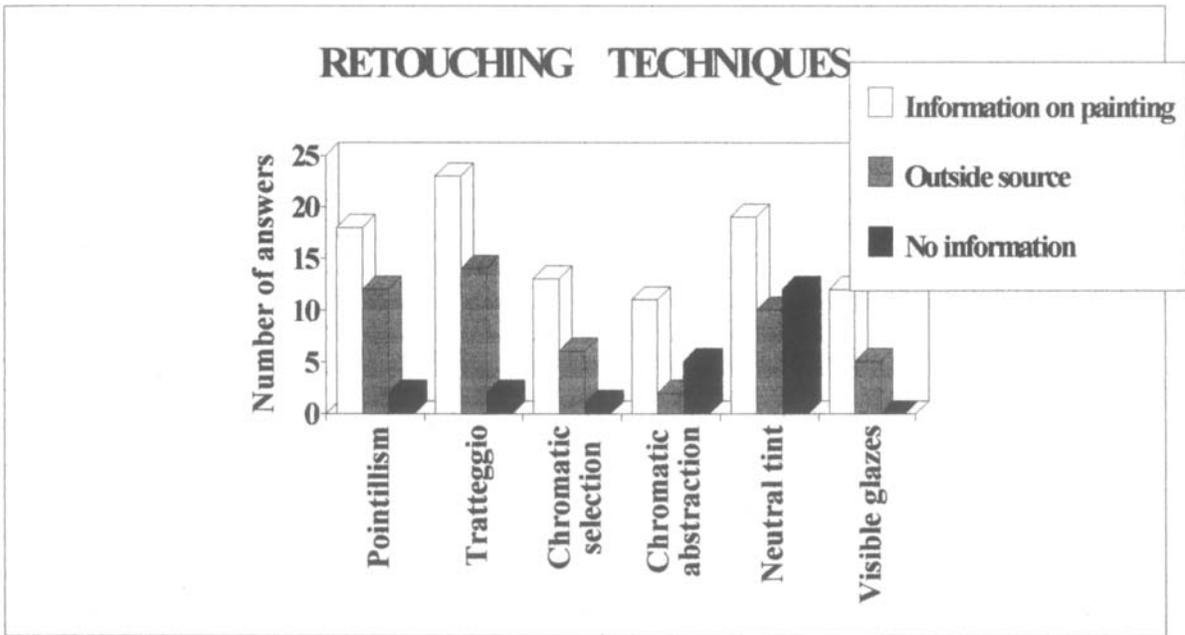
**GRAPH 3**



**GRAPH 4**



**GRAPH 5**



A CASE STUDY OF ORAZIO GENTILESCHI'S *MADONNA AND CHILD*:  
A Victim of Revolution

Elisabeth Mention, Associate Conservator

In December 1989, troops attempting to overthrow the Romanian Dictator Nicolae Ceaucescu fired into the National Palace in Bucharest. In the crossfire that resulted, the National Museum of Art sustained serious damage : thirty works of art were completely destroyed and over a hundred others were damaged. In addition, the museum's conservation laboratories were engulfed in flames.

The international museum community responded by offering aid in various forms. The Getty Museum was one of several museums that undertook the conservation of damaged paintings. Four paintings came to the Getty studio; the most important of these, and sadly, the most severely damaged was the *Madonna and Child*, a painting attributed to the 17th century Italian painter Orazio Gentileschi.

The painting had suffered a tremendous loss when shrapnel forced the vertical stretcher bar from behind through the front of the canvas, resulting in a total destruction of lining canvas, original canvas and paint layers. In addition, this loss incorporated a large and important part of the composition. (Figure 1)

The National Museum of Art and the Getty collaborated in deciding to what extent the painting should be restored. The result was the decision to completely recreate the entire lost area. This was based on the importance of the picture to the Romanian collection and the existence of photo documentation which could be used in recreating the pictorial elements.

The restoration necessitated replacement of the canvas layers and the recreation of ground and paint layers as well as the missing compositional elements.

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Elisabeth Mention, Associate Conservator of Paintings,  
J. Paul Getty Museum, Los Angeles, California.

In keeping with the theme of this years conference, “Compensation for Loss,” details of the cleaning procedures are not described, rather the focus is placed on the reconstruction of the lacuna.

The painting was first cleaned of a heavy deposit of soot from the fire with a simple spit cleaning, and subsequently of a yellowed natural resin varnish using an acetone/mineral spirit solution. The cleaning revealed a painting in remarkably good condition, with the exception of the gaping hole. It had, however, been enlarged on the two sides and the top edge with canvas strips approximately two inches wide. These were removed in order to return the picture to its original dimensions. At the same time, the lining canvas was removed.

In reconstructing the lost portion, care was taken at each step to imitate each layer used in the original painting so that there be structural cohesion and so that the texture of the reconstructed loss would be convincing.

The first step was finding a piece of linen with roughly the same density and thread count as the original. A good match was found among the scraps of old linen which had been saved from old lining removals.

The scrap of linen was washed and stretched to dry. The original painting had a noticeable canvas thread distortion which would need to be mimicked in the reconstruction. In order to duplicate this distortion, the linen scrap was dried on a strainer fashioned from a simple wooden frame on which pegs from a musical instrument were mounted. (Figure 2). The wires on these pegs were attached to metal clips which hold the fabric. By turning the pegs to tighten the wires, the threads were selectively distorted to simulate the irregularities present in the original canvas. Once dry, the fabric was sized with a thin solution of Rhoplex® AC-33 to seal the threads and set the distortions.

The dried linen was placed behind the painting and the outline of the loss was carefully traced onto the fabric. The shape was precisely cut out with fine tipped scissors. To attach the linen patch to the original canvas, threads of Acryloid B-72 were used in the following manner:

1. Beads of Acryloid B-72 were heated on a metal plate on an electric hot plate.
2. When they began to soften, they were drawn out with a small dental pick to form threads.
3. The thread was placed so that it bridged a thread of the original to the corresponding thread on the linen patch.
4. The Acryloid B-72 thread was lightly touched with an electric hot needle which melted the resin and joined the patch thread to the original thread.  
(Figure 3)

In this way the patch was soundly attached to the original canvas, creating a continuous support. On top of the canvas a traditional gesso made of calcium sulfate and rabbit skin glue was applied. A small amount of powdered pigment was added to color the gesso to match the original ground.

Despite the care taken to match the texture of the underlying canvas, the gesso fill lacked the distinctive “dimpled” quality of the rest of the painting. This quality appeared to be the result of the old glue lining.

Various traditional methods of creating the subtle texture on the gesso were tried and were not successful. Andrea Rothe, Paintings Conservator at the Getty, had an example of a finely textured film which he had created with a polyvinyl acetate mixture many years ago in Italy. It was the result of taking a mold of the surface of a painting and then brushing the PVA mixture on it to produce a positive impression of the painting’s surface. The dried film was then attached to the area of loss. Although the recipe had been lost, he did remember the components. Numerous experiments using varying proportions of the ingredients resulted the following recipe, which worked beautifully.

#### PVA Film for Texturing Fills

5g	Dry pigment (to tint gesso to match underpaint)
30 g	Precipitated chalk
25g	PVA emulsion (Vinavil ®NPC, an Italian product was used here)
15g	Water

Mix ingredients together until all lumps disappear. Store in covered container.

A mold of the painting surface was taken using Dow Corning’s Silastic® E RTV silicone rubber. The silicone was poured on an area adjacent to the loss, using an amount that covered an area as large as the loss.

Once cured, the rubber mold was placed, face up on a flat surface, and the PVA mixture was brushed over the entire surface. ( Figure 4) The silicone resisted the liquid, so it was necessary to build up several very thin coats. After brushing on the first coat, a squeegee was used to spread it evenly over the mold. It was a very thin translucent layer which was dried with a hair dryer. Once dry, the subsequent layers were brushed on and dried in the same manner until a layer about the thickness of bond paper was achieved (approximately 5 coats). The squeegee was used only until the silicone mold was evenly coated and no longer resisted the mixture.

Once the layers were completely dried and the desired thickness for the texture film was reached, it separated from the mold. It was removed from the mold and cut into the exact shape of the loss. (Figures 5 and 6)

Before the final texturing was applied, the painting was lined. There was substantial distortion of the original canvas because of the force of the stretcher bar pushing its way through the painting. As a result, there was a need for an interleaf to add additional strength and cohesion to the lining. A spun-bonded polyester of medium thickness was chosen. Hollytex was selected, which is strong and smooth, yet doesn't have the inflexibility or the weave of some interleafs.

The lining method chosen was a BEVA® 371 nap bond for the strength of the adhesive and to avoid impregnation of the original canvas. No adhesive was applied directly to the original. A Belgian linen lining canvas was coated with three coats of a thick solution of BEVA®371. On top of this, the Hollytex interleaf, which was coated on both sides with several thick layers of BEVA® 371 was placed. Finally, the painting was placed on top of the two layers and lined.

Once lined and placed on its new and smaller stretcher, the final texture was applied to the loss. In preparation for the application of the textured film, the gesso fill was scraped down to a level slightly lower than the surrounding canvas. It was well saturated with a dilute Rhoplex® AC 33 solution and the film was placed on it. It was then smoothed with the fingers to remove any air bubbles. It was allowed to dry under weight for 12 hours. Tiny gaps between the original and the film were filled with the liquid PVA mixture with a small brush. Any overlaps of the film were shaved away with a very sharp scalpel. The procedure resulted in a very convincing and continuous surface, with no textural indication of where the film joined the original. (Figure 7)

The final stage of the restoration involved the inpainting of the losses, which encompassed an area almost 10% of the painting's surface. The photodocumentation available to us consisted of one color reproduction from the Romanian National Museum of Art catalog. A color slide was taken of the reproduction and projected onto the painting on its easel. Using the projected image as a guide, the compositional elements were sketched onto the texture fill with a light colored pencil.

A first layer of inpainting was blocked in using Schmincke gouache. Finely ground and densely opaque, it effectively covered the dark fill with a remarkably similar appearance to the adjoining oil paint. The body of the gouache was used to build up a low impasto where distinct brushstrokes were indicated. The gouache was applied in colors slightly cooler and lighter than the colors which it attempted to match. It was varnished locally and Winsor and Newton Artist's Watercolour was brushed on lightly, which gave the effect of dirt trapped in the interstices of the old paint layers. A final layer of retouching consisted of light glazes of Maimeri Colore a Vernice per Restauro, which produced the final color match and the appearance of aged oil paint. The result was remarkably convincing and, thanks to the pre-damage photo documentation, faithful to Gentileschi's original composition. (Figure 8)

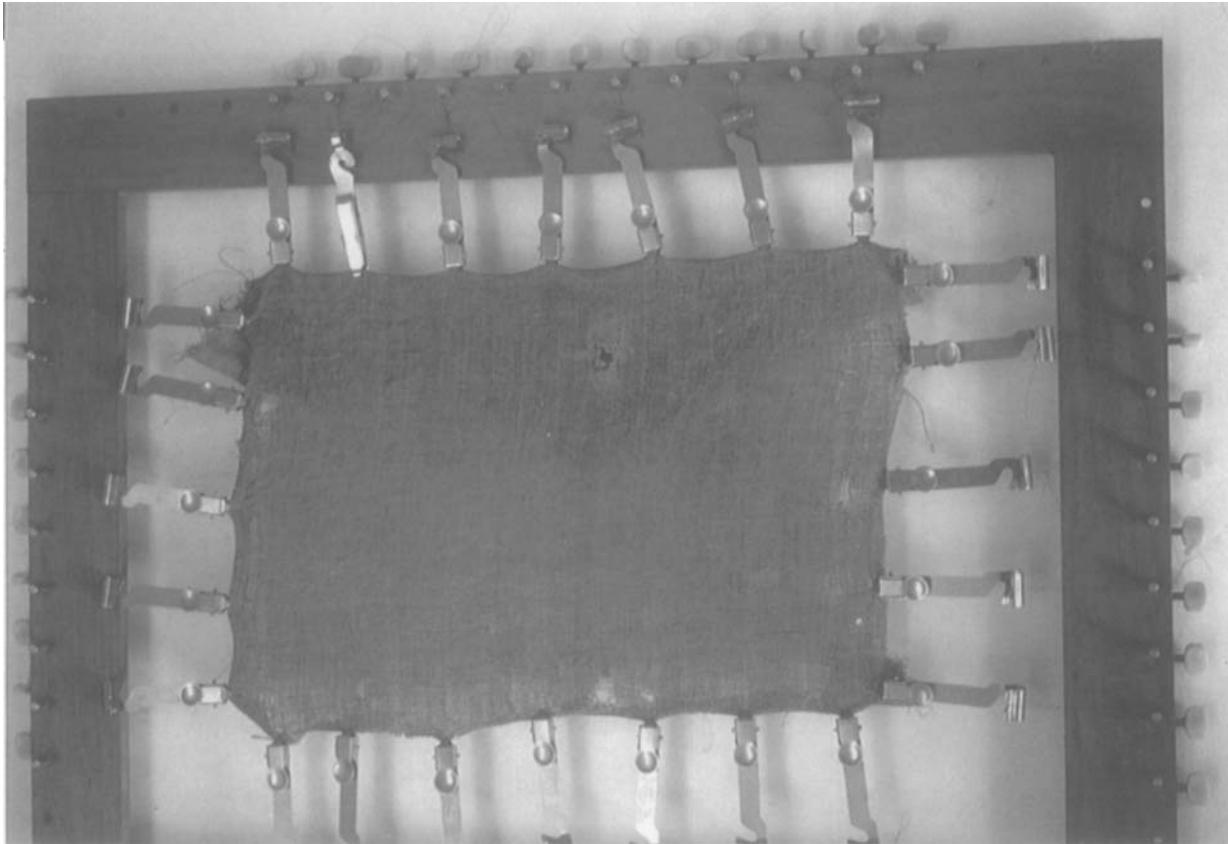
After the restoration, Gentileschi's *Madonna and Child* was displayed in the Getty galleries, where it was the subject of a special exhibition before being returned to Bucharest with the three other damaged paintings.

#### ACKNOWLEDGEMENTS

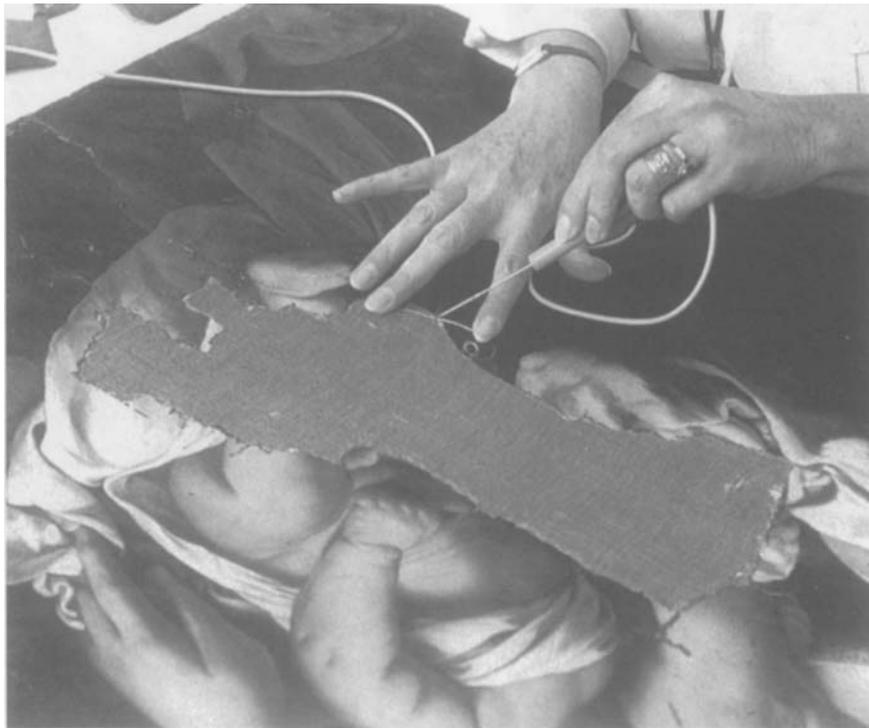
I wish to thank Simona Predescu, the Romanian restorer who collaborated on the project and my colleagues at the Getty Paintings Conservation Studio, particularly Andrea Rothe whose unique contributions made the project a success.



Fig. 1. Orazio Gentileschi's *Madonna and Child*, Museum of Fine Arts, Bucharest Romania. Condition on arrival at the Getty.



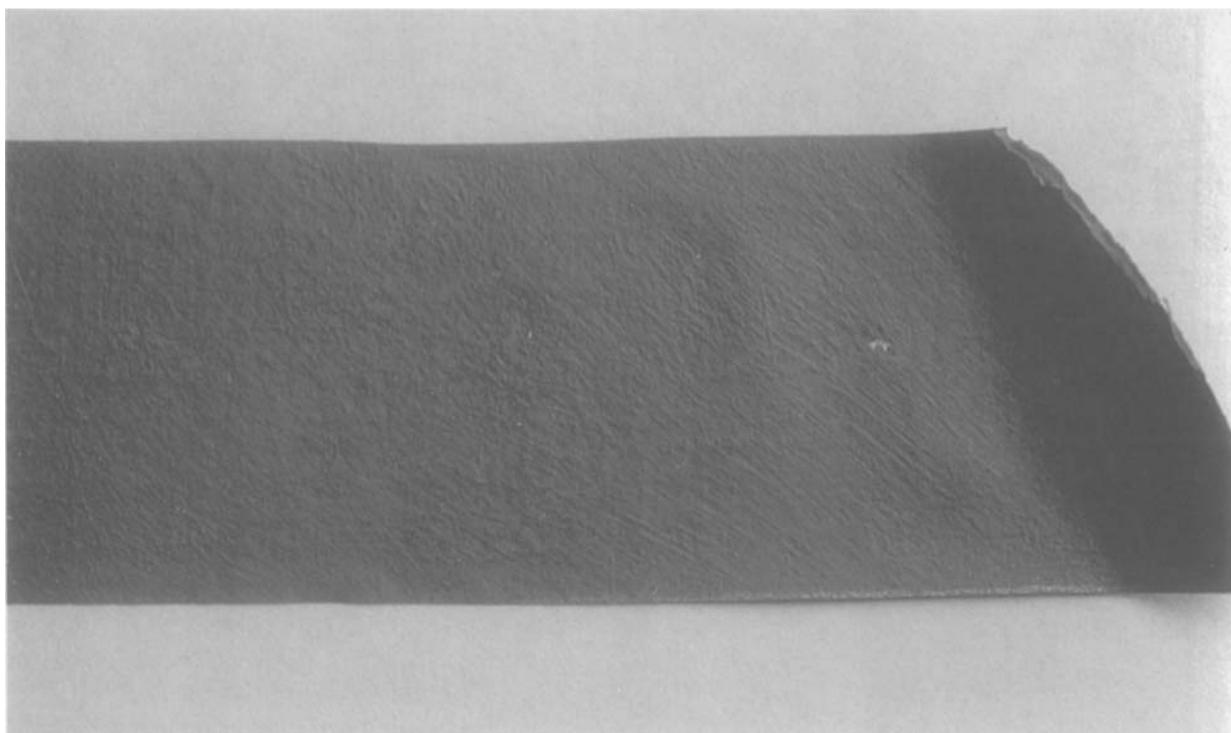
**Fig. 2. Strainer used to stretch old linen.**



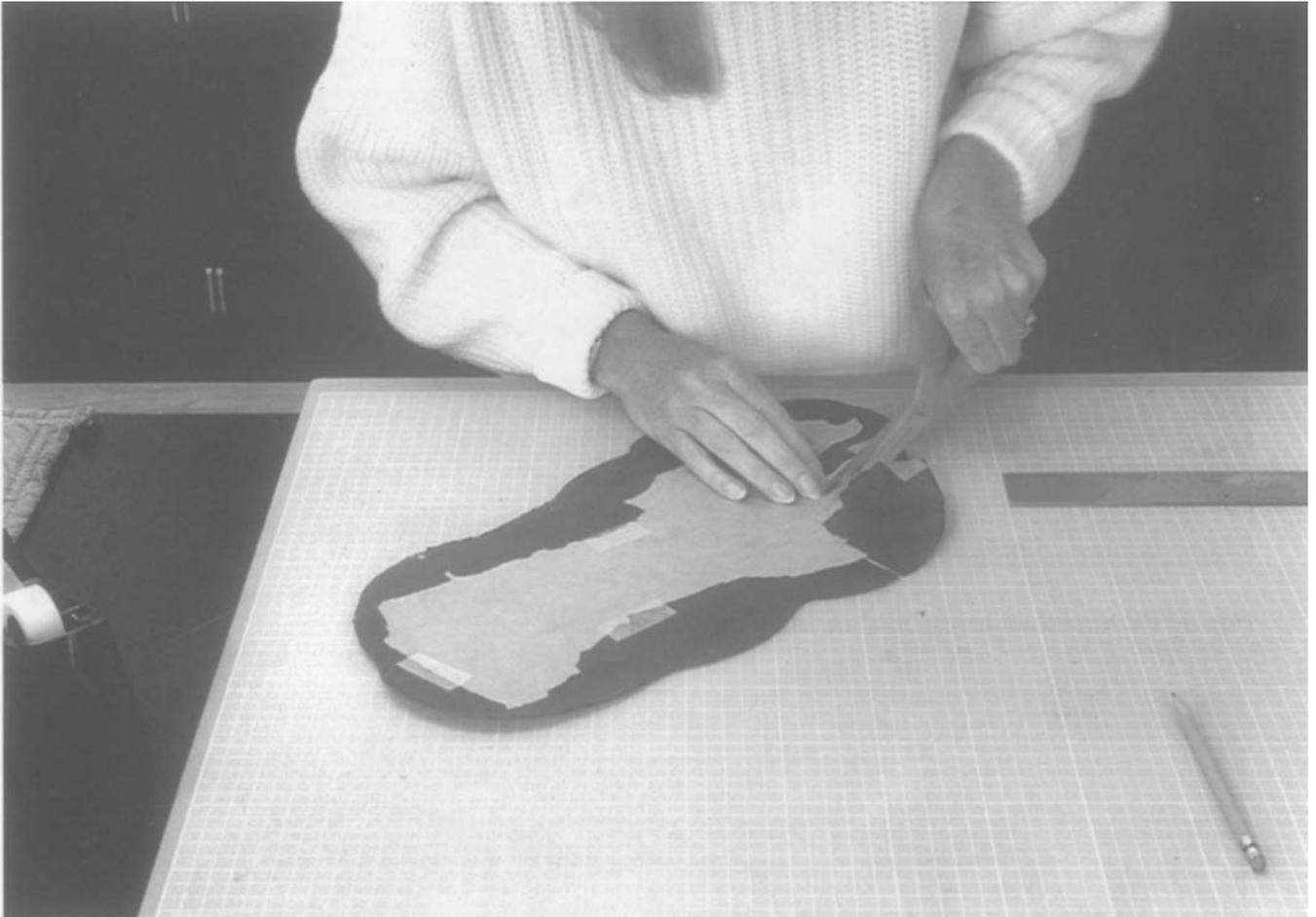
**Fig. 3. Attaching the patch with Acryloid® B-72 thread.**



**Fig. 4. PVA mixture being brushed onto the silicone mold.**



**Fig. 5. Detail of texture film.**



**Fig. 6. Cutting texture film to the shape of the loss.**



**Fig. 7. Detail of loss before inpainting**



Fig. 8. After conservation.

## CONSIDERATIONS IN THE TREATMENT OF JACKSON POLLOCK'S NUMBER 7, 1951

Jay Krueger, Senior Conservator of Modern Paintings

In 1995 painting, paper and textile conservators at the National Gallery of Art began to study Jackson Pollock's 1951 painting Number 7 (figure 1) and plan a treatment which would address the various damages and subsequent restorations which the painting encountered during the first 30 years of its existence. Significant changes in the appearance of the painting could be documented from reports of damage in newspapers and journals from the early 1950's, various exhibition photographs, and from conservation treatment reports and photographs from the 1970's and early 80's. These changes include vandalism; damages relating to theft and subsequent mishandling; severe local stains; and the general uneven discoloration of the canvas and the clear polymer sealer which was applied to the canvas by the artist. Previous restoration efforts which addressed some of these alterations further complicated the treatment of this demanding surface. This paper primarily addresses a large complex stain in the upper left corner of the canvas (figure 2).

Number 7 is one of a series of 28 black enamel paintings executed during the late spring and early fall of 1951 for a fast approaching November exhibition at the Betty Parsons Gallery in New York. In these paintings figurative imagery returns to Pollock's work following the four years during which he developed his seminal field or drip paintings. The black paintings typically are characterized by the clarity and intensity of their linear open design, although some of the canvases exhibit tonally dense passages, dark washes of thinned black or brown paint, and occasional touches of color. These paintings relate very closely to a series of works on paper executed in ink and combinations of ink and paint that Pollock began the year before and continued throughout this period, and you see many of the same marks and visual references that are seen in the paintings. Although smaller in scale, his approach and use of materials is consistent with the paintings on canvas. As with his earlier paintings and drawings, these are stand alone images and not preparatory works for the larger paintings.

The paints favored by Pollock for this body of work were primarily industrial or commercial alkyd enamels such as the Dupont brand Duco®, the Devoe Reynolds brand Dev-o-Lac®, and the Behlen Brothers products Ripolin® and Sapolin®. These paintings have many similarities with the earlier work in that Pollock continued to work with the canvas flat on the floor, guiding the flow of these fluid paints from sticks, dried brushes, and basting syringes...occasionally thinning, blotting and rubbing the paint for different effects. He would unroll several yards from a five foot wide roll of cotton duck and preceded to paint images side by side, cutting and trimming the large canvas into individual works at a later date. At this time he was using remnants and end rolls of canvas from the New York distributor John Boyle, one of several sources for the industrial and commercial materials which the artist favored.

Quoting from Lee Krasner "...typically he would size it with a coat or two of Rivit glue to preserve the canvas and give it a harder surface. Or sometimes, with the black and white paintings, he would size them after they were complete, to seal them." Rivit® glue was a proprietary poly vinyl acetate white glue marketed by Behlen Brothers for innumerable commercial and industrial applications which eventually found its way into many artist's studios during the 1950's and 60's. While the Rivit® diminished the absorbent character of the cotton fabric, resisting the wicking and lateral bleeding of the paint to a great extent, it did not have a readily apparent visual presence in most cases; many of these paintings look like paint on bare canvas until you see them at close range in specular light.

The practice of applying a final layer of the emulsion sealer over the completed picture isn't consistent throughout the series, but this was true for our painting. The painting was completed, signed, coated with the emulsion, and signed again directly over the earlier signature. This feature of the double signature has been observed on several of the black paintings. It may simply be that those paintings which received the final top coat of emulsion sealer had to be resigned to improve contrast relative to the first signature.

The 1951 Parsons Gallery show was a critical and financial disaster for Pollock...a chorus of reviews lamenting the absence of color and loss of the delicate energy found in his earlier work, and the sale of only two small works from the show. Undoubtedly contributing to the disappointment of the exhibition was the vandalism of this painting. An obscenity had been quickly dashed off with a thin line black marker or heavy lead pencil, accounts vary, directly in the center of the canvas. Betty Parsons' account of the incident is as follows..."they came in and cut the canvas and wrote four-letter words on it. I had turned the lights out and gone into my office, not knowing that someone was in the gallery, and found it the next day. It must have been somebody off the street who just got irritated by the work...but protest is better than indifference." This damage was repaired, possibly by Pollock himself, using thinned oil paint which was toned to approximate the color of the unprimed canvas. During our examination with ultraviolet light we could see faint evidence of 2" high block letters, the extent of the oil repaint, and the uneven application of the emulsion sealer (figure 3).

In 1973 the painting was stolen from a private residence in Boston along with two other works by Pollock. It was removed from its stretcher, folded in half then folded once again, and disappeared for nearly two years. An unconfirmed rumor refers to the painting having been buried on Cape Cod for a time, however it isn't clear where the painting was kept during this hiatus. Following an anonymous tip, the police finally recovered the painting in a Newton, Massachusetts motel room in the summer of 1975. The other two paintings were never recovered.

The painting was immediately taken to the Fogg Art Museum where it was successfully treated by conservators using local applications of moisture, steam, and weights to removed the rather severe creases in the canvas. Various erasers were employed to minimize soiling along folds and the edges of the canvas. The painting was restretched, and at this point there was no evidence of a stain in the upper left corner.

The painting was treated again in preparation for the 1982 Pollock exhibition in Paris, this time in an attempt to address the pronounced, uneven discoloration in the canvas. The overall discoloration in the canvas was significantly influenced by the degradation of the emulsion sealer employed by the artist, and the 1981 treatment involved carefully and thoroughly scraping the entire surface of the exposed canvas, working around each of the black lines and drips. Depending upon how much Pollock thinned the emulsion sealer and how it was applied, variations in the tone of the canvas within a single work and from painting to painting can be observed. While completely removed from the surface of the exposed canvas during the course of the 1981 treatment, the surface coating remains intact over the black enamel design. The edge of the remaining coating is indicated by a subtle white halo along the edges of the individual forms. This is evidence of the rising flick of the scalpel blade as pressure is relieved following each repetitive stroke, ever so slightly abrading the top layer of emulsion sealer along the perimeter of the black forms.

The stain in the upper left corner still had not appeared in 1981 as documented by photographs taken during this treatment. Sometime between this treatment and the arrival of the painting at the National Gallery in 1983 the staining incident occurred, and the stain had grown progressively darker ever since.

Because of the disfiguring nature of this damage, our interest in treating this painting focused on the possibility of diminishing the complex series of stains. The damage was characterized by a succession of dark orange-brown tide lines, harsh white over-cleaned areas, and a gradient of discoloration adjacent to the leading edge of the tide line. We don't know what caused the stain or understand the nature of the staining material, but a grayish diagonal stain in the center of the larger stain probably represents the initial stain which was hastily wiped and blotted with water, and the orange rings which radiate away from this point are evidence of successive waves of material which was solubilized and moved during this attempt at cleaning. White areas above and to the left of the initial stain, may indicate the use of hot water during this initial cleaning. The surface of the canvas is particularly degraded in this area, at times approaching the soft clipped pile of velvet, and this collateral damage further limited our treatment options.

In preparation for addressing these damages, the painting was removed from the stretcher and the existing strip lining which was sewn to the original tacking margins was extended by heat sealing bands of a tightly woven polyester fabric to the first strip lining. Following this, the painting was restretched in a work stretcher so that the canvas would rest flat against the table with the image face up, leaving plenty of room to work, in theory to allow us to chase any soluble materials to the edges of the canvas during the cleaning.

Early on in our discussions we made the decision to address the treatment of these damages locally, in a very controlled and limited fashion, rather than attempt any overall cleaning of the painting. While the canvas is unprimed, immeasurably complicating things was the presence of the polyvinyl acetate emulsion sealer in the canvas. This material severely limited the penetration of cleaning solutions, and variations in the concentration and deposition of the emulsion only exacerbated the problem as we worked from area to area. Another concern was that the water and/or solvents required during such a cleaning could easily result in further disruption of this fragile surface. While not literally held together by the remaining emulsion, there were several widely scattered areas of abrasion and clipped fibers which could unravel or fray, further accentuating the occasionally fuzzy appearance of the canvas.

Virtually all of our cleaning involved the use of filtered water, working with variations in temperature, pH, and organic solvents and non-ionic detergent solutions. Different methods of application, with and without suction, which were always followed by thoroughly rinsing the treated areas with filtered water with the suction system running, and controlled drying to minimize the possibility of forming new tide lines. Cleaning proved to be an elusive balance between promising results and frustrating dead ends due in great part to the presence of the polymer sealer and the varying solubility of the stains. Many of the different combinations of materials and methods of application resulted in subtle but noticeable improvements in the appearance of the picture, but each approach or combination of variables invariably reached a point of diminishing returns.

At different points throughout the testing and actual treatment of the picture organic solvents and non-ionic detergent solutions were applied locally along the dark leading edge of the stains thinking that if we could swell or break up the emulsion along this boundary line more of the discoloration could be flushed away. This also met with varying degrees of success.

We returned the canvas to a dry state periodically during our tests and at the close of each session, applying warm air on the reverse of the canvas in order to draw whatever we had solubilized but not completely removed away from the front surface. Assuming that we could never completely dry the canvas at the end of each day, we placed the painting face down, suspended just above the surface of the table, and allowed it to air dry from the reverse. In doing this we felt that the potential for forming new tide lines would be minimized.

Visual compensation for residual staining and over cleaned areas was achieved using a combination of non traditional inpainting materials. A decoction of water soluble materials was used to tone the disfiguring white areas within the larger stain. This decoction is known as "paper dirt" and is obtained by boiling old rag ledger paper until a concentrated brown solution is realized. "Paper dirt" was selected for this application after consulting with paper conservators who occasionally used this material, and it provided a perfect match with the general warm tone of the canvas. Given the good fortune of excellent light control at the National Gallery of Art, a less stable and far less compromising material was able to be considered for part of the compensation.

While this material is not lightfast in uncontrolled conditions, it was felt that the decision to use a non-dye, non-pigment material for this phase of the inpainting was desirable due to the ease with which it can be removed from the canvas relative to other materials. Whatever material was selected had to penetrate and tone the fabric, and not sit on the surface as a discrete layer. We had serious concerns about the feasibility of removing any particulate based pigmenting material, because once in the fabric, particles would become permanently lodged between and among fibers. The resolubility of dyes was also questioned and not seriously pursued, especially given the presence of the porous emulsion sealer.

The ingredient materials in paper dirt are quite close to what you would expect to extract from the canvas itself; bits of cellulose, lignin, small residual amounts of fillers and traces of chlorine from the papermaking process. In all likelihood we could have obtained our decoction from a small piece of the tacking margin had it not been for the contaminating presence of the emulsion sealer.

The gradual build-up of color was achieved using a fine sable brush, and a narrow aperture airbrush. The torn edges of small pieces of blotter were used as masks to control the deposition of material along the edges of the painted

forms. The blotter masks were held 1/4" to 1/2" away from the canvas to minimize the possibility of building up a hard edge as we worked.

Inpainting of the greatly diminished but still apparent tide lines involved the use of pastels which were blended on a piece of sandpaper and applied to the canvas with brushes and a paper stump. These were mixtures of two Rembrandt Royal Talens® soft pastels, stable earth tones which were blended together on the sandpaper. Our decision to use a heavily pigmented material for this phase of the compensation reflects both what had to be covered and how the material was used. Unlike the paper dirt which was used as a penetrating stain to tone the overcleaned areas of canvas, the pastel was applied along the remaining tide lines to lighten these areas, and would reside close to the surface.

After the initial application with the stump, additional blending and removal of excess pastel was achieved with a bristle brush, leaving a surface which wasn't friable or particularly delicate, at least not any more than the surface of the canvas itself. Removal of the pastel is easily accomplished with a slightly moistened swab.

Like many conservation treatments, this one was not without its competing issues and resulting compromises, but all in all we are quite pleased with the end result which ultimately has brought this painting back into balance with other related works by Pollock (figure 4).

I would like to thank my colleagues at the National Gallery of Art who collaborated with me on this treatment, Julia Burke, Head of Textile Conservation, who participated throughout the project; Judy Walsh, Senior Paper Conservator, for her encouragement and insights regarding the use of paper dirt; and Paula Volent, former Leisher Fellow in Painting Conservation, for her work in researching the history of this painting and her invaluable contributions throughout the course of the treatment.

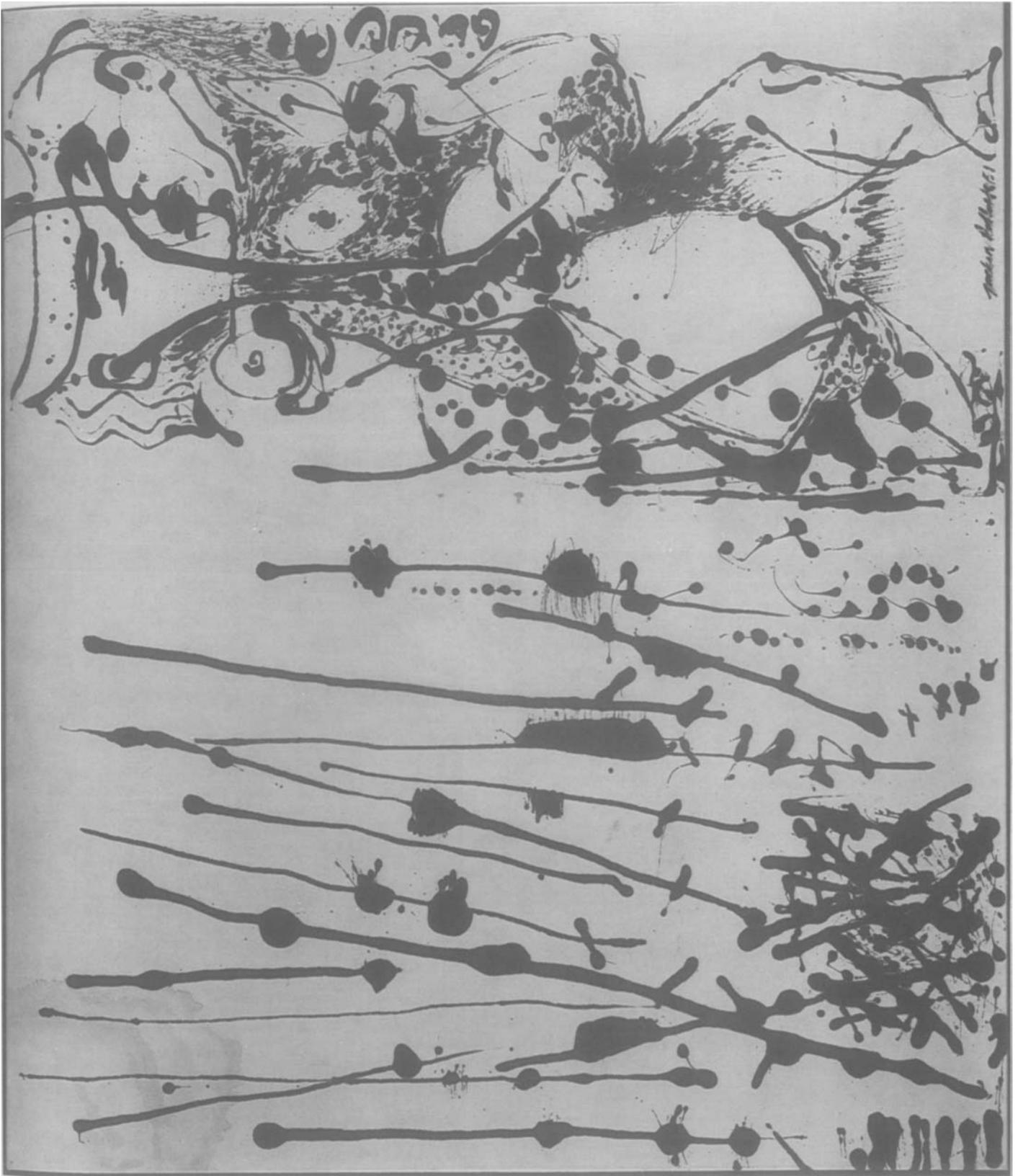


Fig. 1. Number 7, Jackson Pollock, 1951 before treatment.

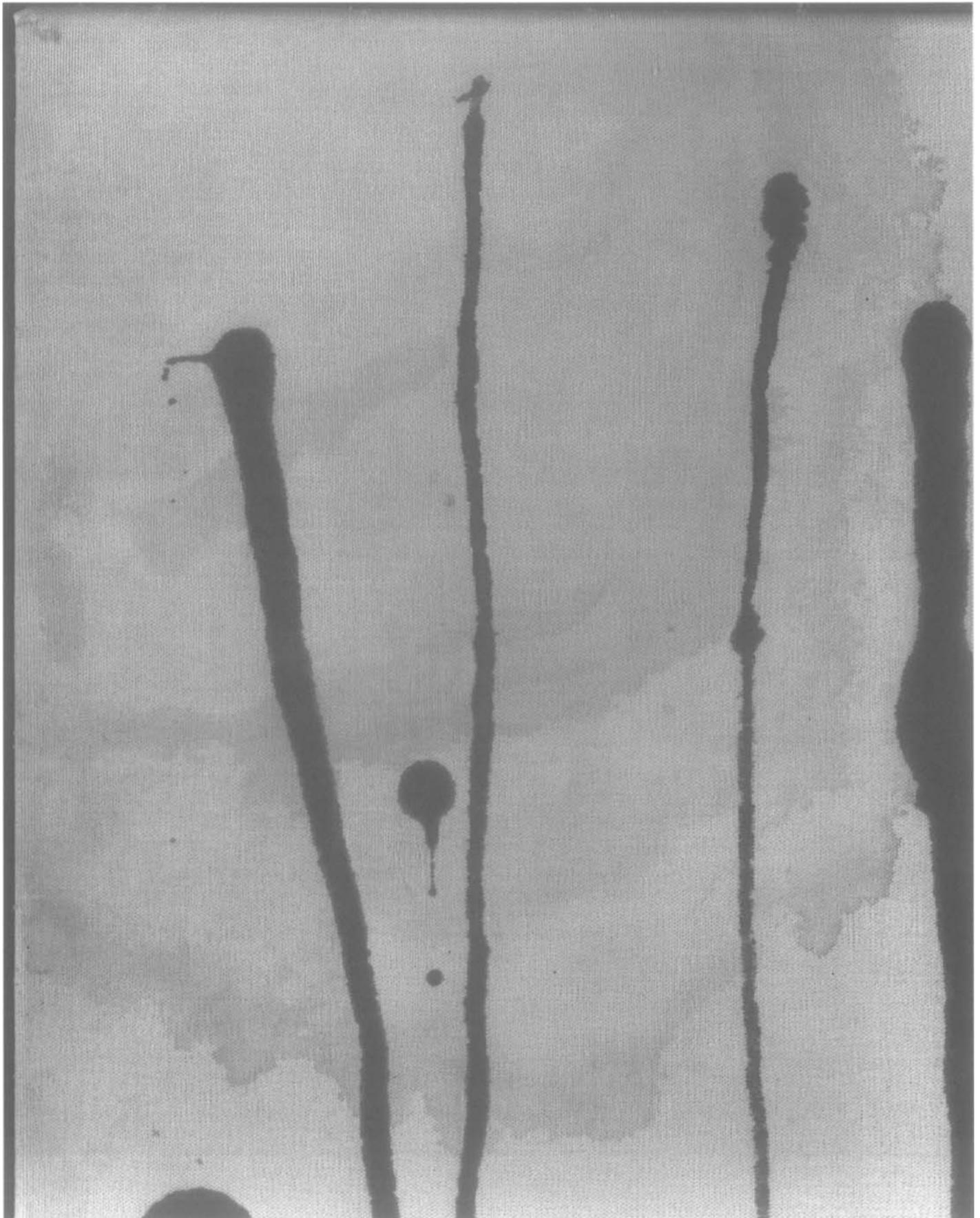


Fig. 2. Number 7, Jackson Pollock, 1951 before treatment detail.

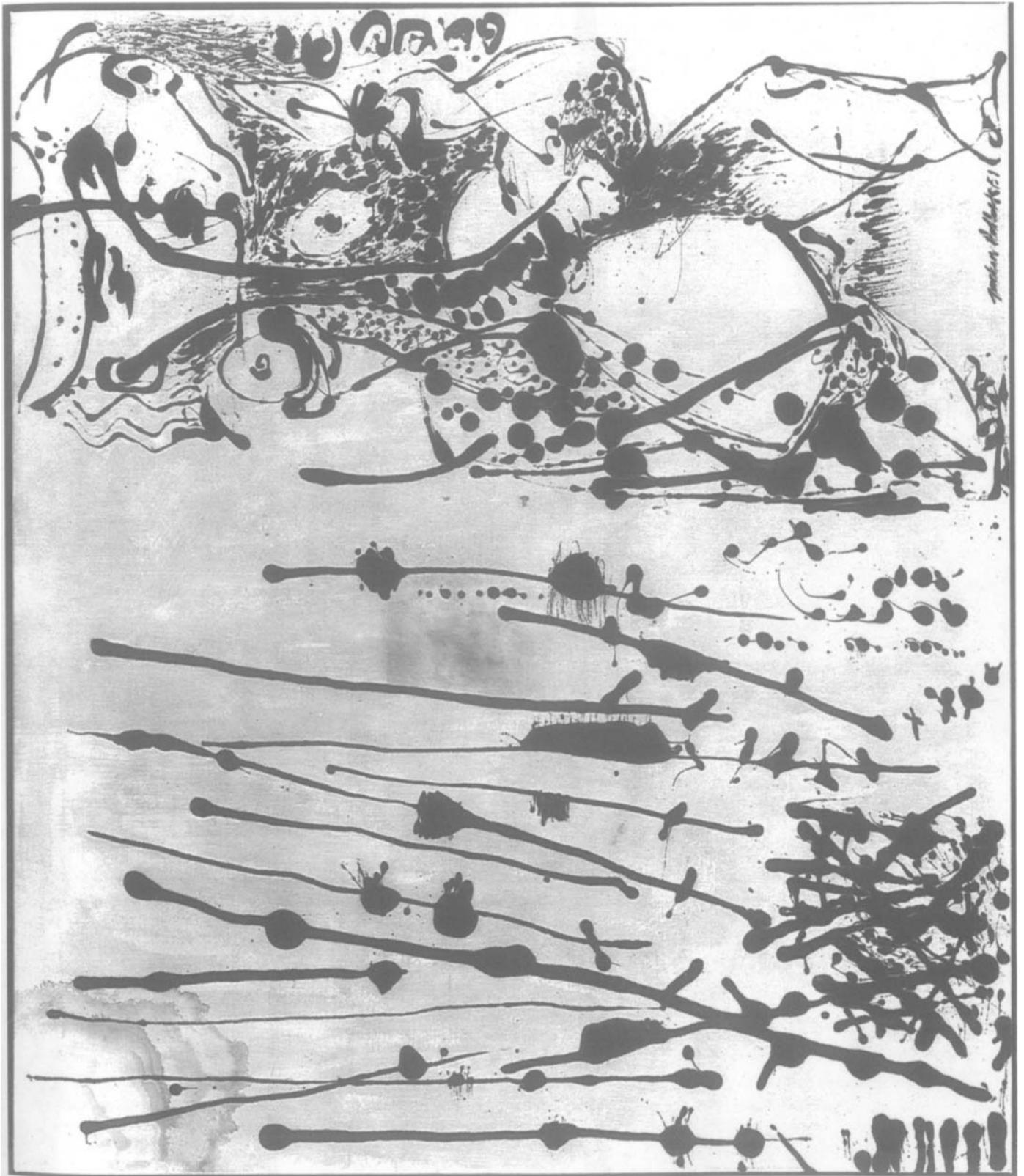


Fig. 3. Number 7, Jackson Pollock, 1951 before treatment, ultraviolet illumination.

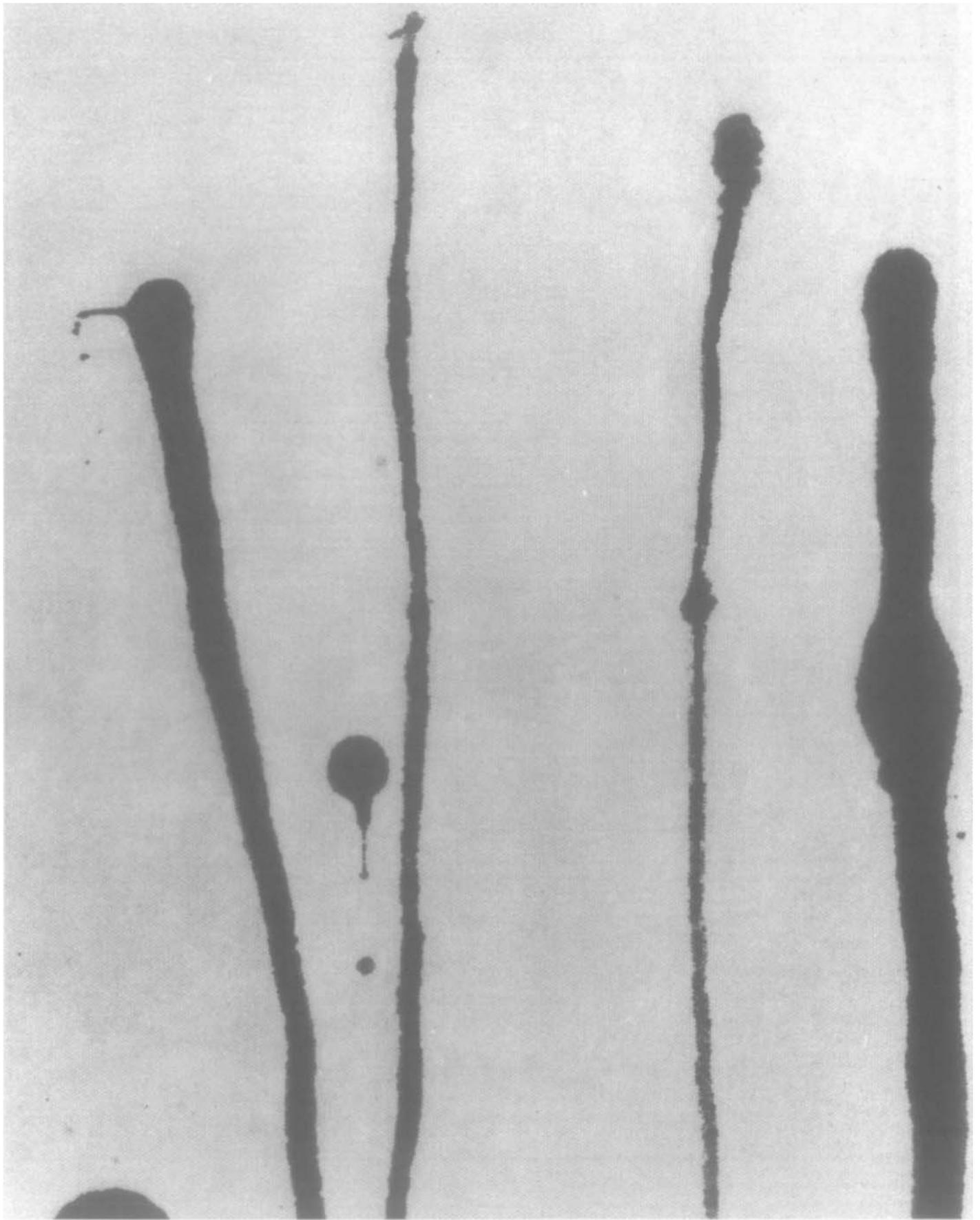


Fig. 4. Number 7, Jackson Pollock, 1951 after treatment detail.

# A LOCAL TREATMENT FOR SETTING DOWN SEVERELY TENTED, WATER-DAMAGED PAINT ON A TRANSFERRED AND LINED PAINTING BY GIAMBATTISTA TIEPOLO

Eric Gordon, Head of Painting Conservation\*  
Karen French, Associate Conservator\*  
Peter Nelsen, Private Conservator\*\*  
Catherine Rogers, Private Conservator\*\*\*

## INTRODUCTION

Setting down severely tented, water damaged paint can be a serious problem. A local treatment involving the use of a Mitka apparatus<sup>1</sup> can safely relax damaged paint and expand the fabric support enough to secure the flakes to the original support without overlap, loss of paint and deformation of picture plane. Additionally, a similar technique using the Mitka apparatus can aid in re-adhering delaminating linings.

## HISTORY OF THE PAINTING

During the blizzard of March 1993, packed snow melted and water seeped through the flashing in the roof of the Walters Art Gallery. Water streamed in rivulets over the front and reverse of the museum's largest painting, a 9' 2" x 16' Tiepolo (Figure 1) causing the original and auxiliary fabric supports to shrink and the paint to tent up precariously. When the painting was examined by conservation, it was discovered that the supports had shrunken and the paint had severely tented in about five distinct bands running vertically down the painting. Additionally, water had pooled under the bottom stretcher bar causing a wider pocket of smaller tents in these areas. In some places, the tenting reached an inch high and two and a half inches wide (Figure 2).

Before the painting arrived at the Walters in 1902, it had been transferred onto muslin and linen. There is a story, perhaps apocryphal, that upon arriving in New York, the painting in its crate fell into New York harbor and floated ashore. Whether or not the account is true, the painting had been transferred before entering the collection and it did seem to have an affinity to water. Once in the museum, in 1938 it was relined. The muslin layer from the transfer was left in place while the auxiliary linen support was removed and replaced with 2 thick layers of animal glue and another strong linen lining support. Soon thereafter, in 1944, the painting was quickly cleaned and inpainted. In short, the painting had been damaged and treated many times before the recent water damage. By the time of the latest damage, overfills were lumpy, generations of generous retouching were disfigured and the varnish had discolored.

Because of the painting's large size and its treatment history which left it in an extremely vulnerable state, a treatment was sought which would set down the cleavage locally without disturbing the lining or removing the painting from its stretcher. Rhona MacBeth from the Boston Museum of Fine Arts, had treated 19th and 20th century, relatively untouched, water-damaged paintings with the Mitka apparatus<sup>2</sup>. Her techniques were incorporated and expanded upon resulting in the following method to set down severely tented, water-damaged paint on a large-scale, poorly conserved, unstable painting.

## EQUIPMENT AND TECHNIQUE FOR SETTING DOWN TENTED PAINT

The goal was to locally relax the lifting paint, expand the underlying fabric layers, re-secure the paint without losing any flakes and without overlap and leave the fabric supports in plane. Specifically to reach

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\*The Walters Art Gallery, 600 N. Charles St., Baltimore, MD 21201

\*\*3167 Lindenwood Lane, Fairfax, VA 22031

\*\*\*P.O. Box 1408, Charleston, SC 29401

this goal, a mini-humidity chamber was created over the tented paint, the support was expanded and the paint was re-attached with sturgeon's glue.

The treatment required the use of the Mitka apparatus or a similar piece of equipment which could produce regulated, localized heat and suction (Figure 3). The equipment basically consists of a flat, perforated, metal platen that is connected through a hose to a vacuum and then to a control panel. With rheostats on the panel, one can heat the platen to a desired temperature and control the amount of suction. The Mitka apparatus allows one to locally apply controlled heat and suction to a specific area. To work under a stretcher bar, a different-sized platen may be interchanged.

Because of the painting's size, it had to be worked on in a vertical position; the Mitka table and those working with it could not reach the center of the painting if the picture were in a horizontal position. Therefore the Mitka's plate was attached to a tripod and positioned behind the painting.

Equipment and materials needed besides the Mitka apparatus were blotting paper, distilled water, mylar, wax, a cotton swab and a hot air gun.

First, all areas of tented paint were clearly delineated with white chalk so that the flaking paint would be avoided during surface cleaning and varnish removal (Figure 4).

Next, the platen from the Mitka apparatus was brought into direct contact with the back of the painting behind the tented paint (Figure 3). Heat was then raised so that on the surface of the painting the temperature reached 100° Fahrenheit. On the Mitka rheostat, the dial was brought up to the maximum power. Temperature strips need to be used to ascertain accurate readings.

A blotter was torn, so that it would have soft edges, just slightly larger than the tented paint surface and dampened with distilled water. The moistened blotter was cupped over the insecure paint and was held in place with Mylar, cut a little larger than the blotter and wax applied with a little heat from the hot air gun (Figure 5). Heat from the Mitka apparatus beneath was kept on for about 1 1/2 hours, depending upon the pigments in the paint being set down. Whites and mixtures with white required slightly more time because of the density of the pigment particles in the paint.

This mini-humidity chamber relaxed the paint, making it more flexible. Simultaneously, the fabric support was becoming looser and more pliable while the adhesives in the transfer and linings were becoming re-activated.

After approximately 1 1/2 hours, the Mylar and wax were removed and the paint was gently tapped to see if it had become malleable.

If the area was ready, an approximately 7 % solution of sturgeon's glue was brushed into the cracks in the paint. Silicone-coated Mylar then was placed over the tent and the paint was quickly laid down with a cotton swab and heat from a hot air gun. This action required speed and concentration, as the paint film hardened rapidly on cooling.

After setting down the paint, the Mylar was removed and sturgeon's glue was brushed again into the cracks. Excess glue was cleared with a cotton swab. The heat from the Mitka apparatus was then turned off and the suction was turned on, so that cool air would pass through the picture and the paint would quickly dry flat. The next day, the discolored varnish was removed with solvents (Figure 6).

This treatment successfully relaxed and set down the tented areas locally without losing paint and without disturbing the overall picture plane. The operation required two people to work very quickly. Speed, teamwork and dexterity were essential. Furthermore, it was very important to carefully test the surface temperature of the painting as the Mitka control panel did not accurately reflect the actual temperature on the picture surface. The dampness of the blotter was also critical; too much water would cause blanching of the paint layer; too little water and the paint would not soften enough and the treatment was ineffective.

## RE-ADHERING DE-LAMINATING LININGS

The Mitka apparatus also re-adhered delaminated layers of the supports. There were scattered air-pockets between the lining and muslin layers of the painting which had been noted in earlier treatment records. To re-adhere these areas, a similar method was used only with the blotters and moisture applied to the reverse.

First, the area behind the delamination was marked in chalk on the back of the canvas. Moisture and a damp blotter then were applied directly to the reverse of the painting within the marked area. The Mitka platen was placed behind the blotter in contact with the back of the painting and the heat was raised to 100° Fahrenheit for 5 minutes. When the area had softened and expanded slightly, indicated by a slight bulging on the front of the canvas, the suction was turned on and the heat turned off. The cool air coming through the front of the painting to the reverse dried the layers while keeping them in plane. In other words, after loosening the muslin and linen and re-activating the adhesive between them, the fabric support layers were brought back in contact and re-adhered by sucking cool air through the Mitka plate. This treatment was carried out throughout the painting and successfully re-adhered all delaminated areas. For further protection and to diminish the possibility of future de-attachment when moving the painting, a camie lining was attached between the reverse of the lining and the stretcher bars.

## CONCLUSION

Both of these treatments using the Mitka apparatus demonstrate the adaptability of the equipment and the advantage of using localized techniques as a conservative approach for structural work.

## ENDNOTES

- 1) Mitka Portable Mini Low-Pressure Suction Apparatus, from Wieslaw Mitka, Kronprinsessegade 58 A, 1306 K, Copenhagen, Denmark.
- 2) G. Hedley, C. Villers, R. Bruce-Gardner, R. Macbeth, "A New Method for Treating Water Damage Flaking," ICOM, 1990.



Fig. 1. Giovanni Battista Tiepolo, *Scipio Africanus Freeing Massiva*, (37.657), oil on fabric, 279.4 x 487.6 cm., The Walters Art Gallery, after water damage, before recent treatment.



Fig. 2. Tiepolo, *Scipio...*, detail of areas of tented paint marked by arrows.



**Fig. 3.** The Mitka apparatus on a triod placed behind the painting.

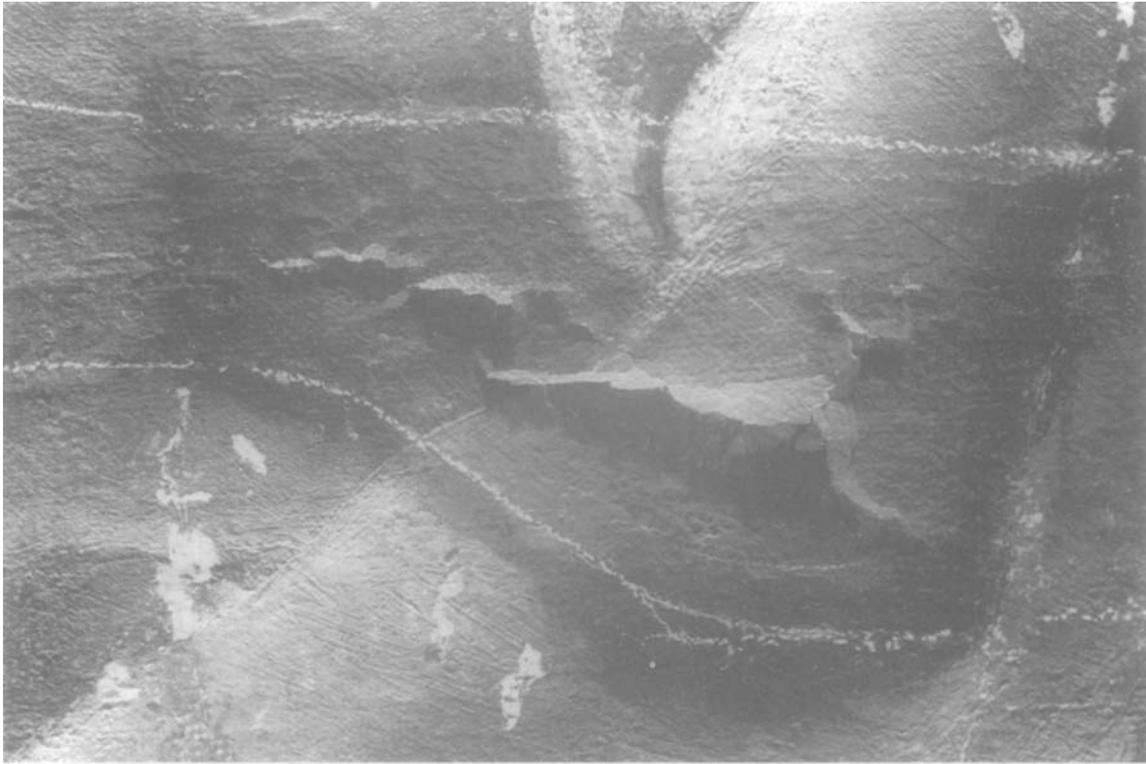


Fig. 4. Tiepolo, *Scipio...*, detail of tented paint, before treatment.



Fig. 5. Tiepolo, *Scipio...*, detail, during treatment, tented paint covered with moist blotter and Mylar®.



**Fig. 6.** Tiepolo, *Scipio...*, detail, tented paint, after setting down tented paint and varnish and overpaint removal.

# ALEXIS JEAN FOURNIER: MURALS AT THE ROYCROFT INN

James Hamm  
Associate Professor Paintings Conservation

## Introduction

Over a seven month period in 1996, the Art Conservation Department at Buffalo State College supervised the treatment of a group of sixteen turn-of-the-century murals painted by Alexis Jean Fournier. The murals played an integral role in the decoration of a small inn built in 1903 to house guests of the Roycrofters, an Arts & Crafts community of artisans located in East Aurora, New York. The project team consisted of conservators in specialties as diverse as fine art on paper, marine archaeology and, of course, mural paintings. Each member contributed by solving treatment problems in a manner that drew from their particular expertise.

Alexis Jean Fournier grew up in Minnesota and Wisconsin during the 1860's and 70's, showed an early proficiency for painting, and traveled to Europe in the 1890's to study in the studios of the French Barbizon painters. Unfortunately, by this time most of the artists associated with Barbizon, such as Millet, Daubigny, or Corot, had recently died. He made pilgrimages to many of their studios and homes anyway, studied with their students, lived with their descendants and later produced a series of twenty paintings described as "Barbizon Homes and Haunts." For awhile, he even maintained his own studio in Paris, but family responsibilities necessitated several trips back and forth between France and Minnesota over a period of years. A prolific artist, he produced over 3,000 easel paintings during his lifetime, plus several murals located in private homes in Chicago, Minneapolis, and later East Aurora. After traveling with an exploring expedition through Colorado and the region of what would become New Mexico, he produced a panoramic mural of Indian Cliff Dwellers for the 1893 Chicago World's Columbia Exposition. Twelve years later, the Roycroft murals became his most ambitious artistic achievement.

The man responsible for Fournier's involvement with the Roycrofters was Elbert Hubbard. He had been a partner in the highly successful Larkin Soap company founded in Buffalo during the 1880's, managing to retire with a small fortune in 1892 at the age of 36. Hubbard established the Roycroft Press in 1895 in East Aurora, a small village outside of Buffalo, after visiting John Ruskin and William Morris in England. He began writing and publishing periodicals such as the *Philistine: A Magazine of Protest*, the *Fra*, and *Little Journeys*, and numerous expensive limited edition handmade books. His direct, often iconoclastic opinions won him an ever enlarging readership.

The Roycroft Community became a flourishing enterprise by 1903, thanks to Hubbard's considerable promotional and advertising skills, requiring the construction of an inn to accommodate the steady stream of visitors and guests. Fournier had recently been invited by Hubbard to take up part-time residence in East Aurora as the official painter of the Roycrofters. The main Salon of the new inn, containing the murals, was conceived and designed by three people in 1905: Hubbard's wife Alice, builder/architect James Cadzow, and Fournier.

The mural paintings comprise a 4' high frieze fitted around the perimeter of three rooms: the main Salon, the Foyer, and the Music room. (figure 1) The overall dimensions of the Salon are 50 feet by 33 feet. Paintings range in width from only 4' up to 25'. Originally, Fournier spent six months producing twenty paintings with a combined area of 800 square feet in his studio one block from the Inn. Sixteen paintings remain today, with an area of 700 square feet, because the four in the Foyer were cut off their stretchers about thirty years ago, for unknown reasons.

Fournier used a medium-heavy weight pre-primed canvas, with a substantial starch and glue sizing, tacked to wooden stretchers. Due to the irregular shape of many of the paintings, some of the joints were screwed tight, thus creating strainers. He painted with commercially prepared oils applied in a lean-to-paste vehicular consistency. His technique was largely *alla prima*, although underpainting and scumble techniques were employed to create twilight atmospheric effects in certain scenes. The quality of these effects is not readily evident today, due to prior restoration repaint still remaining in many areas. A photograph taken within a few years of the installation of the murals clearly shows a specular light playing across the surface of the paintings and the adjacent glossy woodwork. (figure 2) This photograph, in conjunction with the matte condition of the painted surface discovered beneath the trim

moldings, establishes that the paintings were not originally varnished.

The paintings in the salon depict views of Venice, London, Paris, Rome, Greek ruins in Sicily, a Hindu Temple on the island called Elephanta near Bombay, the Pyramids and Sphinx in Giza, and finally the Roycroft Community itself. The inclusion of the Roycroft Community within such an illustrious group of cities and sites suggests that they believed their ambitions would be looked upon quite favorably by future generations.

The paintings were removed from the walls in 1992 and placed in storage, in preparation for extensive architectural restoration work on the Inn<sup>1</sup>. During the ensuing four years, various treatment plans were devised. The plan finally adopted addressed the major condition problems and offered optional treatment extensions. These extensions would either improve the paintings from an appearance standpoint, reinforce the canvases structurally, or offer protection from certain kinds of vandalism. All options were subsequently accepted, but only on selected paintings.

Our goal was to compensate for losses to canvas and paint suffered from over 60 years of documented intermittent contact with water from leaking pipes and/or fire hoses. Coal furnace smoke, previous varnishing, and selected repainting campaigns had altered the visual interpretation and aesthetic enjoyment of these paintings. Given the practical limitations of the project, only some of the previous restoration work could be removed.

The treatment plan consisted of four major components: documentation, removal of non-original materials, stabilization of structure, and compensation for aesthetic problems. This paper will focus on just two aspects of the treatment regarding problems of compensation in a broader sense. The resolution of these problems, as well as the execution of the entire treatment, required a close working cooperation between 3 client parties and the Art Conservation Department. The underlying concerns were to make the paintings suitable for exhibition, especially given their 90 years of neglect, while balancing the needs of all parties. Completing the project within fairly rigid time, space, and budget limitations was also essential.

## Venice

Although nearly every painting had suffered some water damage, the premier painting in the Salon, depicting the entrance to the Grand Canal of Venice, had experienced the worst. At the far left end of Venice, canvas had rotted away and shrunk. (figure 3) Even the stretcher bars had rotted, seriously compromising the structural integrity of the painting. Canvas was entirely missing in this area and along the bottom tacking margin for five feet. The deplorable condition of the plaster wall beneath provided additional evidence for long term water leakage.

As mentioned above, the canvas had shrunk. The schematic drawing (figure 4) illustrates the nature of the shrinkage. Before addressing the large canvas loss along the bottom, the distorted horizontal warp yarns had to be straightened by stretching the weft yarns back to their original length, if possible. Otherwise, the canvas insert with properly oriented warp and weft yarns, would not make an acceptable match. Closely examining the most water damaged areas of the painting along the edges, the "true nature" of the canvas fabric became clear. The weave was actually quite open, where the heavy starch and glue sizing had been washed away. If the sizing could be slightly softened by humidification, then the open weave canvas might allow a considerable expansion when tensioned.

In preparing to straighten the warp yarns, we adhered strips of sailcloth<sup>2</sup> to small spots (1/2" square) along the damaged edge using Beva Film<sup>3</sup>. The opposite side of the painting was clamped just inside the tacking margin face

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<sup>1</sup> Today, the Inn is a fully functioning small hotel with 22 bedroom suites, a fine restaurant, and a great Arts & Crafts ambiance. Each room contains at least one piece of nearly indestructible, original, Roycroft furniture, along with Stickley reproduction pieces.

<sup>2</sup> SAILCLOTH (polyester fabric plus heavy sizing): BSDS 2.2 oz.; Bainbridge International, 252 Revere, Canton, MA 02021. (617) 821-2600. A recent telephone inquiry indicated that this particular weight of sailcloth is no longer available, although similar fabrics of slightly heavier weight are still available.

<sup>3</sup> BEVA FILM (an ethylene vinyl acetate based dry film adhesive) Conservator's Products Co. (CPC), P.O. Box

down to the Mylar<sup>®</sup> covered table. The sailcloth strips were then pinned to the near side of the table, lightly tensioning the canvas. **(figure 5)** Slightly moistened blotters were then laid over the canvas and covered with Mylar<sup>®</sup> for 20 - 30 minutes, until the sizing began expanding. At this point, the blotters were removed and the canvas was re-tensioned to remove the slackness and allowed to dry. This procedure was repeated several times until the benefits became minimal. We recovered approximately 90 - 95% of the original canvas weave conformation.

The next concern was finding a suitably large canvas insert. We couldn't justify using bits of tacking margin pieced together to insert such a large loss. Besides, the typically distorted tacking margin wouldn't make a uniform insert. Locating a modern linen canvas with weave characteristics and sizing equivalent to the original proved fruitless. Fortunately, the stretchers from three of the four missing paintings, once displayed in the Foyer, were discovered in the rafters of the Roycroft laundry building next door. One of them retained a sufficiently large canvas remnant to meet all of our canvas insert needs. To reinforce the insert area, and avoid the expense of a complete lining for this 25 foot wide painting, a thin sailcloth patch was adhered using Beva Film. Since patches usually create bulges over time, we minimized the occurrence of this phenomenon by using very thin patching materials, relative to the original canvas. In this case, a 2.2 oz. sailcloth (.004" thick) plus Beva Film (.003" thick) provided sufficient rigidity and strength for the join, while limiting the potential for the canvas (.037" thick) to bulge. As of the date of this writing, one and a half years later, the canvas in all patched areas continues to remain in plane.

Paint losses were filled with a mixture of Golden Acrylic Gesso<sup>4</sup> and spackling compound applied with small paint brushes. On a project of this scale, being able to directly apply the fills without cleanup saved innumerable hours of work. The fills were self textured by the original canvas weave beneath. The acrylic gesso shrinks somewhat upon drying, thus limiting the tendency of the spackle to smooth out a textured surface. Creating the right balance between the two materials results in a fill which shrinks to the same degree as the oil paint did originally. Inpainting was executed primarily in Bocour Magna<sup>5</sup>, simply because we needed a bodied, pre-dispersed paint we could use without preparation; furthermore, a considerable amount of this paint was available. In this region of Venice, a darker underpainting was required to achieve the finished, but somewhat aged, look. Scumbling the water highlights imitated Fournier's technique. Normally, recreating a loss of this size is not ethically advisable. However, the sketchy nature of the painted water in this area, combined with the fact that the entire loss occurred in a region that merely reflected the architecture and boats along the shore, made such a recreation feasible with an acceptable degree of confidence concerning accuracy. Historical photographs of this painting are numerous, but none provided sufficient detail of this region for our purposes.

## Paris

A second treatment problem involved the painting called "Paris." At some point early in the life of this painting, someone cut a small section (22" x 4" [H x W]) of the canvas out, tacked it back into its original place through the front and sides, and painted over the tacks. Upon initial examination, the reason for such a repair could not be ascertained, since the repair seemed to accomplish nothing. It was suggested that perhaps some important electrical or plumbing work necessitated cutting into the painting, but no utilities could be found behind the painting and the wall had not been disturbed. Further examination suggested that the manner in which the tacks had been painted over greatly resembled several other paintings found in the Foyer and Music rooms. Later examination showed that the cut through the canvas marked the stretcher bar beneath, proving that the canvas had already been stretched before the cut was made. If this repair is considered contemporary with the creation of the murals, why did a miscalculation of such minor proportions occur? If the repair had been made at a somewhat later date, why did it so closely resemble the canvas joins on several other paintings? In order to better understand this crude repair, we need to examine the

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411, Chatham, NJ 07928. (201) 927-4855.

<sup>4</sup> GOLDEN ACRYLIC GESSO (titanium white pigment + acrylic emulsion) Golden Artist Colors, Inc. P.O. Box 91, New Berlin, NY 13411. (607) 847-6154.

<sup>5</sup> MAGNA (n-butyl methacrylate resin plus pigments; jars and tubes); manufactured at Bocour Artist Colors, 1 Bridge St., Garnerville, NY 10923. (currently unavailable)

shape and layout of some of the other paintings in the room.

Five paintings in the main salon were painted to fit over passageways or windows, producing large pieces of canvas as unpainted scrap. These scraps were most likely re-used in the smaller and less important Foyer and Music rooms, as suggested by the schematic drawings. (figures 6 and 7) The most plausible reason is simply economy: making the most of the materials at hand.

But Paris is an important painting in the main Salon, why should it have been patched together and why such a relatively small piece of canvas? The answer may lie in the slightly asymmetrical shape of Paris. The left leg is only 2 feet wide, but the right leg is 2 feet 4 inches. (figure 8) Perhaps the following scenario occurred on installation day: After some edge trimming on several other paintings had become necessary to prevent overlap at the inside corners of the room, someone may have noticed the discrepancy in measurement on either end of Paris. They may have assumed that both legs of Paris should have the same dimensions, or, perhaps, confused one end for the other when measuring the wall space. In either case, the cut was made in order to make both ends the same width (plus tacking margins), the mistake discovered, and then a repair had to be made. Since Fournier had already accepted the idea of tacking together (through the front) large pieces of canvas scrap to create additional paintings for the Foyer and Music rooms, the solution easily presented itself. (figure 9)

Recognizing the likely importance of these tacks to the history of the painting, we endeavored to extract them as carefully as possible to allow for the removal and treatment of the painting as a whole. Flush wire cutters<sup>6</sup> proved invaluable here. We were able to grasp the very edges of each tack head to loosen and then slip underneath to extract them with minimal paint loss. The painted tacks were kept organized in their original positions by temporarily storing them in a piece of Styrofoam insulation board. Regular wire cutters, with double beveled jaws, can't be used in this way.

With the structural work nearly complete, the cut section of canvas was rejoined to the main body, again using a 2.2 oz. sailcloth and Beva Film patch. The canvas was restretched<sup>7</sup> onto the original stretcher and the painted tacks were carefully inserted in their original locations. A balsawood shim placed between the canvas back and the beveled stretcher face helped ensure that the tacked areas would not distort the canvas again. The tack holes in the stretcher were slightly drilled out (through the balsa wood) to ease the insertion of the painted tacks. The butt joined canvas seam was not filled or inpainted because of the strong likelihood that the join existed from the day of installation and therefore retains some secondary historical importance. Although, only minor inpainting was required at the tack edges, the crudely repaired area now appears aesthetically acceptable.

## Conclusions

Two areas of this multi-sectioned mural required compensation for loss following two different approaches. The first ("Venice") had suffered decades of intermittent water damage resulting in rotted canvas and stretcher bars. After realigning the shrunken canvas and inserting the five foot wide canvas loss, filling and inpainting visually re-integrated the damages with the surrounding aged, but intact, areas. The goal in compensating for this loss was typical of most easel paintings, that is, to structurally and visually minimize the effects of the damage, making the painting appear whole again.

The second ("Paris") had minimal water damage, but a peculiar canvas repair greatly distracted the viewer's attention from the enjoyment of the painted image. No records existed regarding when the repair had been made. Ongoing examination finally suggested that the damage and repair probably occurred during the initial installation of the

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<sup>6</sup> FLUSH CUTTER (full flush cutter, 5" length with padded handles: #892PL082) Techni-Tool, 5 Apollo Rd. Box 368, Plymouth Meeting, PA 19462; (800) 832-4866 or (610) 941-2400. Note: Techni-Tool has lots of other small tools useful to the conservator:

<sup>7</sup> All sixteen paintings were completely treated and edge lined without bending the tacking margins. This precaution eliminated the risk of potential paint loss along the vulnerable fold edge.

painting. Similar joins existed in five other paintings in the Foyer and Music rooms, but these joined large canvas pieces in a manner which attempted to minimize the potential distractions and economize canvas. The join in "Paris" is distracting and does not reasonably economize canvas. We could have removed the tacks, filled and inpainted the butt joined canvas and tack holes to visually re-integrate the area, making it appear as it once did. We chose instead to retain the facts of the repair (the join itself, the tacks and tack holes) while removing the crude distortion in the canvas. Although not part of the original artistic intent, the repair has secondary historical value as a record of the artist's attitude toward joining canvas pieces. Therefore, the evidence of the damage is still visible upon close inspection, but does not interfere with the aesthetic enjoyment of the painting at a normal viewing distance. (figure 10)

### **Acknowledgments**

I sincerely thank the following people for their tireless hard work, professionalism, and friendship during this challenging project: Jan Burandt, Craig Crawford, Brad Epley, Amy Krzeminski, Eileen Saracino, Rhonda Wozniak, and my lovely wife Patricia Hamm. I especially thank the Margaret L. Wendt Foundation, the Roycroft Revitalization Corporation, Department Director F. Christopher Tahk, and interim Dean Dennis McCarthy, without whom this project would not have been possible. The historical photograph in figure 2 is used courtesy of Robert Rust.

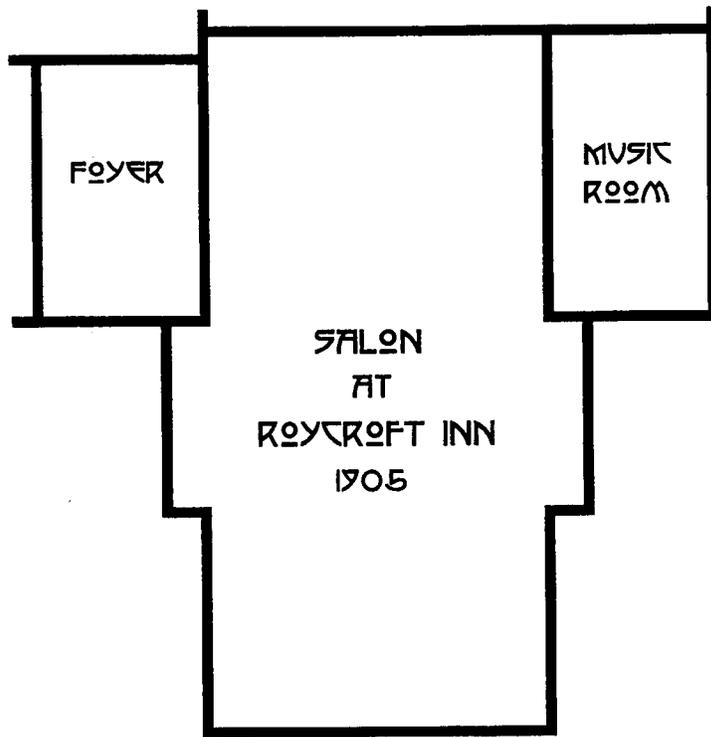


Figure 1. Schematic drawing of part of the Roycroft Inn depicting the Salon floorplan with adjacent rooms.

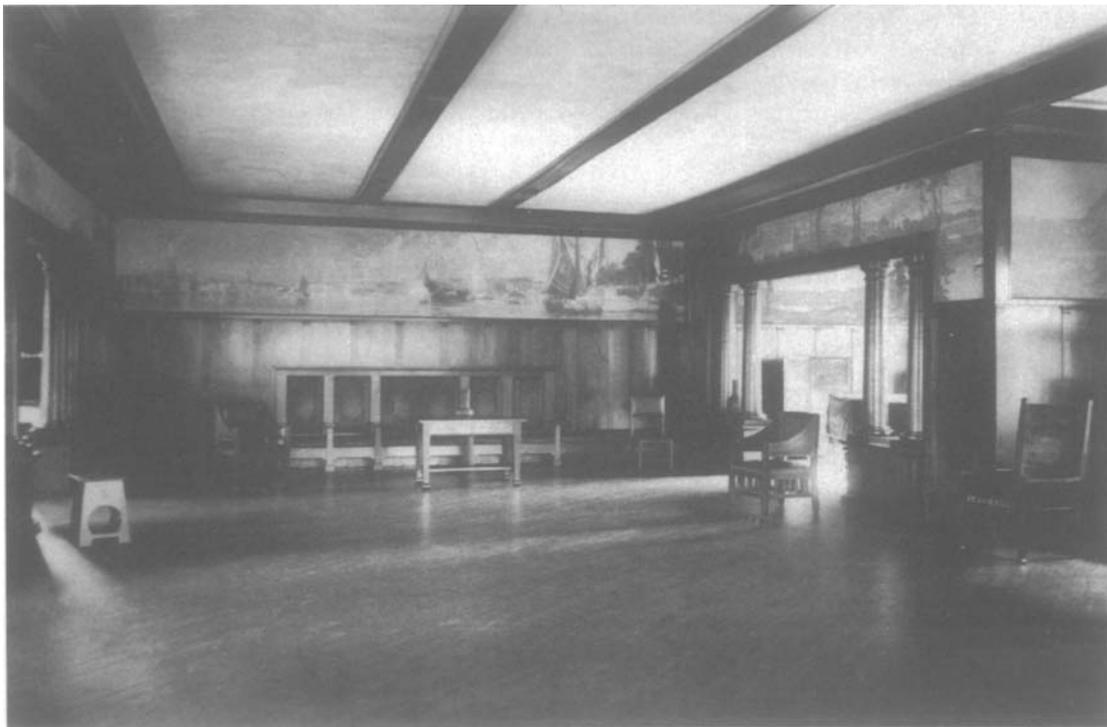
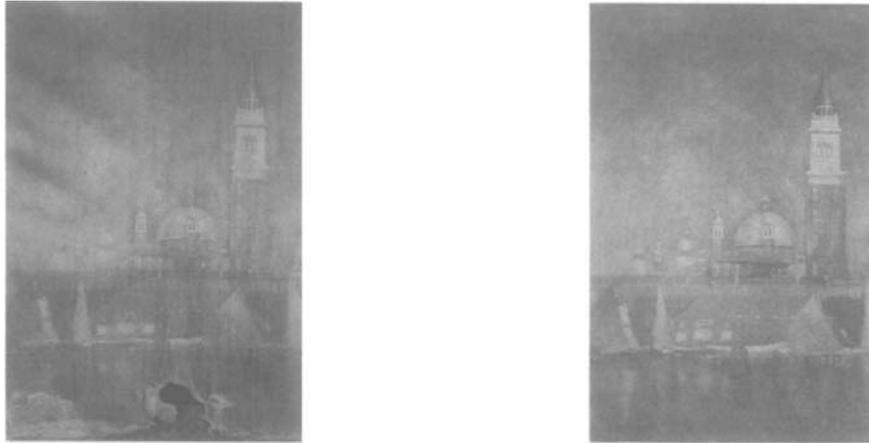


Figure 2. Early photograph of the Salon circa 1908. Note unvarnished murals adjacent to varnished woodwork.



Figures 3A & 3B. The left side of the 25 foot wide painting "Venice." Before and after treatment.

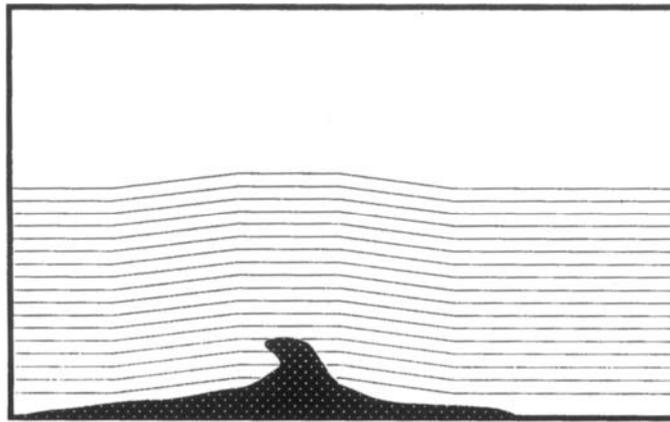


Figure 4. Schematic drawing of canvas weave distortions in "Venice."

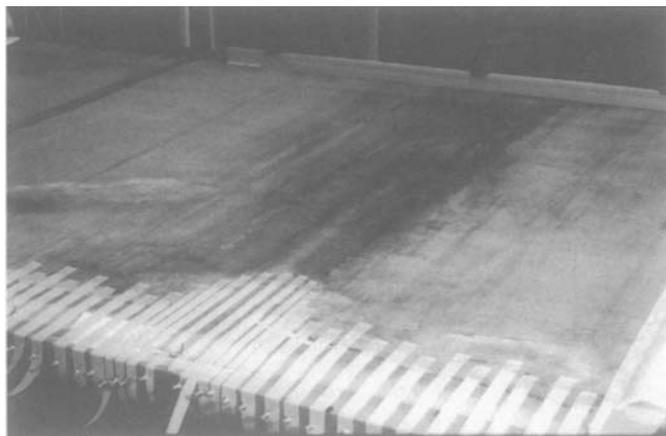


Figure 5. During treatment, sailcloth strips adhered temporarily with Beva Film tensioned the distorted canvas.

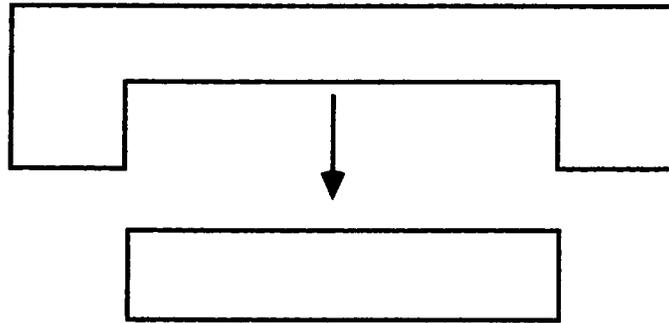


Figure 6. Schematic drawing of five paintings in the Salon used over windows or passageways with the resultant large "scrap" of canvas created after cutting to shape.

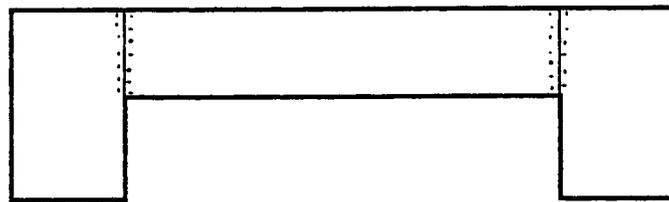


Figure 7. Schematic drawing illustrating the joining of "scrap" pieces with tacks to create most of the paintings used in the adjacent Foyer and Music rooms.

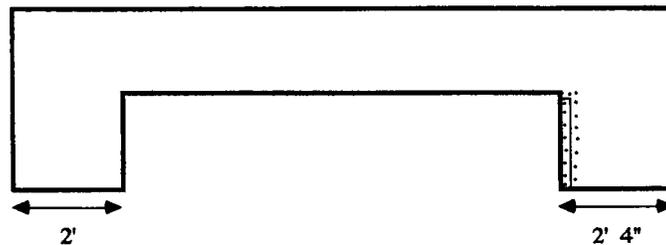
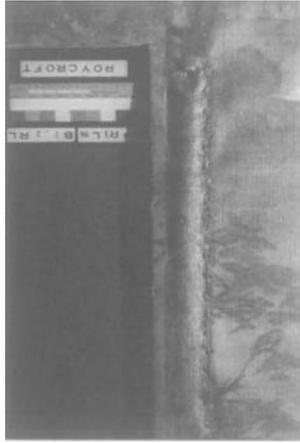


Figure 8. Schematic drawing of "Paris" with tacked repair on the right leg.



Figures 9A & 9B. Details of "Paris" showing peculiar crude repair. Before and after treatment, both in raking light.



Figure 10. Salon as it appears today.

## CONSERVATION OF A HEAVY WEIGHT: THE ROSE BY JAY DeFEO

By

The Rose Conservation Group

Niccolo Caldararo • Thornton Rockwell • Anne Rosenthal  
Conservators in Private Practice

### INTRODUCTION:

The Rose may simply be the heaviest oil painting for its size ever created, and by its very existence and structure poses conservation challenges which are unusual. An abstract work in grays, whites and blacks, The Rose is the creation of artist Jay DeFeo, a legendary figure of the beat era in San Francisco, who died in 1989. The Rose was her masterpiece, on which she worked continuously for seven years, between 1958 and 1965. (see photo #1)

The Rose was first conceived as a smaller, darker painting called Deathrose, which had a focal point just slightly to the viewer's right. DeFeo altered her concept of the work and mounted Deathrose with Elmer's Glue on to a larger canvas, in order to adjust the margins, restretching onto a larger strainer. By doing this, the focal point shifted and became truly centered between right and left edges, creating a symmetrical mandalla-like form.

During the seven years DeFeo devoted herself to this painting renamed The Rose, she added and removed paint with brush and pallet knife though many changes. This fascinating evolution is known through photographic record, and the accounts of fellow artists. The finished painting, essentially a sculptural relief in oil paint, measured 11 feet by 7 ½ feet, and had a paint thickness of 8 inches in some areas. Incredibly, the painting weighed almost a ton.

By 1972 the work was on the verge of self-destruction due to its enormous weight. The canvas was sagging, tears were forming at the tacking edges, and cracks appeared in the paint. In 1973, Tony Rockwell and his staff at the Museum of Modern Art in San Francisco applied a rigid facing of tissue, fabric, plaster and wire mesh to prevent imminent collapse. Further preservation efforts stalled due to lack of funding, and the painting languished like a giant white mummy for 22 years behind a false wall at the San Francisco Art Institute.

For several years preceding the present treatment, Niccolo Caldararo, as conservator for the Jay DeFeo estate, investigated the possibility of conserving The Rose. Lengthy consultations with specialists in ultrasound and fiberoptics and, finally, cutting exploratory holes to uncover the surface of the painting beneath the facing with Tony Rockwell, produced sufficient evidence that the painting remained intact. Tony's original treatment proposal of 1973 was reconsidered, and slightly modified. Joined by Anne Rosenthal, the Rose Conservation Group was formed, and the final proposal with cost estimates was fine-tuned.

The treatment proposal included provision for a new support. As originally planned, this support consisted of a conventional reinforced honeycomb aluminum panel, attached to a leveling layer of fiberglass and epoxy, applied to the painting reverse. Steel anchor pins for additional support would penetrate into the paint from the epoxy layer. After attaching the new support to the painting face down, the work would be turned over and the facing would be removed.

Finally, in June of 1995, The Whitney Museum of American Art authorized the conservation treatment which would allow The Rose to be included in its exhibition *Beat Culture and The New America*, opening that November.

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Niccolo Caldararo • Thornton Rockwell • Anne Rosenthal  
Conservators in Private Practice

**The Move:**

Once the treatment plan was authorized, the false wall was removed and Atthowe Fine Arts was contracted to place the painting face down. The Rose was surrounded with a protective steel cage, then covered with cushioning foam and cinch straps. The painting was strapped into the cage, and suspended within it, in a kind of sling. The package was lowered with pulleys suspended between 2 pairs of steel gantries. (see photo #2)

The cage was supported off the floor with large timbers. The front of the painting rested only against the foam and cinch straps, bolstered from underneath by ethofoam. (see photo #3)

When we took our first unencumbered look at the back side of the painting we were surprised to see the extent of paint which protruded at the lower end, out beyond the strainer.

A height differential of five inches, between the lowest point and the highest point of the back surface, caused us to struggle with the dilemma of whether or not to divest some of this paint to better accommodate the flat panel support system. After consulting with two engineers and other respected colleagues, we decided to leave the paint undisturbed. The consensus opinion was that the flow and shape of the paint had probably stabilized to a reasonable extent, and the consequences of altering its present equilibrium were unknown and could be detrimental.

**Alteration of Treatment Plan:**

Instead of divesting paint, several alternative mounting systems were considered. None of them met all our criteria of strength, stability and rigidity, combined with a degree of re-treatability. Finally, we located engineer John Hulls, whose aeronautical design, combined with structural engineer Katrina Simonen's reinforcements, met these criteria using a wooden grid structure with inset steel. By using epoxy and fiberglass as the principal bonding agent, this design would allow the support to be shaped to fit the contours of the back of the painting. It would also permit the attachment of handling and exhibition hardware.

Anchor pins consisting of threaded steel rods (shaped like candy canes) would be set into the paint; weight pressing downward on the pins would transfer loads from the paint masses to the grid, and from the grid to the embedded steel frame.

**Partial Transfer:**

We began by removing the original strainer, and as much loose canvas as possible. Peeling canvas away from the back confirmed suspicion of delaminations between the original and secondary canvas supports. As more canvas was removed, the inherent structural weakness of The Rose became more obvious. Not only were there many separations between canvases, there was also lack of adhesion between the paint and the canvas.

The Rose was riddled with channels and voids, resembling bone diseased by osteoporosis. With light pressure certain areas would collapse, opening into air pockets; some of these convoluted openings extended several inches into the painting. The layers of the painting (from the exposed reverse) consisted of a tough outer surface of hardened priming (white ground within the area of the Deathrose canvas), followed by less than an inch of well-oxidized paint. Beyond this was an inconsistent marbled layer of hard, soft, or brittle paint. Anything farther was unknown. Tony remembered that the front surface of the paint was hard in 1973.

A strip of redwood lattice and several thin dowels were discovered inside the paint, which may have functioned as a sort of armature. Legend has it that wire, beads, pearls and pieces of jewelry were also inserted and buried in the paint mass, but our investigations with x-ray and ultrasound failed to locate these.

We continued opening voids, intending to fill them with an epoxy consolidant. This would be followed by a lamination of epoxy and fiberglass over the entire back of the painting. In this way the painting would be stabilized as completely as possible, strengthening the interface of the new support.

We chose epoxy over other alternative adhesives for its strength, durability, and compatibility with other laminates and fillers. Using epoxy for both operations, (for consolidation *and* for construction of the support) would integrate the various parts in a way not otherwise possible.

#### **Dangers of Canvas Removal:**

The process of removing canvas was unnerving when we discovered how thin and fragile the painting was in some areas; despite its general massiveness, The Rose was as thin as a smudge in some areas.

We were aware of the danger of working blindly, unable to locate vulnerable areas of thin paint while removing canvas. Because of the risks of paint loss, we left canvas intact at the center and at the top and side edges; the original tacking edges were also left in place. (see photo #4) Since we were performing a partial transfer, we could cause paint losses if there were any punctures through to the facing. Further, any such holes would leak epoxy to the painting surface.

To prepare for the epoxy application, we were required to roughen and pit the back surface for mechanical bonding. To do this safely we needed to know as precisely as possible where the thin areas of the painting were located. Ultrasound and x-ray were employed for their contributions to our understanding of the structure, but ultimately the most useful device was a completely low-tech map of the paint topography.

#### **Map of Paint Thickness:**

A mylar tracing, indicating undercuts and areas of thin paint application, was made from an enlargement of the one extant raking light photograph of The Rose, taken in 1973. (see photo #5) Grid lines were drawn on the mylar, then onto the back of the painting; with mylar reversed, we had a plot map to follow. (see photo #6) Using this guide we were able to avoid roughening the back surface, or removing canvas, in risky areas.

#### **Mechanical Testing:**

Meanwhile, the proposed strategy of inserting supportive steel anchor pins into the paint masses required investigation. So-called “proof-load” tests were conducted to measure the integrity of the paint. The tests involved implanting wood screws into thick paint near the bottom of the painting. The screw heads were left projecting out of the paint film, and were seated into an instrument to measure the force needed to pull the screws out of the holes, both in *sheer* and in *tension* directions. Our structural engineer determined the load requirements, which were more than doubly exceeded by the strength of the paint. Engineering advice and review of progress were critical to each new step of treatment.

#### **Preparation for Epoxy:**

Before consolidation with epoxy, any points of entry through to the paint surface were sealed. Any loose canvas was reattached with Beva D-8. Canvas patches were adhered to cover any holes such as those found at the tacking edges.

Rhoplex AC 234 was applied at the tacking margins to seal the edges.

Two brush coatings of 1:2 Acryloid F10 in naphtha were applied to remaining canvas on the back of the painting. In mock-up testing, this coating produced a sufficient barrier to deter the penetration of epoxy, facilitating mechanical separation between the canvas and paint in those fragile areas in case of re-treatment.

Foamcore strips were placed outside the tacking margins to buttress and maintain their proper shape.

#### **Epoxy Application:**

We contracted epoxy fabricators from Lukas Films' Industrial Light and Magic, who demonstrated excellent skill with this medium for the film industry.

Consolidation of the back was achieved by alternating layers of fiberglass and very slow setting, low exothermal epoxy (Epolite 2410 epoxy resin, with Epolite 2187 hardener from Hexcel Corporation). The first application consisted of thick resin putty, which contained chopped fiberglass and fumed silica. This was pushed into the open

voids and was viscous enough to resist flow to the front of the painting. Over this putty, thin coatings of the same resin (without bulking) were applied, along with three layers of medium weight fiberglass cloth. (see photo #7)

Next, a heavy fiberglass mat was adhered and, lastly, a sheet of nylon “peel ply” fabric which would be removed later. Peel ply is used to create fine surface fractures in the epoxy, to allow good mechanical bonding of additional support structures.

#### **Attachment of Plywood Grid:**

The peel-ply was removed after the epoxy cure. The plywood grid, shaped to fit the back contour of the painting, was adhered with a slurry of epoxy and fumed silica. The back of the wood grid was leveled on the reverse, then tapered at the edges, to simulate the original depth of the strainer.

The spacing of the grid members was calculated by the engineer, based on weight distribution. In the heavier bottom portion of the painting, grids were spaced closer together.

#### **Anchor Pins:**

Guided again by the photo map, we used strings to identify our original grid lines (now covered) to avoid drilling holes in undercuts and areas of thin paint. 3/8” diameter holes were drilled to accept the threaded stainless steel candy-cane rods used as anchor pins, already described. (see photo #8) Depths ranged from 1 / 4 inch to 3 inches. The pins, 92 in total, hook over notches in the wood grid.

Because the pins would be wrapped with fiberglass and epoxy, and the holes filled with epoxy, the pins would resist twisting in their notches in the grid. When upright, the horizontal wood members would support the pins against the weight and possible downward creep of the paint. (see photo #9, #10)

#### **Inset Steel:**

The inset steel support, or “embed frame”, was constructed of three inch box tube steel and set into notches in the wood grid, supported slightly above the back surface of the painting. (see photo #11, #12) Small rods, like wings, were welded onto this embed frame which overlapped onto the top of the grid members to provide strong points of connection. The embed frame added rigidity and strength to the new support, and was used to attach handling and exhibition hardware (e.g. a steel pedestal was connected to the bottom of the embed frame with openings to allow raising the painting safely with a forklift).

The steel pins, wood grid, and embed frame were then wrapped with multiple layers of fiberglass and epoxy onto the back of the already laminated painting. (see photo #13)

#### **Lifting Frame:**

Next, a massive steel carrying frame with welded steel tabs was bolted to the embed frame. The unyielding rigidity of this structure prevents any possibility of torque during handling of The Rose. (see photo #14)

#### **After Attachment of New Support: Facing Removal and Finish Work**

The Rose was turned face up by the Atthowe crew, using the gantries. The entire package weighed approximately 2 tons at this stage. The estimated weight of all added materials was just over 1,500 pounds. (see photo #15)

After removing cinch straps, foam and cage, the chicken wire embedded in the plaster facing was removed mechanically with chisels and rubber mallets. A dilute acetic acid solution, applied by sponge, facilitated this removal. A thin blue layer of plaster, indicating close proximity to the paint film, was carefully removed with hand tools. The final layers of cloth and facing tissue detached easily when dampened, and most of this facing, or “shroud” as we called it, was rolled away from the painting in one piece. (see photo #16)

Removal of the facing exposed extensive wax deposits located around impasto and within deep pockets of the paint film, put there during the 1973 conservation treatment to protect undercuts and fragile projections of impasto. Wax removal required patient, tedious work with dental tools, aided by hot air guns, followed by applications of mild organic solvents.

Scattered small areas of loose, craggy paint were reattached with Beva D8 in the top section and sides.

The paint surface was somewhat moldy beneath the facing, with mold stains scattered overall. The stains reduced with the removal of residual facing paste and old varnish, applied in 1973. The few remaining mold stains were improved by inpainting.

The move to New York required a maiden voyage first to Atthowe's warehouse, for final inpainting and packing. Since the painting was too large now with handling gear to be moved out through the doors of the conference room, the windows were removed, and the painting was lifted by crane to a flatbed truck four stories below. In Atthowe's warehouse, gantries were used again to lift the painting into a vertical position for the first time.

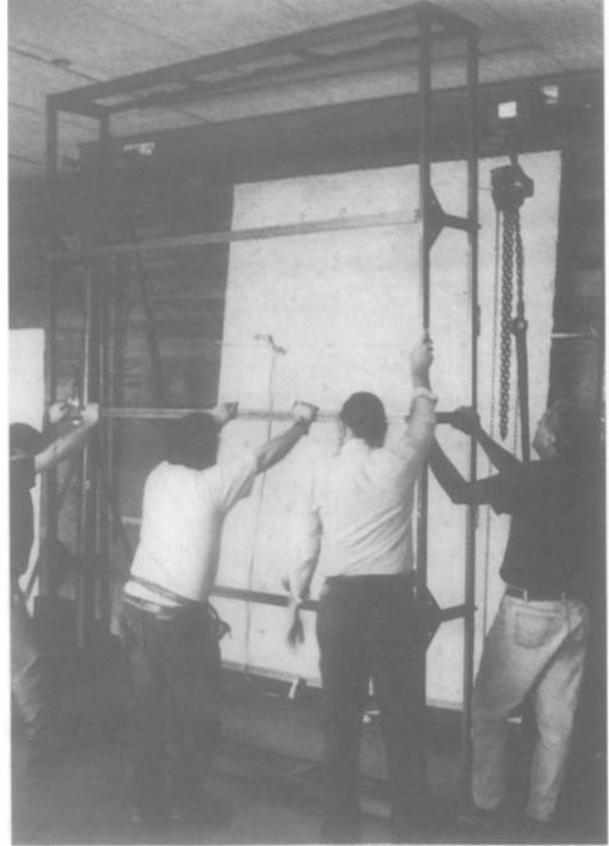
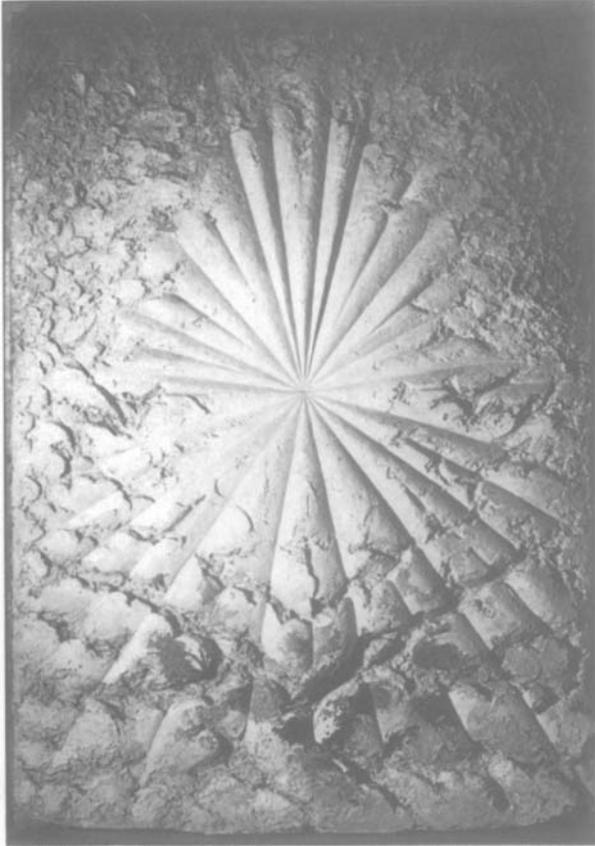
Visually disturbing cracks were inlaid with pigmented microcrystalline wax, including one at the center fondly called the "Mona Lisa Smile". Inpainting was done with LeFranc and Bourgeois acrylic resin Restoration colors. No final varnish coating was applied. (see photo #17)

#### **POSTSCRIPT:**

The Rose has been moved and reinstalled four times for major exhibitions since its treatment in 1995 (see photo #18), and is currently on view through the end of this year at the Berkeley Art Museum. The painting appears on the cover of *Art in America*, and is a feature story in the March 1996 issue.

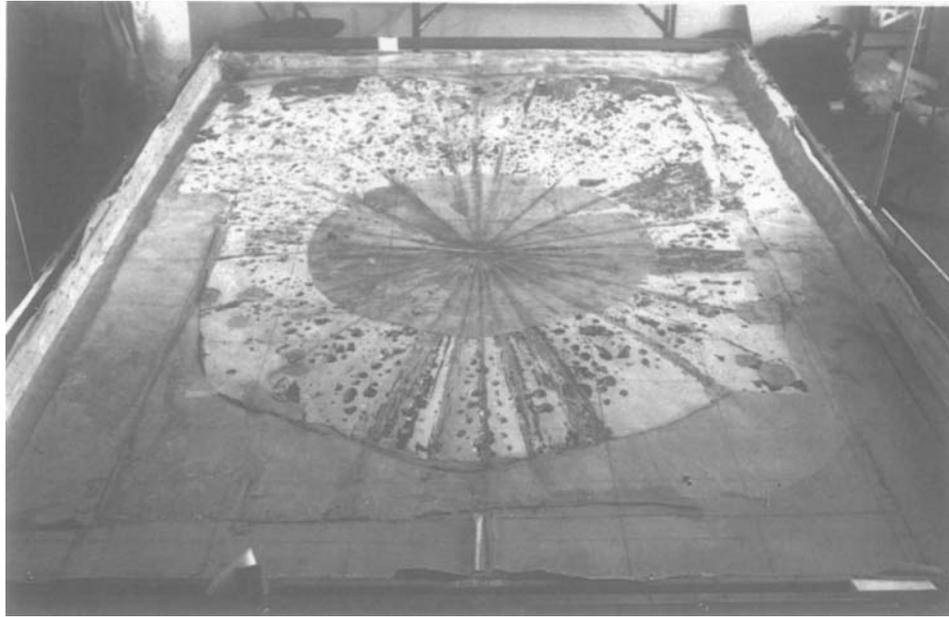
Details of the investigative procedures with ultrasound and fiberoptics, and research into use of epoxy are too lengthy to discuss in these postprints. The epoxy used was Epolite 2410 with Epolite 2187 hardener from Hexcel Corporation. Please contact Niccolo Caldararo with further questions pertaining to this aspect of the treatment.

We offer the treatment of The Rose as a possible method of stabilizing a massive, idiosyncratic work, knowing full well that time may present new challenges to the conservation of this piece, especially considering its inherent vice. This project was truly a collaboration of conservators, engineers, fabricators and art handlers, and we are indebted to them for their generosity, skills and forbearance.

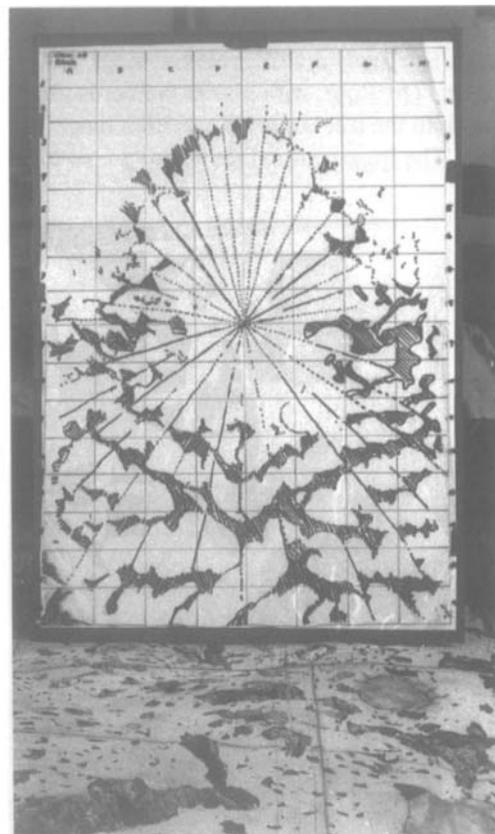
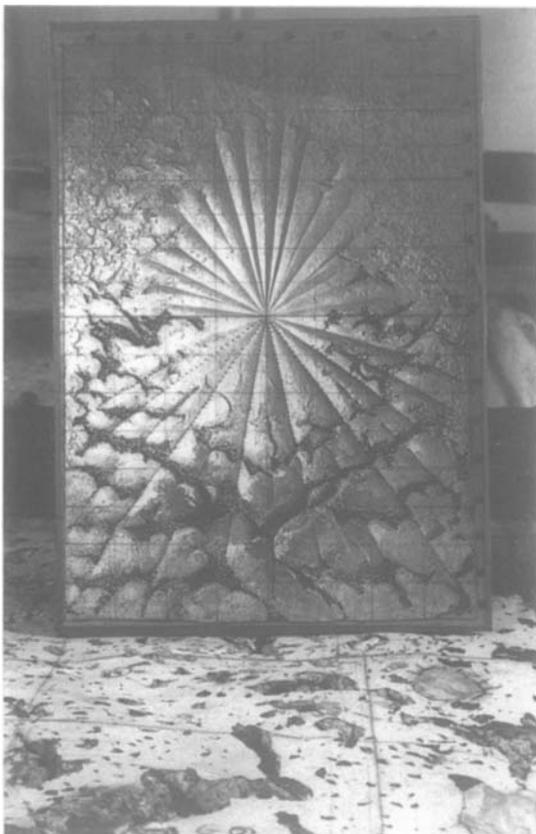


1. **top left:** The Rose in 1973, before facing.
2. **top right:** The Rose, with plaster facing, is unbolted from the wall; it will be covered with cushioning foam and tied into the steel cage with cinch straps.
3. **bottom:** The Rose resting face down, prepared for treatment. Note irregular back surface beneath excess canvas.



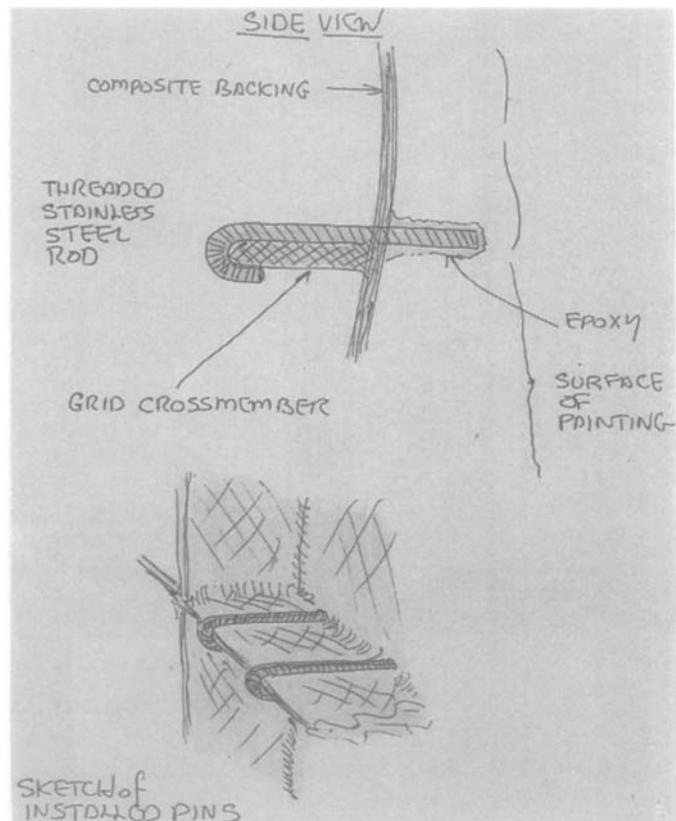


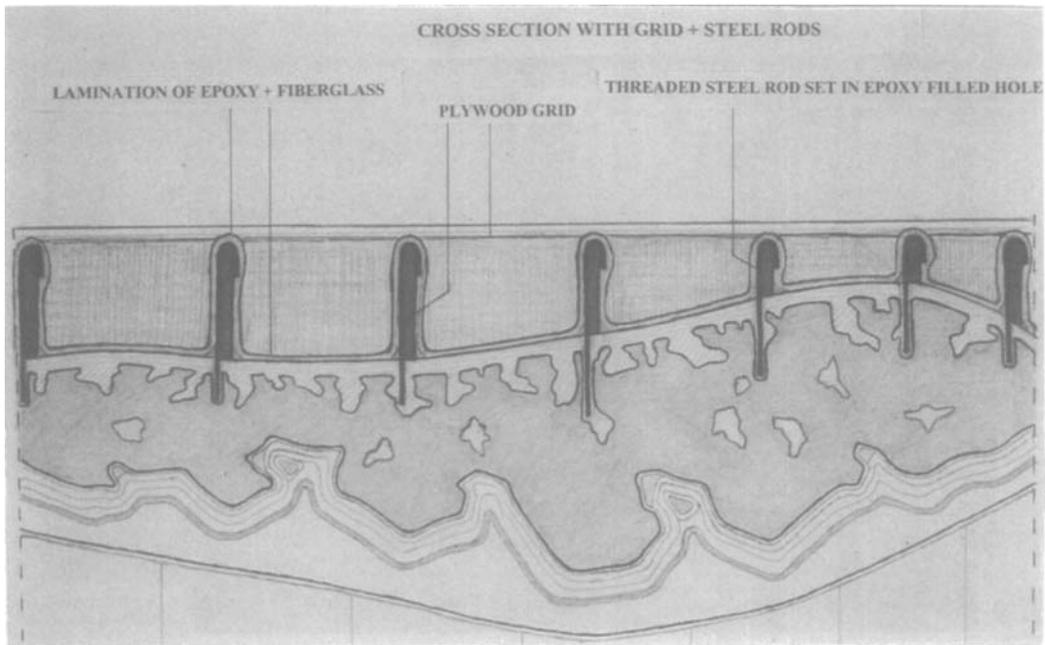
4. **top:** Back of painting with canvas remaining at center and along perimeter. Back surface is pitted in preparation for epoxy application.
5. **bottom left:** With grid lines drawn onto reverse of The Rose, corresponding grid lines are drawn onto mylar, over a 1973 raking light photograph. Shadows indicating undercuts and thin areas of the paint are also indicated.
6. **bottom right:** The mylar tracing is turned over, providing a key from the reverse to thin areas of the painting.



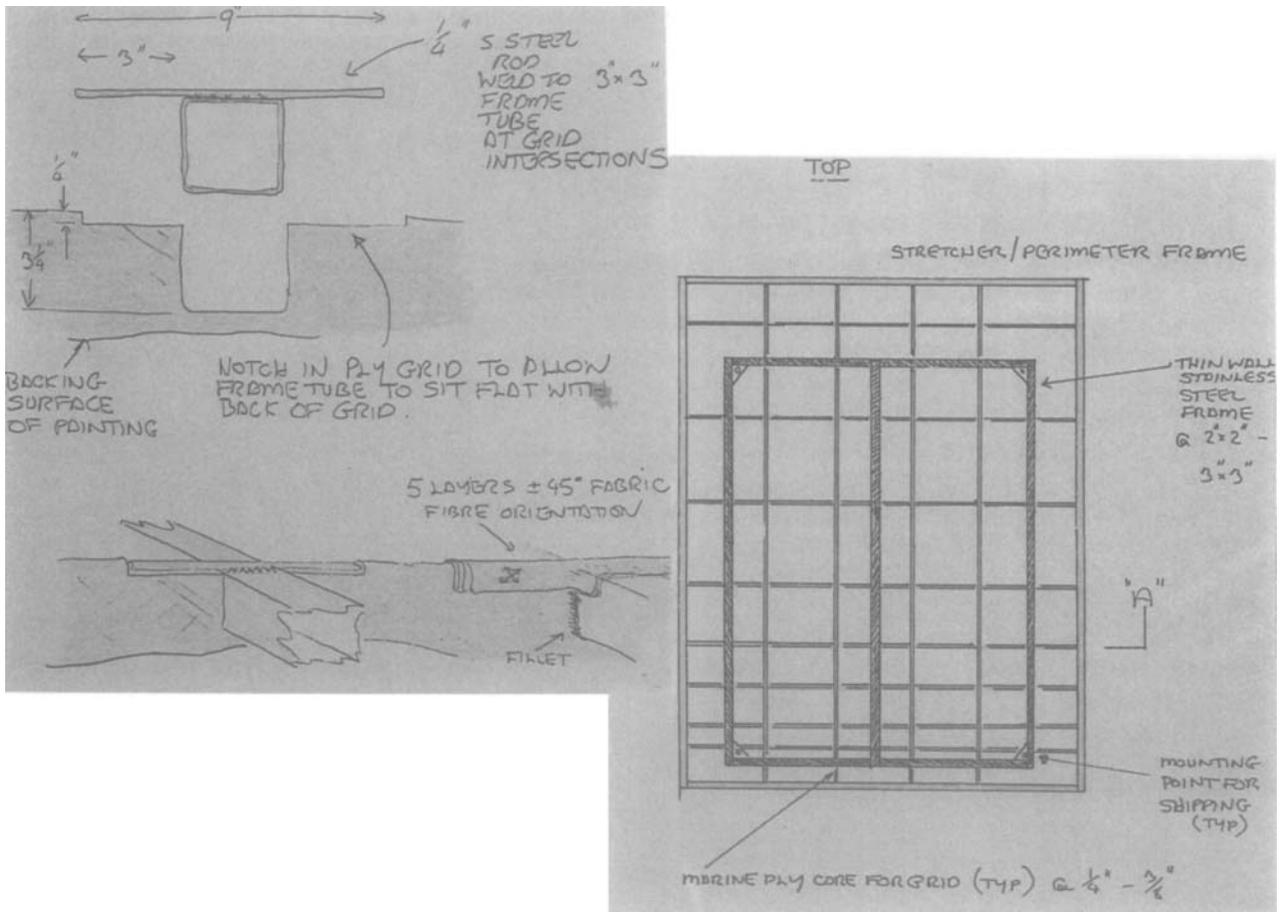


7. **top:** After a thick, putty-like application of epoxy, pushed into the voids and covering the reverse of the painting, laminations of thinner epoxy and fiberglass were applied.
8. **bottom left:** Holes were drilled to accept threaded steel candy-cane shaped rods (anchor pins). The bent-ends fit over the wood grid, and were supported by the wood members against downward flow or creep of the paint.
9. **bottom right:** Diagram of anchor pins. Spaces around rods were filled with epoxy. Pins were further held in place by fiberglass and epoxy wrapping.



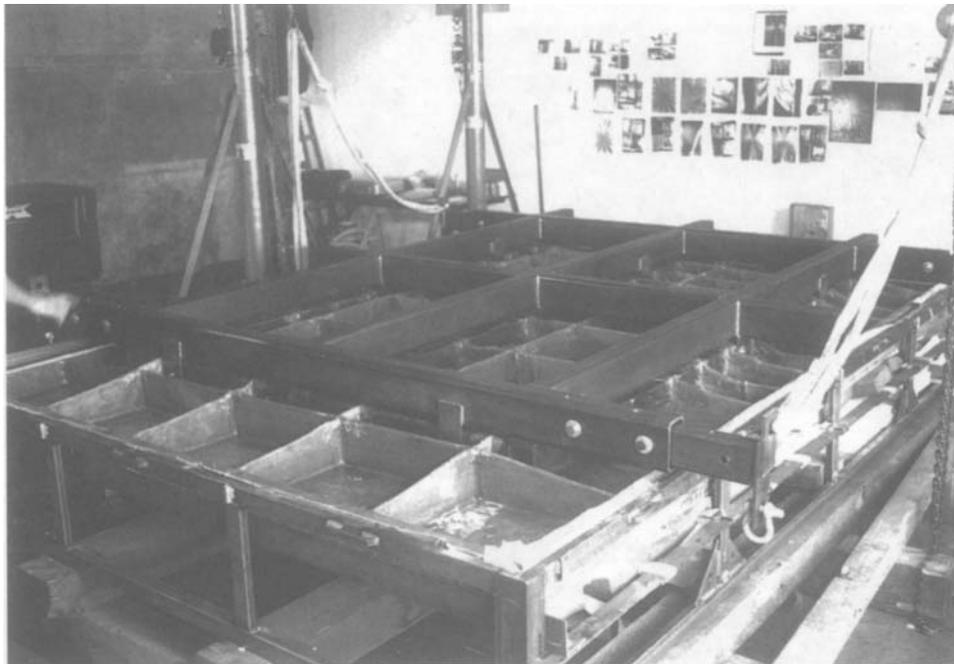


- 10. **top:** Diagram of faced painting (face down) with fiberglass and epoxy lamination, wood grid and anchor pins.
- 11. **bottom left:** Diagram of steel “embed frame” in *cross section*.
- 12. **bottom right:** Diagram of steel “embed frame” in *plan*, set into plywood grid.

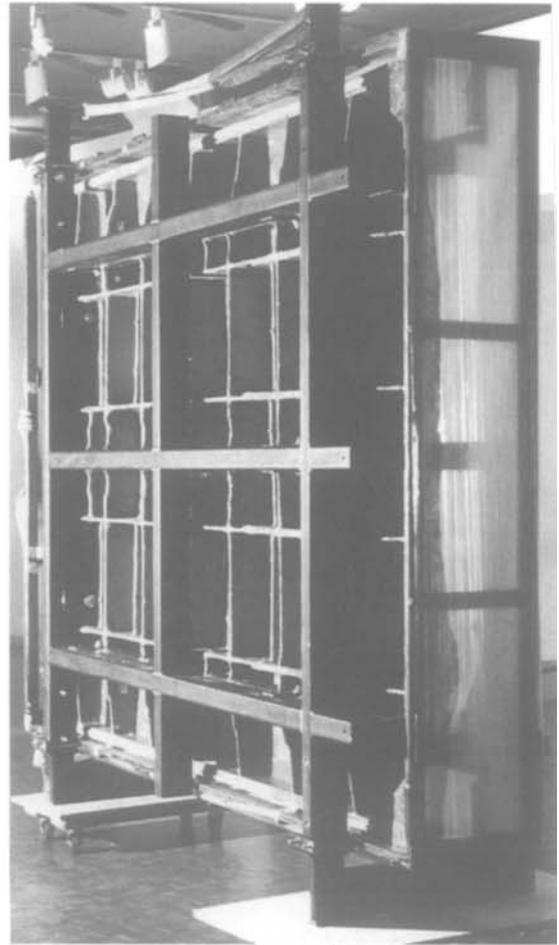
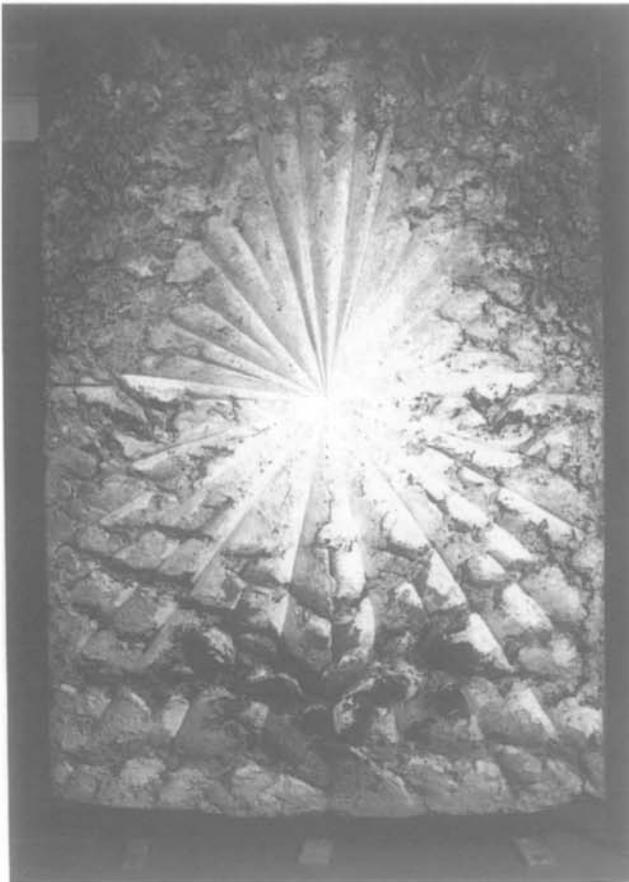




13. **top:** Back of painting with pins, grid, and embed frame, bonded with wrappings of fiberglass and epoxy.  
 14. **bottom:** Massive steel “lifting frame” in position, bolted to the embed frame.



15. →**Next Page, top left:** Turning The Rose over.  
 16. →**top right:** Removing the plaster facing, revealing intact painting at top edge.  
 17. →**bottom left:** The Rose after treatment.  
 18. →**bottom right:** The Rose upright on skids at the DeYoung Museum, with steel cage and lifting frame in use.



UNDERSTANDING A PICTURE THROUGH ITS CONSERVATION HISTORY:  
THE CRUCIFIXION BY NICOLAS POUSSIN

By Patricia Sherwin Garland and Stephen Kornhauser

The Crucifixion by Nicolas Poussin, which was acquired by the Wadsworth Atheneum in 1935, has unique visual problems which scholars and the public have speculated about for much of its 60 years in Hartford. In 1993, we took The Crucifixion to the J. Paul Getty Museum<sup>1</sup>, where, in concert with both the staff painting conservators and the Getty Conservation Institute scientists, it was treated for the major retrospective of Nicolas Poussin. During this time, the painting was scrutinized both visually and analytically in an attempt to address some of the questions and assumptions which have arisen, some ultimately more puzzling than others. (Figure I. The Crucifixion, prior to treatment.)



The extreme darkness and monochromatic nature of the present palette call into question whether or not it is a finished work, a night scene, whether it has darkened or whether it had been ruined in restoration.

From Poussin's correspondence, we know that the painting was commissioned in 1644, and completed two years later. In his letter to M. de Chantelou, in June 1646, he wrote: "Now that I find myself finished with The Crucifixion of M. de Thou, which greatly burdened me, I have firmly resolved to undertake nothing, whatever profit may be in it for me."<sup>2</sup> And Poussin wrote to the French Abbott and member of Parliament, de Thou, who commissioned the painting, that he declined de Thou's request for a pendant of Carrying the Cross, by emphatically stating.. "I have no longer the joy nor the health to undertake these sad subjects. The Crucifixion has made me ill; I took many pains with it; but the Carrying of the Cross would kill me. I cannot resist the serious and afflicting

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Patricia Sherwin Garland is Conservator of Paintings at the Yale University Art Gallery, New Haven, CT.  
Stephen Kornhauser is Chief Conservator at the Wadsworth Atheneum, Hartford, CT.

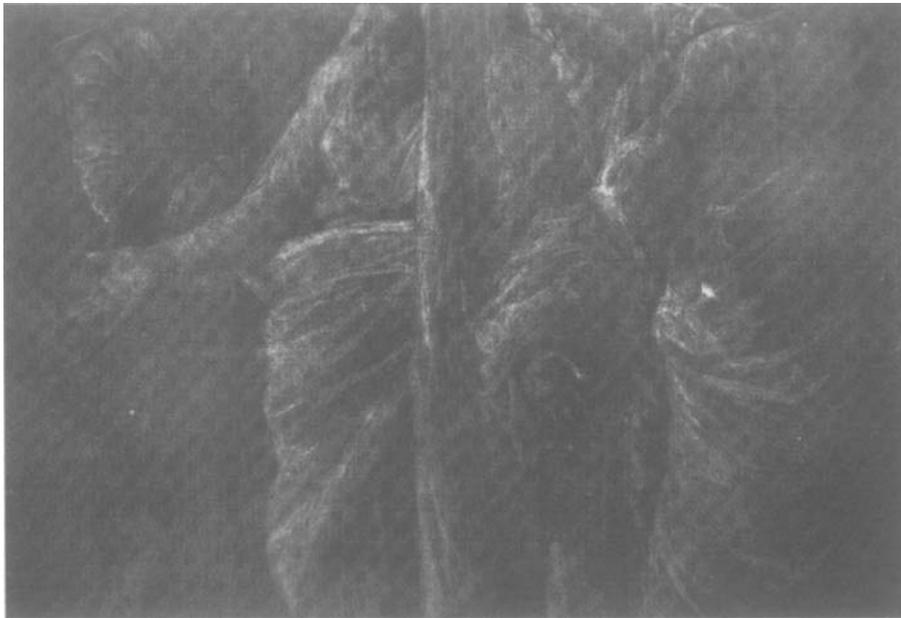
thoughts that must fill my mind in order to paint these sad and lugubrious subjects. Release me from it, please!"<sup>3</sup>

At least one contemporary copy exists today, in a private collection in Switzerland. It was executed during the 17th century, probably by Antoine Stella, who admired the original in his letters. There is an engraving, as well, which was done by Stella's niece and bronze and wax reliefs, done after the painting. All show the work as completed and resolved.

The Crucifixion depicts the moment of Christ's death, when, according to Luke (23:44-45), "It was now about the sixth hour, and there was darkness over the whole land until the ninth hour, while the sun's light failed" and, according to Matthew (27:51-54) "the earth shook, and the rocks were split; the tombs were opened and many bodies of the saints who had fallen asleep were raised." So we can correctly assume that Poussin intended his Crucifixion to be darkly dramatic, consistently lit from the left of the composition.

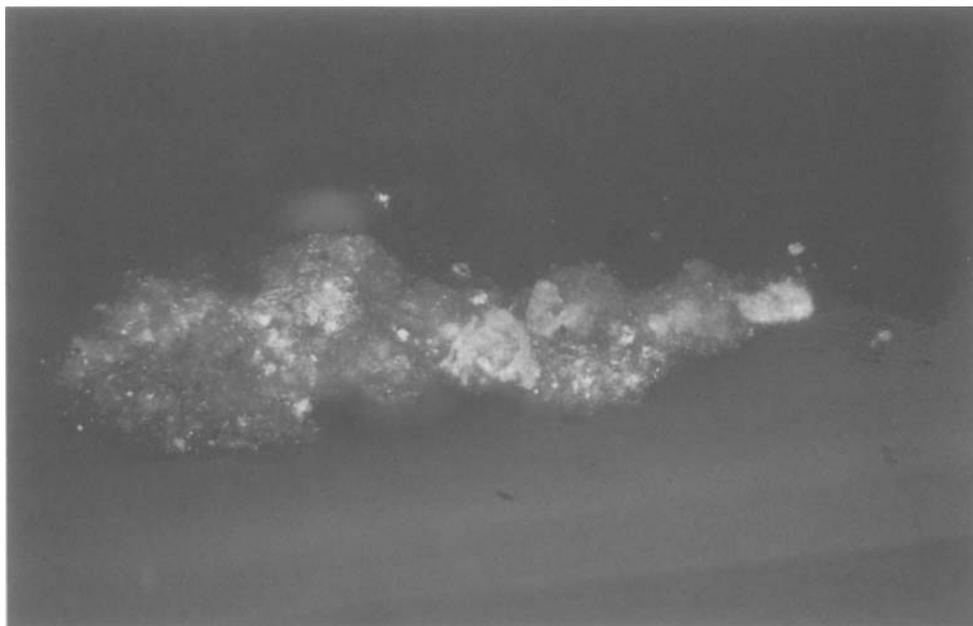
It is more difficult to ascertain whether the painting has darkened or whether the visible palette is intentional. When comparing it to the contemporary copy, one must consider that there may be some license taken on the part of the copyist. But, in spite of this, the comparison offers tremendous insight into the original state of the Hartford picture. Although the copy is smaller in size and more crudely painted, there is a sense of space within the setting and articulation of the sparse landscape forms. We can see from the copy that the Hartford painting has changed dramatically-- both in tonality and detail. Clearly the palette had originally been more broad ranging.

The present state of the Hartford picture is due, in part, to the artist's choice of materials, as well as his penchant for working meticulously. X-ray analysis helps to understand condition. The Hartford picture has a disturbing visual texture. The reason for this becomes more apparent when looking at the x-ray. It is the result of Poussin's choice of a diamond-weave cloth fabric for the support<sup>4</sup>. (Figure II. X-radiograph showing diamond weave pattern of the canvas.)



It is in keeping with Poussin's desire to present a dark, dramatic scene, that he chose to use his dark ground to express the mid-tones-- the transitions defining the forms. His choice of ground also figures into the present state of the picture. Chemical analysis shows it to contain iron, presumably an iron oxide, which would account for its dark, warm color. The absence of white lead possibly makes it more porous. But, the ground in the Hartford painting has taken on a disproportionate importance, no longer simply expressing mid-tones. The forms and space are ambiguous. While Poussin's distinctively dramatic composition is still evident and clearly Poussin, it is a ghost of

its former self. Cross-sections of the painting reveal that the ground's thickness is 25 microns, which is about 5 times the thickness of the paint film. The thin film, characteristic of Poussin in the 1640's<sup>5</sup>, coupled with the thick, dark ground, accentuate the uniform darkness of the composition. The result is a loss of the important transitional tones, most obvious in the figures. (Figure III. Cross-section taken from the upper left of the painting, above the Centurion's head.)



Poussin painted directly, most preparatory working out of the composition having been completed prior to laying brush to canvas. He would apply his paint thinly, returning later to highlight. And Poussin's use of primary colors to express the hierarchy of the personae in his paintings-- the most central characters in his compositions painted in pure primaries and/or white. Certain colors have fared better than others. The robe of the Virgin, for instance, was painted with a mixture of ultramarine and white lead. The lead gave body to the ultramarine, also adding to its luminosity. Poussin's thin paint film is visibly thinner than it should be for readability. It is almost transparent in areas.

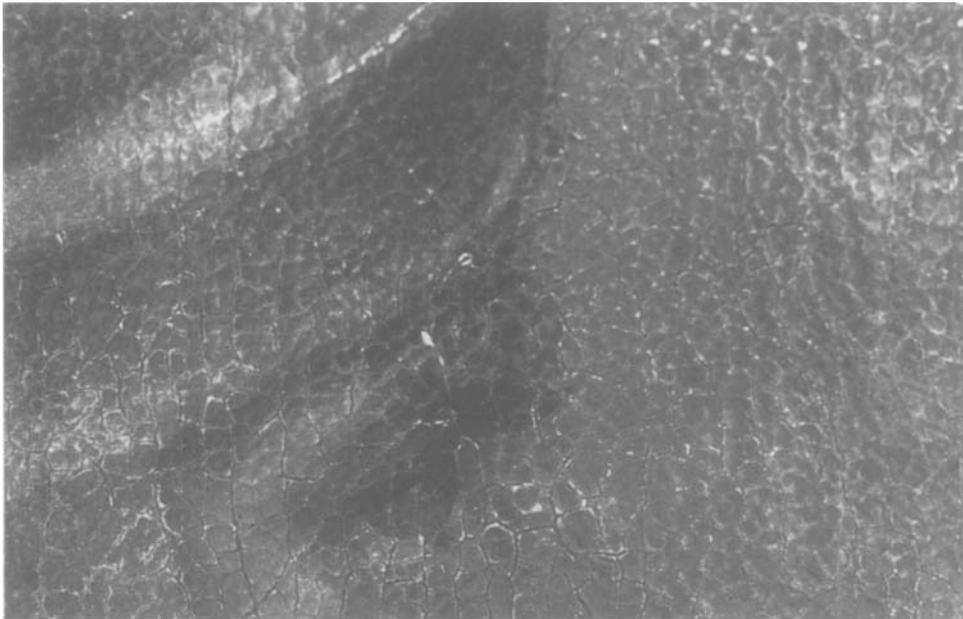
While some of the changes may be caused by the natural aging process of materials, much of the current state of the picture may be attributed to the overzealous and misunderstanding hands of restorers in the past. Again, the copy has given us a good point of departure to say that the Hartford Crucifixion has changed in both form and tone. Earlier photographs of the painting, taken in 1940, shortly after its acquisition, reveal the physical changes that have taken place, even in the last 55 years. And our pre-treatment photographs can further demonstrate damages caused by restoration.

In 1993, when we brought the painting to the J. Paul Getty Painting Conservation Studio, a number of discoveries were made to further explain the state of the picture. These discoveries helped us document the conservation history, as well as set realistic expectations for treatment.

Certain elements in the picture were easily detectable and more immediately attributable to the hand of a restorer, rather than that of the master. The uniformity of the sky, for instance, may be attributed to overpaint which covered a more dramatically lit sky. Some figures had been uncharacteristically outlined in black, taking away from the voluminous forms that are more in keeping with Poussin's style.

The paint film has severe cracklure. The cupping corresponds to the darker forms. The painting was glue-lined, which flattened it and accentuated the pronounced diamond-weave fabric. This would ensure that it would become a conspicuous visual interference.

Chromatographic analysis of materials done at the Getty Conservation Research Laboratory found samples to contain a Copal Resin as part of the paint film. Copal resin is brittle and readily darkens. In addition, the presence of an oleo resin found in balsams was detected. Copaiva balsam was used in the second half of the 19th century as a rejuvenative for clouded pictures. The process was patented by Max von Pettenkoffer<sup>6</sup>, in the 1860's, and experimented with, as well in England, where, in fact the picture resided. The treatment involves feeding copaiva balsam and turpentine into darkened pictures to restore clarity and, according to Pettenkoffer, "re-establish lost molecular cohesion of varnish and paint". In a later note, Max Doerner<sup>7</sup>, in his "Materials of the Artist", cautions not to continue the treatment too long, otherwise the paint at the edges of the cracks will stand up. This helps to explain The Crucifixion's present cupped state. Balsams remain irreversible and continue to darken paint and varnish layers. This further helps us to understand the present darkened state of the picture. (Figure IV. Detail illustrating cupping and paint loss along edges.)



Another chromatogram showed the absence of azaleic acid, a water soluble acid found in oil films. Its absence could potentially explain subsequent damage to the painting from cleaning with a strong base. This water soluble component of linseed oil, easily removable in cleaning with a strong detergent accounts for the extremely brittle nature of the paint film, as well as the extensive loss throughout.

Our intervention began with the minimization of the newer, discolored varnish films on the surface, as well as the clumsy, overbearing retouches. However, there was negligible change in the tonality. The treatment improved the legibility of the figures and forms. Removal of old retouches to the extent that underlying original could be seen, was effective. Extensive overpaint was minimized, revealing clouds in the sky and returning volume to figures. Rocky forms emerged to reestablish a sense of depth to the landscape. There was, however, a clear point of diminishing returns, at which there was such extensive loss, that removal was not advantageous. By knitting forms

back together by retouching the many minute losses and abrasions, we attempted to return weight to the figures and dimension to the landscape. (Figure V. The Crucifixion, after treatment.)



We considered an attempt at relaxation of the cupped surface, in order to minimize that aspect of the visual distortion. But we felt that the risk of relining such a brittle paint film far outweighed any possible gain.

There was a defined limit, in our minds, as to the ultimate extent of plausible retouching. Due to the conservation history of the painting, we could never hope to approach the painting's original state in our treatment of it. The unnaturally imposed, and, hence, overwhelming, darkening, and the disturbing surface texture are irreversible.

We have relied on passive measures to enhance legibility. By hanging the painting on a dark wall and angling it down, we have attempted to further intensify the composition and minimize light reflection. Attempts were made to incorporate polarized light filters into the installation, but a practical means of incorporation could not be found.

While the conservation of The Crucifixion resulted in a painting that remains dark and irretrievably damaged, we can, in the very least, say that we currently have a better understanding of the painting, and the artist's intent, relative to its present state.

### Acknowledgements and Footnotes

1. The authors would like to thank the following for supporting the research and restoration of The Crucifixion: The J. Paul Getty Museum, John Walsh, Director, Deborah Gribbon, Associate Director and Chief Curator, Andrea Rothe, Conservator-in-Charge, Paintings Conservation, and Mark Leonard, Paintings Conservator; Getty Conservation Institute, Scientific Program, Arie Wallert; Chrisofer McGlinchey, Conservation Scientist, The Metropolitan Museum of Art; John Dick, Keeper of Conservation, National Gallery of Scotland; Henry de Philips, Kriebel Professor of Chemistry, Trinity College; Catherine Skinner, Research Affiliate in Geology and Geophysics, Yale University; Andrew Lins, Objects Conservator, Philadelphia Museum of Art; and Margaret Holbein Ellis, Conservator, Conservation Center, Institute of Fine Arts, New York University.
2. Poussin, Nicolas, Correspondance, edited by C. Jouanny, Archive de l'Art francais, n.s. V, 1911, reprinted Paris: de Nobelele, 1968, pp. 268, 322, 339.
3. This passage is presumably taken from lost correspondence of Poussin and de Thou. It was included in the Comte de Brienne's "Discours sur les ouvrages des plus excellens peintres anciens et nouveaux" of 1693--95, and cited in J. Thuillier, "Pour un 'Corpus Pussinianum,'" Nicolas Poussin: Centre National de la Recherche Scientifique, Colloques Internationaux, Paris, 1960, II, p. 219.
4. Poussin generally used canvases with simple weaves, but on occasion, he used more complex twill weaves; see Paris, Musee du Louvre, *Exposition Nicolas Poussin*, May-July, 1960, pp. 333-348.
5. S. Rees Jones, "Notes on Radiographs of Five Paintings by Poussin," Burlington Magazine, CII, 1960, p. 307.
6. Max Doerner, Materials of the Artist, 1934, p. 400.
7. *ibid.*

## A TECHNICAL STUDY OF PAINTINGS BY GRANT WOOD

Helen Mar Parkin\* and James S. Horns\*\*

In the fall of 1994, the authors were asked to write a technical article on Grant Wood's paintings for the catalogue of the retrospective exhibition, *Grant Wood: An American Master Revealed*, organized by the Davenport Museum of Art.<sup>1</sup> The exhibition spanned the artist's career, from his youth in rural Iowa to his rise to fame, along with John Steuart Curry and Thomas Hart Benton, as one of the triumvirate of American Regionalist painters. The purposes of our research were to characterize the artist's materials and techniques and relate them to observed changes in painting style, particularly those which took place around 1930. Twenty-eight paintings, dating from 1921 to 1941, were included in the study. The paintings were examined with the unaided eye in normal, raking and specular light, as appropriate, and with the binocular microscope. Samples from fourteen of the paintings were sent to the Williamstown Art Conservation Center for cross-section and analysis (fig. 17) using polarized light and fluorescence microscopy (PLM/FM), scanning electron microscopy with energy-dispersive x-ray spectrometry (SEM-EDS), and Fourier transform infrared microspectroscopy (FT-IR).<sup>2</sup> Inge Fiedler at the Art Institute of Chicago undertook the analysis on samples from *American Gothic*, using polarized light microscopy with electron microprobe for confirmation.<sup>3</sup> While some pigment analysis was carried out, the focus of this paper will be primarily on supports, grounds and media.

Grant Wood was born February 13, 1891, on a farm near Alamosa, Iowa, and grew up in Cedar Rapids. Three times during the 1920s he took time off from teaching art in the Cedar Rapids School system to visit Paris, where he looked at collections, studied at the Académie Julien, and exhibited his work. His paintings of this period resemble the work of the Impressionists and Post-impressionists he saw in Europe (fig.5). During a trip to Munich in 1928, he admired Late Gothic and Northern Renaissance painters (fig. 4) for their primitive style and attention to detail. He was "drawn to the 'rationalism' involved in [their] methods of designing cohesive compositions overlaid with a multiplicity of details."<sup>4</sup> He also noted the use of wood panels and thin, transparent glazes of paint. Wood was perhaps also influenced by the contemporary German art movement, "die Neue Sachlichkeit" (the New Realism or Objectivity), which included artists such as Max Beckmann and Otto Dix (fig. 3), and which drew some of its inspiration from Northern Renaissance painting.<sup>5</sup> After this trip, the style of Wood's paintings changed from loose, painterly, and impressionistic to more tightly controlled, carefully calculated and highly finished. In 1930 he painted his pivotal work, *American Gothic* (fig. 2), combining the style of the Flemish Primitives with uniquely American subject matter. For the remaining twelve years, until his death in 1942, he continued to teach and paint scenes of his native Midwest.

### EARLY PAINTINGS

The paintings of the 1920s are most often executed on pulpboard panels which could be carried easily to outdoor sketching locations. Wood's slotted carrying case for paintings, measuring 13" x 15", may have been used to transport the paintings, many of which fit these dimensions. The thick, fluid paint was applied "alla prima". directly onto the support, with brushmarking clearly defined. In some areas, a sharp object, such as the end of a brush or palette knife, was scratched through the paint to create additional lines or texture. Exposed areas of the panel were evidently intended to show in the finished design. Drawing lines, where visible, appear to have been applied only to block in the composition. These paintings seem to have been finished in one stage, without reworking or revision. One painting of this period which stands out in contrast is *The Spotted Man* (fig. 6), painted in 1924 on linen canvas. The paint is applied as a rich paste in many layers, using a broad, pointillist technique of short brush strokes with low to medium impasto. Wood began the painting while a student at the Académie Julien, then reworked it after returning to the United States, applying smaller brush strokes over the existing design to refine the surface.

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\* Chief Conservator, Taft Museum, Cincinnati, Ohio

\*\* Conservator in Private Practice, Minneapolis, Minnesota

During the 1920s, Wood began to use glazes in the construction and finishing of his paintings, an interest which would become an essential part of his later work. Between 1925 and 1927, he painted a series of large interior murals on preprimed canvas for several Iowa hotels which came to be known as the Corn Room murals. One of Wood's assistants recalled that the artist applied a transparent glaze over the ground, then worked in the wet paint, wiping off the glaze where necessary and using his thumb or a dry brush to create rabbits and cornstalks.<sup>6</sup> Cross-sections of one of the murals reveal layers of opaque paint alternating with transparent or lightly pigmented layers.<sup>7</sup> In a small painting of *Indian Creek* dated to 1928 (fig. 7), the surface includes areas of transparent, pigmented glazes as well as an overall yellowed oil layer containing little or no pigment. The cross-section shows alternating layers of paint and glazes. A broad pattern of shrinkage crackle is present, suggesting incompatible layers and drying stresses. As with many of Wood's paintings, *Indian Creek* shows evidence that it was placed in a frame (which marked the soft, undried paint at the edges), then removed and reworked, with the glazes added at the final stage. This painting might be considered transitional between Wood's early and mature periods, because it anticipates the purposeful use of glazes seen in later compositions.

Working from preliminary oil sketches, Wood made drawings in pencil, chalk or charcoal on heavy brown paper, at each stage editing and simplifying the design. "The public does not realize...", he said, "the amount of work that goes into one painting before I begin to set it down on canvas. In my last picture, I spent two months--fourteen hours a day, including Sundays--sketching, making notes, rejecting ideas. Because I paint so few pictures, I must necessarily be highly selective before I start to work."<sup>8</sup> For many of the later paintings, such as *Spring Turning*, *Parson Weems' Fable*, and *Spring in the Country*, full-scale cartoons in charcoal, pencil and chalk were prepared. For *Dinner for Threshers*, Wood made two chalk, pencil and paint sketches, one of each end of the composition, before executing a full-scale, full-color preliminary drawing of the entire work.

## MATURE PAINTINGS: THE 1930S

### Supports

At the beginning of the 1930s, Wood was using pulpboard, Upson Board,<sup>9</sup> plywood (as in the case of *Stone City, Iowa*) and occasionally canvas for supports, but soon switched to Masonite<sup>®</sup> for both oil sketches and finished paintings, usually working on the smooth side. His preference for rigid supports may relate to the convenience of drawing, painting details and applying glazes on a non-flexible surface. As Masonite was developed in 1926, Wood may have been one of the first artists to use it.<sup>10</sup> Sometimes, particularly later in the decade, he glued fabric to laminates of pulpboard and Masonite or to Masonite alone in preparation for painting. *Iowa Cornfield*, a late sketch dated 1941, is painted on a hardboard panel slightly thicker than Masonite and smooth on both sides. Radiographs reveal a single screen pattern in the interior, not the double screen that might be expected if two boards had been glued together. According to Alexander Katlan, the support is probably S2S (smooth two sides) hardboard, first manufactured by U.S. Gypsum Co. in 1938, under a license agreement with Masonite Corporation.<sup>11</sup>

### Grounds

The grounds in the 1930s are usually white layers of varying thickness, often toned with a thin wash of color and/or a pigmented glaze. Grounds covering solid supports are applied by brush in fluid, sweeping, curved or horizontal strokes, clearly visible in raking light, which often overlap the edges of the panel slightly. In some paintings, the ground is thinner and smoother or appears to have been scraped or sanded before application of the paint. Two of Wood's coworkers recalled that the artist primed his panels with a commercial, oil-base paint (which his assistant, Arnold Pyle, referred to as "Moore's White Undercoat,"<sup>12</sup> perhaps a carryover from his occasional work as an interior decorator. The paint was allowed to settle in the can for a period of time, after which excess oil was poured off and the remaining thick, white paint was brushed onto the panel.<sup>13</sup> Ground samples from all but two of the paintings analyzed by James Martin at Williamstown were found to contain a zinc/barium/sulfur base in an oil medium with additions of chalk and quartz, a formulation which would not be inconsistent with commercial paint.<sup>14</sup> Inge Fiedler's analysis of the ground in *American Gothic* also identified a zinc/barium/sulfur mixture, subsequently confirmed by x-ray diffraction as lithopone.<sup>15</sup> A 1924 formula for

White Enamel Underbody, a primer manufactured by Benjamin Moore & Company and furnished to the authors by the research department (fig. 9), indicates a product containing a high percentage of lithopone with some magnesium silicate in a vehicle composed of treated drying oils, resins, and mineral spirits.<sup>16</sup> A comparison of this recipe and the ground analysis lends strong support to Pyle's contention that Wood used a Benjamin Moore product.<sup>17</sup> In contrast to the paintings on panel, the canvas paintings have thin, white primings usually containing lead white or zinc white and chalk in oil. Only the Corn Room murals and *The Spotted Man*, all of which were painted on commercially primed canvas, were found to have grounds containing lead white.<sup>18</sup>

### Preparation and Drawings

The preparatory drawings were transferred to the ground either freehand or, in the case of some large murals and possibly other paintings, with a pouncing technique. In *American Gothic*, crumbly, black drawing lines, identified as possible lamp black,<sup>19</sup> are visible in many areas, including the facade of the house (fig. 10). A thin, warm tone is present over the ground and drawing. In addition, there is a discolored coating covering areas of exposed ground; the opaque paint of the design lies over a yellowed, transparent layer, indicating that the lower layer may have been applied as a glaze. Red drawing lines may be seen in the study for *Stone City, Iowa*, as well as around the edges of the finished composition. In *Birthplace of Herbert Hoover*, a layer of clear resin identified as a lac type<sup>20</sup> may be seen in the cross-section lying over the red underdrawing, below the design layer. In some paintings, the drawings may have been enhanced mechanically with raised or incised lines. In *Midnight Ride of Paul Revere*, narrow ridges of ground, formed by drawing a sharp instrument along a straight edge, are visible around the windows and in the church steeple. In *Parson Weems' Fable*, inscribed lines are visible around some of the architectural elements as well as the tassel. In addition, perfectly circular inscribed lines are visible with the naked eye, and confirmed with the x-radiograph, around each of the circles of the ball fringe, suggesting the use of a compass or circular cutting tool. For some of the balls, more than one circle was inscribed, but only one outline was followed in the final design; lines of traction document the change (fig. 8).

### Paint Application

The paintings of Wood's mature style, such as *Self Portrait*, rely on the use of smaller, more uniform and more carefully applied overlapping or crosshatching brush strokes to achieve softly contoured, simplified, hard edged forms, a process which James Dennis calls "reductive abstraction,"<sup>21</sup> while still incorporating passages of broader handling. The paintings were apparently developed in two stages. The first layer of paint was laid in following the drawing and background colors were brought up to, but not over, the edges of design elements, sometimes allowing narrow areas of ground and drawing lines to remain visible. Then additional layers of small brush strokes were added to refine the design. As mentioned above, the multiple layers of paint are often separated by transparent, unpigmented layers and possibly by pigmented glazes. The dress in *American Gothic* was first painted by dark brown paint accented with white dots and circles. A reddish-brown glaze was then applied, followed with lighter, more opaque brown paint brushed carefully around the white areas. In *Portrait of Nan*, a transparent yellow layer covers much of the painting and extends under some of the flesh tones in the face and elsewhere. As in *American Gothic*, the brush strokes which lie above the yellowed layer are noticeably lighter than the surrounding paint, suggesting that the application of an artist-applied glaze or coating has altered color relationships in this area.

There are occasional indications that Wood used his fingers to aid in modeling; a fingerprint is present in the face of the man in *American Gothic* (fig. 11) and in the eye of the woman at far right in *Daughters of Revolution*. In some paintings, infrared examination reveals that beneath the tightly controlled surfaces are passages of freely crosshatched underpainting resembling the oil sketches of this period. Crosshatched underlayers are present even in paintings where a full-scale cartoon exists, as in the case of *Parson Weems' Fable* (fig. 12). X-radiographs also reveal many interesting design changes. In *Birthplace of Herbert Hoover*, initial layers of paint closely follow the drawing, which includes a vignette of the original Hoover house at lower left. The vignette can be seen in the radiograph, but this and other design elements are missing in the final composition. In *Daughters of Revolution*, changes in the hand and teacup of the central figure are clearly documented in the radiograph, indicating that their original position was much closer to the preliminary drawing.

## Changes in *Self Portrait*

An unusual example of reworking occurs in *Self Portrait* (fig. 1). In the charcoal and pastel study on paper (fig. 14), the sitter is depicted in a white shirt and strapped overalls, with amorphous trees behind his shoulders. In the painting, begun in 1932, he is wearing a blue shirt and the background has been simplified into a series of repeating horizontal lines and small cornshocks. The infrared reflectance photograph shows changes in the neckline, shoulders, and upper contour of the head. The image taken from the infrared vidicon also reveals shoulder straps beneath the blue shirt (fig. 15). The x-radiograph shows a design nearly identical to that of the study (fig. 16). The lack of density in the face and along the straps can be explained by the absence of white lead in the ground. Raking light also documents the changes and shows clearly the horizontal application of the ground and pointillist texture of the paint (fig. 13). At left, near the horizon, the outline of what may have been an amorphous tree from an earlier design may be seen in the raking light photograph. In 1942, according to the artist's sister, Nan, Wood reworked the painting, feeling that the overalls distracted attention from the face, but was still unhappy with it at the end of his life. After his death, Nan asked Marvin Cone, one of Wood's colleagues, to "paint what he thought Grant would like."<sup>22</sup> Cone wrote to Nan in 1950, "I have repainted *only* the little, somewhat triangular shapes on either side of the neck, *following very carefully the lines* originally used by Grant *also the colors*. These could be seen despite his scratching out of the area. The little haystacks on the left, I introduced because in the first painting (or underpainting) of which David Turner has a photograph, they appear. I am pleased with the result and hope it meets...your approval."<sup>23</sup>

## Media and Glazes

The medium in Wood's paintings was found to be a drying oil,<sup>24</sup> in some cases admixed with resin,<sup>25</sup> but the presence of linseed oil could not be confirmed by FT-IR alone. Although according to one of his students Wood sought to copy the technique of the Flemish Primitives as described by Max Doerner,<sup>26</sup> he evidently never used egg tempera for underpainting,<sup>27</sup> which accounts for the absence of protein binder in the samples analyzed. There is evidence, however, that he used additives in his paint. Inge Fiedler's most recent research on *American Gothic*, using FTIR microspectroscopy, has identified a "possible metal salt of an organic acid used as a drier," which she hopes to isolate and characterize further with gas chromatography or mass spectrometry.<sup>28</sup> Nan Wood claimed that her brother used a lot of banana oil in his paints and that the odor filled the house for days, permeating the food.<sup>29</sup> In *Birthplace of Herbert Hoover*, the lac type resin covering the ground was also found in a colorless intermediate layer and in a green glaze, suggesting that shellac may have been used to seal the ground or isolate paint layers.

Glazes were also used to tone, mute, or unify final appearance. Arnold Pyle recalled that Wood's " 'glaze technique' consisted of 'wash glazes' with a single tint of color applied as a unifying tone over large areas of finished painting or over an entire work." The glaze was "lightly brushed onto the surface and then blotted with a rag before being sprayed with a retouch varnish as a drier in preparation for the next coat of glaze".<sup>30</sup> Two other colleagues recalled that, in preparation for glazing, the artist mixed equal parts of linseed oil, damar, and turpentine and added pigment from tube paints. He then brushed this mixture over the entire surface of a well-dried painting until the image was almost totally obscured. After waiting several hours, Wood used a lint-free cloth to wipe off the thickened glaze until the desired effect was achieved. He then reworked details into the fresh glaze using tube colors.<sup>31</sup>

The technique described by the three assistants could account for an unusual condition noted on several paintings from the 1930s. In *Midnight Ride of Paul Revere*, an uneven, stippled pattern of transparent, dark blue dots may be seen throughout. At the edges of the painting, where evidence of a lower design layer is visible, a tideline or buildup of this color has occurred, suggesting a broad application. A cross-section shows several blue glaze layers with intervening clear coatings. In several paintings, grey, blue or brown glazes may be seen in the sky. In *American Gothic*, an uneven, unpigmented, stippled grayish-yellow coating extends not over the blue paint of the sky but under it, as can be seen in an area where the chimney has been painted out, suggesting that it was applied by the artist and has discolored with time. In a photograph taken in 1932, showing Nan and the town dentist, Dr. McKeeby, standing beside *American Gothic*, the painting that made them famous, the contrast

between the glazed and repainted areas of the sky is already apparent. Landscape areas are sometimes toned with a brown glaze, such as in *Birthplace of Herbert Hoover*, in which the amount of pigment appears to vary from one area to another, perhaps depending on the degree of modeling or unification desired. In some cases, of course, it is possible that abrasion from previous cleanings has resulted in unevenness that has become more noticeable with age.

#### Alterations in the Paint Film

Many of the paintings have developed patterns of wrinkling and shrinkage crackle from uneven drying or interaction of materials. In *Sultry Night*, the wide traction crackle corresponds to an area that the artist repainted. In the eyebrow of the man in *American Gothic*, beading of the upper black paint layer apparently took place immediately and may have been intentional. In *Arnold Comes of Age*, painted in 1930, pronounced traction crackle was apparently noticeable within ten years of completion.<sup>32</sup> James Swope, the conservator who treated the painting in 1985, felt that the cracks were caused by stresses in certain glazed areas of the design layer, but he was unsure whether the varnish had pulled the paint apart or vice versa.<sup>33</sup> Wood frequently worked against deadlines and is known to have tried to hasten the drying of one painting by placing it near a hot plate. When blisters formed, he pushed them back into place with his finger.<sup>34</sup> Not surprisingly, a number of conservators have reported difficulty in cleaning Wood's paintings, noting sensitivity of upper and lower paint layers to mild solvents. In several cases, the authors found that the zinc/barium/sulfur ground was soluble in organic solvents or water<sup>35</sup> and, in another case, surface layers were sensitive to water.

While this first technical study has offered better insights into many aspects of Grant Wood's mature paintings, it also raises a number of questions for further study, such as the subject of surface coatings. Limited time and funding prevented the authors from conducting a more comprehensive study and using gas chromatography and x-ray diffraction for more accurate identification, but this research has provided a better understanding of the way in which Wood used his materials and techniques to realize his changing artistic intentions. The authors hope that the groundwork has been laid for further investigation of the work of this important American artist.

#### NOTES

1. Brady M. Roberts, James M. Dennis, James S. Horns, and Helen Mar Parkin, *Grant Wood: An American Master Revealed*, Davenport Museum of Art (San Francisco: Pomegranate Artbooks, 1995).
2. James S. Martin, "Technical Study of Materials Comprising Fourteen Paintings by Grant Wood," Appendix A of Brady M. Roberts et al., *Ibid.*, 92-95.
3. Inge Fiedler, "A Study of the Materials Used in Grant Wood's *American Gothic*," Appendix B of Brady M. Roberts et al., *Ibid.*, 96-98.
4. James M. Dennis, *Grant Wood: A Study in American Art and Culture* (Columbia: University of Missouri Press, 1987), 68.
5. Brady M. Roberts, "The European Roots of Regionalism: Grant Wood's Stylistic Synthesis," *Ibid.*, 36, 1, 20.
6. Carl Eybers Jr., interview with Scott Sorensen, Sioux City, Iowa, March 20, 1979.
7. Martin, "Technical Study of Materials," *Grant Wood: An American Master Revealed*.
8. Nan Wood Graham, John Zug, and Julie Jensen McDonald, *My Brother, Grant Wood* (Iowa City: State Historical Society of Iowa, 1993), 161-65.
9. A label on the reverse of *Arnold Comes of Age* indicates that the support is "Upson Board," a three-eighths-inch thick pulpboard that is much softer than Masonite.
10. Alexander W. Katlan, "Early Wood-Fiber Panels: Masonite, Hardboard, and Lower-Density Boards," *Journal of the American Institute for Conservation* 33, (fall-winter 1994), 304.
11. *Ibid.*, 304-5, and verbal communication, 1995.
12. Dennis, *Grant Wood: A Study in American Art and Culture*, 238, and verbal communication, 1995.
13. Lee Allen, verbal communication, 1995.
14. Martin, "Technical Study of Materials," *Grant Wood: An American Master Revealed*.
15. Fiedler, "Grant Wood's *American Gothic*," *Ibid.*, and written communication, 1997.
16. William J. Mulherin, Benjamin Moore & Company, written communication, 1995.

17. A letter dated January 13, 1938, addressed to John Steuart Curry from H.D. Rasmusson, Chemist at Benjamin Moore & Company, mentions that Grant Wood uses Moore's Primer Sealer in the preparation of his grounds and refers Curry to Wood for advice on how to use it for this purpose. The letter indicates that the non-volatile portion of the Primer Sealer is composed entirely of Tung and Linseed oils. The non-volatile portion of the Enamel Underbody is composed almost entirely of the same oils, with seven and one-half percent resinous material (not specified). Archives of American Art, John Steuart Curry papers, roll 167, frame 786. A reference on a later frame on this roll to a handwritten note on Mrs. Grant Wood's stationery reads, "Moore's White Enamel Underbody. Pour off liquid before using as a thick paste". Another letter from Rasmusson to Curry, dated January 5, 1938, recommends that the artist use this product "with its full amount of liquid, rather than pouring it off, as you are now doing." This information was provided to the authors by Lance Mayer, with additional verbal communication, 1997. See also article by Lance Mayer and Gay Myers to be published in the Journal of the American Institute for Conservation at a later date.
18. Martin, "Technical Study of Materials," *Grant Wood: An American Master Revealed*.
19. Fiedler, "Grant Wood's *American Gothic*", Ibid.
20. Martin, "Technical Study of Materials", Ibid.
21. James M. Dennis, "Grant Wood's Native-born Modernism," Ibid., 55.
22. Graham, *My Brother, Grant Wood*, 109.
23. Grant Wood Archives, Davenport Museum of Art. David Turner was an important patron of Grant Wood.
24. Martin, "Technical Study of Materials," *Grant Wood: An American Master Revealed*.
25. Ibid.
26. Byron Burford, verbal and written communication, 1997. Mr. Burford wrote to the authors on June 4, 1997, "Re the glazing: At time, I remember well that I and many of my fellow students using the formula from Max Doerner's *The Materials of the Artist* (first published 1921) which was the "bible" of that period. This was the turpentine, damar, and either sun-thickened [linseed oil] or stand oil and I would imagine that was what Wood used."
27. Dennis, *Grant Wood: A Study in American Art and Culture*, 238, and verbal communication, 1995, regarding earlier interview with Arnold Pyle.
28. Inge Fiedler, verbal and written communication, 1997. Ms. Fiedler presented a paper titled, "A Study of the Materials and Painting Technique of Grant Wood's *American Gothic*" at Inter-Micro 96 in Chicago, July, 1996. This research, as well as pigment identification by polarized light microscopy and electron microprobe analysis and research on the beaver board support, will be published at a later date.
29. Graham, Ibid., 11.
30. Dennis, *Grant Wood: A Study in American Art and Culture*, 238.
31. Lee Allen and William Bunn, verbal communications, 1995.
32. "Resource/Reservoir", Sheldon Memorial Art Gallery, Volume 1, Number 3, provided to the authors by James Swope Fine Arts Conservation, Inc., along with additional written communication.
33. James Swope, verbal communication, 1997.
34. Graham, Ibid., 68.
35. Perhaps this solubility can be explained by Wood's practice of pouring off most of the oil medium before applying the ground.

#### ILLUSTRATION CREDITS

##### Paintings by Grant Wood:

*The Spotted Man*, 1924, Oil on canvas, 30 x 20 in., Davenport Museum of Art  
*Yellow Doorway*, St. Emilion, 1927, Oil on composition board, 15 7/8 x 13 in., Cedar Rapids Museum of Art  
*Indian Creek*, 1928, Oil on pulpboard, 13 1/16 x 14 7/8 in., private collection  
*American Gothic*, 1930, Oil on beaver board, 29 7/8 x 24 7/8 in., The Art Institute of Chicago  
*Study for Self Portrait*, 1932, Charcoal and pastel on paper, 14 1/2 x 12 in., Cedar Rapids Museum of Art  
*Self Portrait*, 1932-41, Oil on Masonite panel, 14 3/4 x 12 3/8 in., Davenport Museum of Art  
*Parson Weems' Fable*, 1939, Oil on canvas, 38 3/8 x 50 1/8 in., Amon Carter Museum of Art

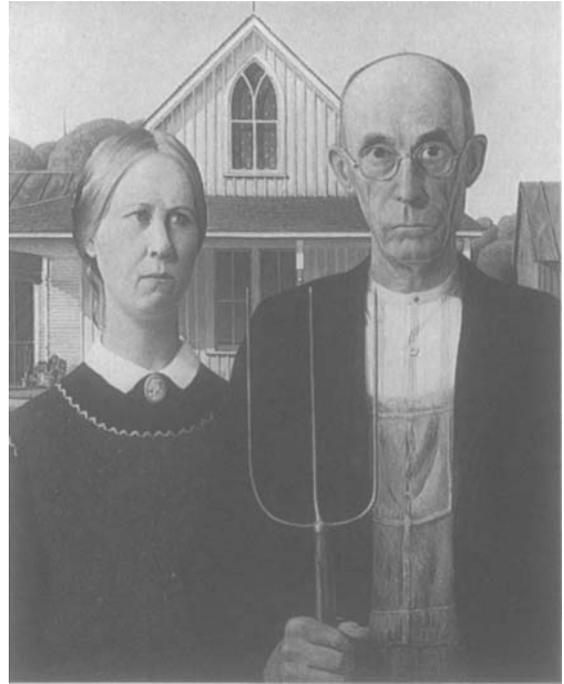
##### Other paintings:

Jan van Eyck, *A Man in a Red Turban*, 1433, tempera (?) and oil on panel, The National Gallery, London  
 Otto Dix, *Self Portrait with Easel*, 1926, Oil on panel, 31 3/4 x 21 7/8 in., Leopold-Hoesch-Museum, Düren, Germany

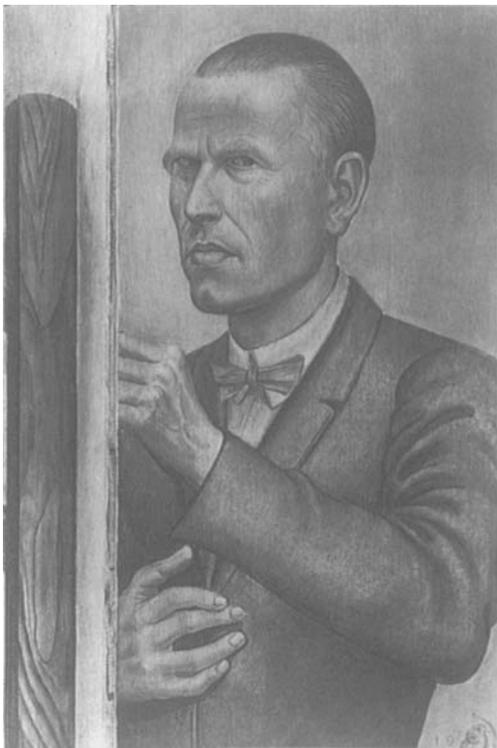
FIGURES



1. *Self Portrait*



2. *American Gothic*



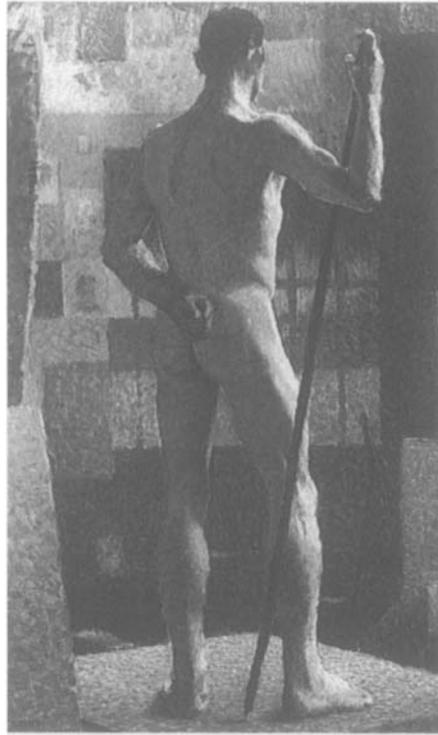
3. Otto Dix, *Self Portrait with Easel*



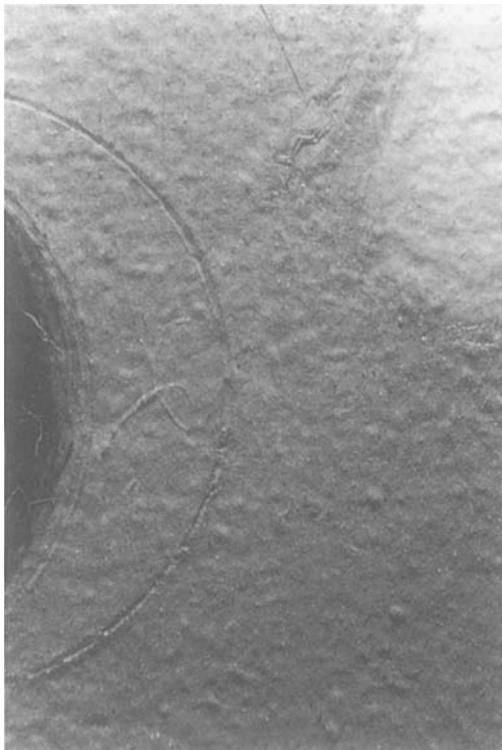
4. Jan van Eyck, *A Man in a Red Turban*



5. *Yellow Doorway, St. Emilion*



6. *The Spotted Man*

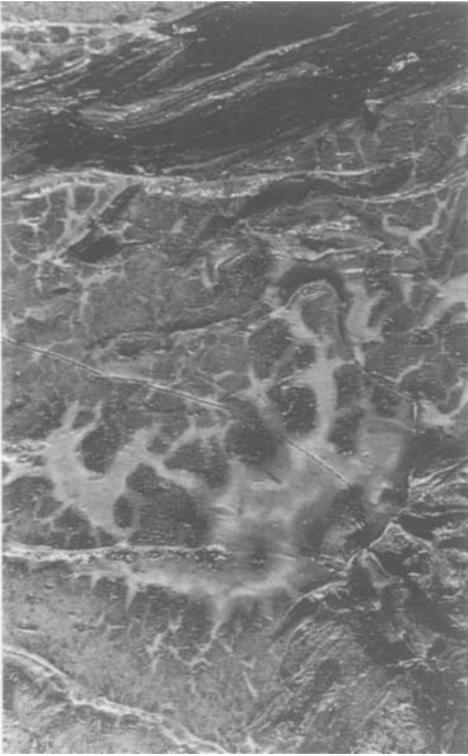


8. Photomicrograph of *Parson Weems' Fable*, showing detail of inscribed lines around the edges of the ball fringe

White Enamel Underbody  
12/2/24

490 lbs.	Lithopone								
100 "	Asbestine								
3 "	#90								
28 gals.	#21 Oil								
3 "	#520 Oil								
<hr/>									
806 lbs.	Paste								
1612 lbs.	Above Paste								
24 gals.	Texens								
<hr/>									
8 "	#13L V.r.n.								
1 "	#105 Dryer								
3 "	Refined Oil								
<hr/>									
130 gals.									
<hr/>									
14-1/4 lbs.									
EUB	12.2.24								
Composition	62.50%								
Pigment	27.50%								
Vehicle	100.00%								
Pigment		63.04%							
Lithopone		16.95%							
Magnesium Silicate		100.00%							
Vehicle									
Trawl Drying Oil		35.44%							
Resins		8.72%							
Mineral Spirits		58.84%							
		100.00%							
									Benjamin Moore & Co.

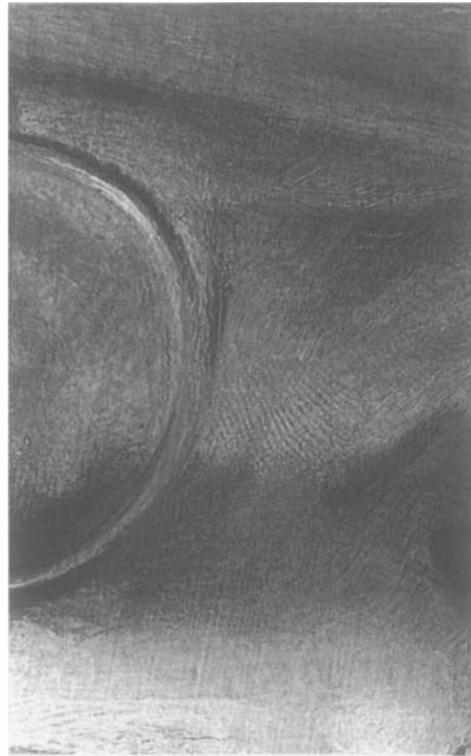
9. Recipe for White Enamel Underbody, dated 1924, a primer manufactured by Benjamin Moore & Company.



7. Photomicrograph of *Indian Creek*, showing shrinkage crackle caused by incompatibility of layers and uneven drying



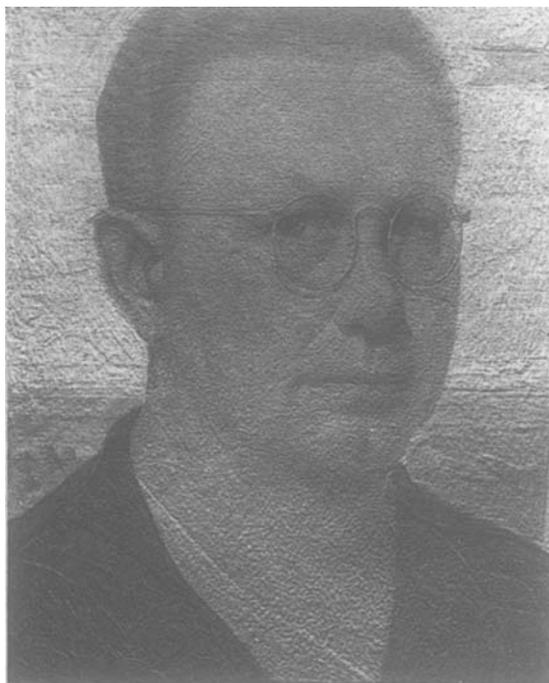
10. Photomicrograph of *American Gothic*, showing drawing lines and areas of exposed ground in the facade of the house



11. Photomicrograph of *American Gothic*, showing fingerprint in cheek of man's face



12. Infrared vidicon image of *Parson Weems' Fable*, showing loose crosshatching in the lower paint layers



13. Raking light photograph of *Self Portrait*, detail, showing design changes, grooved lines of unevenly applied ground, and texture of paint



14. *Study for Self Portrait*



15. Infrared vidicon image of *Self Portrait*, detail, showing design changes in head and shirt



16. X-radiograph of *Self Portrait*, showing the underlying design, which is nearly identical to the study

This table compares the types of layers and materials found in samples from fourteen paintings by Grant Wood. Coatings and grounds from each painting were analyzed, but not all paint, glaze, and interlayer coatings were analyzed. Samples from some paintings contained only single layers, such as ground, paint, or coating; thus, information on other layers in these paintings is lacking. These results are not necessarily inclusive of all layers and materials present in the paintings, only of those layers in the samples provided that were analyzed. Additional analysis of samples may provide more conclusive data about specific binders and coatings and identify pigments and minor or trace components.

The Spotted Man (1924)  
 Corn Room murals (c. 1925)  
 Indian Creek (c. 1926)  
 Arnold Comes of Age (1930)  
 American Gothic (1930)  
 Study for Stone City (1930)  
 Stone City, Iowa (1930)  
 The Birthplace of  
 Herbert Hoover (1931)  
 Midnight Ride of  
 Paul Revere (1931)  
 Daughters of Revolution (1932)  
 Self Portrait (1932)  
 Dinner for Threshers (1934)  
 Parson Weems' Fable (1939)  
 Iowa Cornfield (1941)

Grounds (Primary Pigment and Binder)	The Spotted Man (1924)	Corn Room murals (c. 1925)	Indian Creek (c. 1926)	Arnold Comes of Age (1930)	American Gothic (1930)	Study for Stone City (1930)	Stone City, Iowa (1930)	The Birthplace of Herbert Hoover (1931)	Midnight Ride of Paul Revere (1931)	Daughters of Revolution (1932)	Self Portrait (1932)	Dinner for Threshers (1934)	Parson Weems' Fable (1939)	Iowa Cornfield (1941)
Barium-zinc white in oil														
Lead white in oil														
Lead white, barium-zinc white														
Zinc white in oil														
<b>Underdrawing</b>														
<b>Interlayer Coatings</b>														
Lac-type resin														
Oil or oil-resin mixture														
Present but not accessible														
Not present														
<b>Paints and Glazes (Binders in Selected Layers)</b>														
Oil														
Natural resin, lac-type														
Synthetic														
Not conclusively analyzed														
Additional layers not analyzed														
Not present														
<b>Surface Coatings</b>														
Natural resin														
Natural resin, lac-type														
Oil														
Possible oil-resin mixture														
Synthetic														
Not present														

17. James S. Martin, Layer Types and Materials in Selected Paintings by Grant Wood, from Brady Roberts et al., *Grant Wood: An American Master Revealed*, Davenport Museum of Art (San Francisco: Pomegranate Artbooks, 1995), Appendix A

## USE OF A *RIGATINO* INPAINTING TECHNIQUE FOR COMPENSATION OF LOSSES IN PANEL PAINTINGS - A CASE STUDY

Teresa A. Lignelli, Associate Conservator of Paintings

In preparation for a reinstallation of the Philadelphia Museum of Art's medieval and early Renaissance galleries, the treatment of three panels from a 14th c. Italian altarpiece by the Sieneese painter Pietro Lorenzetti was undertaken in 1992. The panels include an Enthroned Madonna and Child (Fig. 1), belonging to the John G. Johnson collection since 1912, and two surmounting Spandrel Angels, separated from the structure at an unknown time in the past and acquired by the Museum in 1985. The altarpiece, possibly painted for the *badia*, the abbey church in Arezzo, dates from the early 1320's. The poplar wood supports have been prepared with a gesso ground and painted with egg tempera using traditional 14th c. Italian techniques. Measuring about five feet tall by a little over two feet wide, the panels are the central section of a large polyptych similar in scale and structure to Lorenzetti's signed work for the high altar of Santa Maria della Pieve in Arezzo, commissioned in 1320, just a few years prior to the execution of the Philadelphia panels. The Arezzo altarpiece was a valuable comparative source, both pictorially and structurally, during the restoration phase of treatment.

The treatment of the paintings sought to reassemble the panels and visually reintegrate the images, presenting the work as a fragment which can be more readily and accurately associated with its cultural, structural, and aesthetic context. Compensation issues throughout the project included structural treatment of the spandrels, carried out by George Bisacca of the Metropolitan Museum of Art, reconstruction of moldings as well as presentation considerations. This paper will address the compensation for loss of the pictorial layer. While the same approach and techniques were used for all three panels, inpainting of the Spandrels was relatively straightforward, and discussion will thus be limited to the Enthroned Madonna and Child, which presented reconstruction issues of greater complexity.

Before treatment, the painting exhibited an extremely darkened 19th c. restoration executed in oil paint. The painting had last undergone varnish removal in 1929, and during the ensuing years, had received at least seven additional applications of varnish, which discolored to a disfiguring yellow/brown. Before treatment began, curators were apprised of the extent of damage to be uncovered by cleaning. The X-radiograph clearly revealed the losses in the lower half of the painting. The panel probably stood in water at some point, resulting in a band of loss along the bottom and at the sides where water would have traveled up the lateral joins, and also along a central crack, resulting in the largest loss to the drapery.

Consideration was first given to a reworking of the 19th c. restoration, particularly of the drapery losses, but, as cleaning proceeded, it became obvious that the oil paint had darkened intolerably, and the opacity of the heavy application overwhelmed the delicate luminosity of the original paint surface. Furthermore, the freely invented pattern of the drapery reconstructions was clumsily executed, without fully comprehending Lorenzetti's modeling and spatial devices. In addition, the larger reconstructions broadly transgressed the boundaries of loss, obscuring fragmentary details. In the end, all previous restorations were removed. Although forewarned of the actual state of the picture, the reality was still startling (Fig. 2). Curatorial collaboration was essential in establishing methodology to guide the restoration. Restoration philosophies and plans for compensation were discussed at length before cleaning began. For various reasons, a complete reintegration of the image was advocated.

Considered one of the most important *trecento* works among the Museum's holdings, the painting represents Lorenzetti's only full length Madonna in an American institution, and is one of the artist's first attempts at this genre. The image shows Lorenzetti's growing concern with the monumentality of the figure in a fictive three dimensional space. The losses to the sides of the throne, the stepped dais, and major folds of the Virgin's mantle seriously compromise the illusion of depth and volume. Culturally, the panel would have been an important work of public

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Teresa A. Lignelli  
Conservation Department  
Philadelphia Museum of Art  
P.O. Box 7646  
Philadelphia, PA 19101-7646

devotion, whose sacred effect depended on imposing and convincing three dimensionality. As testament to the durability of the tempera technique, the original paint surface is very well preserved, and the painting retains a remarkably intact, and continuous greyed patina. In addition, enough fragmentary evidence was uncovered by cleaning to suggest a comprehensive reintegration of the image. Decisive, plausible reconstructions were carried out in all areas of loss based primarily on evidence from the painting itself, and supplemented by comparative sources. Fortunately, there are numerous extant Lorenzetti works available for first hand study. Together with Carl Strehlke, Adjunct Curator of the Johnson Collection, I made a visual survey of the artist's related Enthroned Madonnas, and other works, in Arezzo, Cortona, Siena, and Florence. Photographs, sketches, measurements, and insights gathered during that trip provided critical reference material throughout the restoration.

A *rigatino* inpainting technique was chosen for compensation. Given the extent of loss, this method seemed best suited to reintegrate the image while respecting the original surface. The technique resulted in a reconstruction that is inconspicuous at a normal viewing distance, but readily discernible on close inspection. While all current methods of visible inpainting are philosophically based on Cesare Brandi's theories of restoration, in my experience, *rigatino* is the colloquial term for a variety of practical application derivatives of the *tratteggio* technique. As used in this case, the *rigatino* is a systematic application of discrete vertical strokes to produce directly matched color. Practically speaking, the direct color match of this *rigatino* perhaps aligns the technique more closely with the "middle road" of hatching proposed by Doerner in the 1920's<sup>1</sup> rather than the strict division of tones and optical color mixing of traditional *tratteggio*.

Losses were filled with a chalk and gelatin mixture with some kaolin added to facilitate a smoother surface. It is important to have flat white fills, which will reflect the greatest amount of light through the inpainting. With few exceptions, all inpainting was carried out directly using a polyvinyl acetate resin palette<sup>2</sup>. In general, compensation proceeded systematically, progressing from the reintegration of abrasions and small losses to reconstruction of the larger passages. This approach ensured a clarity of the image and a familiarity of the paint surface as losses of increasing size and complexity were assessed. The primary aim of restoration was the reestablishment of the artist's spatial objective.

The following examples will illustrate various aspects of this *rigatino* technique and the considerations which guided the reconstruction of some specific damages. Along with original details recovered during cleaning, the most important aid to reconstruction came from the incisions the artist had drawn in the gesso to delineate his composition. Many were visible on the surface, but at several points, the incisions could only be detected by x-radiography, particularly in damages where the gesso had been abraded. In a detail of the right side of the throne seat (**Fig. 3**), a curved incision line fragment, and a bit of original gilding were revealed upon removal of the previous restoration which had squared off the seat. The X-radiograph clarified the incision, and the seat was restored to its original coved contour (**Fig. 4**). The effect of the inpainting is flickering, rather than strongly vibrating, to give visual texture to the flat fills, and the translucency of color produces a silvery tone which is nicely compatible with the well preserved tempera surface.

The reconstruction of the child's hand held in benediction was a case in which the X-radiograph showed fragments of incisions that weren't visible on the surface. A tracing of the incisions onto a polyester resin film (Mylar®) was taken from the X-radiograph and used to work up a sketch. For this damage, a comparative source was needed to complete the reconstruction. A Lorenzetti fresco in the Basilica of San Francesco in Assisi, dating from about 1319, shows a child gesturing in a similar manner. Although the angle of the hand is slightly different, the finger configuration is identical. The consistency of Lorenzetti's handling of poses and rendering of anatomical detail from one painting to the next proved useful in several of the reconstructions.

In another such example, the child's left hand is held in a pose akin to that painted in Lorenzetti's Carmelite Altarpiece of 1329. The comparison was used to reconstruct the relative positioning of the missing fingers. By approaching the reintegration of damages by degrees the translucent color build-up and visibility between strokes allowed a nearly

<sup>1</sup> Doerner, Max, *The Materials of the Artist*. Translated by Eugen Neuhaus, Harcourt, Brace and Company, New York, 1934, pp. 406-407.

<sup>2</sup> Dry pigments are ground in poly vinyl acetate resin [grades AYAA and AYAC (2:1). Manufactured by Union Carbide].

constant view of fills during the reconstruction process, and a means for monitoring the borders of loss to fully incorporate all fragments and any surviving modeling into the reconstruction. Moreover, damages to the Virgin's face, although numerous, were fairly straightforward to reconstruct. The Virgin from the 1320 Arezzo Altarpiece was an important reference for flesh tone modeling, while the Cortona Enthroned Madonna of c.1319 was consulted specifically for reconstruction of the ear. Although a consistency of inpainting technique was maintained overall, the size and thickness of the juxtaposed vertical strokes was varied in response to loss size and location. Smaller losses, such as those in the Virgin's face, were inpainted to a high degree of finish and modulation, given their evident reconstruction and direct comparative source.

The large drapery passages of the Virgin's mantle were the last areas of the painting to be reconstructed. The mantle represents a brocaded silk textile, typical of the type that would have been manufactured in nearby Lucca. With his concern for illusionistic space, Lorenzetti's drapery is strongly modeled, the deep folds colored with azurite. Of the original mordant gilded brocade, only traces of gold survived past cleanings. While the ornamental foliate pattern is non-repeating, the individual motifs create a tight configuration of inter-locked forms. Lorenzetti has deliberately varied the density of the pattern to heighten the spatial illusion. Directly corresponding to the modeling, the individual motifs are noticeably larger and spaced farther apart in areas of highlighted projection, such as the Virgin's proper right knee; while a smaller motif, more tightly configured, is used in areas of recessed shadow, for example, in the Virgin's lap above the child's feet. Further analysis of the pattern reveals a head-to-tail positioning of motifs around forms that superimpose the drapery, as well as the placement of partial motifs perpendicular to edges to suggest where the fabric passes behind an overlapped form. Our recognition of the significance of Lorenzetti's manipulation of the pattern as a spatial device warranted reconstruction of the mordant design. Careful study of the artist's technique coupled with large areas of intact drapery upon which to draw the pattern led to a plausible reconstruction.

A stencil was chosen as the most effective method of transferring the pattern onto the fills. It allowed a tight control over the reconstruction and direct utilization of Lorenzetti's own motifs lifted from analogous passages.

The smaller drapery loss adjacent to the donor monk was reconstructed first, following restoration of all surrounding areas. A base tone indicating modeling of the folds was applied to the fill, lighter than finally desired, to allow tonal shift and color interaction from the superimposed motifs (**Fig. 5**). The stencil was produced from a sheet of Mylar film. The film was positioned over the loss, and all motifs surrounding the fill, including any fragments along the borders, were traced onto it with a black permanent marking pen. The contours of surrounding forms were also traced to place the loss in context. The Mylar was then moved over areas of intact pattern on other areas of drapery to choose clusters of motifs, that by size, and spatial function would produce a compensation of loss supportive of Lorenzetti's spatial scheme. Consideration was first given to incorporation of border fragments before the remainder of the pattern was realized. Reconstruction motifs were traced onto the Mylar with a red marking pen. The overlay was then photocopied, producing the overall visual effect of the reconstruction in black and white. Due to the specific interrelationship between motifs, it was immediately apparent when an element of the reconstruction didn't "fit". In such instances, the rejected motif or cluster was erased from the Mylar with ethanol and replaced with those more appropriate. When the proposal was judged satisfactory, the red motifs were then cut from the Mylar with a scalpel blade to produce the stencil (**Fig. 6**). Working through the stencil, the design was transferred onto the base tone. With the stencil then removed, inpainting was continued to completion (**Fig. 7**). In areas of drapery reconstruction, the recreation of modeling blends, particularly across the boundaries of loss was achieved using a translucent build-up of *rigatino*. Moreover, while the paint surface on the rest of the painting was quite good, the monk's robe had suffered extensive abrasion. The *rigatino* application was useful in allowing some of the fill to show through the reconstruction, to maintain a compatible surface appearance with the inpainted abrasions, in other words, so it didn't look too solid.

The larger central drapery loss, including the child's foot, was the very last area to be addressed. It was completed in two sections, by the transfer process previously described, with the motifs surrounding the foot reconstructed first, followed by completion of the deep central fold. The stencil was quite successful, but a bit tedious to use, as each cut edge had to be held down with one hand while inpainting with the other to achieve a clean edged pattern. The foot was placed with a base tone and then finished after completion of the drapery. Incision lines were again important in determining here the angle of the foot, by using an incised line indicating the heel. Comparative sources included Lorenzetti's Enthroned Madonna and Child of 1340 in the Uffizi Gallery. Of note is the slight shift in angle of the foot between the 19th c. restoration and the present reconstruction. Study of the pattern of modeling on the leg and the "character" of the other intact foot contributed to a plausible reconstruction.

Several losses were inpainted to remain legible as damages, either where they reflected devotional use or served as evidence of the polyptych's construction. For instance, the two circular losses above the child's head remain visible following treatment to document that a votive crown had at one time been nailed to the panel. Another example is the treatment of fills at the ends of the tri-lobed molding. These losses correspond to the capitals of colonettes which would have been attached to the panel to cover the open joints between this plank and those on either side. After inpainting, the damages visibly suggest the placement and shape of the capitals. For the viewer who takes notice of these areas, attention is also drawn to a thinly painted dark line, a framer's sight edge which occurs on either side of the panel.

As losses were assessed and reconstructed according to their contribution to the effect of illusionistic space, a few decorative elements were not reconstructed at all as their presence exceeded our requirement for the general recovery of spatial effect. For instance, the decorative surface of glazed silver leaf along the borders of the mantle has been lost, and no attempt was made to reconstruct the design. Likewise, decorative medallions on the front edges of the throne were not reconstructed where missing, as they weren't necessary for the spatial illusion.

The results of reintegration represent a well supported critical interpretation of the picture and a true collaboration of curatorial and conservation concerns. Use of a discernible *rigatino* technique for loss compensation, as opposed to more deceptive methods, allowed continuing evaluation of the reintegration as it progressed. While I executed the inpainting, the studied reconstructions were determined through continuous dialogue and exchange with curators, conservation colleagues, and visiting scholars. The Enthroned Madonna and Child was again reunited with its Spandrels; the reassembly of the three pieces restored the configuration of the panels and the formal relationship of the images (**Fig. 8**). The gallery installation now presents the viewer with a central section of an altarpiece, an impressive fragment of a much larger whole.

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Figure 1. Pietro Lorenzetti, Enthroned Madonna and Child with Kneeling Donor, John G. Johnson Collection, cat. 91, before treatment.



Figure 2. Before inpainting.

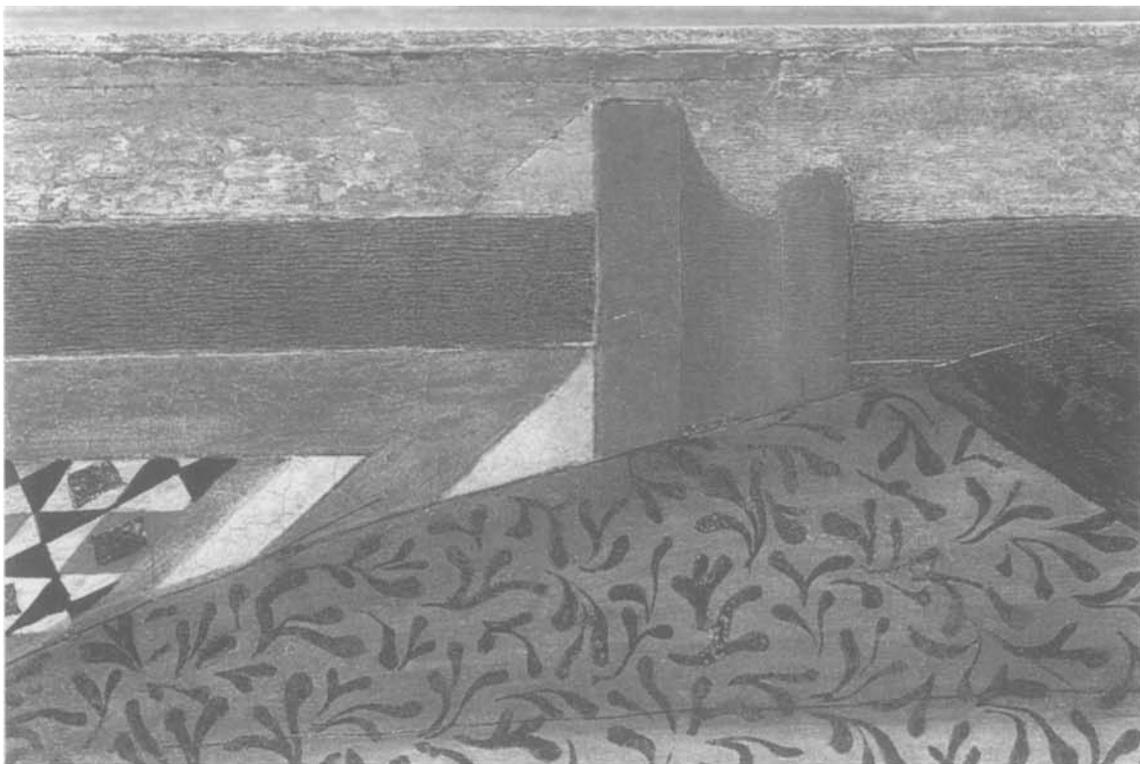


Figure 4. Detail; right side of throne seat, after treatment.

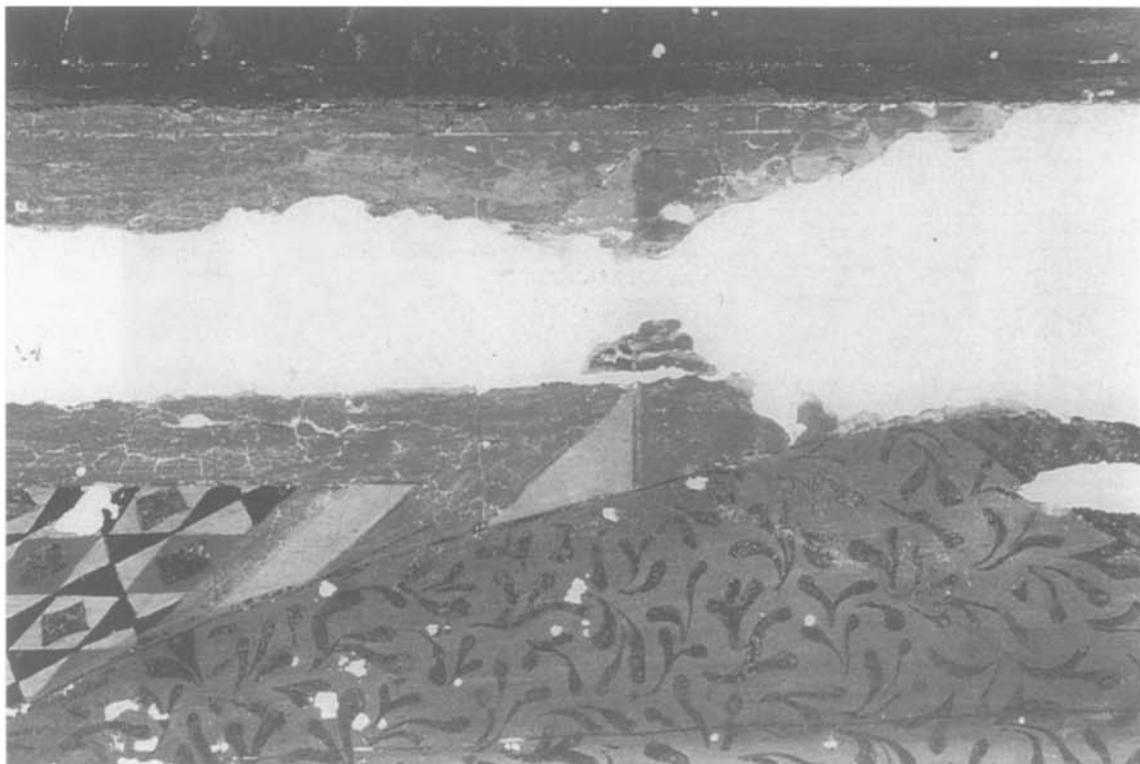


Figure 3. Detail; right side of throne seat, before inpainting.



Figure 5. Detail; during inpainting, before reconstruction of decorative pattern.

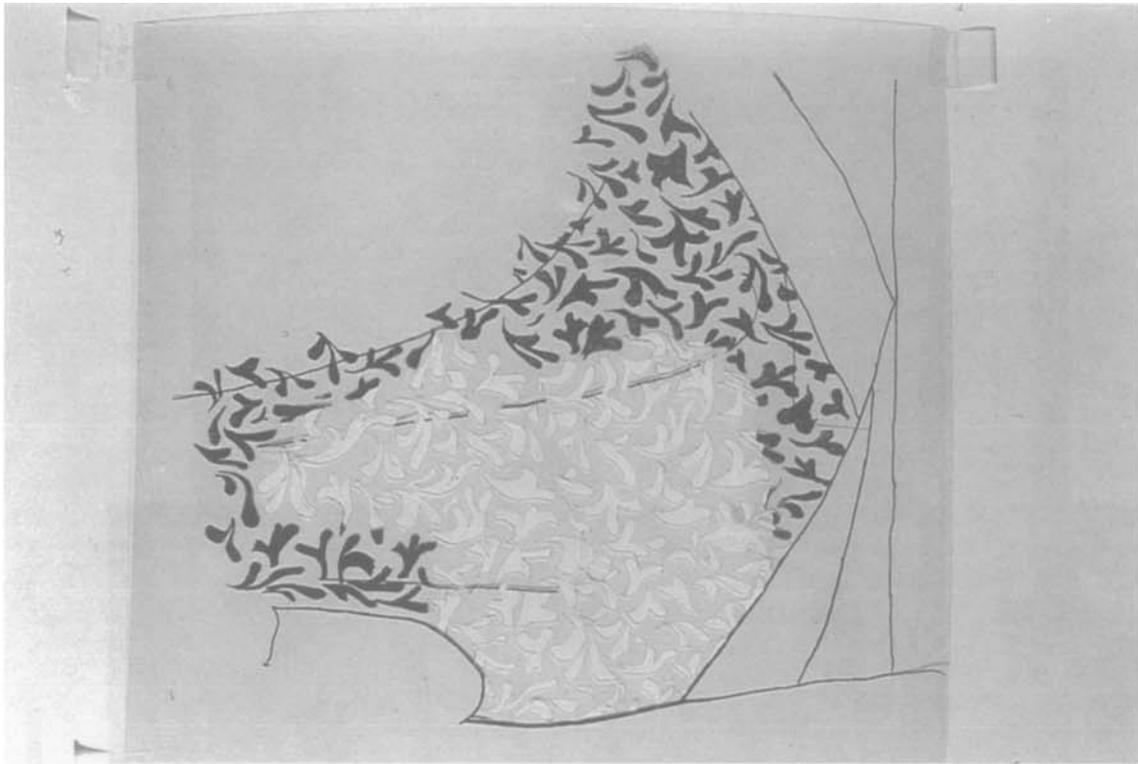
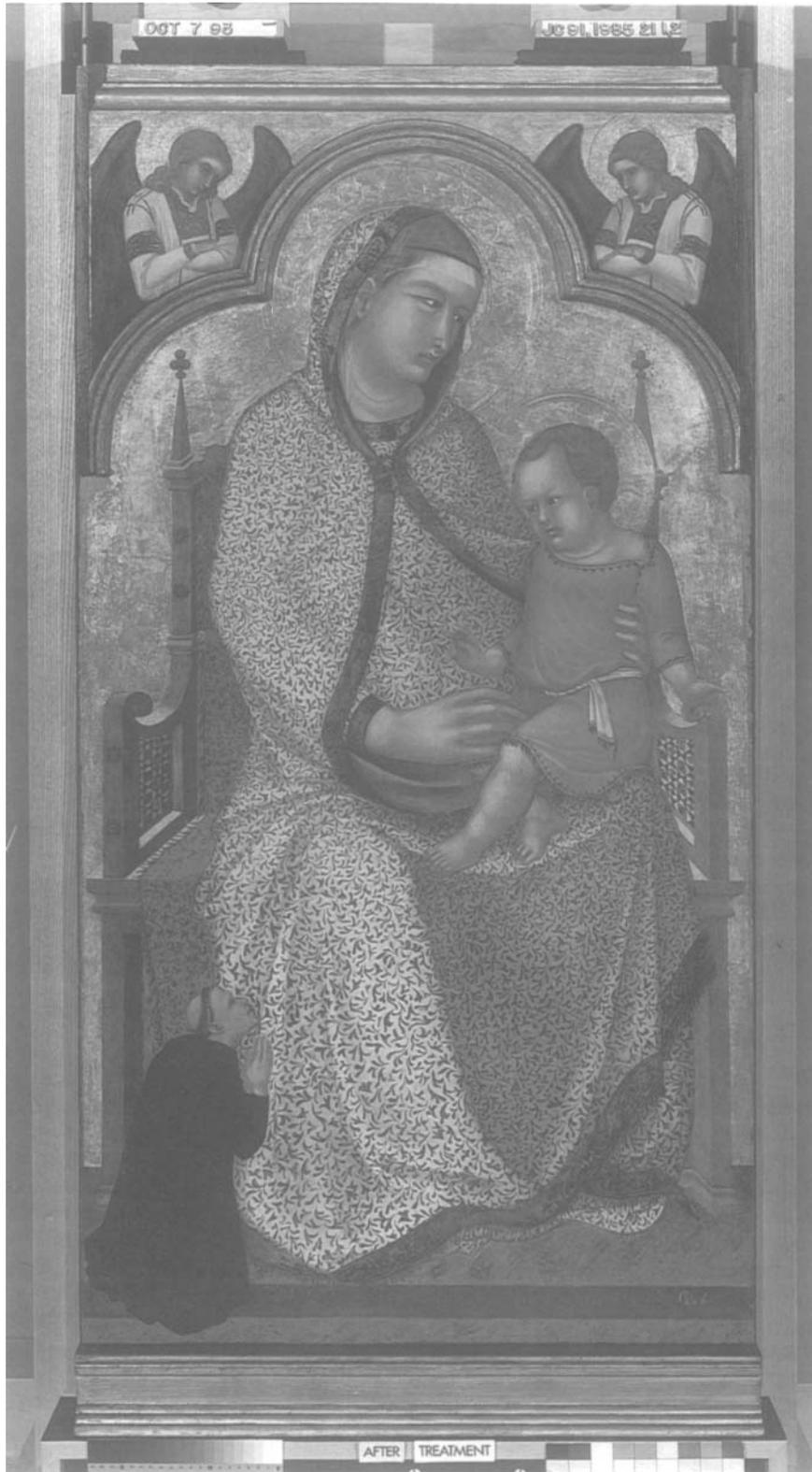


Figure 6. Completed Mylar stencil; decorative motifs cut out.



**Figure 7. Detail; after treatment.**



8. After treatment with Spandrel Angels (EW 1985-21-1, 2).

# FILLING IN THE GAPS; THE CONSERVATION OF A 17THC ENGLISH PANEL PAINTING

Mark V. Lewis

This paper will outline the testing and development of an appropriate fill material to compensate worm damage in a wooden support. This particular need arose during the conservation treatment of an English 17th C. portrait on panel attributed to the circle of Robert Peake. (St. John's College, Cambridge. HKI # 1851)

## Introduction

In the course of treating an English 17th century oak panel painting, numerous losses from wood worm activity were discovered along an original joint that had become separated and required regluing. In numerous places, the wood had been eaten right up to the paint layer, leaving it with a precarious lack of support. Before regluing the joint, it was necessary to consolidate these unstable areas and to compensate the areas of loss. The filling of these losses was complicated by the fact that lacy fragments of wood from both sides of the joint had been undermined by worm activity, and were now attached to the opposite side of the joint. These delicate fragments were still adhered along the original glue line. This meant that the two joined edges needed to lace together like opposing fingers, and the fills must allow for this precise alignment as well as fill the voids created by wood worm.

This problem led me to research the available fill materials that would satisfy a number of criteria:

- 1) Compatibility with wood; something that would offer firm support but allow for wood movement. Avoiding something that could become hard enough to create compression set shrinkage problems. Avoiding a material more hygroscopic than the wood itself, which could cause future paint loss.
- 2) A material that would take an impression; so that the irregular contours of the opposing sides of the joint could be perfectly accommodated.
- 3) Workability. A plastic easily tooled putty would greatly facilitate the delicate operation.
- 4) Stability and reversibility. The standard criteria of all materials used in conservation; stability being the more critical, as reversibility would be highly difficult

My first step was to conduct a literature search. A previous student project at the Hamilton Kerr Institute, had covered a lot of the same ground. In 1992, Kathryn Hebb experimented with a number of different fill materials, designed to meet a similar need. Her samples and results were still available for comparison. She ended up selecting a putty made up of: Acryloid B72,<sup>®</sup> (40% in xylene) to which whiting and sawdust were added in equal parts. Her samples were applied to both wood and mylar to better observe properties of adhesion, flexibility and shrinkage. I elected to follow her example and set up similar tests to compare these and other properties.

Some previous structural treatments at the HKI involved the use of epoxy/ microballoon fill materials. I was less interested in epoxies due to my lack of knowledge about their long term stability and reversibility. Being a cross-linked network polymer by design, epoxies may become excessively brittle with time. I was interested in the use of microballoons as bulking agents. Microballoons, also known as microspheres, are hollow spheres which can be used to modify the properties of a resin or adhesive. They can be used to increase the volume and reduce the density of a material. In their selection and proportion, the relative elasticity of a binding material can be specifically tailored to the need. Additional benefits include, reduced shrinkage and a greater degree of reversibility. Objects conservators have been using them successfully for some time. In boat building, they are used to modify filled epoxy resins. We had on hand, three different types of microballoons produced for the boat building industry. The first is a glass microsphere, the second a phenolic resin and the third an acrylonitrile. I thought it would be useful to evaluate how each of these three different materials would alter the mechanical properties of different binding systems. Product literature describes the glass microspheres as white particles, 40-80 microns in diameter, with a density of 230g./liter. Being composed of glass, they are harder than the other two plastic spheres, and in epoxy systems produce a harder and more waterproof material. Being glass, they are chemically inert and can be mixed into almost any resin/solvent mix.

Associate Paintings Conservator, High Museum of Art Regional Conservation Center. 1280 Peachtree St. N.E.  
Atlanta, Georgia 30309

Phenolic resin microballoons are a reddish - brown powder with a particle size of 50 microns and a density of 250g./liter, about the same as the glass spheres. Filled epoxy mixes utilizing these microballoons are less hard and less waterproof than those made with glass microspheres. The third microsphere is a thermoplastic composed of an acrylonitrile polymer. It is a fluffy white powder composed of particles which are also about 50 microns in diameter. It is however, two thirds less dense than the other two, at only 75g./liter. It can be used to make a composite material that is softer, lighter and more flexible than the other two. One note about the polymer microspheres: It is recommended that they not be used with polyester or vinyl ester resins, or any other resin system that utilizes styrene monomers, as they can cause the microsphere to collapse.

Besides microballons, several other bulking agents were tested. Chalk and two types of wood dust, oak and mahogany were also utilized. These materials have long been traditionally been employed to alter the properties of adhesives. Chalk has the additional benefit of neutralizing the pH of slightly acidic polymer dispersions.

As for binders, I chose to test a number of different materials in combination with the previously mentioned fillers. The binders tested were :

### **Binders**

#### **Acrylic resins**

Acryloid B72 ® ( proven stability in conservation) 30% in toluene ( w/v)  
Acryloid B67 ® (solubility in less aromatic solvents) 50 % in white spirit (w/v)

#### **Poly (vinyl acetates) - PVA 55 % solids**

Vinamul 6825 pva + 25% 2 ethyl hexyl acrylate  
Vinamul 3252 vinyl acetate-ethylene 50: 50  
Mowilith DMC2 65% vinyl acetate/ 35% di-n-Butyl maleate (Internally plasticized copolymer)

#### **Poly (vinyl alcohols): -PVOH 4% sol. in DI water**

Mowiol 04-M1 internally plasticized copolymer PVOH + small amount of PVA  
Mowiol 2899 internally plasticized copolymer PVOH + small amount of PVA

**Sodium Carboxy Methyl Cellulose** 1 % sol. 1500cp

#### **Polyfilla ®**

Regular - calcium sulfate + cellulose derivatives (like HPMC) + modifiers  
Fine Surface- resin emulsion (PVA? proprietary formula subject to change)

### **Bulking agents:**

#### **Microballoons**

Glass  
Phenolic  
Acrylonitrile

**Wood dust** ( very fine, sifted through a nylon stocking)

mahogany  
oak

#### **Chalk**

### **Procedure**

Samples were produced with each material in a slightly different way. As a starting point, the general goal was to produce a putty with the density and feel of a proprietary compound like Dap ® vinyl spackling paste or fine surface Pollyfilla. ® Proportions were adjusted as required. (When mixing aqueous fill materials, it was useful to add a bit of water to hygroscopic components such as sawdust, thereby adding it to the binder in the form of a heavy slurry.)

The properties that I chose to evaluate and rate were:

Adhesion	to wood
Wet Tack	how tacky is the material initially
Shrinkage	when applied to mylar, does it buckle and distort
Slump	does it hold its shape
Sandability	with #150 sandpaper
Carvability	does it hold together well enough to carve it with a scalpel
Removability ( after 1 week)	Water, Industrial Methylated Spirit (Ethanol), Toluene  rolling with a small cotton swab; dissolves in less than 10 sec.+, dissolves in 10-20 sec. 0  takes longer than 20 seconds to dissolve —

Ideally, solubility should be tested again after 6 months and 1 year. Most of the materials selected had a proven record of stability and usefulness in conservation.

### See Chart for results

After comparing these different combinations of materials, I realized that many of them would be useful in different applications. It also became evident that the proportions of binder to bulking agent greatly influenced the final working properties of each of these fillers.

In the end, my selection came down to two different binders with the same phenolic microballoons ; Acryloid B72® and Mowilith DMC2, a poly (vinyl acetate). The average volumetric proportions of an acrylic resin putty was:

Acryloid B72® 30% in toluene	2 parts
phenolic microballoons	3 parts
fine mahogany sawdust	1 part

For a PVA dispersion such as Mowilith DMC2:	
Mowilith DMC2 55% sol. in Water	1 part
phenolic microballoons	3 parts
fine mahogany sawdust	10% as a slurry in DI water
chalk-	10% as a slurry in DI water

The phenolic microballoons were chosen because they make a putty that is solid and firm, yet somewhat more flexible than the glass microspheres. Its density is such that you can dent it with a fingernail like a very soft wood. The addition of fine sawdust adds a marked stringy toughness to the material, the fibers seeming to knit the putty together. Ideally, this addition would contribute to creating an open cellular structure in the fill material, which would behave more like wood itself.

To test solvent sensitivity, all three microballoons were immersed in water, toluene and xylene for one week in separate glass vials. They were then dried and compared with unexposed microballoons under the microscope. No change was discernible.

Having narrowed down my choices, I conducted one more series of tests. I split a piece of wood in two lengthwise, to approximate the irregular contours of my worm channeled joints that needed filling. I wanted a putty that would take and hold a sharp impression and insure a good fit for the final gluing. I chiseled out a diamond shaped depression in one half of the split wood, which I filled with the two different putties. After letting them set up slightly, until they became slightly doughy, (a period of time that was determined through trial and error) I pressed the two halves together in a vise. After about thirty seconds, I gently parted them. Both the Acryloid B -72® and the Mowilith DMC2 putties took fine impressions without coming apart cohesively or adhering so strongly that the two halves could not be separated.

This was necessary as I wanted to accomplish the filling and gluing as two separate stages. It was my aim to achieve a perfect fit along the join and then re-glue the pieces with the same sort of animal glue as they had originally been adhered with. If the fit is right, an adhesive of this sort has great strength and yet is brittle enough that under shock or great stress it is more likely to give than create a new split in the wood. It also has the added benefit of being readily reversible. Since this was my aim, I also applied a bit of animal glue to my putty samples to insure that it penetrated and adhered well.

Comparing the two putties, I actually preferred the handling properties of the Mowilith DMC2 material. When given a choice, I prefer to avoid the toxicity of aromatic solvents when a water based system will do. The Mowilith has been tested for its aging properties and appears to be quite stable. It has been used in textile conservation for over thirty years. Having made this selection, I did run into a snag. When mixing up a batch of putty with flexible Italian steel spatula, the putty began to darken to a blue gray color. After researching the manufacturers literature more closely, I realized that this polymer dispersion is somewhat acidic (pH 4-5) and can react with iron forming a colored complex. Tannins in oak can also produce colored complexes. In the manufacturers handbook, it was recommended that a small amount of calcium carbonate be added to the polymer to overcome this problem. This worked well.

This testing took about two weeks to complete but was very beneficial to my understanding of the materials involved. The samples that were applied to mylar have been mounted to acid free foam core and fitted into an archival file box to serve as future reference in the selection of fill materials. The samples adhered to wood will be light aged for the next several years and then re-examined. All of the unaged samples were photographed with Kodak Ektachrome color slide film and tungsten lights to serve as color reference standards. The use of a colorimeter would be a more practical and precise means of measuring color change.

Prior to using this fill material, the worm channeled wood was consolidated with several dilute applications of Acryloid B72 ® in toluene. The Mowilith DMC2 based putty was applied in stages, with the final fit created a section at a time, by pressing the two panel pieces together at the appropriate time. This was about 5-10 minutes after application, when the putty was no longer sticky, but more dough like. Pressing the two sections together at this time cast a molded fit that was held together for about thirty seconds and then carefully separated. All of the irregular contours of the join were in this way re-established, and the worm holes filled. Following this, the joint was reglued with a high quality animal glue.

## **Conclusions**

Many of these materials tested would be suitable for various needs. Acryloid B72 ® is often chosen for conservation uses because of its exceptional stability. In this particular case, a poly (vinyl acetate) dispersion, Mowilith DMC2 was chosen as the binder most suited to the project. It has been used successfully by conservators for the past thirty years. In the course of this project, it became evident that another aspect that needs to be explored and scientifically tested are the properties of composite materials, which in effect, is what all these fill materials really are. Although many of these polymers have been tested individually as cast films, how do they age and respond to changes in temperature and humidity when combined with other materials? Chemical interactions between materials certainly seem to modify their physical properties. Perhaps more research will reveal the answers.

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	ADHESION	WET TACK	SHRINKAGE	SLUMP	SANDABLE	CARVABLE	REMOVABLE H20 IMS TOL
<b>PARALOID B-72</b>							
1 ACRYL MB	-	0	+	0	-	0	- + +
2 GLASS MB	+	0	+	0	+	+	- + +
3 PHENOLIC MB	0	0	+	0	+	+	- + +
4 MAH DUST	+	-	+	+	+	+	- 0 0
4a OAK DUST	+	-	+	+	+	+	- 0 0
<b>PARALOID B-67</b>							
5 ACRYL MB	+	0	+	0	+	0	- - -
6 GLASS MB	+	0	+	0	+	+	- - -
7 PHENOL MB	+	0	+	0	+	+	- - -
8 MAH DUST	+	0	+	+	+	0	- - 0
<b>VINAMUL 6825</b>							
9 ACRYL MB	0	0	+	+	0	-	- + +
10 GLASS MB	+	+	+	+	+	+	- + +
11 PHENOL MB	+	+	+	+	+	+	- + +
12 MAH DUST	+	+	+	+	+	+	- 0 0
13 ACRYL+MAH	+	+	+	+	0	+	- + +
14 GLS+MAH D	+	+	+	+	+	+	- 0 +
15 PHEN+ MAH	+	+	+	+	+	+	- + +
<b>MOWILITH DMC2</b>							
16 ACRYL MB	+	+	+	+	+	+	- + +
17 GLASS MB	+	+	+	+	+	+	- + +
18 PHENOL MB	+	+	+	+	+	+	- 0 +
19+ MAH D	+	+	0	+	0	+	- - 0
20 ACRYL+MAH	+	+	0	+	0	+	- - 0
21 GLS+MAH	+	+	-	+	+	+	- 0 0
22 PHEN+MAH	+	+	-	+	+	+	- 0 0

KEY TO SYMBOLS + GOOD 0 AVERAGE - POOR

	ADHESION	WET TACK	SHRINKAGE	SLUMP	SANDABLE	CARVABLE	REMOVABLE H2O IMS TOL
HPMC							
23 GLASS MB	0	+	0	+	+	+	+ + -
24 GLS+MAH	0	+	0	+	+	+	+ 0 -
25ACRYL MB	-	+	-	0	+	+	+ 0 -
25aACRY+MAH	-	+	-	+	+	+	+ 0 -
26 PHENOL MB	-	+	-	0	+	+	+ 0 -
26aPHEN+MAH	0	+	-	+	+	-	+ 0 -
27 POLYFILL FI	+	+	0	+	+	+	+ + +
28POLYFILLA	+	+	0	+	+	+	+ + 0
29 POLY+OAK I	+	+	-	+	+	+	+ + 0
30 POLY+GLS	+	+	0	+	+	0	+ + +
31 POLY+PHEN	0	+	-	+	+	0	+ + + 0
32 POLY+ACRYI	0	+	-	+	+	0	+ + +
33 POLY+ CHAL	+	+	-	+	+	+	+ + +
34 POLYF FN	+	+	0	+	+	+	+ + +
35 PF+ACRYL	+	+	0	+	+	+	+ + +
36 PF+GLS	+	+	0	+	+	+	+ + +
37 PF+PHEN	+	+	0	+	+	+	+ + +
38 PF+ OAK D	+	+	0	+	+	+	+ + +
MOWIOL 04/M1							
39+ACRYL MB	-	+	0	+	-	-	+ + + -
40+GLS MB	-	+	0	+	+	0	+ + + 0
41+PHEN MB	-	+	-	+	-	-	+ + + -
42+OAK D	0	+	-	+	0	-	+ + + -
43+CHALK	0	+	-	+	+	+	+ + + -
44+MAH WD	-	0	0	+	-	-	+ + + 0
45+CHLK+MAH	+	+	-	+	+	0	+ + + -

KEY TO SYMBOLS + GOOD 0 AVERAGE - POOR

	ADHESION	WET TACK	SHRINKAGE	SLUMP	SANDABLE	CARVABLE	REMOVABLE H2O IMS TOL
MOWIOL 28/99							
46+ACRYL MB	-	+	-	+	0	-	+ + -
47+GLS MB	+	-	-	0	+	0	+ - -
48+PHEN MB	0	+	-	+	+	-	+ + 0 -
49+OAK D	+	+	-	+	+	0	+ - -
50+MAH D	+	0	-	+	0	-	+ - -
51+CHALK	+	+	-	0	+	+	+ + 0 -
52 CHLK+MAH I	+	+	-	0	+	+	+ - -
VINAMUL 3252							
53+GLS MB	+	-	0	+	+	0	- + +
54+PHEN MB	+	0	0	+	+	0	- + +
55+OAK D	+	0	0	+	+	0	- + +
56+MAH D	+	0	0	+	0	0	- 0 0
57 GLS+MAH	+	0	-	+	+	+	- 0 0
58 PHEN+MAH	+	0	0	+	+	+	- 0 0

KEY TO SYMBOLS + GOOD 0 AVERAGE - POOR

## NOTES

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