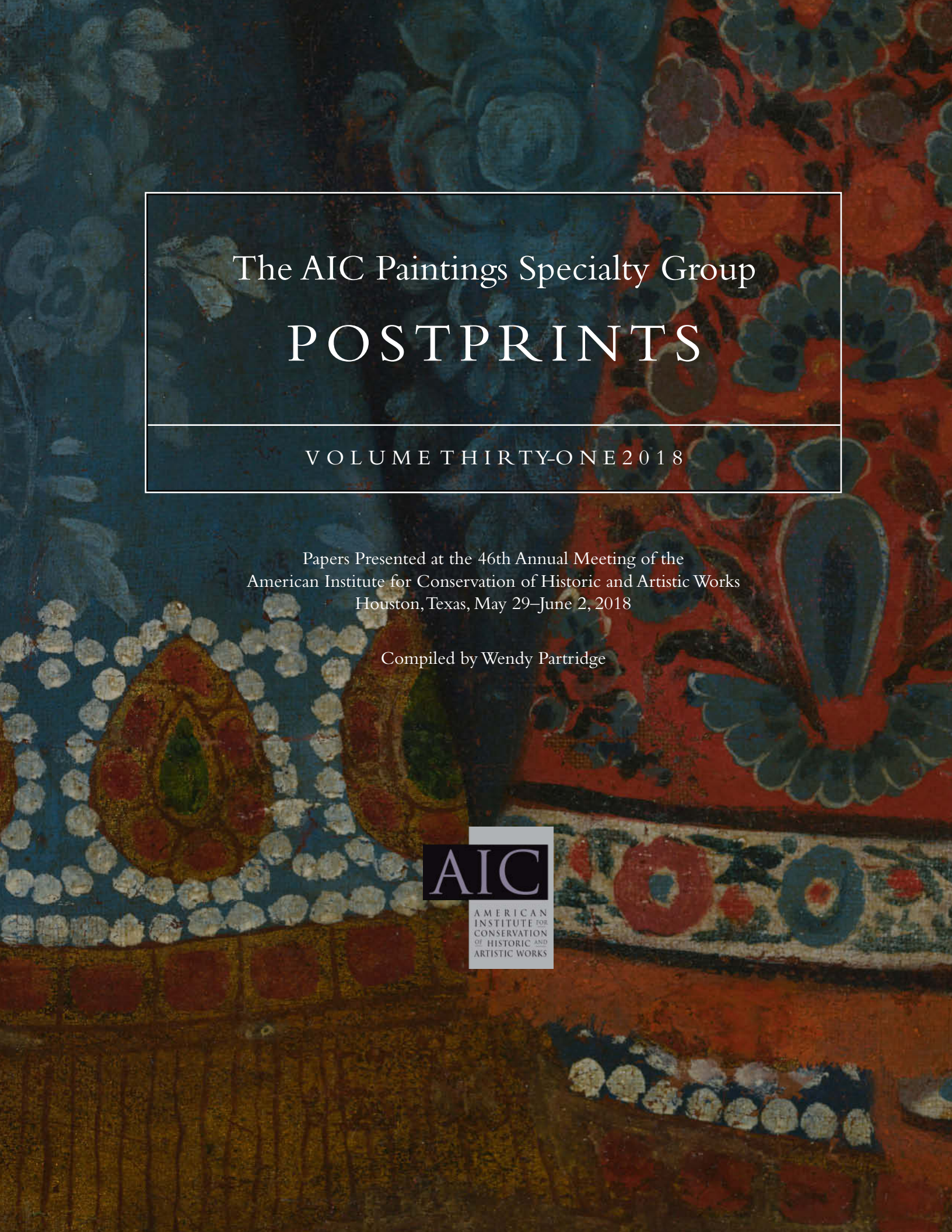

The AIC Paintings Specialty Group

POSTPRINTS

VOLUME THIRTY-ONE 2018

Papers Presented at the 46th Annual Meeting of the
American Institute for Conservation of Historic and Artistic Works
Houston, Texas, May 29–June 2, 2018

Compiled by Wendy Partridge

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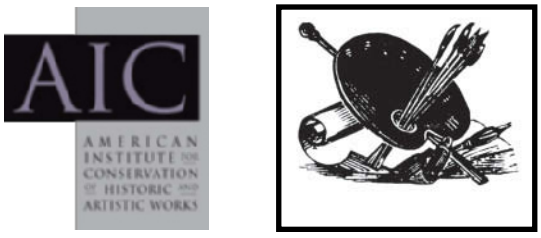

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AIC PAINTINGS SPECIALTY GROUP

POSTPRINTS

VOLUME 31 2018 ANNUAL MEETING

Papers Presented at the 46th Annual Meeting of the American Institute for Conservation of Historic and Artistic Works
Houston, Texas, May 29–June 2, 2018

Thursday, May 31

Friday, June 1

RACHEL SABINO, KEN SUTHERLAND, EMELINE POUYET, FEDERICA POZZI, and MARC WALTON

Surprise Encounters with Mummy Portraits at the Art Institute of Chicago

ABSTRACT

In recent years, mummy portraits have been the focus of considerable study within the conservation and scientific communities. Toward this broader effort, two portraits in the collection of the Art Institute of Chicago were examined in detail and intriguing differences were noted between them. The most compelling of the findings—concerning binding media, distribution of blue pigment, and gilding methods—are presented in this work and discussed in relation to the visual differences. The work also constitutes a clarion call for increased dialogue between objects and paintings specialties across which care of the mummy portraits is roughly divided.

1. INTRODUCTION

Mummy portraits—or Fayum portraits—are paintings, often highly naturalistic and made on thin wood panels, between 1 and 2 mm, that covered the faces of mummified bodies in Roman Egypt. The paintings represent a remarkable fusion of the predominant Egyptian culture; the politics of Roman citizenship; and the self-identification of an elite, Greek minority. They date to between the 1st and 3rd century AD, corresponding roughly to the Imperial era. This specific mummification practice was concentrated primarily in and around the eponymous Fayum Basin region. About 900 of these portraits are known, and the overwhelming majority have been removed from their mummies.[1]

The Art Institute of Chicago houses two such portraits in its collection dated to the mid-2nd century (figs. 1, 2). They were gifts in 1922 from Emily Crane Chadbourne, an inveterate art collector and Art Institute benefactor whose family fortune was amassed from the manufacture of plumbing supplies. It is unclear exactly when or where Ms. Chadbourne obtained the portraits. She could have purchased them in Chicago from the Austrian archaeologist Theodore Graf's display of mummy portraits at the 1893 World's Columbian Exposition or perhaps in the process of furnishing her Paris and London apartments sometime after 1905 when she moved to Europe and became friends with other notable collectors like Isabella Stewart Gardner (Knudsen 2016, para 36).

2. BINDING MEDIA

In general, mummy portraits have traditionally been divided into two distinct groups according to their binding media. Prior to analytical methods capable of precise characterization, these classifications were assigned largely on the basis of the surface appearance and paint handling. Those with a glossy appearance, and particularly with obvious texture or toolmarks, have been described as encaustic. Those with a more chalky, blocky paint application, suggestive of a water-based binder, and often with a naïve, "child-like" quality of painting, have been described as tempera.

One of the AIC portraits (1922.4799) displays the hallmark impasto and vigorous zigzags indicative of molten wax manipulated with the aid of heat or heated tools (fig. 3). Analyses by FTIR and gas chromatography–mass spectroscopy (GC-MS) confirmed the binding medium as beeswax.[2] This result combined with the evident toolmarks supported a description of the technique as encaustic. The visual impression on the other portrait (1922.4798), however, was very different: the painting has a flat appearance with a relative lack of impasto and a matte, dry-looking surface (fig. 4). Most crucially, around the eyes and the bridge of the nose, the artist employed *tratteggio*, a layering or crosshatching technique used to convey depth and texture (fig. 5). Given this type of paint handling, together with the overall appearance, the work was perceived as a possible example of tempera painting. However, the results of the organic analyses were instead consistent with

Figure 1. *Mummy Portrait of a Man Wearing a Laurel Wreath*, Roman, early to mid-2nd century AD. Lime (linden) wood, beeswax, pigments, gold, textile, natural resin; 16 1/2 × 9 1/2 × 1/16 in. (41.9 × 24.1 × 0.2 cm). Gift of Emily Crane Chadbourne. Courtesy of The Art Institute of Chicago, 1922.4799.

Figure 2. *Mummy Portrait of a Man Wearing an Ivy Wreath*, Roman, early to mid-2nd century AD. Lime (linden) wood, beeswax, pigments, gold, textile, natural resin; 15 1/2 × 8 5/8 × 1/16 in. (39.4 × 22 × 0.2 cm). Gift of Emily Crane Chadbourne. Courtesy of The Art Institute of Chicago, 1922.4798.

the first portrait, indicating the use of beeswax. Having made such assumptions about the binding media, it merits stepping back to understand their basis. Broadly, scholarship of these objects has been challenged not only by the limitations of scientific analysis but also by the ambiguous and inconsistent terminology used to describe them. When and how did this binary nomenclature arise and what do the terms *encaustic* and *tempera* actually mean?

With respect to encaustic, a number of ancient sources refer to the use of wax for painting (Rinaldi 2012). Pliny the Elder (1855, 21.49) specifically mentions the use of so-called Punic wax—a type of beeswax that has been prepared or modified in some way. But the interpretation of historic texts is rife with challenges. These early sources are often cryptic, inconsistent, open to a wide range of interpretations, and prone to error through translation. Nonetheless, Pliny's writings were highly influential in various encaustic "revivals" beginning in the 18th century. The discovery of paintings at the excavations of Herculaneum and Pompeii in the mid-18th century—speculated by some scholars to have been painted with wax—inspired a quest for a true recreation of

Figure 3. Raking light detail of the impasto on *Mummy Portrait of a Man Wearing a Laurel*. Courtesy of The Art Institute of Chicago, 1922.4799.

Figure 4. Detail of *Mummy Portrait of a Man Wearing an Ivy Wreath* showing its flat, matte surface. Courtesy of The Art Institute of Chicago, 1922.4798.

the encaustic medium that has continued unabated across the centuries. Experiments with wax-based media were often highly creative and subjective, employing mixtures with various resins and other materials, layering strategies, and heat treatments (Rice 1999).

In the 1880s, excavations by Graf and the British archaeologist Flinders Petrie brought large numbers of the mummy portraits to light and made them available for direct observation. It was Petrie (1911) who first suggested that the sunny, temperate climate of Egypt was more than sufficient to allow painting with a simple wax medium. Others have made the correlation between the use of wax and the use of very thin panels, implying that the panels themselves may have been warmed to make this medium more workable without any modification. Despite these more prosaic theories, speculation and experimentation continued in the decades that followed, aided by a renewed interest in encaustic techniques in Europe and America. Around the turn of the 20th century, theories about the use of wax emulsions became popular, promoted by scholars such as Ernst Berger (1904). And in the 1950s and 1960s, ancient painting techniques were once again in the spotlight when American artists adopted the encaustic technique. Like their earlier antecedents, they too took for granted that the wax was modified in some way. Many of the more widely held assertions about the techniques of the painters who made the mummy portraits stem from artists' and scholars' reconstructions based on their empirical experience of paint application. And while artistic experimentation is a helpful exercise, it can be misleading. After all, the ability to replicate a painting's appearance is not in itself compelling evidence that the same technique was used.

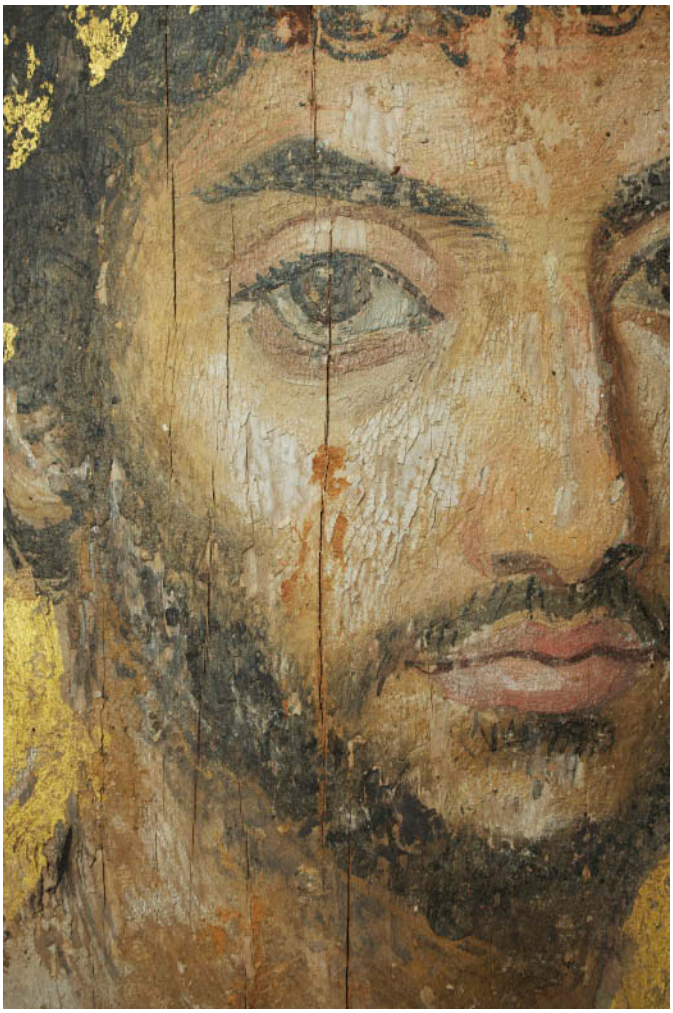

Figure 5. Detail of *Mummy Portrait of a Man Wearing an Ivy Wreath* showing the use of *tratteggio* around the eyes and the bridge of the nose. Courtesy of the Art Institute of Chicago, 1922.1798.

Petrie and Graf's excavations of the late 19th century also brought to light the fact that the painters were not working solely in wax. But the absence of formal analyses confirming the composition of this second category of "tempera" portraits helped promote the black and white, either/or scenario with respect to binding media in which scholars and researchers have operated until this moment. As was the case with encaustic, a "tempera revival" around the turn of the 20th century generated renewed interest in Roman, medieval, and early Italian painting, possibly conflating opinions about techniques used in art of different periods. In particular, the historical association of tempera with the use of egg in paintings such as those of the early Italian Renaissance may have informed an assumption that mummy portraits identified as tempera were painted with the same medium. But scientific studies to date indicate that egg was used as a medium for these portraits rarely, if at all. In portraits that exhibit the "classic" tempera appearance, the medium has most often been identified as animal glue (Mazurek, Svoboda, and Schilling, 2019).

With regard to characterization of the beeswax medium, and theories about its composition and preparation, early scientific studies must be interpreted with caution. An improved understanding of the chemistry and aging behavior of painting materials has developed in recent decades, necessitating a reevaluation of some of the earlier published data. For example, a 1978 analysis by Raymond White of a portrait in the Petrie Museum suggested the possible use of a saponified Punic wax based on variations in the relative proportions of esters and alkanes in the wax (White 1978). And this finding was cited in the highly influential work of Euphrosyne Doxiadis as "proving beyond all doubt" the use of Punic wax (Doxiadis 1995, 97). However, subsequent research has demonstrated that alterations in the relative amounts of wax components can occur as a result of natural aging effects such as hydrolysis of wax esters and selective sublimation of the more volatile molecular components in a hot climate. Similar claims of "identifying" saponified wax have been made based on the detection of metal soaps in paint samples, with various authors interpreting these as evidence for Punic wax. But these interpretations too are challenged by recent studies demonstrating that soap formation is a common result of natural aging in paints that contain metal-based pigments (Casadio et al. 2019).

Another major concern with analysis is contamination, which may derive from the original context and treatment of the mummy, from its subsequent environment, or from conservation treatments. It is an unfortunate fact that the most common binding media identified to date (beeswax and animal glue) are also among the most ubiquitous restoration materials, leading to a high possibility of encountering these same materials as later additions. Data from the Art Institute portraits exemplify the issue, presenting a strange cocktail of materials (fig 6) (Sutherland, Sabino, and Pozzi, forthcoming). The major component is clearly beeswax. Although some of the other materials, particularly cellulose nitrate and likely shellac, can certainly be attributed to restoration, others are less certain. The pine resin could be part of the medium but could alternatively be attributed to an adhesive used to insert the portrait into the wrappings. Or, again, it could be a residue of some later treatment. Evidence has been found in other portraits for the presence of oil or fat along with the wax. Are these intentional additives to the paint, or do they come from another source? The possible presence on mummy portraits of varnish or other surface treatments may also influence our initial impression of the technique, based on criteria such as surface gloss, as outlined earlier (Spaabæk 2010, 127–128).

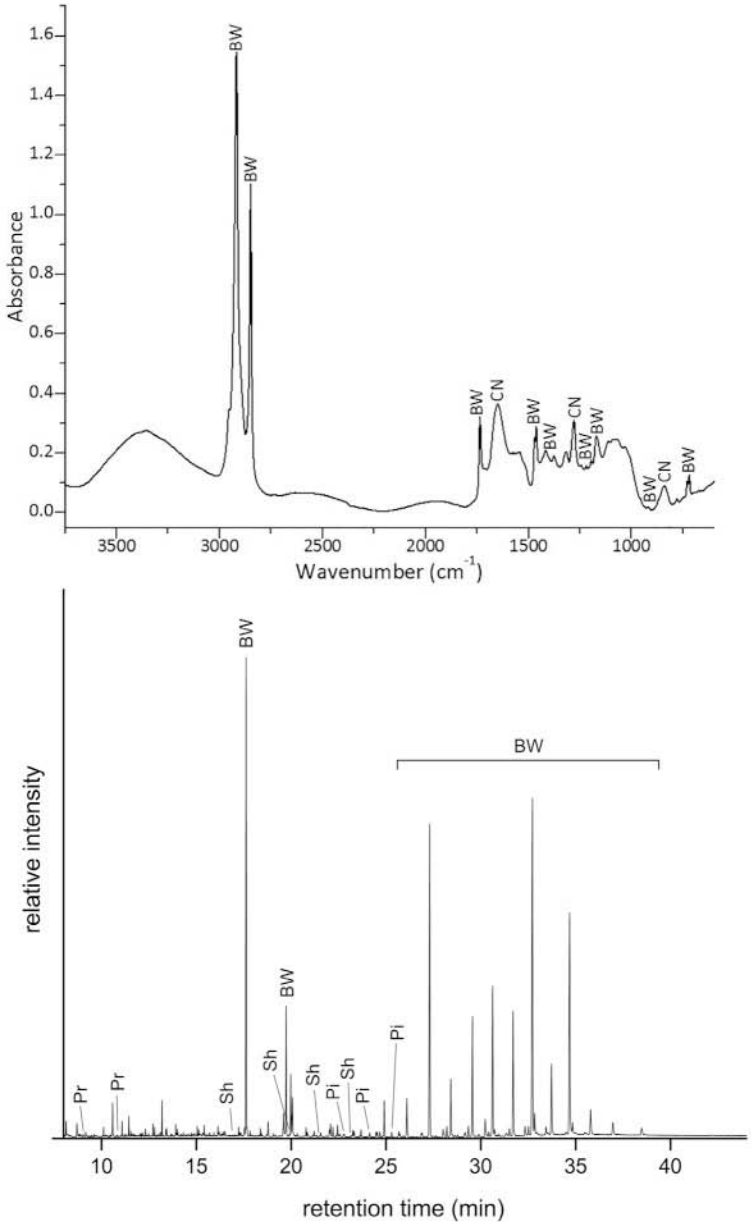

Figure 6. Top: FTIR data for a sample of black paint from the hair of *Man Wearing an Ivy Wreath* showing characteristic peaks for beeswax (BW) and cellulose nitrate (CN). Bottom: Pyrolysis GC-MS data for a sample of black paint from the hair of *Man Wearing an Ivy Wreath* showing characteristic marker compounds for beeswax (BW), Pinaceae resin (Pi), shellac (Sh), and protein (Pr). Courtesy of The Art Institute of Chicago, 1922.4799.

Aside from the analytical challenges, one of the biggest hurdles in understanding and describing mummy portraits is a commonplace but important one: semantics. Commonly used descriptive terms are ambiguous, shifting in meaning according to individual preference or over time. The term *encaustic* may refer, in general, to the use of beeswax. Or it can signify a specific method of application, namely with the use of heat. In the case of *tempera*, the term has been employed most generically to simply mean "binder." Or it can imply the specificity of the egg yolk–based binder used in early Italian paintings. The indiscriminate and unqualified use of the terms clouds discussion and limits the descriptive vocabulary.

Returning to the two Art Institute portraits, both are made with beeswax. Yet it is clear that something differentiates their technique. How could one painting have been done using the same material as the other and look so radically

different? What should a portrait with no visible signs of encaustic application be called? Descriptions like "cold wax," "wax emulsion," or "wax tempera" have been variously accepted at times, but there is no convincing documentary or scientific evidence to support the use of such terms. It is humbling to acknowledge that despite recent advances in analytical capabilities, there is still no reliable scientific test to determine if or how wax was manipulated for use in ancient paintings (Stacey et al. 2018). At present, all that can be stated with confidence about the Art Institute portraits is that they were painted with a wax medium.

This problem of nomenclature is certainly not unique to mummy portraits, and in the museum world, semantic confusion is driven in part by the peculiar tradition of categorizing objects in a few words according to their materials, notably in labels or catalog entries. This habit forces reductionism, speculation, and generalization. For instance, the commonplace term *oil on canvas* is routinely used to describe paintings with radically different appearances. In a broader sense, this problem stems from the basic human need to classify things neatly and simply, which is in direct conflict with the equally human tendency to be creative and idiosyncratic. In a quest for classification, it is easy to forget that objects are created by individuals—artists, no less. Even if a descriptive system can be agreed on, it should not come as a surprise to find exceptions to the "rules."

3. EGYPTIAN BLUE

Some scholars see the Fayum portraits as a direct link between the traditions of Greek panel painting and Byzantine icon painting, and on the basis of this linkage assert that the portraits were made using the restricted Greek palette, called *tetrachromy*.[3] It was said to contain pigments of only four colors (yellow, red, black, and white) interpreted variously as the four basic elements of the universe (earth, fire, water, and air) or the four humors of the body. From just these colors, painters were said to be capable of creating a wide repertoire of other tones. Analyses of the Art Institute portraits indeed revealed the presence of red, yellow, white, and black pigments: yellow ochre and jarosite, red earth, madder, calcite, and carbon black.[4]

But this four-color theory has persisted despite abundant archaeological and analytical evidence to the contrary. One of a set of six paint pots (BM 1888,0920.23–28) from the interior of an artist's studio excavated by Flinders Petrie in his 1887–1888 field season at Hawara, now in the collection of the British Museum, contains a blue pigment that has been identified as Egyptian blue.[5] Egyptian blue, or calcium copper silicate, is believed to be the world's first synthetic pigment. A proto-dynastic bowl in the Museum of Fine Arts Boston dated to around 3200 to 3300 BC may constitute evidence of its first use (MFA 98.1011) (Ganio 2015, 814). In Egypt, Old Kingdom sources of copper were most probably malachite or azurite. Beginning in the 18th dynasty, tin can be detected, attesting to the use of bronze scrapings and filings as sources (Ganio 2015, 814).

Egyptian blue exhibits strong luminescence in the near-infrared (IR) spectrum at around 910 nm when illuminated by visible light (Dyer and Sotiropoulou 2017; Verri 2009a, 2009b). An imaging technique designed to exploit this property, known as visible-induced luminescence (VIL), was used to noninvasively detect and map Egyptian blue over the entire surface of the painting. When examined using VIL, the two Art Institute portraits demonstrated startling differences.[6] On the first portrait, the presence of Egyptian blue was concentrated in the face around the proper right cheek (fig. 7). No signs of the pigment were seen elsewhere on the portrait, either in the background or in the drapery. Most interestingly, the pigment appeared in areas that were decidedly not blue in appearance and, moreover, constituted areas of highlight, not shadow. The character of the application appears to have been rather painterly and diffuse.

The other portrait demonstrated a contrasting response. No use of Egyptian blue was indicated on the face, save for a small square above the bridge of the nose between the eyes and a fine line tracing the top edge of the upper lip (fig. 8). Its presence was, however, quite emphatic in the folds of the tunic below the neck. Discussions with the curator confirmed that these lines of pigment correlated to shadows within the folds of drapery and not to decorative stripes or embellishments on the tunic. From an artistic perspective, the use of blue to render shadow in an otherwise completely white area was not terribly surprising. However, the total lack of the pigment in the face, in comparison with the other portrait, was significant. The paint application appeared equally contrasting where it had been set down in an extremely crisp and well-delineated manner.

Because of the distinct and unexpected VIL responses observed on the two portraits, complementary analyses were employed to rule out the possibility that other phenomena may be contributing to the luminescence. Scanning XRF permitted visualization of the distribution of the element copper, present in the composition of the Egyptian blue pigment[7] (figs. 9, 10). The distribution of copper on both portraits indeed corresponded to the areas highlighted by the VIL imaging (figs. 11, 12). In addition to the presence of copper, intensity distribution maps of other elements brought further interesting features to light. On the first portrait

Figure 7. VIL image of *Mummy Portrait of a Man Wearing a Laurel Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4799.

Figure 8. VIL image of *Mummy Portrait of a Man Wearing an Ivy Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4798.

(1922.4799), the distributions of zinc and barium corresponded precisely to the use of lithopone that was detected by FTIR in the heavily restored areas of the proper right cheek and bridge of the nose. The distribution maps for chlorine on the second portrait (1922.4798) posed challenging questions as well. Considering that salts were used during the embalming process, was the chlorine present as an exudate from the mummified body? Or was it instead linked with chlorine in the burial environment?

These intriguing results prompted communication with colleagues at other institutions whose portraits revealed even more divergent patterns of pigment usage than those indicated by the Art Institute's portraits.[8] In most instances, the Egyptian blue pigment also appeared in areas with no apparent need for the use of blue. What is to be made of this? Do these different usage patterns correspond to specific workshops? Or did painters employ materials differently even within workshops? It would seem that the use of Egyptian blue may have the potential to help organize mummy portraits into "schools" or even identify the hands of individual artists. Even still, researchers should remain open to the possibility that a single artist varied his pigment use from portrait to portrait as the need, desire, supply, or economy dictated. But what of the blue in such diverse areas? One theory is that Egyptian blue was used as an optical brightener.[9] Another is that the use of

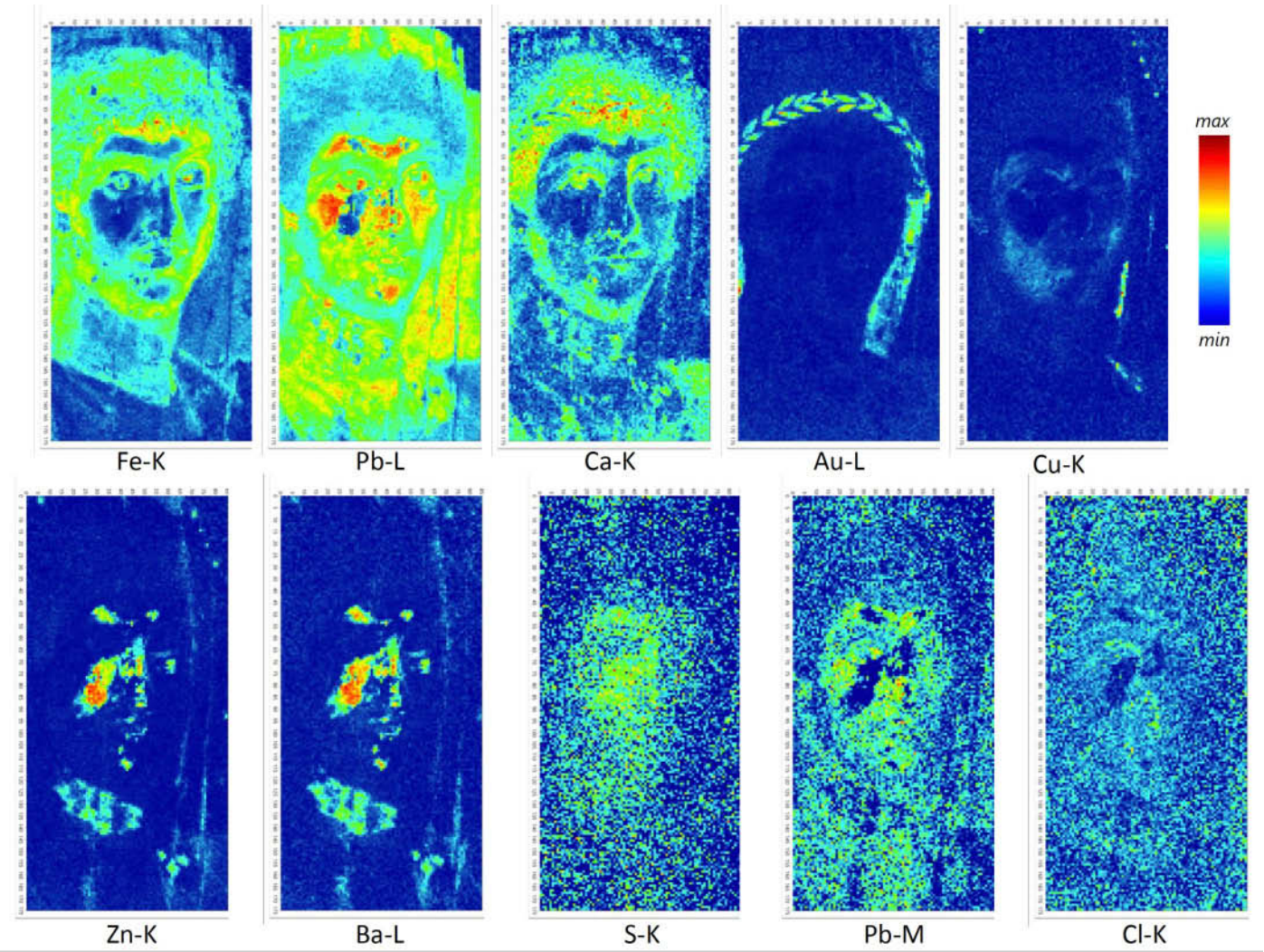

Figure 9. Intensity distribution maps of the elements iron, lead, calcium, gold, copper, zinc, barium, sulfur, and chlorine in *Mummy Portrait of a Man Wearing a Laurel Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4799.

Egyptian blue served the same function as that of *verdaccio* in early Italian paintings: to modify and render skin tones in a more naturalistic manner.[10] These latter two theories stem from the insights of paintings conservators, highlighting the need to incorporate the sensibilities and experience of both objects and paintings specialties to enable a richer, fuller conversation about how the portraits might have been made.

4. GILDING

Much is known about the use of gold in ancient Egypt. Direct observation of objects has demonstrated that Egyptian goldsmiths understood and were in sufficient command of gold's malleability to hammer it into thin foils and sheets (James 1972, 40–41). Secondary evidence of gilding practices is gleaned by way of preserved scenes of goldbeaters' workshops carved into the stone walls of tombs (James 1972, 39, 41). But less is known about their methods of application.

Modern gilders use gold beaten into squares and, to avoid problematic gaps between the leaves that would require tedious infilling, lay the sheets down such that there is a uniform and regular overlap at the margins. Making for a delightful discovery, the distribution map for gold generated from the scanning XRF data on the second portrait revealed the regular placement of uniformly sized, straight-sided leaves with a consistent overlap as evidenced by the repetition of strips of increased density (fig. 13). At the time of writing, these analytical images are believed to be the first to capture the gilding process so clearly and graphically, revealing a working methodology virtually identical to modern practice.

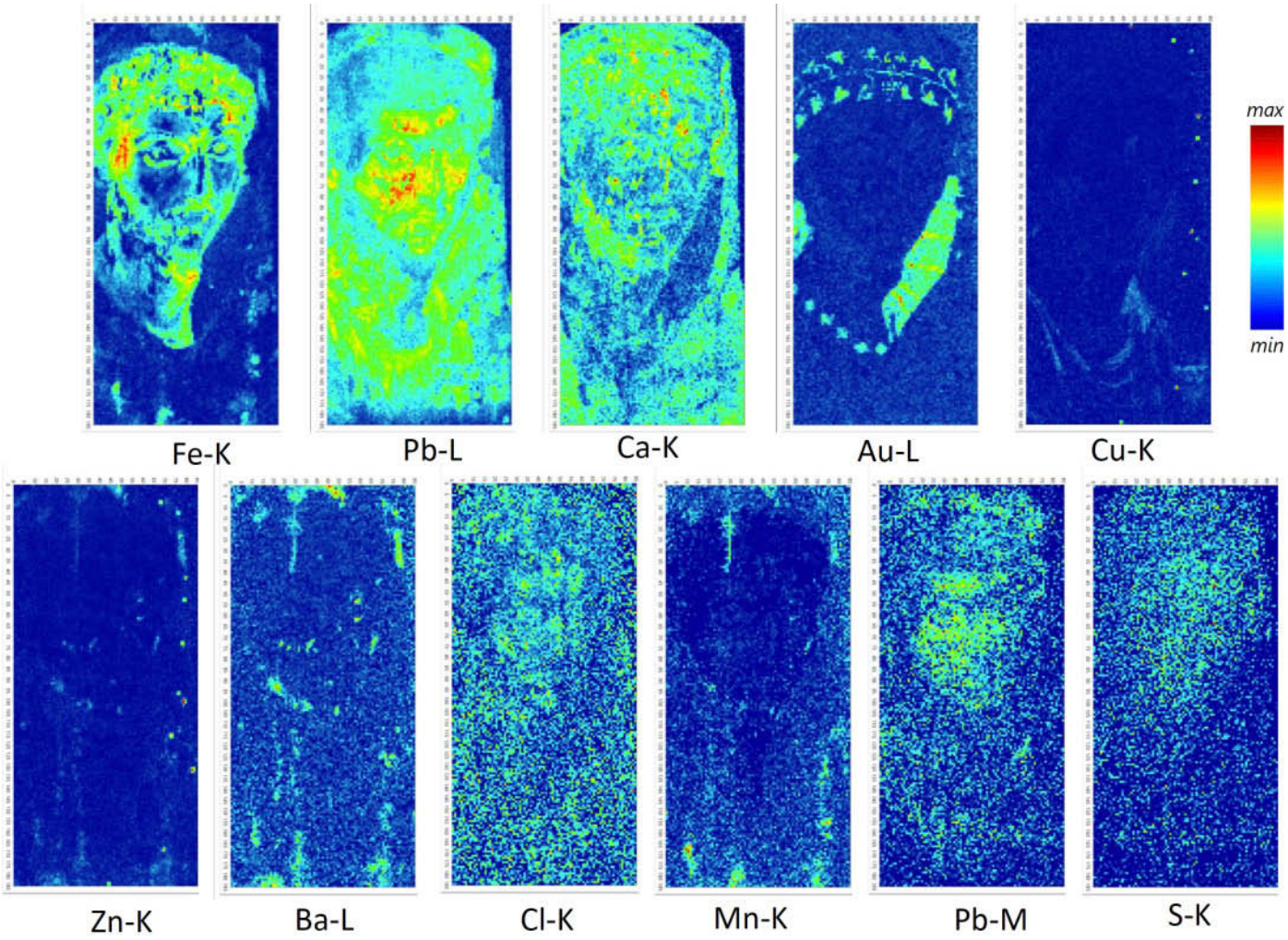

Figure 10. Intensity distribution maps of the elements iron, lead, calcium, gold, copper, zinc, barium, sulfur, and chlorine in *Mummy Portrait of a Man Wearing an Ivy Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4798.

5. CONCLUSION AND FUTURE DIRECTIONS

These are exciting times for mummy portrait scholars, with researchers busy across the globe, most notably represented by the efforts of the APPEAR (Ancient Panel Paintings: Examination, Analysis and Research) project, coordinated by the J. Paul Getty Museum, a database of information derived from the study of portrait mummies from 35 collections and counting. In an informal survey taken of attendees at the APPEAR conference held at the Getty Villa in May 2018, care of the portraits was split roughly equally between paintings and objects conservators. Although the two different specialties operate on the basis of different training and underlying assumptions that can sometimes result in divergent approaches to practical treatment, they are clearly united in a shared enthusiasm for the faces of these portraits that trace a direct line to individual people—not just to the sitters with their personalities, their struggles, achievements, and disappointments, but to the artists, also with their own idiosyncrasies, habits, and preferences, beholden to clients and suppliers through good years and bad. It is vital to keep this fact in mind as the two specialties work together, incorporating lessons and insights from each discipline, and move forward toward a greater understanding of these paintings.

ACKNOWLEDGMENTS

We wish to thank many colleagues who gave so generously of their time and expertise in support of this work: Agnese

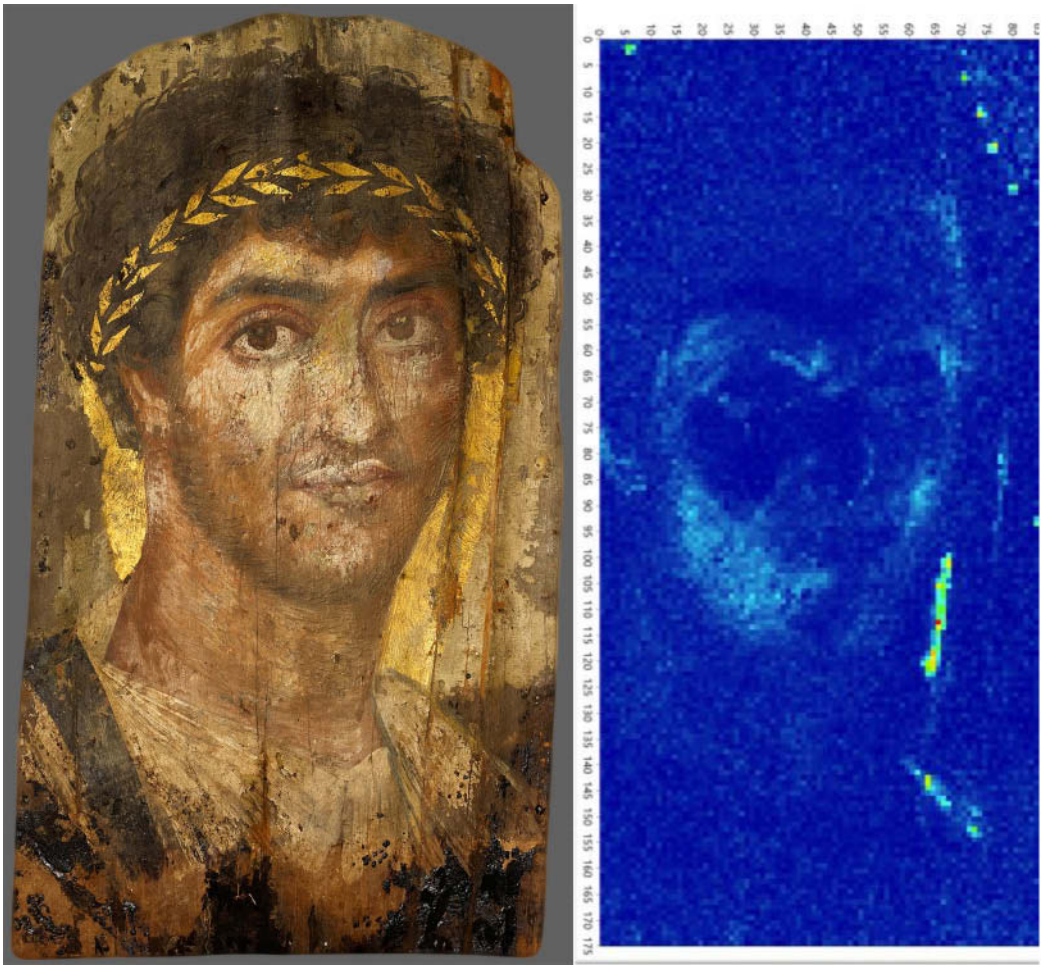

Figure 11. Intensity distribution map for copper on *Mummy Portrait of a Man Wearing a Laurel Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4799. The high-density spots and lines to the right of the image are artifacts from copper-based materials used in mounting and restoration.

Babini, Veronica Biolcati, Danielle Duggins, and Gianluca Pastorelli, NU/ACCESS; Francesca Casadio, Karen Manchester, Katharine Raff, and Giovanni Verri, Art Institute of Chicago; Patrick Dietemann, Doerner Institute; Joy Mazurek and Marie Svoboda, J. Paul Getty Museum; Richard Newman, Museum of Fine Arts Boston; Johanna Salvant, Centre de recherche et de restauration des musées de France; and Jevon Thistlewood and Susan Walker, Ashmolean Museum.

NOTES

1. Classical archaeologist Klaus Parlasca of the Archäologisches Institut der Universität Erlangen compiled images and descriptions to publish a four-volume catalog of all known portraits (Parlasca 1969–2003).
2. For a detailed discussion of binding media in mummy portraits, and instrumental parameters for analysis of the AIC portraits using FTIR and GC-MS, see Sutherland, Sabino, and Pozzi (forthcoming).
3. On the linkages with Byzatine icons, see Doxiadis (1995, 90–92). On the Greek four-color palette, see Bruno (1977, 53–59). Pliny alludes to the tetrachromy in *The Natural History* (Pliny the Elder 1955, 35.50).
4. Noninvasive examination with XRF using a Bruker/Keymaster TRACeR III-V energy dispersive x-ray fluorescence analyzer with a Peltier-cooled, high-resolution, silver-free SiPIN detector and a rhodium tube suggested the presence of iron oxide–containing pigments, calcium compounds, and jarosite. The presence of calcite and jarosite was confirmed micro-invasively with FTIR; see Sutherland, Sabino, and Pozzi (forthcoming) for instrumental details. Micro-invasive Raman microspectroscopy using a Jobin Yvon Horiba LabRAM 300 confocal Raman microscope

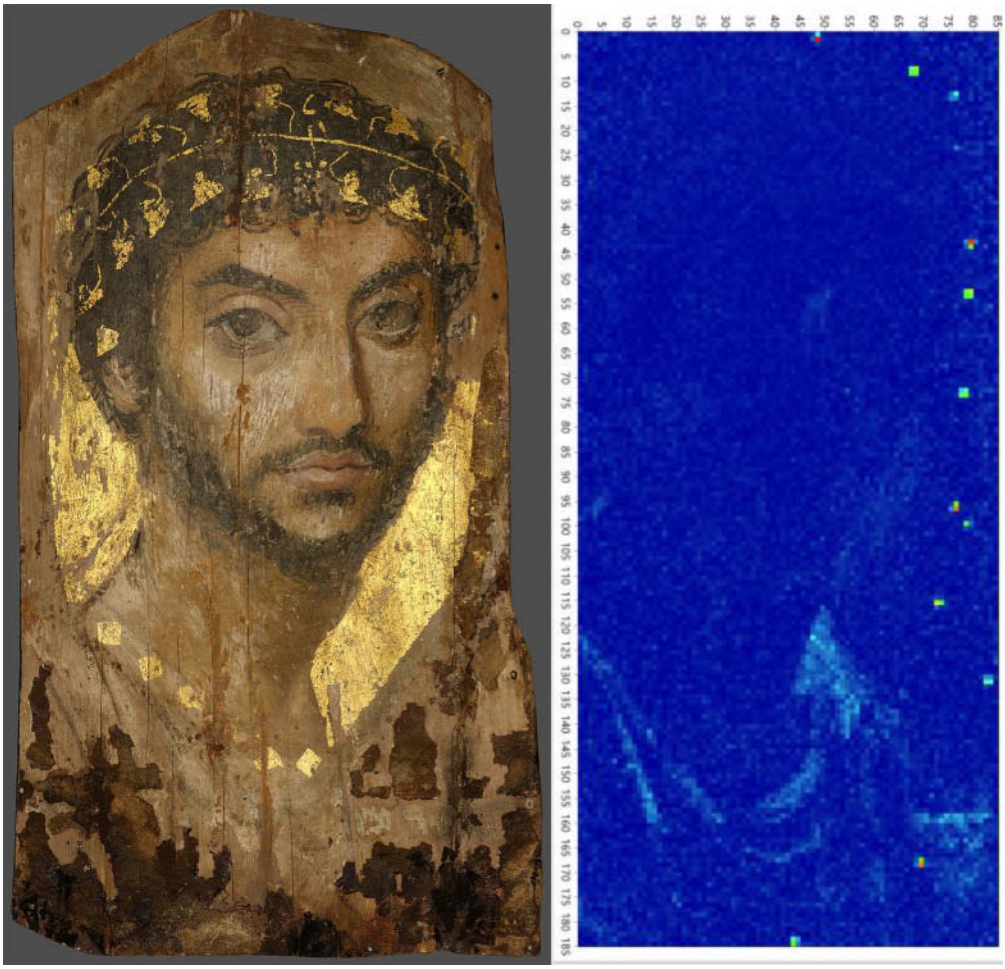

Figure 12. Intensity distribution map for copper on *Mummy Portrait of a Man Wearing an Ivy Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4798. The high-density spots to the right of the image are artifacts from copper-based materials used in mounting and restoration.

(laser excitation lines λ0 = 532 nm, 632.8 nm, 785.7 nm) confirmed the presence of red and yellow iron oxides and carbon black. The madder was identified micro-invasively with surface-enhanced Raman microspectroscopy; for instrumental details, see Pozzi et al. 2012.

5. British Museum 1888,0920.23-28. Six pottery paint saucers respectively containing light blue–colored paint (Egyptian blue), dark red–colored paint (hematite), yellow-colored paint (jarosite), white-colored paint (gypsum), red-colored paint (minium, or red lead), and pink-colored paint (madder mixed with gypsum), once belonging to a fresco painter. Romano Egyptian, 1st century AD. See Cartwright and Middleton (2008, 61).
6. Hyperspectral imaging was conducted in partnership with the Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), which is generously funded by the Andrew W. Mellon Foundation to carry out objects-based and objects-inspired research at no cost to cultural institutions on a merit review basis. For more information, see http://www.nuaccess.northwestern.edu. For the examinations described in this work, a xenon flashlight was used as the radiation source. An X-Nite CC1 daylight filter with a 50% transmittance efficiency between 325 and 645 nm was placed in front of the radiation source to eliminate the UV and IR contributions of the light source. A Canon EOS 5D Mark III DSLR camera body modified by removing the IR blocking filter was used to record the luminescence responses. To select the emission range under investigation and eliminate the contribution from the visible range, the camera was fitted with an S-Nite850 cut on filter with 50% transmittance efficiency at around 850 nm. To eliminate any possible light

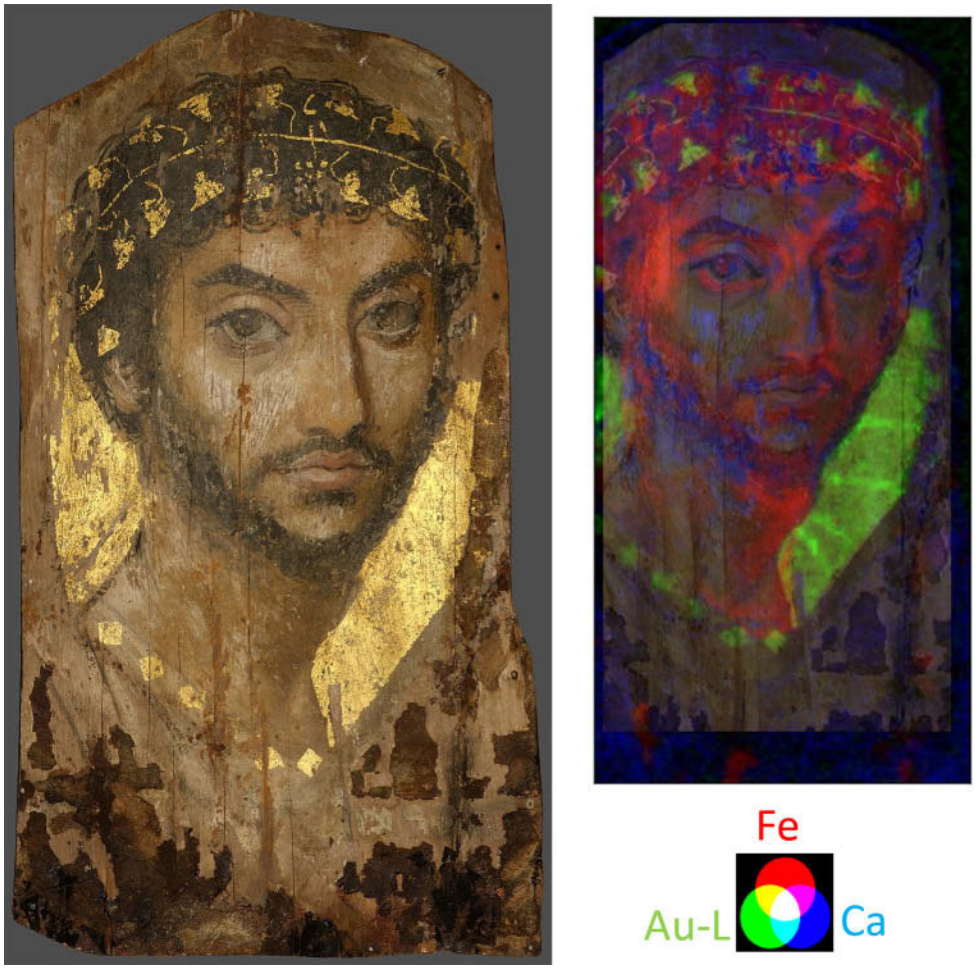

Figure 13. Intensity distribution map for gold (depicted in green) on *Mummy Portrait of a Man Wearing an Ivy Wreath*. Courtesy of Northwestern University/Art Institute of Chicago Center for Scientific Studies in the Arts (NU-ACCESS), 1922.4798.

contributions other than the filtered flash, the imaging was conducted in a dark room ensured to have no leaks from stray light. See Ganio et al. (2015, 815).

7. The scanning XRF and subsequent data analysis was also conducted in partnership with NU-ACCESS using an ELIO spectrometer (XGLab) equipped with an RH tube and a 1-mm spot size and an integrated CCD camera with two laser pointers. All analyses were performed in atmospheric conditions. For the current study, point analyses were performed at 40 kV and 100 μA with a collection time of 120 seconds. For maps, the rastering was executed with a step size of 250 μm and acquisition time of 1 second for each point. See Ganio et al. (2015, 815).
8. British Museum portrait numbers EA74714, EA74715, EA74716, EA74718, and EA65345. The results of these VIL examinations will be published in a chapter authored by Joanne Dyer and Nicola Newman entitled "Multispectral Imaging Techniques Applied to the Study of Graeco-Roman Funerary Portraits from Egypt at the British Museum" in a forthcoming Getty publication.
9. According to Verri, Opper, and Deviese (2010), "particles of the blue pigment were mixed with lead white, probably to achieve a 'brighter' white, as pure lead white can give a cream colour rather than a 'pure' white; the addition of even small amounts of blue reduces this yellowish appearance" (49).
10. See Verri, Opper, and Lazzarini (2014, 166). The paucity of exemplars supported by analysis makes it problematic to attempt a direct link or to suggest a continuous tradition from Greco-Egyptian paintings to the Italian Renaissance. But it is certainly obvious that the need to incorporate some kind of "cool" pigment to satisfactorily render skin tones has been a continuous necessity for artists.

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JEAN DOMMERMUTH

A Convenient Method: Canvas Painting in 16th-Century Florence

ABSTRACT

In 16th-century Italy, the use of canvas as a support for paintings was more closely associated with Venice than with Florence, yet Florentine painters utilized canvas for certain projects. It has been noted that this practice usually indicates that these paintings were created for specific purposes, such as banners. However, these functions are not always so obvious, and this major clue to the origin of a work may be ignored. This study explores the reasons for using canvas by looking at the works themselves as well as contemporary writings. Giorgio Vasari, proudly grounded in the Tuscan tradition of panel painting, had a definite respect for the utility of canvas; he wrote that it is a "convenient" support.

Such research can help recontextualize works, especially those that were not originally conceived as independent paintings. By looking at materials and techniques, as well as evidence of damage and alteration, a painting has recently been identified as part of a temporary decoration (apparato) *created for the Medici wedding of 1565; that case study is the core of this work. At the time, such decoration was extremely important, created by the leading artists of the day, including Pontormo, Bronzino, and Alessandro Allori. Designed as ephemera, few have survived, and they are almost forgotten as an art form. Canvas was "convenient" for these decorations not only because—as is often mentioned—it was cheaper, lighter, and could be made quite large but also because it could easily be made to an exact, predetermined size so as to fit in an architectural framework that was itself the ancestor of the modern theater set.*

Using very simple examination techniques, such as measuring canvas widths and looking at seaming and scalloping, in addition to ground types and thicknesses and the range of pigments used, a great deal can be understood about this early modern installation art, as well as other uses of canvas by artists for whom it was a specific choice.

This study began with the consideration of one painting in the Acton Collection at Villa La Pietra, the Florentine campus of New York University. Although many art historians have visited the collection and seen the work in passing, it has never been truly studied, and there is no provenance available for it. The only information available is the painting itself. Because of its style, there is general agreement that it was painted in Florence in the mid-16th century. However, neither its creator nor its subject had been identified before it was examined in 2016. This examination was fairly brief and quite simple (using only visible light and magnification) to check the work's stability.

What immediately seemed unusual was that the work was on a canvas support, not on panel. However, in the 16th century, painting on canvas, rather than panel, was more often associated with Venice than Central Italy. This began a research project on the use of canvas in 16th-century Florence.

A review of the literature found no publications specifically on this subject. On canvas painting in general, research began with the seminal article of Villers (1981): "Artist Canvases: A History." Villers pointed out the link between canvas and Venice but also made other important points. The first was about survival; paintings on canvas are inherently fragile, and thus it should be presumed that originally there was a much higher percentage of canvas supports than survive today. In another classic article, "The Lining Cycle," Percival-Prescott (1974) notes that 200 years would have been an extraordinary length of time for a canvas painting to survive before advances in lining techniques in the late 17th and early 18th centuries.

Villers also observed that two extant milestones in the history of painting on canvas are, in fact, Florentine. One of these is *The Intercession of Christ and the Virgin* attributed to Lorenzo Monaco (before 1402, tempera on canvas, 239.4 × 153 cm, The Metropolitan Museum of Art, 53.37).

This is considered to be the earliest large-scale altarpiece on canvas. Another is *St. George and the Dragon* by Paolo Uccello (probably 1470s, tempera and oil on canvas, 56.5 × 74 cm, National Gallery of Art, London, UK, NG6294), which is an early example of painting in oil, rather than some aqueous medium, on canvas (Bromelle 1959; Dunkerton and Roy 1998; Higgitt and White 2005). Clearly, canvas was a well-known support in Florence. Of course, even earlier, Cennini wrote fairly extensively about it (Cennini 1960, 103–108).

Giorgio Vasari can be considered a representative 16th-century Florentine artist. A recent study (Canarella 2012) of his *Ricordanze* found that a full 25% of the artist's work was painted on canvas. This is particularly interesting because it is a record of what was produced rather than what survives. It is perhaps a surprisingly high percentage for a Tuscan artist—and particularly for Vasari. His writing on the lives of the artists included a fair amount of technical information, and he clearly presumed that panels were the default support. Vasari does enumerate some of the advantages of canvas over panel, describing it as "a convenient method."

In the *Life* of the Bellini family, he wrote "[I]t is much the custom in Venice to paint on canvas either because it does not split or become worm-eaten, or because they can make pictures whatever size they wish, or again for the convenience, as said elsewhere, of being able to send paintings wherever they want, with little bother or expense" (Vasari 1987, 59) because such paintings were both lighter than panels and could be rolled for transport. Further, the cost would have been lower, because the material was less expensive and less labor was required. For example, the ground preparation was much less time consuming (Villers 2000).

A 16th-century Florentine artist might well choose to use canvas over panel, but there would almost certainly be a specific reason. One of the best-known reasons for using canvas is for painting banners that were carried in processions, often by confraternities (Franklin 1995; Aldrovandi, Ciatti, and Scarzanella 2000; Bury 2000; Bayer 2003; Chui 2007). These were always religious subjects and of a size that could be carried easily. Not only is the Acton painting a secular subject, but it would have been too large to carry. Both of these reasons exclude the Acton painting from having been a banner.

The issue of size is relevant here. When Vasari (1960) says that canvases "can be made whatever size they wish" it is true that he means that canvases can be made quite large; elsewhere, he says that "where the panels are not sufficiently large they are replaced by canvases." However, it was not strictly necessary to make this substitution. The panel support of Bronzino's *Descent into Limbo* measures 444 × 291 cm (1552, oil on panel, Santa Croce, Florence, Italy). Another problem is making a painting support to an exact, predetermined size. Looking at contemporary panel paintings, it becomes clear that there were no standard sizes for panels of independent paintings. For example, the portraits of the Medici children commissioned by Cosimo I de'Medici from Bronzino were created in a continuum of sizes.[1] Unlike in later centuries, the exact size was not crucial.

However, the support of the Acton painting was made to be a specific size: 200.5 × 143 cm; all evidence indicates that the work is very close to its original dimensions. Making a support an exact size is much easier with canvas than with wood. First, rather than starting with planks of different widths, it starts with a material manmade to a specific width. This was limited by the distance a weaver could throw the shuttle through the shed of the warp threads, about 100 to 120 cm.[2]

Next, it was much easier to shape that material into the size desired; it could be trimmed with scissors and stitched together. The Acton painting has two seams: a short horizontal one and a long vertical one. This arrangement is not at all unique, and, in fact, the Lorenzo Monaco *Intercession* is made up in a very similar way (Hale 2000).

Looking at an example closer in date to the Acton painting, but from the Veneto rather than Tuscany, the *Baptism of Christ* by Jacopo Bassano (ca. 1590, oil on canvas, 191.8 × 160.3 cm, The Metropolitan Museum of Art, 2012.99) was constructed in the same way, which is evident in both a published cleaned state photograph and in raking light. Michael Gallagher has written about it: "[T]he large piece is orientated with the warp threads running vertically and is almost the full width of the loom at 118 cm since the selvage is preserved on the right. The two narrower pieces were possibly offcuts that were turned 90 degrees placing the warp threads in a horizontal orientation" (Bayer, Gallagher, and Centeno 2013, 102). This piecing technique allows a support to be made exactly the desired size with as little waste as possible.

The Acton painting was made to be a specific size in an era when that was not important. The Lorenzo Monaco and the Bassano were made to deliberate dimensions because they were intended for particular destinations; they were both altarpieces. It therefore seemed logical to hypothesize that the Acton painting was also made for a particular destination, possibly part of a decorative cycle.

This would make sense with both the support and the subject, a group of monumental nudes. It can be compared with a pair of paintings by Giuliano Bugiardini now at the

Metropolitan Museum (*Adam and Eve*, ca. 1520, oil on canvas, each 67 × 156.8 cm, 1971.115.3ab) (Pagnotta 1987, 42). They were very likely painted to decorate a bedroom in a noble residence, perhaps installed at the time of a wedding.[3] This type of commission was most often redecoration of an existing space—updating it to the latest fashion—and generally such works fit into wall paneling. Thus, they would need to be made to a specific size.

Art historians have suggested that the use of canvas for paintings of this type might imply that they were meant for a country villa rather than a city palazzo, as canvases would have been easier to transport out to the country (Franklin 2015; Zöllner 2015). However, there are many documented instances of canvas decorative cycles in the city, as well as cases where canvas and panel were used for different parts of the same decorative cycle (Panofsky 1937; Bromelle 1959; Ettlinger 1972).

This is true of Botticelli's *Primavera*, on panel (ca. 1480, oil and tempera on panel, 203 × 314 cm, Uffizi Gallery) and *Minerva and the Centaur*, on canvas (ca. 1480, oil and tempera on canvas, 207 × 148 cm, Uffizi Gallery), which hung in the same room in Palazzo Medici in the center of Florence (Thornton 1991, 52; Sebregondi and Parks 2011, 230; Zöllner 2015, 67.) There must have been a reason for the use of different support; however, that could neither have been expense nor ease of transportation. Weight could have been a factor: the *Minerva* hung over a door, so perhaps a lighter-weight painting was easier or safer to hang there. But there might be other issues that are rarely considered, such as texture. A canvas painting would have had a rougher surface, almost like a fresco. This could have been an advantage if glare from a window might be a problem, provided that the painting was fairly light in color and unvarnished.

Looking at the example of Giuliano, the artist sometimes used canvas and other times panel for very similar projects. A pair of Ledas, which were pendants, are on panel, whereas a similarly sized Venus is on canvas (Pagnotta 1987, cat. #17–19). This use of different supports is also found in his portraiture. Some of his portraits are on canvas and others on panel; this is true even when they are relatively small such that neither the material cost nor the weight would have been significantly different (Pagnotta 1987, cat. #16, 49, 50, and 59). In these cases, the reason for the choice of support is an open question.

In addition to permanent cycles, there were also temporary ones: *apparati*, or "festival furnishings," temporary decorations created for elaborate banquets and ballets, as well as parades, that were the ceremonial entries of rulers or brides into a city (Strong 1973a, b; Buccheri 2014). Along the route of such a parade, a series of arches and other structures would have been built. Some of these were structures of wood built to cover the facades of buildings, akin to modern theater sets. These would have been decorated with sculptures and paintings representing various allegorical themes, both Christian and Classical, all designed to reinforce the idea of the legitimacy and of the rulers. In addition to weddings, temporary decorations were also made for funerals; these included macabre imagery of skeletons, as well as scenes from the life of the deceased and his family. These were highly important events, and the works were created by highly important artists. However, they were temporary, so the sculptures were made of plaster instead of marble, and the paintings were not on panel but on canvas. This was also useful because they had to fit, like frescoes, into a specific architectural framework, so they had to be a specific size.

Very few paintings from *apparati* have survived, so relatively little is known about their technique. Some of the paintings created for *apparati* would have been done in grisaille. Vasari (1960) describes painting in monochrome "on canvas, to adorn arches erected on the occasion of the entrance of princes into the city, and of processions, or in the apparatus for fêtes and plays, since on such structures they produce a very beautiful effect" (240). For such works, he says the preparation (ground) should be clay (*terretta*) bound with size (animal glue). Fictive bronzes would then be painted with earths, with shadows in black (possibly bound in egg for a more saturated effect than could be achieved with size) and lead-based pigments (white, red, and yellow) for the highlights. Other monochromes might be painted with umbers, terra verde, and other earths along with lead white.

But not all of these paintings were monochrome; a few from the *apparato* of 1589 have survived. One, *An Allegory with the Triumph of Florence*, was examined and conserved for exhibition in 2009 (Saslow 1996; Bietti 2009; Lavorini and Orata 2011). It is painted on canvas in oil, and although the light gray ground and paint layer are notably thin, the palette compares closely to that of the Acton painting.

Canvases from an *apparato* might be reused, and there were several ways that this might happen. Perhaps the reuse that would most likely ensure a painting's survival was to be turned into permanent decorations for an interior. This is what happened with several of the 1589 paintings; they were used to decorate Palazzo Pitti (Bietti 2009). If the subject suited a later *apparato*, it might be used exactly as it was. However, a few simple changes might adapt it to a new subject. One intriguing example is a canvas originally painted for the 1587 funeral of Francesco I de'Medici; this showed him receiving the Tensho embassy: a group of four boys from Japan who came to Europe in 1585. Twelve years after Francesco's funeral, the canvas was reused for the

funeral of King Phillip II of Spain. Francesco's head was replaced with the head of Phillip, and the Japanese boys were turned into Native Americans (Borsook 1969).

In addition, paintings might be reused simply as material, as canvas. There are archival records that paintings from Phillip's funeral were considered for this reuse for the wedding of 1608. In the end, it was thought this might offend the bride, who was related to Phillip, so the canvases were used as they were (Borsook 1969).

In light of this type of reuse, it is interesting to consider the Uccello at the National Gallery, London. It had long been realized that it had a complex layering structure, but this took decades to understand. Underneath *St. George and the Princess* is a "decorative, heraldic, or emblematic composition" painted with a ground of orange red ochre and a little lead white in walnut oil and a design in black and dull green (Dunkerton and Roy 1998). This is very similar to Vasari's description of grisaille painting for *apparati* and a clear example of a canvas being frugally reused. The original composition was very difficult to image—even for the National Gallery. Neither traditional x-ray radiography nor infrared reflectography showed it well. There might be many such earlier images under paintings that have yet to be seen.

There are two canvas portraits by Mirabello Cavalori dating to 1566 (*Portrait of a Knight of Malta*, oil on canvas, 88.9 × 66.7 cm, The Metropolitan Museum of Art, 41.100.15; *Portrait of a Young Man as an Allegory of Friendship*, oil on canvas, 182 × 105 cm, Private Collection). These paintings were created soon after the funeral of Michelangelo in 1564 and the Medici wedding of 1565. For each of those events, there were important *apparati*; Mirabello himself painted canvases for both (Feinberg 1992). Combined, those decorations would have required approximately a kilometer of canvas. Thus, in 1566, there was a great deal of canvas available to be repurposed; it is conceivable that these portraits were painted over other works.

By the end of the 16th century, canvas was a common choice that does not need to be explained. Some of the many factors influencing this include the continued deforestation of Europe that created a shortage of wood. However, it may not be coincidental that those from that generation had painted a large number of *apparati*; they had considerable experience painting on canvas.

For the Acton painting, the simple consideration of the support suggested that the painting could have come from an *apparato*. Looking at contemporary documents, comparative works, and art historical research, a royal entry was found that fit very well with the dating by style of the painting. In 1565, Joanna of Austria entered Florence for her wedding to Francesco I de'Medici (Mellini 1566; Ginori Conti 1936; Pillsbury 1969; Scorza 1981; Lepri 2017). By locating the Acton painting in that *apparato*, from the façade of Palazzo Ricasoli, it was attributed it to the studio of Bronzino (probably Lorenzo Sciorini), and its subject was identified as *An Allegory of Beauty, Happiness, Youth, and Delight*; the details will be published separately.

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NOTES

1. On these portraits, see Heikamp (1955); this author lists the sizes of the works but does not consider the implications of this. Thornton (1991, 261) discusses the rise of "detached pictures" over the course of the 16th century. The present author is researching dimensions and ratios of 16th-century panels.
2. Although there is not much evidence of Florentine canvas widths of this period, 16th-century Venetian canvases are generally 106 to 110 cm wide (see Plesters 1980, 37). Gallagher notes that the Met Bassano is at least 118 cm wide in Bayer et al. (2013). Earlier canvases were often narrower (see Aldrovandi et al. [2000] and Hale [2000]).
3. For a consideration of commissions for weddings, see Barriault (1994); none of the author's examples are on canvas.

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Material Insights and Challenges in the Treatment of *Portrait of an Old Woman* by Maarten de Vos

ABSTRACT

Material analysis was crucial in treating Portrait of an Old Woman *by Maarten de Vos (National Gallery of Art, Washington). Noninvasive analytical imaging and invasive analytical methods were used to determine the composition and distribution of non-original materials, including a cross-linked synthetic varnish; discolored drying-oil layer; and overpaint covering the background, cap, and garment. The treatment of* Portrait of an Old Woman *offers an example of the important role that analytical techniques can play when carried out before and during treatment in making informed decisions while highlighting the humbling physical limitations of treatment options that conservators often encounter.*

1. INTRODUCTION

Portrait of an Old Woman (fig. 1) by Maarten de Vos (1532–1603) was gifted to the National Gallery of Art by a private donor in 2015. Dating to 1556, this portrait was thought to be one of this Flemish painter's earliest known works. Although de Vos is known to have been enrolled as a Master of the Antwerp Guild by 1558, the date of this painting has also been used as evidence that de Vos possibly returned to Antwerp from travels in Italy 2 years earlier (Schuckman 2003). Considering that de Vos is largely known for his religious and historical scenes, this intimate, small-format single portrait could be considered relatively unusual. Unfortunately, the identity of the sitter is unknown, but her age at the time the portrait was painted can be discerned from the inscription in the upper left corner: "Aeta 68" in which "Aeta" is an abbreviation for "Aetatis," or "age" in Latin.

Treatment of the painting carried out from 2016 to 2018 revealed that much of the painting's surface had been overpainted, challenging the little known about this work. This treatment was also complicated by the presence of coatings and materials that were difficult to characterize by visual analysis alone.

Materials analysis carried out by the Scientific Research department at the National Gallery of Art played a crucial role as the treatment progressed in distinguishing between original and nonoriginal materials and identifying the composition of foreign coatings, which aided the development of treatment solutions and guided decision making. What also became clear through this treatment was the importance of using multiple complementary analytical techniques in combination with close observation of material behavior during treatment.

2. CONDITION BEFORE TREATMENT AND VARNISH REMOVAL

On arrival at the National Gallery of Art, the painting was visually obscured by thick, discolored varnish. The before treatment image in raking light demonstrates that there was significant lifting and cupping to the paint in the upper right corner. A vertical split along the wood grain extended from the top edge, which had been repaired previously and was held in place with a small block of wood added on the reverse.

Examination of the work under UV radiation (fig. 2) and capture of an x-radiograph (fig. 3) made clear that extensive losses were present in the upper right quadrant of the painting and within the cap. The images also showed that the overpaint had been copiously applied well beyond the confines of the damage.

Although no records regarding the work's treatment history exist, an anecdote from the painting's donor clarified the origins of the most recent retouching campaign. The donor relayed that a relative "went to a restorer because there was a small patch in the middle of the painting's forehead that

Figure 1. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. Before treatment in normal light. Credit Greg A. Williams.

Figure 2. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. Before treatment in UV radiation. Credit Greg A. Williams.

needed touched up. [The relative] was outraged by the amount of money the restorer wanted to fix it. So she did it herself."[1]

The true extent of numerous overpaint campaigns present would become clearer during varnish removal. Small tests with various organic solvents in different areas of the painting found that in the background a great deal of dark pigment solubilized onto cotton swabs in addition to the varnish. This prompted sampling of the background to gain a better understanding of the paint stratigraphy and any non-original materials present.

The cross section sample showed that two coatings followed by at least three to four layers of nonoriginal overpaint interlayered with varnish were present over the original background[2] (fig. 4). This stratigraphy in combination with information gleaned from UV radiation and the x-radiograph suggested that the entire background—including the inscriptions—had been overpainted during a series of restoration campaigns.

Considering that the solubility tests also found that the varnish was insoluble in a wide range of organic solvents when applied directly with cotton swabs, an attempt to identify the varnish was undertaken. Fourier Transform Infrared Spectroscopy

Figure 3. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. X-radiograph before treatment. Credit Doug Lachance.

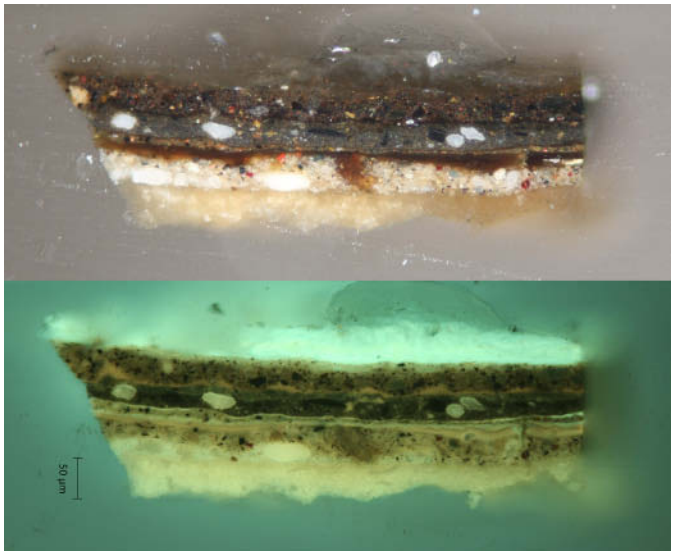

Figure 4. Paint sample in cross section from the background of Maarten de Vos, *Portrait of an Old Woman*, 1556, taken before treatment.

(FTIR) of a micro-sample identified the resin as a poly(iso-butyl methacrylate).[3] The propensity of this varnish to cross-link over time likely explains the reduced solubility in the solvents tested. After testing numerous solvent mixtures and gels, a xylene: ethanol: water emulsion was found to best solubilize both this coating and at least one additional coating underneath, likely a natural resin varnish.

In addition to removing the varnish, this solution readily solubilized much of the overpaint in the background. Original paint required consolidation to some extent during the process of overpaint removal; however, much of the lifting and flaking paint observed previously proved to be within the overpaint layer.

Overpaint removal also revealed that, fortunately, the original inscriptions were still present. The inscription "Aeta 68" had been completely repainted directly on top of the original inscription. The artist's signature and the date of the painting, meanwhile, had been shifted slightly downward and enlarged in the repainting. Because remnants of overpaint covering the original inscription were more difficult to remove, it was unclear at this point in the treatment whether or not this overpainted inscription faithfully matched that of the original signature and date.

3. REMAINING OVERPAINT IN THE BACKGROUND

Overpaint in the upper register of the painting and over the central region of the cap proved to be more tenacious than that covering other parts of the background (fig. 5). It was

Figure 5. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. During overpaint removal in normal light. Credit Greg A. Williams.

also observed at this time that a translucent yellow-brown layer remained over most of the background and the edges of the cap. Considering that this layer was slightly affected by some of the different solutions and gels tested to remove the overpaint, further investigation was undertaken to better understand the composition of this layer and to determine whether or not it was original to the painting.

One new cross section was taken from the background after varnish removal, which indicated that a discrete, translucent brown layer remained over the original paint. This layer could be seen directly above the original paint and had a slightly orange fluorescence under UV radiation; examination of this layer using scanning electron microscopy with energy dispersive X-ray analysis (SEM-EDX) confirmed that it did not contain pigment.[4] The thickness and unevenness of the coating, its indiscriminate application over parts of the cap and background, and its traversal over damage (seen both in cross sections and under microscopic examination) led to the conclusion that it was not original to the painting.

The presence of this non-original, unpigmented discolored layer helped facilitate overpaint removal, providing a barrier between the original paint and overpaint. After further testing of various solutions, gels, and mechanical methods, overpaint removal proceeded working under the microscope and using a solvent gel in combination with the use of a scalpel. The remaining overpaint in the background was reduced as far as possible but could not be entirely removed along the edges of all of the losses, as the original paint underneath in these areas tended to be particularly friable.

4. REDUCTION OF OVERPAINT IN THE CAP

In addition to the background, overpaint covered the majority of the cap (fig. 6). This overpaint altered the cap's original color and contours, and although large losses were known to be present underneath from examination of the x-radiograph, it was determined that revealing the original paint would be beneficial if it were possible to do so safely. This overpaint was reduced mechanically in tandem with the use of a solvent gel under the microscope, and the same method was used to reduce overpaint in the ruffle at the sitter's neck.

Although the overpainted date for the painting read "1556," once the overpaint had been reduced to the greatest extent possible, the remnants of the original inscription appeared instead to correspond to "1569." Extensive research into the costume was not conducted; however, a survey of 16th-century Dutch portraits suggests that the sitter's peaked, rather stiff cap as depicted in the overpaint was more typical for the 1550s and may have been seen to agree with the 1556 dating, whereas the more organic, draped shape of the original cap agrees with the original 1569 dating.

5. REDUCTION OF THE NON-ORIGINAL OIL LAYER

Subsequently, attempts were made to reduce the aforementioned discolored, unpigmented, non-original layer directly over the background and parts of the cap. After an initial survey with FTIR analysis, which suggested that the medium of this layer consisted of protein, perhaps with an oil or egg component, tests were carried out consisting of aqueous solutions of varying pH with and without the addition of surfactants, as well as with rigid agar gels with and without the addition of the enzyme protease.[3] The relative unresponsiveness of the layer to these different solutions and gels prompted additional analysis, and a sample analyzed using gas chromatography mass spectrometry (GC-MS) indicated that the medium consisted of primarily drying oil with a smaller amount of diterpenoid resin.[5] This examination protocol would not have identified protein, although protein was observed in FTIR; therefore, it seems likely that any protein present was due to residues of previous consolidation or past treatments. An additional round of

Figure 6. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. Three details of the hat at different stages of overpaint removal in normal light. Credit Greg A. Williams.

testing with various solvent gels was more effective, and the discolored coating was successfully reduced as much as safely possible.

Reduction of this layer caused discolorations and staining to the original paint underneath to become somewhat more visible; however, it provided a significant aesthetic benefit in terms of improved legibility of the lively brushstrokes in the original paint of the background.

6. STUDY OF THE GARMENT

Microscopic examination of the paint surface in the sitter's black garment also indicated that overpaint was present: a coarse-textured dark paint layer traversed cracks and damage in the underlying paint and obscured fine details where the contours of the garment were painted wet-in-wet with the background. Analysis of a paint cross section and dispersed pigment samples helped to further distinguish this overpaint from the original.

Two cross sections taken from the garment confirmed that a dark paint layer covered another dark, original layer. Both samples also showed very thin, lighter layers underneath the darker paint, directly on top of the ground. Although there was not an intervening varnish or oil layer between dark paint layers in the particular areas sampled, other analysis and observations supported the identification of the upper layer as later overpaint. In shard-like particles packed densely throughout the upper layer of the cross section, SEM-EDX analysis identified silicon, cobalt, arsenic, and nickel, which correspond to the pigment smalt. The arsenic and nickel found here, as well as the elements iron and bismuth, relate to the source of cobalt ore used to color the glass, which varies by the geological location of the cobalt ore deposit (Spring et al. 2005, 63). The significant proportion of this pigment in the overpaint layer was confirmed with examination of a dispersed pigment sample using polarized light microscopy.[6]

The smalt particles from the dispersed pigment sample of the overpaint layer appear completely colorless under magnification. Smalt was readily available in different intensities of blue, and colorless smalt could have been selected for this restoration campaign, utilizing the pigment primarily as a bulking agent. Alternatively, the lack of color could also be due to degradation. Elemental data gathered through SEM-EDX indicates that although cobalt is clearly detected, the proportion of silicon to potassium in the smalt is quite high, as very little potassium within pigment particles is detected in SEM-EDX, and this may indicate that a degree of discoloration has occurred.[7]

While both dark paint layers in the cross section contain lead white and carbon black, the upper layer contains mostly smalt; the dispersed pigment sample from the upper layer also showed traces of a resinous earth pigment, such as Van Dyke brown. By comparison, a dispersed pigment sample from the lower, original layer consists primarily of carbon black with additions of lead white, red lake, umber, and iron earths.

The inclusion of smalt in the overpaint, rare after the 17th century, suggests that it was an early intervention, but this does not preclude the possibility that smalt could have been used at a later date. For instance, smalt was found in a restoration campaign of a recently treated 18th-century painting at the National Gallery of Art.[8]

Although the overpaint could be distinguished to an extent through microscopic examination of the paint surface as a coarser layer, a better understanding of its distribution was sought. X-ray fluorescence imaging spectroscopy, otherwise known as macroscopic x-ray fluorescence (MA-XRF), was used to help identify and map the presence of a variety of elements.[9] Of particular interest was cobalt, and the associated trace elements from the cobalt ore: nickel and arsenic. Such maps would provide insight into the location and extent of the smalt overpaint in the garment and were hoped to provide a better understanding of the original paint's composition and condition. The co-localization of cobalt, arsenic, and nickel in the XRF maps indicated the presence of smalt across the garment, seen most clearly in the cobalt map (fig. 7). These XRF maps show distributions that can be related to the surface design; this restoration campaign perhaps sought to embellish the garment and reinforce the appearance of folds.

Elements corresponding with smalt (cobalt, nickel, and arsenic) were also detected in parts of the painting known to be original, including in the shadowed side of the proper right eye, in the proper left, shadowed portion of the cap, and on the right side of the background. However, a scatterplot of the relative amounts of nickel to cobalt showed that smalt sourced from two different cobalt ore deposits were present in the painting. Figure 8 shows that the smalt used in the background, eye, and cap has a similar nickel to cobalt ratio (mapping to green), with a higher nickel content compared with that found in the garment (mapping to red), suggesting that a different source of smalt was used in overpaint than that of the original. The smalt in the garment also appears to be the same as that detected in an overpainted loss in the cap. This technique to distinguish sources of smalt has been employed previously in the study of Rembrandt's *Saul and David*, which aided the conclusion that Rembrandt used two types of smalt in this painting, likely during two different periods of his career (Janssens et al. 2016).

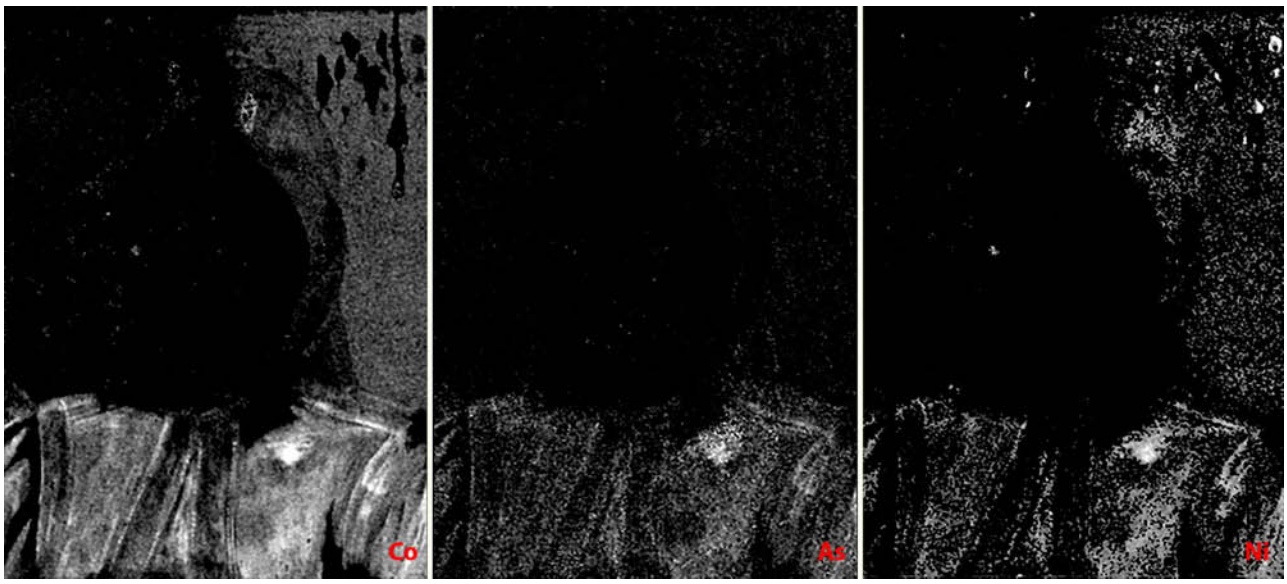

Figure 7. Distributions of cobalt, arsenic, and nickel as determined through x-ray fluorescence imaging spectroscopy in Maarten de Vos, *Portrait of an Old Woman*. Credit John Delaney and Kathryn Dooley.

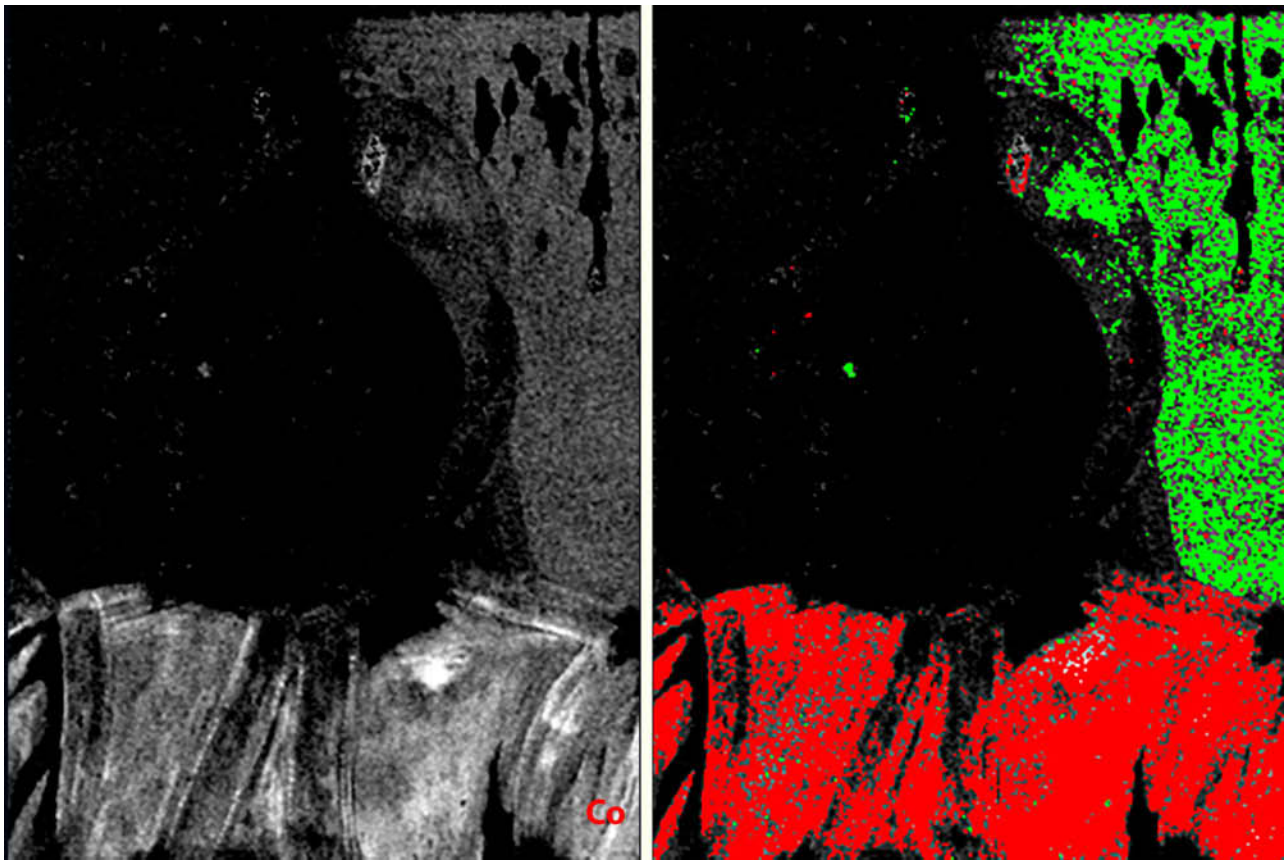

Figure 8. Distribution of cobalt (left) with locations of smalt from two different sources (right) in Maarten de Vos, *Portrait of an Old Woman*, with the areas in green containing a higher nickel content than areas mapping to red. Credit John Delaney and Kathryn Dooley.

In addition, XRF maps of lead, iron, and manganese showed a different design in the garment (fig. 9), which may relate more to the lower, original paint layers identified in the cross section. The lead map, in combination with the analysis of cross sections from different parts of the garment, suggest that underneath the dark original paint layer, the two main panels of the garment were underpainted in lead white and may have originally contrasted more with the darker trim, which seems to have been underpainted with gray. Manganese and iron (corresponding to earth pigments, including umber) are present in higher proportions in the trim than in these panels, indicating that the trim would also have perhaps been browner or warmer in color.

Despite the wealth of information that instrumental analysis and imaging provided, it was not possible to safely remove the overpaint in the garment. All tests to remove the overpaint found that even when working under the microscope, it was still challenging to determine a clear separation between the overpaint and original layer. It was decided that removal imparted too much risk, and discontinuities between overpaint and exposed original paint were instead compensated in the retouching phase.

Figure 9. Distributions of lead, manganese, iron, copper, tin, and mercury as determined through x-ray fluorescence imaging spectroscopy in Maarten de Vos, *Portrait of an Old Woman*. Credit John Delaney and Kathryn Dooley.

Study of the MA-XRF maps also revealed previously unrecognized tonal subtleties in De Vos's composition. The copper, tin, and mercury maps also appear to relate primarily to the original paint, with dispersed pigment samples supporting the conclusion that the copper corresponds to azurite, tin with lead tin yellow, and mercury with vermilion. Although vermilion is found in the overpaint, it clearly was used in original passages as well. The artist appears to have used these pigments to establish contrasting warmer and cooler zones, with copper (azurite) mapping to the left side of the garment, the shadowed side of the face, and the right side of the background, and mercury (vermilion) mapping to the right side of the garment, the highlighted side of the face, and the left side of the background. It is possible that the cooler pigments on the left side of the garment would originally have contrasted with warmer pigments on the right side of the garment. This suggests that light would have more obviously struck the proper left shoulder, with the opposite side of the torso in shadow, and that the torso would have appeared slightly angled with the sitter's proper right shoulder receding from the viewer.

Additionally, lead tin yellow in the upper left corner of the painting would have modulated the warm tonality in this part of the background, whereas the original smalt and azurite detected on the right side of the background would have perhaps indicated a slight shadow behind the sitter. Original smalt also may have lent a slightly blue tonality to the shadowed side of the cap. Many of these subtle distinctions of tonality in the background unfortunately are not readily discernible at present, likely due in large part to damage.

It is important to note that the intensities seen in the XRF maps do not necessarily relate to the quantity of pigment, which contributes to the visual color appearance on a macro level in the painting. Correlating the XRF maps with other analytical methods, such as analysis of cross sections and dispersed pigment samples, was therefore critical. In looking at the intensity of the signal in the copper map, for example, one might think that the right side of the background was painted in solid azurite; however, dispersed pigment samples from the single layer of original background paint contain only a relatively small proportion of azurite particles.

7. COMPENSATION

Prior to filling and retouching, an isolating layer of varnish was brushed overall. Additional layers were spray varnished overall to increase the evenness, gloss, and saturation, and losses were filled with a putty consisting of chalk in gelatin (fig. 10).

Figure 10. Maarten de Vos, *Portrait of an Old Woman*, 1556, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. After filling in normal light. Credit Greg A. Williams.

The largest areas of paint loss were present in the background, through the inscription in the upper right corner, and in the cap. Other paintings by de Vos, as well as portraits of a similar geographic location and date, were used as references during the retouching stage. As mentioned previously, although the overpainted date for the painting read "1556," once the overpaint had been reduced to the greatest extent possible, the remnants of the original inscription appear to correspond instead to "1569." Fragments of the letter "A" in front of the date also had become visible during treatment. In consulting inscriptions on other paintings by de Vos, such as *Portrait of a Man* in the Kunstmuseum der Stadt, Düsseldorf (Zweite 1980, 321), an "A" or "AN" corresponding to "Annum" or "year" along with a small circle or colon was found to commonly precede the date. Although it is possible that an "N" also existed alongside, the extent of loss made this impossible to ascertain, so only the "A" and "1569" date were retouched accordingly. In the compensation of the cap, meanwhile, several images of similar Netherlandish portraits were used as references, including a portrait of Anne Fernely by Anthonis Mor (c. 1560–1565) from the Rijksmuseum.

Figure 11. Maarten de Vos, *Portrait of an Old Woman*, 1569, oil on panel, 14 5/8 × 12 1/8 in (37.2 × 30.8 cm), National Gallery of Art. After treatment in normal light. Credit Greg A. Williams.

As inpainting was nearing completion, the painting was spray varnished overall periodically to increase gloss and saturation; however, due to the remaining coarse smalt in the black garment, this area proved challenging to saturate and remained uneven. Airbrushing this area locally with additional varnish proved to be successful (fig. 11).

8, REFLECTIONS ON MATERIALS ANALYSIS

In keeping with the "Material Matters" theme of this Annual Meeting, reflection on the role of materials analysis during this treatment is apropos. The ability to study paint layering in cross section, the composition of dispersed pigment samples, and the distribution of elements visualized with XRF imaging spectroscopy provided fascinating insights into Maarten de Vos's construction of the picture and material choices, especially with regard to his intended palette and gradations in tonality that we can no longer detect today due to changes in the artwork. The ability to successfully identify and remove overpaint in the background and the cap led to the redating of the picture and revealed the original contours of the cap, as well as minute details that speak to de Vos's skillful application and manipulation of paint.

Access to these various forms of material analysis is indeed a rare privilege, and it must be acknowledged that the treatment would likely have taken a slightly different course if these techniques had not been available. Without having carried out FTIR analysis of the varnish at the outset of the treatment, surely a solution would have been found to remove the coatings; however, the testing process may have been prolonged, exposing the artwork to additional solvents and materials. Identification of this coating improved efficiency and guided tests to remove it.

As conservators constantly seeking to hone our skills, this sort of material identification is beneficial to improving an understanding of how and why particular materials behave in certain ways in interactions with the materials conservators introduce to works of art during treatment. And yet the necessity of interpretation in materials analysis is always present, and it is critical that it is is partnered with the close study of the interaction of treatment materials with the original artwork.

8. CONCLUSION

The impact of materials analysis before and during the treatment of *Portrait of an Old Woman* on decision making and increased understanding of the significance of original artistic choices cannot be overstated. No one analytical technique could have provided this knowledge: the use of complementary analytical techniques—invasive and noninvasive, microscopic and macroscopic—were necessary to gain this level of information. Of course, it is humbling to realize that the presumed future availability of more sophisticated analytical techniques may have supported different treatment decisions. In light of this, we have to consider a "successful treatment" one that accounts for the limitations of our circumstances and knowledge at a particular moment in time.

NOTES

1. Personal communication with Mara Bralove, June 11, 2017.
2. All samples were mounted in Bio-Plastic (Ward's Natural Science Liquid Casting Plastic), a polyester resin, with Bio-Plastic Catalyst (Methyl Ethyl Ketone Peroxide). Samples were examined in cross section in

reflected light and UV light at magnifications of up to 500× with a LEICA DMRX microscope and were photographed with a Canon EOS camera.

3. See the October 2016 Analysis Report by Suzanne Lomax. A scraping of the coating was provided. FTIR analysis was conducted using a Nicolet Nexus 670 spectrometer equipped with a Continuum microscope. The solid sample was compressed between windows of a diamond cell (Spectra-Tech). The MCT/A detector was cooled with liquid nitrogen before analysis, and the data were collected from 4000 to 650 cm^{-1}. In addition, 256 scans were collected at 4 cm^{-1} resolution.
4. For elemental analysis, cross sections were affixed to aluminum sample stubs using carbon tabs and subsequently coated with carbon (≈18 nm) using a Leica EM ACE600 coater. Following this, samples were analyzed using a Hitachi S3400-N variable pressure scanning electron microscope fitted with an Oxford X-max detector and Oxford AZtec x-ray spectrometer. The SEM was operated at standard pressures (<1 Pa) using an accelerating voltage of 20 kV and at a working distance of 10 mm. Imaging was achieved in backscattered electron mode and both point identification and elemental mapping routines were used to collect and display characteristic x-ray data.
5. See the May 2018 Analysis Report by Christopher Maines. The sample is put into in a 50-uL deactivated stainless steel cup. The sample cup is then dropped into the helium-purged furnace of a Frontier Labs PY-3030D Pyrolyzer (furnace: 600°C; interface: 300°C) and the pyrolysates are swept for 6 seconds directly into a Shimadzu GCMS-QP2010 SE equipped with a split/splitless injector held at 320°C with a 50:1 split. The capillary column is a Restek Rtx-5MS; 30 × 0.25-mm inner diameter; 0.25-μm film thickness; Helium flow of 1.2 mL/min controlled by linear velocity. The GC oven is programmed with an initial temperature of 40°C, which is held for 5 minutes. The temperature is increased at a rate of 20°C per minute to 300°C and held for 5 minutes. Operating conditions for the quadrupole mass spectrometer are as follows: solvent cut time of 1.5 minutes, interface temperature 300°C, ion source 200°C; ionization at 70 V; scan range 45 to 600 amu; 3 scans per second; and data analysis by Shimadzu GCMSsolution v.4.41 software and the NIST 2014 spectral libraries.
6. Dispersed pigment samples were mounted on glass slides with cover slips using Cargille Meltmount (refractive index approximately 1.66). The samples were examined in transmitted light and polarized light at magnifications of up to 500× with a LEICA DMRX microscope and were photographed with a Canon EOS camera.
7. "It has been established that, by looking at the proportion of silica (Si) to potassium (K) and silica to cobalt (Co), we can in fact differentiate between various qualities of smalt and between degraded and well-preserved smalt, the Si : Co ratio determining the intensity of the colour and the Si:K ratio the degree of discoloration. In well-preserved smalt, regardless of colour, the proportion of Si to K is in the order of 3:1 or 2:1" (Noble and van Loon 2005, 85).
8. Joanna Strombek's presentation on the treatment and technical examination of *Three Figures Dressed for a Masquerade* by Louis-Joseph Le Lorrain, dated to the 1740s, on May 2, 2018.
9. XRF image cubes were collected with a scanner designed in-house using a rhodium x-ray source operating at 50 kV and 750 μA (XOS) with a 1-mm diameter illumination spot, and a silicon drift detector (Vortex-90EX, Hitachi High-Technologies Science America, Inc.) operating at a peaking time of 0.5 μs and 13.7 eV spectral sampling. The scanning was completed with a high-precision, 2-axis easel (SmartDrive, Cambridge, UK) at an integration time of 200 ms/pixel. The resulting XRF image cube was registered to the color image, and a sum-of-Gaussians peak fitting routine was used to produce maps showing the distribution of individual elements.

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ANNIKA FINNE and IRMA PASSERI

Unusual Activities between Image and Panel: A 16th-Century Painting of St. Catherine in the Yale University Art Gallery

ABSTRACT

Recent examination and treatment of the Yale University Art Gallery's Ecstasy of Saint Catherine *uncovered an unusual relationship between the image held in its paint film and the underlying panel support. Computed tomography scans suggest that, at a date prior to the painting's purchase by James Jackson Jarves around 1850, the paint film was temporarily separated from its panel and then reattached to the same panel, in what could be named an* autotransfer. *This work will explore this possibility and its implications, which productively complicate the notion that pre-20th-century transfer practitioners understood the material of a painting to reside exclusively inside the "thin skin of color that composes the picture" (Mogford 1851, 36).*

In 1916, in his catalog of the James Jackson Jarves collection of Italian paintings at the Yale University Art Gallery, the art historian Osvald Sirén (1916) looked at a small painting of St. Catherine of Siena and remarked that the picture "has lost a good deal of its pictorial bouquet" (222). His sympathetic but dismissive words are one of the only published statements on this painting, which was made in early-16th-century Siena and has recently been reattributed to the Italian painter Giovanni Antonio Bazzi, known as Sodoma (1477–1549). It represents St. Catherine in an ecstatic swoon supported by angels, presumably during the moments immediately after she received the marks of the stigmata (fig. 1).[1] The composition can be linked to a drawing in the British Museum made by Sodoma in preparation for his fresco cycle in the church of San Domenico, Siena (Salomon 2008). Although Sodoma would exchange the angels in the drawing for nuns during his revisions and development of the fresco image, this early conception proved attractive enough in its own right to be copied in the series of paintings to which the Yale *Saint Catherine* belongs; a minimum of three other paintings with nearly identical compositions exist.[2] The persistent popularity of the saint and the proliferation of this image are undoubtedly connected (Norman 2003).

Roughly 300 years after Sodoma's death, in the 1850s, the art collector and educator James Jackson Jarves traveled to Italy and purchased the St. Catherine painting in question. It traveled with him back to the United States in 1860, and by 1871 it officially belonged to the Yale University Art Gallery (Aronson 2002). There the *Saint Catherine* was one of only a handful of paintings purchased by Jarves overlooked by the mid-20th-century restoration campaign that took place at Yale, and it remained understudied until the fall of 2016, when it was pulled from storage for conservation treatment and examination.

The resulting project uncovered an unusual relationship between the thin film of paint and ground that holds the image, and the wooden panel that supports that film. The physical realities of this relationship have prompted the formulation of an equally unusual narrative for the painting's structural history: namely that the paint film was, prior to 1850, lifted from its wooden support and then immediately reattached to that same support. This work will examine the evidence that inspired this narrative and explore the implications that the *Saint Catherine* example holds for our present understanding of how 18th- and early-19th-century restorers understood the materiality of the paintings they treated.

Initially, the most striking aspect of the painting's physical condition was the curvilinear cracks that segment both paint and ground layers into large and thick wedge-like fragments (fig. 2). Early-20th-century condition reports blame such damage on knots in the panel, and knots inside other Italian panel paintings have been found to cause similar patterns of fragmentation. What is extraordinary in *Saint Catherine* is the extent of this pattern, the degree to which the adhesive bond between the wood and the ground layer has failed. Thanks to a collaboration with Quinnipiac University, it was possible to take the painting through a computed tomography (CT) scanner,[3] and visible in the CT images are numerous black spaces between the ground and the panel (see fig. 2). These

Figure 1. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, oil on panel, 22.2 × 16.1 in. (56.5 × 41 cm), Yale University Art Gallery, New Haven.

Figure 2. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, specular light detail and CT scan details showing detachment of ground layer from panel support.

appear to represent empty voids where the two materials have completely detached from one another.

The first idea proposed to explain this widespread detachment of ground from panel was that St. Catherine may have been painted on paper and then mounted to the panel, as is the case for the roughly contemporary *Virgin and Child* by Parmigianino in the Getty Museum. However, although the paper layer in the Parmigianino appears to be readily visible along the edges of the painting, extensive visual and instrumental examination of *Saint Catherine* has not uncovered any trace of paper, making its presence unlikely.

Not only does the ground layer of *Saint Catherine* fail to adhere to the panel, but it also has a strikingly irregular consistency; its thickness varies markedly across the surface of the painting. In the CT scan images, the ground appears quite substantial in some areas and scarcely present in others (see figs. 2, 10). This irregularity is also visible simply by examining the edges of the painting (fig. 3).

Located immediately beneath the irregular ground layer is another curious feature. The x-ray radiograph and CT scan show a radio-opaque material within insect tunnels near the face of the panel, indicating that the wood developed an insect infestation, which was subsequently consolidated from the image side of the painting and not from the reverse (fig. 4). Either the painting was made, from the beginning, on a panel previously damaged by insects or the painting underwent a procedure that allowed the consolidation material to be inserted between the paint film and the panel support.

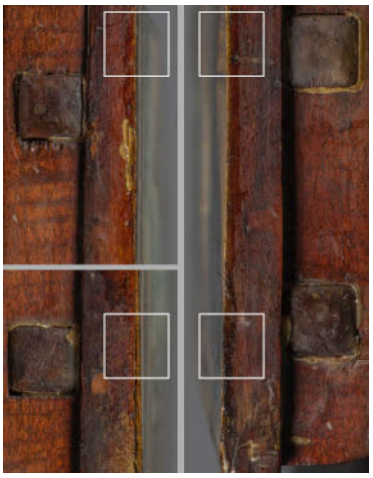

Figure 3. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, irregularity in ground layer thickness visible along the left and right edges of the painting.

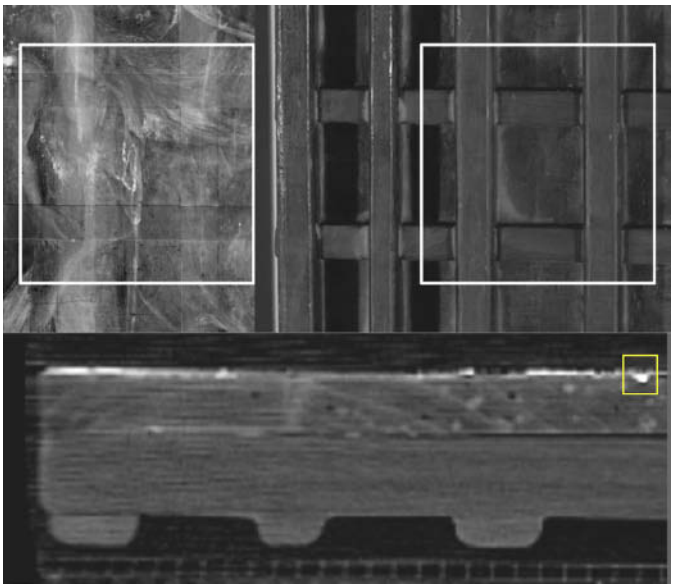

Figure 4. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery. The upper register shows radio-opaque insect tunnels visible in x-ray radiograph but not from verso of the panel. The lower register shows a CT scan image with an insect tunnel (highlighted with a yellow square) filled with radio-opaque material from the face of the panel.

In the lower right-hand corner of the painting, an entirely different type of damage likewise suggests manipulation to the underside of the paint film. Here, three mechanical cuts run through the paint and the ground layers; their deep and systematic appearance suggest that they were not created accidentally (fig. 5). A sharp, knife-like tool was initially thought to have inscribed them. However, paint fragments appear to press together over the line of damage in several locations, suggesting that these cuts may have been made not by inscribing the face of the painting but by inscribing the underside side of the paint film. This scenario would explain why the cuts completely travel through the ground layers while fracturing only certain portions of the paint layer.

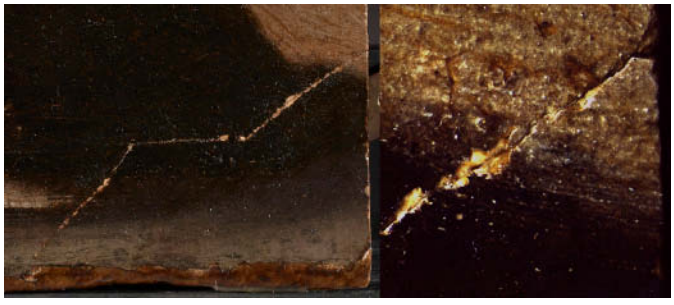

Figure 5. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, detail and photomicrograph of cuts in the lower right corner.

Together, these physical features—the failure of the adhesive bond between the ground and the panel, the irregularity of the ground, the evidence of consolidated insect tunnels located directly beneath the face of the painting, the mechanical cuts in the lower right corner—suggest that the *Saint Catherine* paint film was, at some point in its history, separated from the panel presently beneath it.

To peel an intact paint film off its support is, of course, entirely possible, though nonetheless remarkable. The technique was invented as part of the process known as transfer, a method developed to address situations where the painting support begins to threaten the paint film that it carries. The earliest documented transfers of non-architectural paintings date to the last decades of the seventeenth century (McClure and Kanter 2010; Hayes 2013; Conti 2007). An eyewitness account written by the French aristocrat and writer Charles de Brosses in 1739 gives an impression of the wonders the procedure could produce in its early observers:

> [A]n old man . . . is given an oil painting with rotten canvas: he puts it on wood or on a new canvas and gives you the old canvas. If painted on a worm-eaten wood, he puts it on canvas or on a new panel, and gives back the old panel to the people who hate throwing anything away . . . The piece that he has shown me, half on canvas half left on the wood, made me believe he has carried out some witchcraft. (McClure and Kanter 2010, 71)

Two basic transfer strategies exist: one where the restorer mechanically removes the wood or canvas support, destroying it in the process, and the other where the restorer dissolves the ground layer that binds the paint film to its carrier, allowing for the separation of the color layers while retaining the first support material.

Here is one possible narrative for the physical history of the *Saint Catherine* panel. First, it is painted on an entirely separate, now-lost wooden panel. Then, presumably at some point between 1700 and 1850, *Saint Catherine* is transferred to the panel that is its present support. An insufficiently strong transfer adhesive could have caused the *Saint Catherine* paint and ground layers to lift from the new panel in the manner observed, and the dissolution, removal, and reapplication of the ground layer required by the transfer process could have produced the irregular ground distribution. A cross section taken from the painting also supports the idea that it was transferred; in the location of this particular sample, the paint layers appear to rest directly on a thick, carbon-rich layer with calcium present[4] (fig. 6). A calcium resinate material that has been identified as an

Figure 6. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, annotated cross section with SEM-EDAX analysis showing calcium concentration in a carbon-rich, likely resinous, material. Annotations by Anikó Bezur.

adhesive used in 18th-century French transfers is a material prone to hardening and loss of plasticity (Émile-Mâle 2004).

This scenario, however, leaves several questions unanswered. The first question is why the individuals responsible for the transfer would choose to move the *Saint Catherine* paint film onto such an unstable piece of wood. Not only does this support have a history of insect infestation that required consolidation, but for a relatively small panel, it has a remarkable concentration of knots; at least six can be identified via the CT scan images (fig. 7). The growth rings visible in its end grain also vary markedly in orientation, occasionally running nearly parallel to the painting surface.

The apparent instability of this panel is curious because the primary reason to transfer a painting (with a few notable exceptions) is preventative: to better preserve the paint film by transporting it from a compromised surface to a more stable surface. It is difficult to imagine that the the hypothetical first panel of *Saint Catherine* was even more unstable than the current one.

Moreover, the defects in the current panel correspond almost exactly to the fragmentation of the *Saint Catherine* paint film that is visible today. The pattern of cracks across the surface of the painting is intimately tied to both the location of knots in the panel and to irregularities in the grain pattern (fig. 8). Certain losses have a shape that could certainly be linked to the collapse of the paint film into the insect tunnels that were subsequently filled with the observed radio-opaque material (fig. 9).

What the surface of the painting does not show, however, is any sign of the hypothetical previous panel. Often, the topography of a transferred paint film will carry at least a marker of the first material that supported it. Hans Memling's *Annunciation* in the Metropolitan Museum of Art has a slight ridge down its center from a seam in the panel that was its original support, as well as a weave texture from the canvas to which it was transferred.

The final physical aspect of the Yale *Saint Catherine* that this first scenario does not explain is why the previously discussed unevenness of the ground layer appears to follow a certain pattern. As demonstrated by the CT images, the ground consistently thickens as it approaches the left edge of the

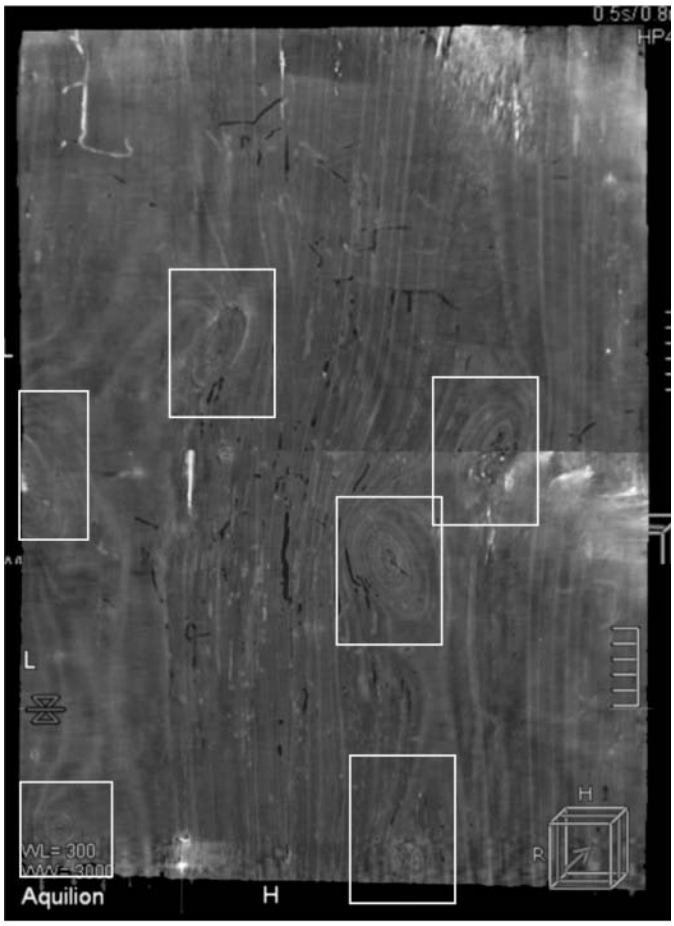

Figure 7. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, CT scan images showing concentration of knots in the panel surface, highlighted with white squares.

painting, and it is along this left edge that most of the lifting apparently induced by knots occurs (fig. 10; see fig. 8).

Such correspondence between areas of damage and the ground layers underlying the paint film suggests that the additional ground may have been applied as a type of consolidant from the underside of the paint film. The hands that performed the transfer seem to have been aware of and respond to fragile areas of paint that were themselves created by the current panel, not by a hypothetical previous panel. This a strong indication that the painting was never on a different support material.

In summary, the first scenario does not resolve questions of why the present panel is so unstable, why areas of damage can be strongly linked to the current support but not to a previous one, and why the ground layer appears to thicken in response to fragility induced by the current support. These questions compelled the formulation of a second possible narrative.

Here, the painting is created, from the start, on the same defective wooden panel that it rests on today. At some point, the panel develops an insect infestation and its inherent defects begin to produce damage on the painting surface. In response to these issues, the paint film is temporarily separated from the panel, the panel is consolidated with the radio-opaque material, and then the paint film is reattached to this same support, in what could be named an *autotransfer*.

If this autotransfer did take place, it would represent a radical departure from typical practices: bound into the very definition of transfer is the idea that a new support takes the place of an old one. But the autotransfer technique is not without precedent in the history of conservation. In Pisa, in the 1970s, Giovanni di Nicola's *Annunciate Madonna* was similarly lifted and then reattached to the same support in an effort to completely consolidate its water-damaged surface (Caleca et al. 1971). In Florence, after the flood of 1966, Cimabue's monumental crucifix in Santa Croce was likewise lifted and then reattached to its original support (Baldini and Casazza 1982).

In these examples, the autotransfer technique was selected because of a desire to keep the original materials of the painting collected together in the same object. The actions of these conservators reflect a holistic appreciation of the work of art that matches precepts articulated by multiple 20th-century conservation theorists, including Umberto Baldini, who suggestively likened a painting to a "composite organism that we have to consider as indivisible" (Baldini and Dal Poggetto 1973, 57–58).

But the individuals who carried out the potential autotransfer of *Saint Catherine* did not live in the 20th century. The *terminus post quem* for the *Saint Catherine* autotransfer is near 1700, when the first instances of panel painting transfers appear in surviving records. The *terminus ante quem* is near 1850, when Jarves purchased the painting in Italy. During this span of time, from 1700 to 1850, well-documented episodes of restoration suggest that the "painting organism" was understood not as indivisible but rather as quite amenable to division. In 1750, the French restorer Robert Picault famously transferred Andrea del Sarto's *Charity* to a new canvas, and the damaged original panel was displayed alongside the newly transferred painting, as if a hunting trophy from Picault's triumph over time. A glowing review of Picault's work framed transfer as a solution to the entire problem of aging paintings, a pathway to pictorial immortality (*Observations* 1751). In 1771, Duccio's double-sided *Maestà* was cut in half to produce two paintings from the formerly single panel; the captivating pictorial value of Duccio's two paint films clearly outweighed any value associated with how these colors originally shared the same support (Rothe 2004). In 1851, the British restorer

Figure 8. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, overlay of fragmentation map (in green) on a CT scan image showing correspondence between defects in the present panel and patterns of damage.

Henry Mogford wrote a handbook on preservation, wherein he described a painting as only the "thin skin of color [that] composes the picture" (Mogford 1851, 36). The support material is not worth mentioning.

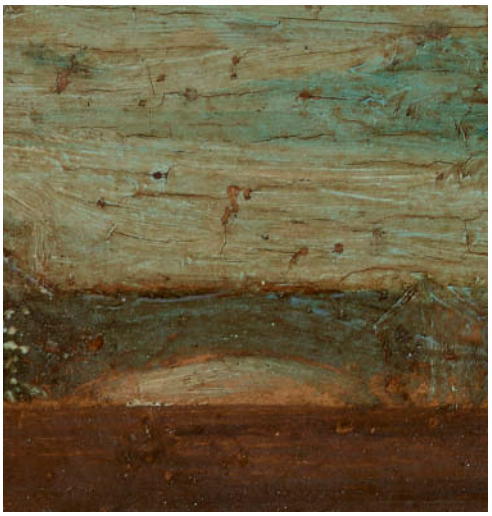

Figure 9. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, detail of surface showing losses that could be ascribed to paint film collapse into insect tunnels.

This is not to imply that the transfer process was taken lightly; in fact, strong conservative tendencies are present in the earliest examples of the technique. In 1674, Mechiori and Vecchia restored Giorgione's Castelfranco altarpiece by lifting only portions of the flaking panel, laying them onto canvas, and then reattaching them back to the panel (Conti 2007). The same review that praised the transfer of the *Charity* also mentions a more cautious technique that Picault was able to use, wherein he "lifts the part that is on the damaged portion, he repairs it, and he replaces this part" (*Observations* 1751, 460).

Yet these conservative alternatives to full transfer seem less to reflect philosophical qualms about dividing a painting into parts than they reflect concern about the risks of dragging a painting through the risky transfer process (Hayes 2013). Mogford (1851), immediately before he describes the color layer as the container for the painting, energetically warns that the procedure is "very troublesome and expensive" (36), worthwhile only for high-value works of art.

It is tempting to conclude from these examples the concept of the "work of art as indivisible organism" simply did not exist during this period. Picault and Mogford would

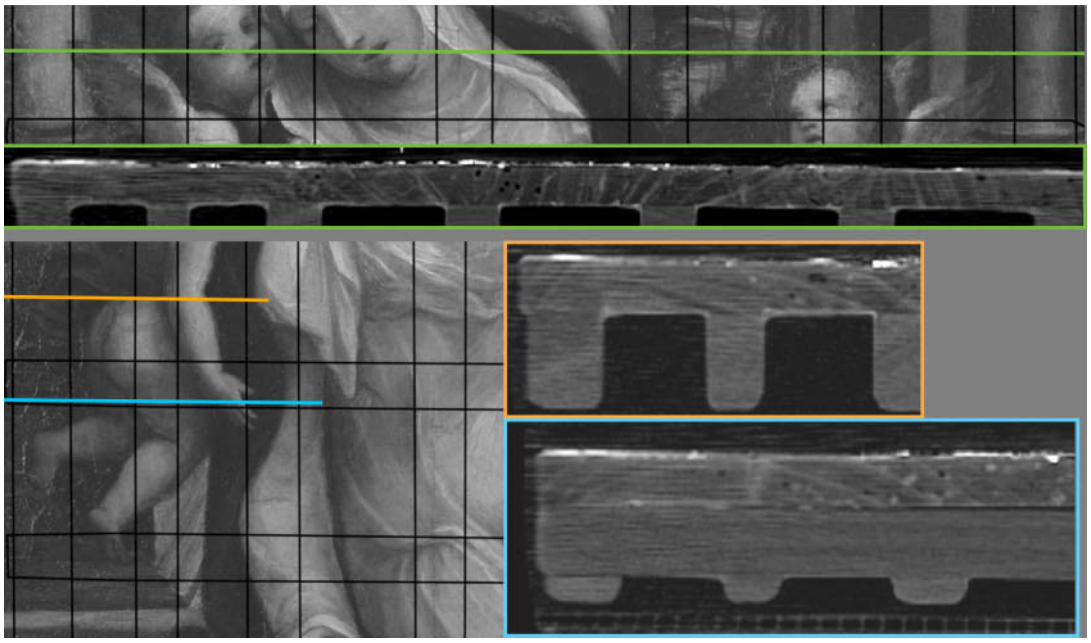

Figure 10. Giovanni Antonio Bazzi, *Saint Catherine in Ecstasy*, Yale University Art Gallery, CT scan images showing thickening of the ground layer as it approaches the left edge of the painting. Blue, orange, and green lines on the grayscale images show the position of the CT scan images, whereas black lines correspond to cradle bars.

presumably have been baffled by the potential autotransfer of *Saint Catherine*, as this measure could only have been motivated by a desire to keep the basic structure of the artwork intact, unless it was simply a bravura display of painting-manipulation skills. A transfer away from and then back onto the original support poses equal risk to the paint film as a transfer to a new support.

If *Saint Catherine* was autotransferred, the case would therefore stand in radical contradiction to our general understanding of how the materiality of a painting was appreciated by restorers at work in the 18th- and early-19th centuries. But perhaps such a counterpoint ought not to be too surprising. Baldini was certainly not the first individual to consider certain works of art as indivisible wholes. The painting, given its attribution to an artist working in Siena on a Sienese commission, could very well have remained close to St. Catherine's home before coming to the United States. Perhaps its devotional resonance caused the image held in the paint film to grow a relic-like significance, which then migrated outward to encompass the support material. When Raymond of Capua describes St. Catherine's reception of the stigmata, the precise moment that the painting appears to represent, he writes that "her soul . . . separated itself, as much as it could, from her body" before returning to it (Raymond of Capua 1862, 134). The soul, much like a paint film, rises and then falls back to its corporeal carrier. The possibility that those transferring paintings might make decisions in response to the content of the paintings they transferred should not be overlooked; in 1777, Jean Louis Hacquin selected paper taken from St. Augustine's *Confessions* to reinforce the paint film of Eustache Le Sueur's *St. Bruno Teaches Theology* during its transfer to canvas (Massing 2016, 201).

Or perhaps, to return to Charles de Brosses, the owners of the *Saint Catherine* panel were simply "people who hate throwing anything away" (McClure and Kanter 2010, 71). A wish to keep the original physical components of a work of art in the same object is certainly far from a new phenomenon. In the 8th century, during a still poorly understood episode of iconoclasm in churches located in the area of present-day Jordan, the tesserae that constituted living figures and animals in mosaic floors and walls were lifted, shuffled, and then reattached inside the same silhouette (Schick 2015).

Worth entertaining is also the possibility that the future aging trajectory of *Saint Catherine* was appreciated as part of its identity. Placing the paint film on a different piece of wood would change the deterioration mechanisms that it was destined to experience, and perhaps such change to future decay patterns could be considered a type of loss. That the future look of a painting might constitute a valuable part of

its present state is suggested by Francesco Algarotti, when he wrote in his 1762 *Saggio sopra la pittura* that Paolo Veronese "left to time the task of bringing harmony to his paintings and, to a certain degree, seasoning them" (Conti 2007, 112). To transport a Veronese onto a new support would be to introduce an entirely different flavor of the seasoning delivered by time, and perhaps this new flavor would deliver in turn a foreign, and less desirable, type of harmony.

Whether or not the Yale *Saint Catherine* experienced an autotransfer, it is an isolated example. Even if sure evidence emerged that confirmed the hypothesis, the history of this particular painting would not provide proof that there was an entire school of holistically oriented restorers in the 18th- and early-19th centuries whose work has so far escaped major notice. The aim of this work is less to presuppose a solution to the puzzle of the painting than to provide a reminder that restorers in the past often acted in idiosyncratic and highly individual ways. Although the documentary record convincingly demonstrates that the materiality of a work of art was appreciated differently in preceding centuries than it is today, it is entirely possible that certain individuals then did hold values that are now named *modern* and that those individuals restored paintings as if they were indeed indivisible organisms. The *Saint Catherine* panel suggests that what is new about the values that painting conservators share today is not, perhaps, their content but in the fact that they are shared—that the profession is sufficiently interconnected to allow for a level of collective agreement or disagreement.

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NOTES

1. Salomon (2008) argues that the moment depicted is a generalized summary of the many fainting episodes St. Catherine experienced rather than the specific episode after she received the stigmata (289). However, the clear emphasis on the presence of the stigmata in the painting suggests that the former reading is still plausible.
2. One in the Palazzo Chigi-Saracini, Siena, Inv. No. 389; one in the Hermitage collection, St. Petersburg, Inv. No. 4984; one sold at Christie's, New York, April 19, 2007, lot 207. The Yale painting is approximately 30% larger than these other versions and also differs in small details such as the curl of St. Catherine's proper right fingers and the presence of her proper left foot. Interestingly, the design layers of the Yale panel appear to include these features, which were then altered in the painting stage.
3. Toshiba Aquilion 64, protocol: 100 kVp; 300 mA; 0.5-second rotation time; 240-mm display field of view (DFOV); 0.5-mm slice thickness; 64 detectors; 41 helical pitch; data processed using a high-resolution bone algorithm (maximum edge enhancement). Scan conducted and results interpreted by Gerald Conlogue, professor of diagnostic imaging, Quinnipiac University.
4. Analysis performed by Anikó Bezur, Wallace S. Wilson director of the Institute for the Preservation of Cultural Heritage at Yale University, with a Zeiss EVO 15-MA variable pressure scanning electron microscope equipped with a tungsten filament emission system. At a chamber pressure of 45 Pa, images were acquired with the backscattered electron detectors and elemental analysis was performed using an EDAX energy dispersive x-ray spectrometer with an Octane silicone drive detector operated using the TEAM software; EHT: 22.00 kV, WD 8.5 mm.

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Research and Conservation of Peter Paul Rubens' *The Raising of the Cross*, Oil on Paper, 1638

ABSTRACT

The Raising of the Cross, an oil painting on paper, was painted by Peter Paul Rubens for the production of an engraving by Jan Witdoeck, and the image is based on the triptych of the same title, now in the Cathedral of Our Lady in Antwerp and painted by Peter in 1610–1611. The sketch was acquired in 1928 as an "oil on canvas," by the Art Gallery of Toronto (currently the Art Gallery of Ontario [AGO]) from the Holford Collection through Christie's London. The painting was "cleaned" by Thomas Agnew & Sons in London prior to the sale.

Extensive restoration followed: first in 1937 in New York City and, after two thefts in 1954 and 1959, at the AGO. It is not known at what point the paper was lined to canvas, but it is currently glue lined to cotton canvas. Restoration methods followed the traditions of painting conservation, and the paper support at some point became obscured by extensive overpainting. Documentation and understanding of the work were essential to complex decisions of removal and the reconstruction of areas that suffered loss of form and detail. Interruptions in the surface tonality by discolored retouchings and the discontinuity and flattening of form due to severe abrasion and loss of surface paint interfered with one's appreciation of the work.

Scientists at the Canadian Conservation Institute provided support in the initial investigations and at intervals in the treatment process by undertaking noninvasive x-ray fluorescence and analysis of samples as required. Samples were analyzed by Fourier transform infrared spectroscopy, polarized light microscopy, Raman spectroscopy, SEM–energy dispersive spectrometry, and, in one case, by pyrolysis–gas chromatography–mass spectrometry. Infrared reflectography was carried out by Rachel Billinge of the National Gallery, London.

Removal of restoration additions was challenging and time consuming, and areas of ambiguity remain untouched. Recent work exposes at least some of the original intentions of the artist. Much of the paper support, however modified in color and texture, now contributes to the final image. The leached and damaged paint layers were minimally saturated with MS2A, and retouching was carried out with watercolor.

The relationship of the sketch to the engraving and to the earlier painting will be discussed. Both informed the finish of the AGO painting. Several pentimenti remain visible and reveal the working method of the artist. The painting will be presented in a new frame that will conceal the 8-cm extension at the top border that is not by Rubens.

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Evolon CR: Its Use from a Scientific and Practical Conservation Perspective

ABSTRACT

1. INTRODUCTION

In recent years, Evolon CR,[1] a highly absorbent polyester/polyamide microfilament fabric, has begun to be used by many conservators for the removal of varnish layers on paintings. Its potential for controlled solvent application and dramatic reduction of mechanical action is particularly appealing. Moreover, it is especially suited for large-scale paintings. Despite the advantages for varnish removal, the wholesale use of Evolon CR for varnish removal cannot be recommended until it has been tested thoroughly.

In this extended abstract, we present a novel procedure for controlled loading of Evolon CR with solvent for varnish removal. The used sheets of Evolon CR also permit documentation of the varnish removal. Although several case studies about the use of Evolon CR have been published (as posters), to our knowledge there has been no in-depth scientific study into the behavior of Evolon CR with solvents for conservation applications.[2]

2. EVOLON CR: DOSED SOLVENT APPLICATION

After extensive trials, conservators at the Restauratieatelier Amsterdam developed a simple but highly effective system for controlled loading of Evolon CR sheets with solvent in large test tubes. By calculating the weight of any desired size of Evolon CR and the weight of any given solvent, it is possible to attain an optimal loading/percentage of solvent to Evolon CR. In this way, the most effective solvent at the lowest concentration (weight/weight) for the least amount of time can be determined. This information can be recorded in a simple chart for easy reference (fig. 1).

Before varnish removal, timed trials can be done with tiny pieces of Evolon CR to choose the best solvent (or solvent mixture), exposure time, and desired percentage of solvents. Several test pieces of Evolon CR can be placed in a glass jar into which the desired amount of solvent can be introduced (based on information from the chart). These pieces can then be used for testing on various areas of the painting.

Once the optimal percentage of solvent is calculated (w/w), the rolled-up sheets of Evolon CR are placed inside a test tube and loaded with solvent using a pipette or syringe. The tubes are tightly sealed with a silicone plug and are left for several hours for the solvent to diffuse evenly through the fabric (fig. 2). This method ensures that the least amount of solvent is administered to the painting to swell and remove the varnish layer(s) for a chosen amount of time and that the painting

Solvent capacity of Evolon CR Ethanol or Isopropanol: 0.78 g/ml	**0.1-m^2 Evolon CR (e.g., 20 X 50 cm)**	**0.0001-m^2 Evolon CR (1 X 1 cm)**
100% based on Evolon's capacity to absorb 4 times its weight	30.4 g/39 mL	0.0304 g/0.039 mL
Ca. 51%	15.6 g/20 mL	0.015 g/0.02 mL
Ca. 44%	13.4 g/17.2 mL	0.013 g/0.0172 mL
Ca. 34%	10.1g/13 mL	0.01 g/0.013 mL

Figure 1. Make a chart to calculate the relative weight of any desired size of Evolon CR and the weight of any given solvent. Here, as an example, is a chart for ethanol or isopropanol loading of Evolon CR. Courtesy of Restauratieatelier Amsterdam, A.Siejek.

receives the same amount of solvent. The loaded sheets of Evolon CR are applied to the paint surface and covered with Mylar to prevent rapid evaporation of the solvent. The surface can be gently smoothed with a roller or soft brush to ensure good contact with the paint surface. The varnish removal can then proceed, though care must be taken to ensure that there is no overlapping.

As with all materials used in conservation, there are practical advantages and disadvantages. Two major disadvantages with the use of Evolon CR include the opacity of the material, which prevents observation of the paint surface during varnish removal, and that sometimes "lines" can appear where two sheets of Evolon CR abut on the paint surface. Usually these lines can be reduced or eliminated entirely.

3. EVOLON DOCUMENTATION: IMAGING AND ANALYSIS

The removed products absorbed into the Evolon CR sheets may also a mirrored image of the painting. This is currently under investigation and may be due to differences in varnish absorption from one (color) area on the painting to another, as lean paints often absorb more varnish than well-bound areas. Retouching and fine details such as crack patterns in the paint are also recorded. The used sheets of Evolon CR are then placed in the fume hood. After evaporation of the solvent, the sheets of Evolon CR can be scanned and assembled to form a mosaic corresponding to the entire painting, creating a physical document of what was removed and from where. The used Evolon CR sheets (or pieces thereof) can in turn be analyzed, for example with macro-XRF scanning.[3] The resulting elemental maps give a good indication of the pigments used for retouching (fig. 3).

4. EVOLON RESEARCH: RELEASE OF EVOLON COMPONENTS

To investigate the possible release of components from the Evolon CR itself, solvent extractions of unused Evolon CR were analyzed. Using pyrolysis–gas chromatography–mass spectrometry, loose nano/micro-scale polyamide (nylon-6) and polyester-containing fibers with pyrolysis–gas chromatography–mass spectrometry in the solvent extraction of the Evolon were identified. Pre-rinsing with solvent or washing (without detergent) may reduce the number of extractable micro-scale fibers, but further analyses are necessary to determine the optimal pretreatment of the Evolon CR.

5. EVOLON RESEARCH: EXTRACTION OF PAINT AND VARNISH COMPONENTS

Research is continuing: using multilayered, nonporous and nonpigmented, artificially aged oil paint mock-ups containing markers, will make it possible to follow any possible migration of oil components from underlying paint layers. Preliminary results show when controlled loading is carried out the degree of extraction of free fatty acids by Evolon CR is similar to that of cotton swabs.

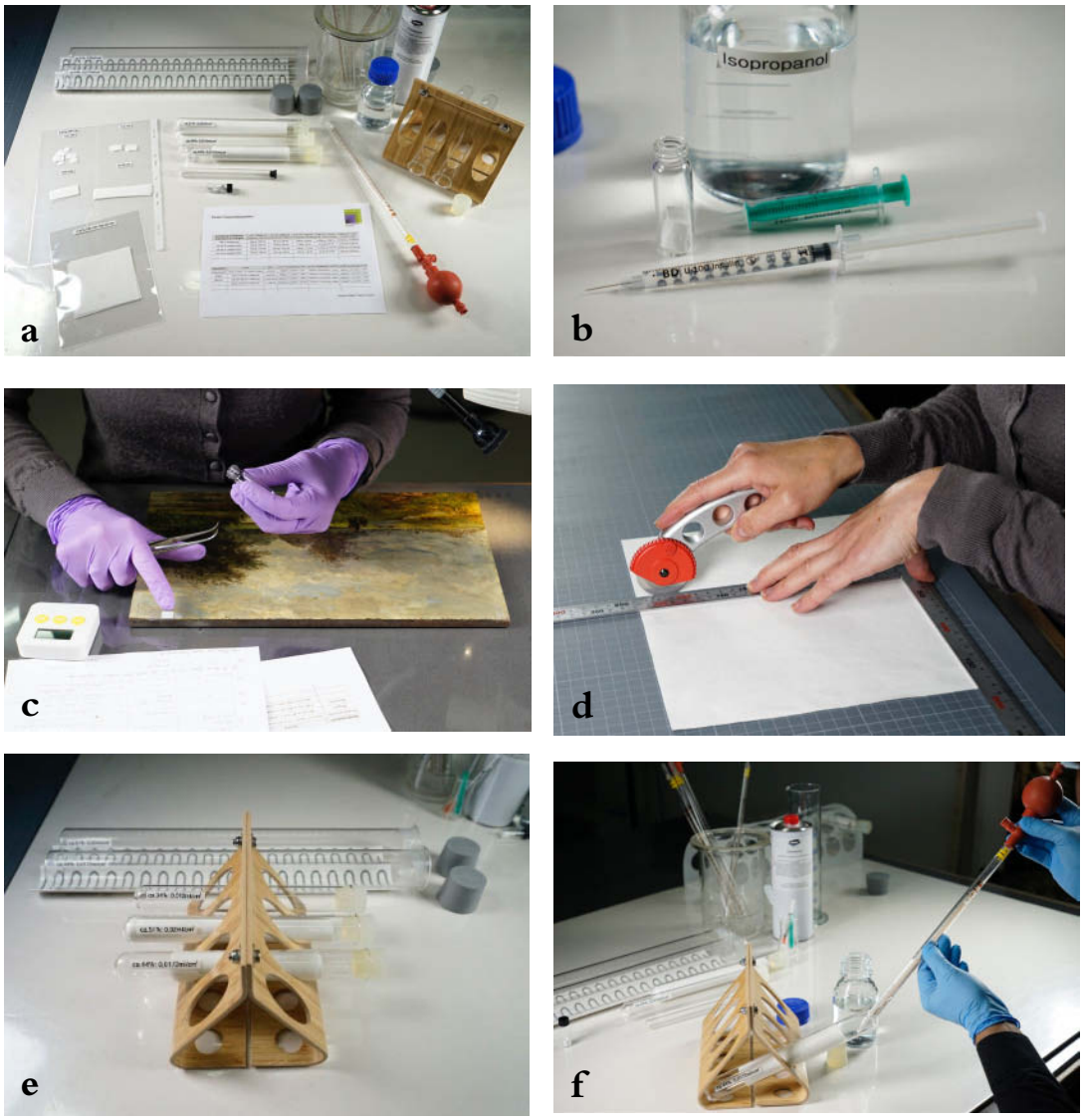

Figure 2. Procedure and setup for loading sheets of Evolon CR. (a) The rolled-up sheets or pieces of Evolon CR are placed in test tubes or jars, and the chosen solvent is introduced with pipette or syringe. (b) Small jars containing tiny test pieces of Evolon CR can be injected with the appropriate amount of solvent. (c) Different (color) areas can be tested with small (1 × 1 cm) pieces using timed trials with various solvents, percentages, and exposures, with and without covering with Mylar (to reduce evaporation), before moving onto larger sheets of Evolon. (d) When preparing Evolon CR fabric, careful cutting is essential because pieces must be abutted neatly. (e) Labeling the tubes according to the solvent/Evolon CR percentage and the corresponding amount mL/cm^2 is recommended. (f) Once the desired percentage is calculated, the tubes containing is loaded with solvent using a pipette or syringe. The tubes are tightly sealed with a silicone plug and are left for several hours for the solvent to diffuse evenly through the fabric. Courtesy of Restauratieatelier Amsterdam.

6. CONCLUSION

It can be concluded that although the application of solvents using Evolon CR makes varnish removal more efficient and controlled in comparison with free solvents and, further research is necessary. Moreover, the used sheets of Evolon CR provide an invaluable record of the removed varnish and retouching. After scanning, further analysis (either nondestructive or destructive) can be conducted on the used sheets to research any ensuing questions regarding removed materials.

Figure 3. A used sheet of Evolon CR scanned at 1,200 dpi showing differences in varnish absorption from one compositional area to another along with cracks and retouching

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NOTES

1. Evolon CR is produced by Freudenberg specifically for preservation and conservation purposes and is exclusively available from Deffner and Johan Conservation Materials (https://www.deffner-johann.de/evolon-cr.html). Other Evolon products have not been tested for the conservation field.
2. J. Ribbits, "Lifting the Microfiber Veil: Utilizing Evolon® Fabric at the Mauritshuis to Remove Aged Varnish from Hendrick Heerschop's *A Visit to the Doctor*" Poster, AIC, Chicago, 2017; K. Rayner, "The Evolution of a Method: Optimizing the Use of Evolon CR® to Poultice Varnish on a Large Scale," Poster, ICOM-CC Annual Meeting, Copenhagen, 2017; M. Vergeer, M. J. N. Stols-Witlox, K. J. van den Berg, and S. van Oudheusden, "Evolon CR® Microfibre Cloth as a Tool for Varnish Removal; the Use of a Conservation Material Unraveled," Poster, Conference on Modern Oil Paints (CMOP), Amsterdam, 2018.
3. Carried out using Bruker M6 Jetstream: rhodium source, 50 kV, 600 μA, 400-μm stepsize, 70-ms/pixel dwell time. The acquired spectra were exported and processed using the PyMCa and Datamuncher software.

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The Blues of Jan de Bray's *Judith and Holofernes*: A Technical Study of Two Blue Pigments and Its Impact on Treatment

ABSTRACT

Examination and analysis of a damaged area of blue paint in Jan de Bray's (1626/7–1697) Judith and Holofernes *(fig. 1), a 1659 Dutch panel painting from the collection of the Rijksmuseum in Amsterdam, was conducted to better understand the artist's materials and technique, as well as the damage and degradation that had occurred. Ultimately, the results were used to inform the retouching stage of treatment.*

Initial examination showed that the painting was generally in good condition, but following the removal of multiple layers of discolored varnish and old retouching, more extensive damages in the blue area of the blanket became visible. Abrasions, some round and ring-shaped (fig. 2), and a whitish material, visible as tiny islands under magnification (fig. 3), were observed in this area. Although whitish islands have been reported previously as degradation deposits in ultramarine blue paint layers (Howard 2013), it was unclear in this case if the islands were remains of abraded paint, degradation deposits, or both.

Non-invasive techniques used to study this phenomenon include x-radiography, infrared reflectography, Hirox digital microscopy, macro x-ray fluorescence spectroscopy, and in situ portable micro-Raman spectroscopy and portable x-ray powder diffractometry. Micro-sample techniques include cross-sectional analysis using light microscopy and scanning electron microscopy, as well as ultra-high-performance liquid chromatography with a photo diode array. Two different blue pigments were identified in the blue blanket: indigo in the dark blue underlayer of the blanket with a glaze of ultramarine on top to model the folds. Palmierite, a lead-potassium-sulfate compound previously detected as a degradation product in oil paint layers (Noble and Van Loon 2007; Van Loon 2008; Boon and Oberthaler 2010; Van Loon et al. 2011; Howard 2013) was detected in the blue blanket, but it was found to have formed within the paint layers and not in substantial amounts at the surface (fig. 4). Therefore, it was not considered a significant component of the whitish islands. Instead, the islands were characterized as remnants of an abraded and degraded ultramarine paint layer. A sample taken from a particularly degraded area of ultramarine paint displayed reduced levels of sulfur, which may be linked to the discoloration of the blue pigment. Sulfur is associated with the blue hue of lazurite, and the extraction of this chromophoric sulfur species, along with its consequent loss of color, may occur in acidic and basic environments (Del Federico et al. 2006). This type of discoloration of ultramarine—distinct from the phenomenon known as ultramarine disease—is commonly observed in frescos, but it is not well known in easel paintings.

Another significant finding includes the likely presence of alum in the indigo. Unlike lake pigments, indigo does not require a substrate. Its presence here may be explained by an attempt to improve the permanence of this colorant, which was already known in the 17th century to be fugitive. The alum may also explain a light blue UV-induced visible fluorescence observed in the indigo paint layers. Research has shown that trivalent aluminum ions enhance fluorescence of certain organic yellow colorants (Favaro et al. 2007); perhaps the same is true for indigo.

It is unclear if the indigo-containing paint layer has, in fact, faded in this painting. The transparent appearance of the indigo-containing layer in a paint cross section may indicate that fading has occurred in certain areas (fig. 5). However,

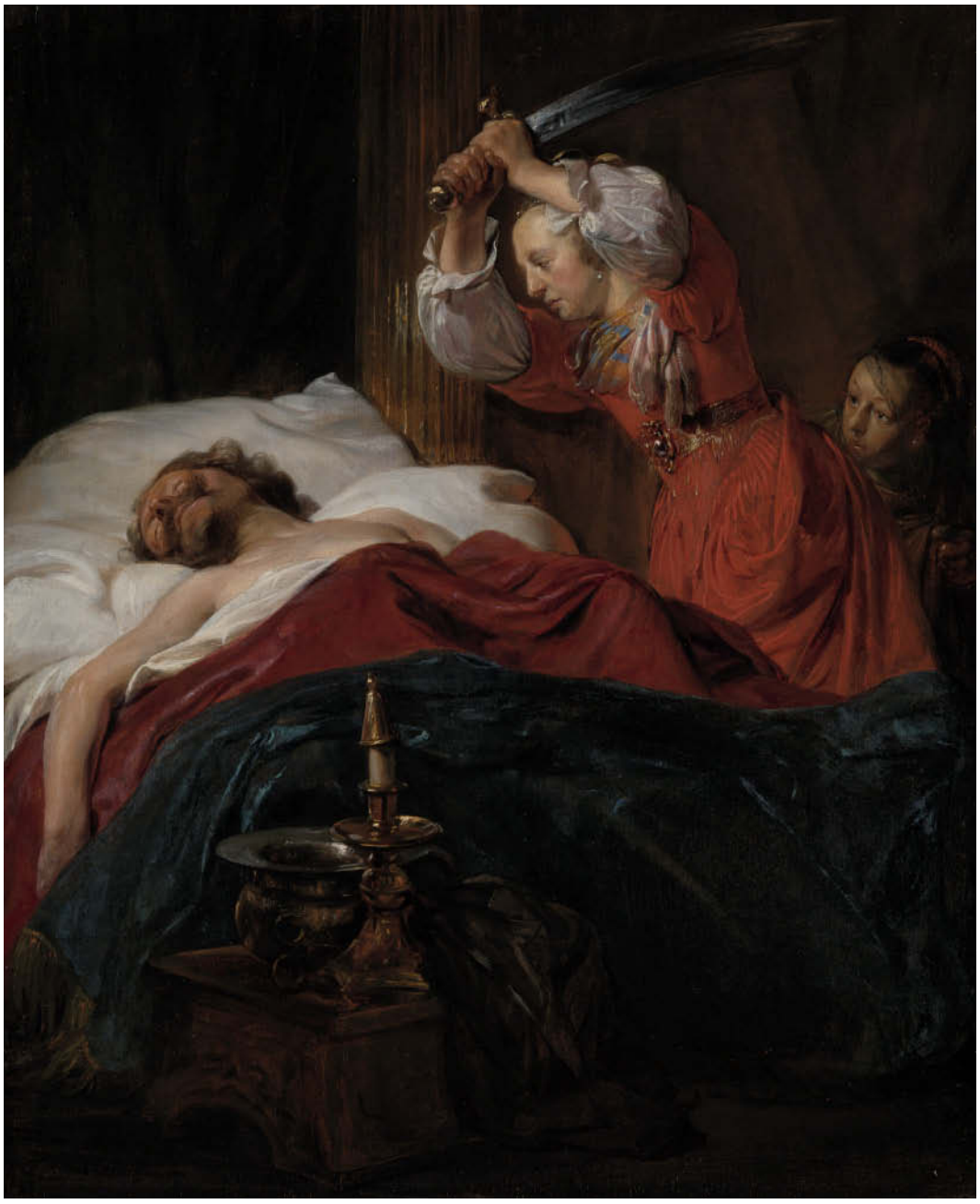

Figure 1. Jan de Bray (1626/7–1697), *Judith and Holofernes*, 1659, oil on oak panel, 15-7/8 × 12-7/8 in. (40.2 × 32.7 cm), Rijksmuseum, Amsterdam, SK-A-2353 (after treatment)

indigo in oil is very dark, and the addition of black pigment (and no white particles) in the paint samples suggests that this dark blue paint layer was always intended to be dark. Increased transparency of this layer over the dark brown undermodeling may have shifted the hue from blue toward brown, however.

The recently treated *St. Jerome at Prayer* (ca. 1490–1495, Museum voor Schone Kunsten, Ghent) by Hieronymus Bosch was found to exhibit round and ring-shaped abrasions very similar to those in de Bray's painting. In a published account of this examination and treatment, the author proposes that a caustic soap solution may have caused this damage (Genbrugge 2016). Such a solution could explain not only the unusual abrasions in de Bray's work but also the discoloration of the ultramarine and possible fading of the indigo, which undergoes a halochromic effect in basic environments.

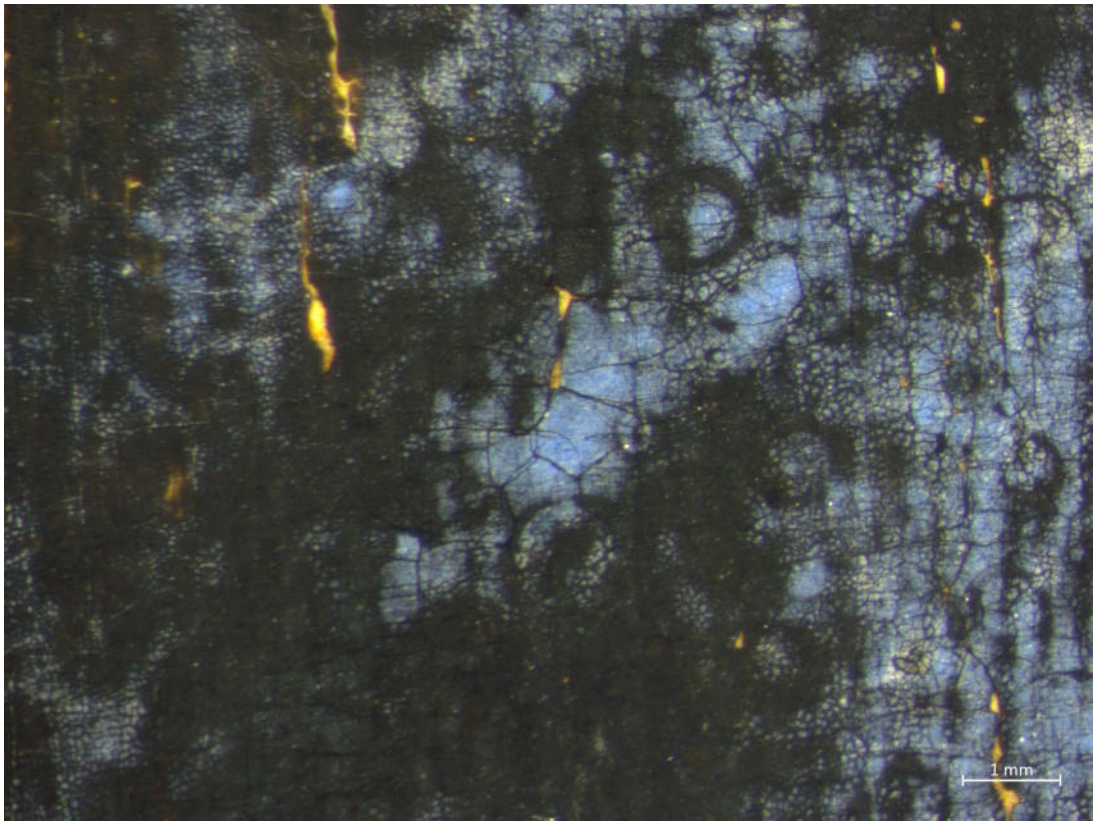

Figure 2. Photomicrograph of round and ring-shaped abrasions in the blue blanket

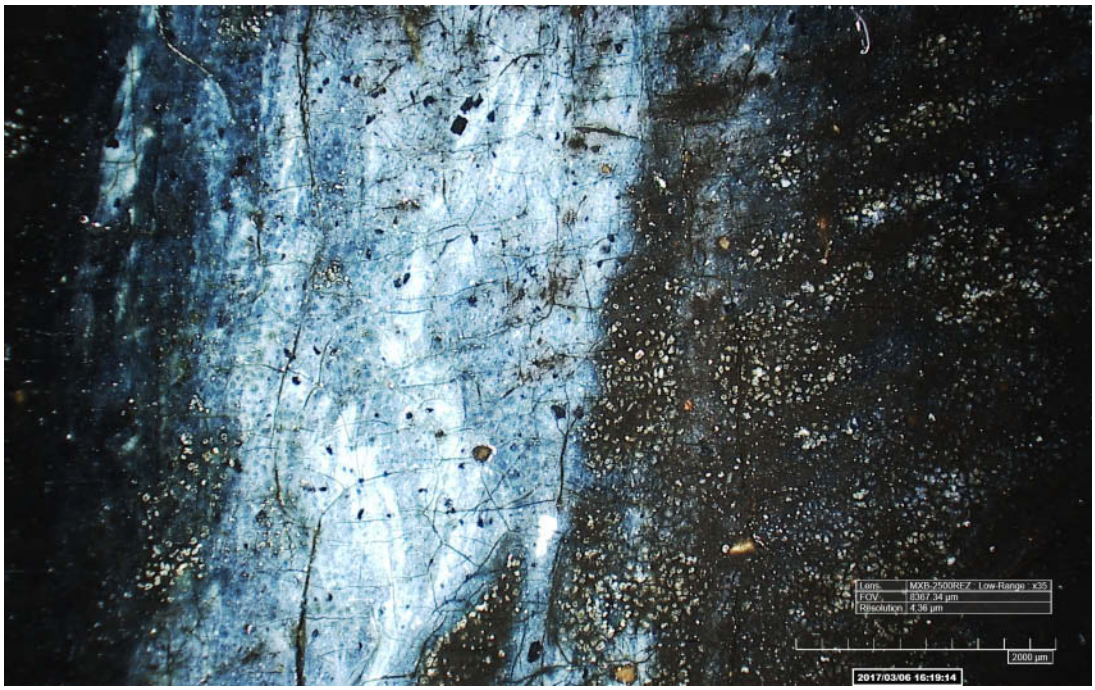

Figure 3. Hirox digital photomicrograph of whitish islands scattered over dark paint on the right side

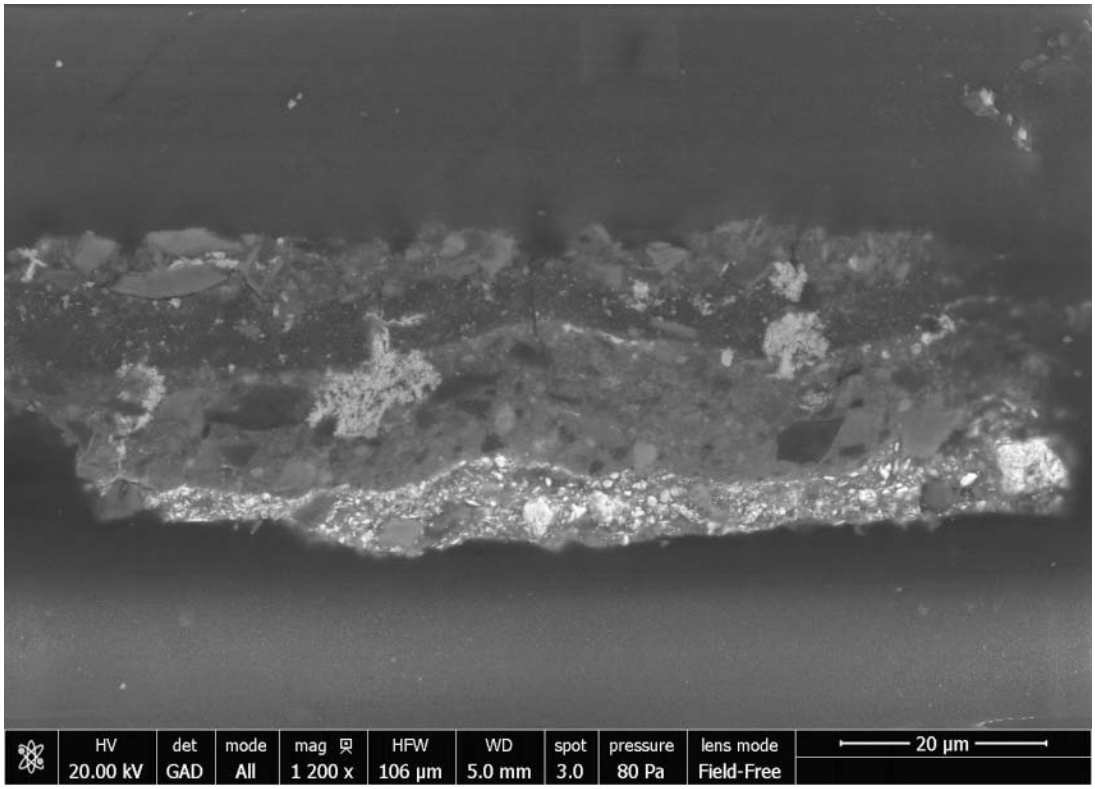

Figure 4. Backscatter electron image of sample 3, with highly scattering amorphous masses of a lead-potassium-sulfate (palmierite) degradation product forming within the paint layers. This sample was taken from a particularly degraded-looking area of blue paint.

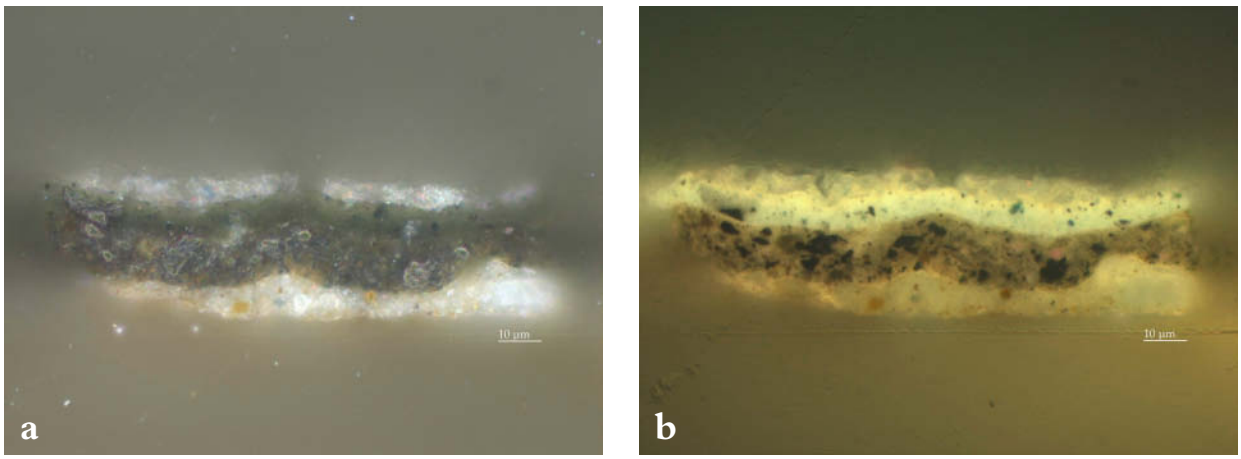

Figure 5. Sample 3 viewed in dark field illumination (left) and in UV illumination (right) both at 1000x magnification. The transparency and UV-induced fluorescence of the indigo-containing layer (second from top) are visible in these images; the degraded and discolored ultramarine is found in the top layer.

A more complete understanding of the materials, damage, and alterations of the blue blanket ultimately informed the retouching stage of treatment. The abrasion and discoloration of the ultramarine layer, which was intended to model the folds in the blanket, has had a significant visual effect on the composition. The abrasions have created patchy and seemingly random forms never intended by the artist, producing a confused and formless space. Small dots of

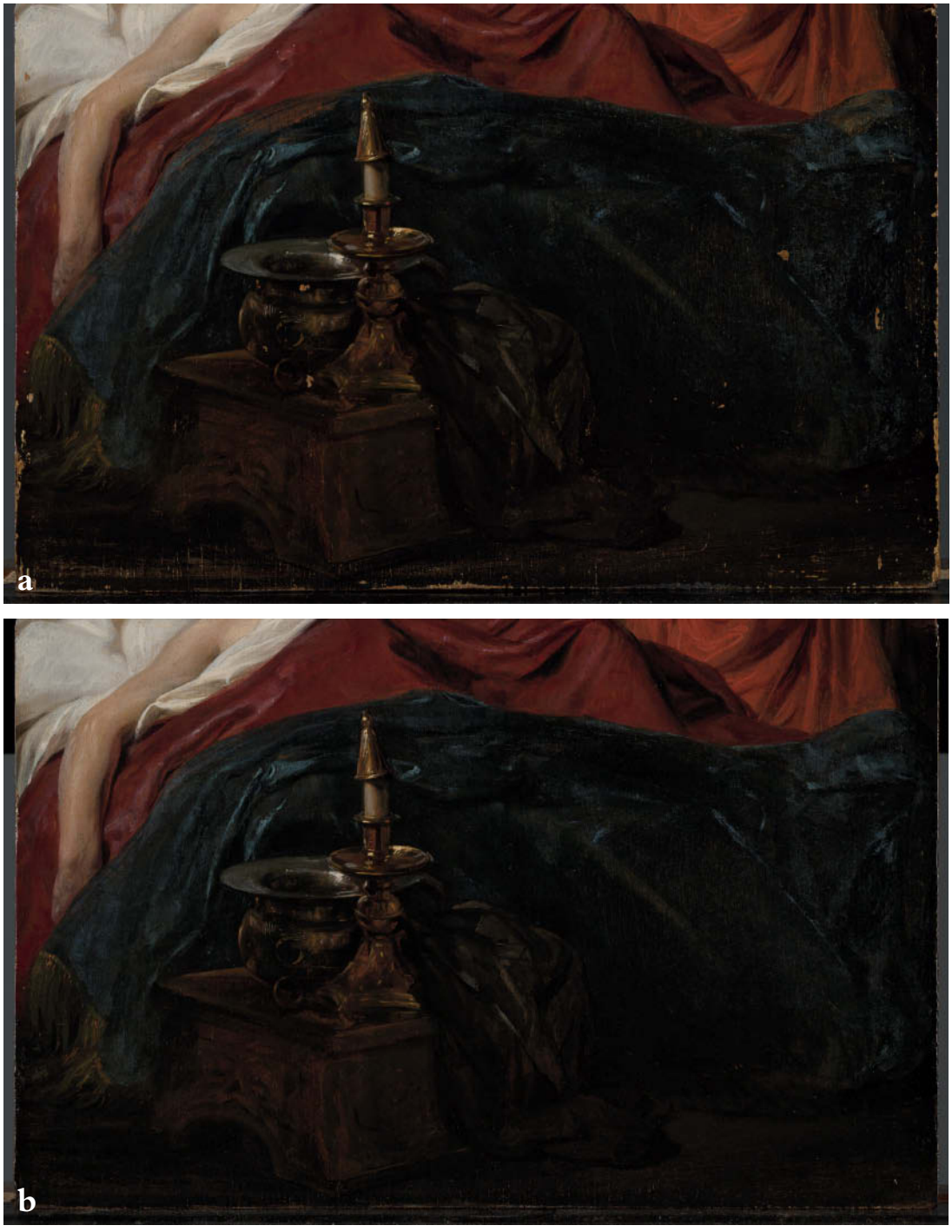

Figure 6. The blue blanket after varnish and retouch removal (top) and after retouching (bottom). Forms interrupted by abrasion were linked together using dots of retouch to restore a sense of volume and structure in the blanket.

retouching were added to link forms interrupted by abrasion, returning some sense of volume and structure to the damaged blanket. This was carried out only until the damage was no longer deemed distracting from the lively and dramatic scene that unfolds above (fig. 6). A cursory examination could instead have led to a misinterpretation of the whitish islands as deposits of degradation product, which could have led to a retouching strategy that suppressed original material. A publication with a more detailed explanation of this technical study and treatment is forthcoming.

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NINA OLSSON and SAMANTHA SPRINGER

Gabriel Revel's *Portrait of a Sculptor*: A Painting and Treatment in Transition

ABSTRACT

This work discusses Portrait of a Sculptor*, a painting by French Baroque academic painter Gabriel Revel, as the sum of multiple historical identities and describes the decision-making process that guided the conservation treatment choices and subsequent formal interpretation. During cleaning, the case was complicated by the dramatic revelation of compositional features in part obscured by the painter himself in* pentimento*. Diagnostic imaging was hindered by an aluminum sheet concealed within the relining support. The curatorial choice to leave exposed compositional elements from two states of the painting was acknowledged to be perhaps a temporary state.*

1. INTRODUCTION

The examination and treatment of an Old Master work inevitably involves the interpretation and conceptual deconstruction of a complex overlay of visual evidence of the artist's studio practice; the natural aging of materials; past structural treatments, cleanings, restorations; and even associated damage that make each work a *unicum* (Brandi 1977, 29). In the case of *Portrait of a Sculptor* by the French Baroque academic painter Gabriel Revel (fig. 1), these tasks were complicated by the dramatic revelation of compositional features that had been in part obscured by the painter himself in *pentimento.* In particular, the rendering of a small statuette that had been covered by past restoration raised questions about the correct reading of the piece, owing to the ambiguous placement of the subject's fingers. Revel's portrait had been subjected to any number of previous structural and restoration treatments, resulting in a complex tangle of natural and artificially imposed aging and alterations.

In the principal painting treatise of Revel's time by Roger de Piles, the author recommends that painters perfect their judgment through "the study of the Ancients" (by which he meant sculpture from antiquity) and particularly those examples that have been preserved "in spite of the Fury of Time and the Barbarians"(De Piles 1706, 2). Conservators follow a similar investigative path during their examination of a painting, identifying visual evidence consistent with the artist's technique ("studying the Ancients"), seeking the best-conserved examples for comparison ("studying Nature"), the natural aging of the materials ("the Fury of Time"), as well as evidence of the effects of prior treatments that have altered the artwork ("[the fury of] the Barbarians"). This parallel is made, of course, in jest, but it is made also in the spirit of renewing the need for critical understanding of past techniques and their cultural and art historical context and meaning, to recognize them as works of art, appreciate the physical and metaphysical strata and the twofold aesthetic and historical nature, and transmit them to the future in a structured, informed, and sustained way that also provides perspective toward improvement of our own treatment approaches and methodologies.

The 2004 case of the treatment of a portrait by Elisabetta Siriani,[1] among others, demonstrates the challenges and limitations that arise when reconciling original and nonoriginal elements in the interpretation of highly altered artworks. In the case of Revel's *Portrait of a Sculptor*, analysis of the work's constituent materials, diagnostic imaging, research of the historical context, technical art history background, and treatment history provided essential information and context in guiding the treatment choices. However, they did not deliver clear evidence to support a definitive formal interpretation of the work. The burden of this choice was ultimately made in response to the painting's own unique and unrepeatable history and specific aesthetic demands, reflecting the compromised state of the work.

2. BIOGRAPHICAL BACKGROUND

Gabriel Revel was born in 1643, in Château Thierry, to a family of decorative painters. By the age of 16 years, Revel was active in Paris as part of a select entourage of painters working under court painter Charles Le Brun during the

Figure 1. Gabriel Revel, *Portrait of a Sculptor*, ca. 1680, oil on canvas, 26.3 × 22.2 in. (66.7 × 56.5 cm), Portland Art Museum, gift of Dr. and Mrs. Edwin Binney III, inv. 68.34. Courtesy of the Portland Art Museum.

30-year apex (1660–1690) of his service to Louis XIV. Revel excelled in his ability to seamlessly transfer Le Brun's compositions in colossal decorative interior schemes, and therefore much of his own work is anonymously embedded within the paintings that define the *grand goût* of the period of the Sun King. Early in his career, he assisted on the ceilings at the Château Vaux and on the decoration of the ship the *Soleil-Royale*, and he created scale cartoons for numerous Gobelins tapestries designed by Le Brun. During his years with Le Burn, he went on to collaborate on many other royal *chantiers*, such as Versailles in the 1670s.

Revel ultimately found his own preferred form of painting in portraiture, and today he is known principally as a portrait painter who imbued in his subjects a good-natured and melancholy air (Brême 2015), such as the portrayal of the unidentified subject in *Portrait of a Sculptor*, which dates to around 1680. He was admitted to the French Royal Academy in 1683, with the successful completion of two *morceaus de reception* portraits of François Girardon and Michel Anguier, both sculptors (Williams 2015, 315). After the death of Le Brun in 1690, Revel departed Paris for Dijon, where he lived the final decades of his life, until his death in the year 1712.

3. *PORTRAIT OF A SCULPTOR*

Portrait of a Sculptor was originally identified as a candidate for conservation because of the coarse, discolored, and disfiguring reconstructions of lacunae from prior treatment in the painting's lower left. During the cleaning phase, five distinct colorations of fill material were identified, evidence that it had been subjected to at least five campaigns of restoration and perhaps as many cleanings, a testament to the painting's complicated treatment history, filled with events or choices over time that remain unclear today.

The work came into the collection of the Portland Art Museum in 1968 with at least two documented structural treatments, the most recent having taken place locally in 1966 (fig. 2). The canvas was, and continues to be, mounted on an octagonal wood stretcher that is inconsistent with the artist's studio practices and the prevailing taste of his milieu. Pretreatment condition notes from 1966 describe paper overlays at the perimeter, suggesting an attempt to mask or

Figure 2. Gabriel Revel, *Portrait of a Sculptor*, ca. 1680, before treatment

bridge a discrepancy between the shape of the painting and the stretcher, which were replicated with canvas inlays during 1966 treatment (fig. 3). Exactly when the painting was trimmed from its original format is unknown, as are its original dimensions or shape of the work. Gabriel painted a great number of rectangular or oval portraits, such as the recently attributed *Portrait of an Astronomer*,[2] but no octagonal compositions by Revel are known. Hence, the painter's known body of work suggests that the portrait was originally either rectangular, rectangular with an oval, or—most probably—an oval, given the characteristics of sections of the original canvas edges (fig. 4).

The painting's surface shows evidence of irreversible damage, likely a result of the flour-paste lining documented in the 1966 condition assessment. Dabs of impasto that highlight the subject's eye have been compressed, and the surface exhibits diffuse abrasions echoing the canvas's weave, a typical consequence of the excessive heat usually applied to the recto in flour paste linings. Several areas of the surface present as scorched look, with contracted and darkened residue of varnish or glazes in the drapery, again a result of uncontrolled heat transfer to the recto. Surface damage of this type is by no means an uncommon condition in Old Master works, and,

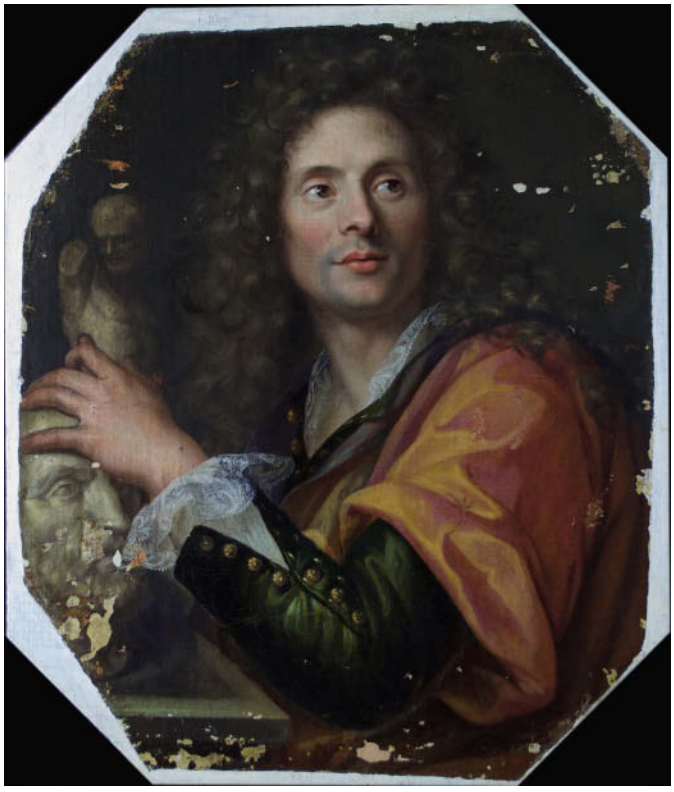

Figure 3. Gabriel Revel, *Portrait of a Sculptor*, during treatment after cleaning, showing the perimeter inlays

Figure 4. Overlay graphic depiction of the potential original format of the painting

when viewed in their historic context, even rather predictable given the introduction of high levels of humidity and the lack of control and uniformity common to the era's routine use of hand irons or hot sand.

The 1966 treatment also had a significant impact on the present condition and appearance of the painting. The structural treatment is a relic of the mid-20th-century practice of wax-resin lining on a hot table, which was widely implemented and often the default treatment prior to the Greenwich Linings conference. A label on the backing board details the 1966 treatment and describes the lining as "double linen with an aluminum core, using Plenderleith #13 wax resin adhesive" (fig. 5). British conservator Harold Plenderleith disseminated his wax-resin lining formula during the 1950s and 1960s in his papers and in a manual titled *The Conservation of Antiquities*, which had been reprinted in 1966, the same year as the treatment. In that book, Plenderleith mentions Helmut Ruhemann's innovative and then-state-of-the-art hot vacuum table for wax impregnation of paintings (Plenderleith 1957, 169), a replica of which had been constructed in Portland by the conservator. As noted on the label, an aluminum sheet was

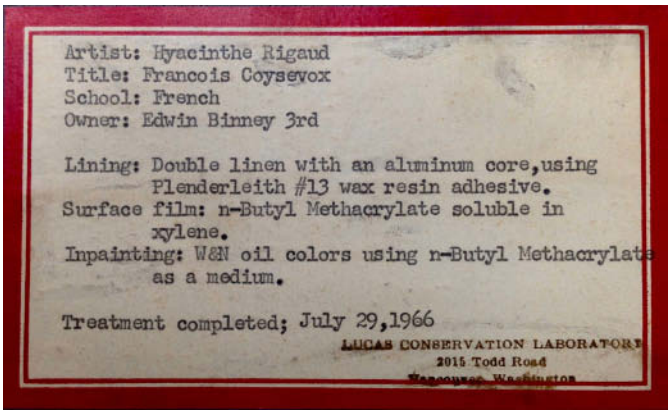

Figure 5. Label detailing the 1966 treatment and materials

encapsulated between two layers of linen within the wax resin lining, which may have been conceived as an improvement over the tendency of wax-resin impregnated paintings to sag from creep deformation. This laminated lining support is documented in the Paintings Specialties Group's *Stretchers and Strainers* catalog of the Paintings Specialties Group (2008, 240) as having been practiced in the Boston area from the mid-20th century onward. The transferred weave of the original and relining canvases to the paint surface may be attributed to the hot table vacuum lining of the painting onto the rigid aluminum sheet, whereas the painting's low tonal range, even compared with another work by Revel in the Portland Art Museum's collection, is often associated with the wax impregnation of the ground and priming layers. In light of the irreversibility of the existing effects of the previous relinings, as well as the actual stability of the paint and ground layers, the decision was made to maintain the wax-lined structural status of the work rather than delining the piece.

In examining the paint layer itself, pentimenti were observed in several areas, such as a pale yellow–colored triangle in the center of the composition on the iridescent yellow drapery (fig. 6). Further evidence of pentimenti in the lower left quadrant of the painting signaled that more extensive compositional changes had taken place. In modifying the composition, the painter reintegrated surfaces painted in the prior state. For example, one may observe a salmon-colored fringe, or perhaps the marble veining of a tabletop, immediately below the figure's left forearm (fig. 7). Also repurposed from the prior state is an area of vibrant purple that appears on the right shoulder of the subject, reappearing below the chin of the classical head with modulation that suggests drapery folds. The purple areas may have been part of the previous depiction of a cloak falling from the subject's right shoulder, reminiscent of the use of falling drapery in his portrait of Jean Dubois from 1680.[3] Other examples of

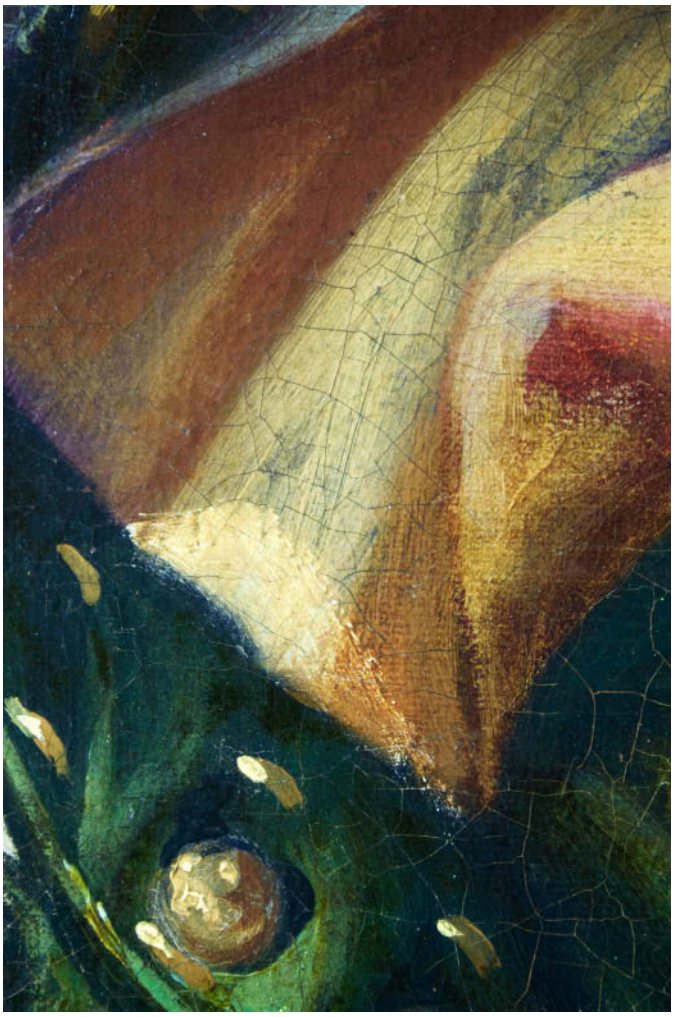

Figure 6. Detail of pale yellow triangular evidence of pentimento

pentimenti may be observed in paintings by Revel, such as in the portrait of François Girardon (fig. 8), where a ghost image of the longer shape of the sculptor's mallet handle is visible, which the painter later shortened.

Yet the greatest challenge in the treatment of this painting came in the exposure of a small statuette that had been covered by past restoration. As part of the creative evolution of the portrait, Revel modified the subject's proper left forearm and hand position to include a classical statuary head. The statuette may have been obscured by the painter himself in oil in pentimento, but by the time of the 2016 treatment, it was covered only by discolored restoration. Considering that examples of ghost images from pentimenti exist in Revel's opus, the question of potential damage from an erroneous and aggressive cleaning to excavate a partially visible substrate layer was taken into consideration. With the removal of the discolored restoration, the statuette figure was "unveiled," as

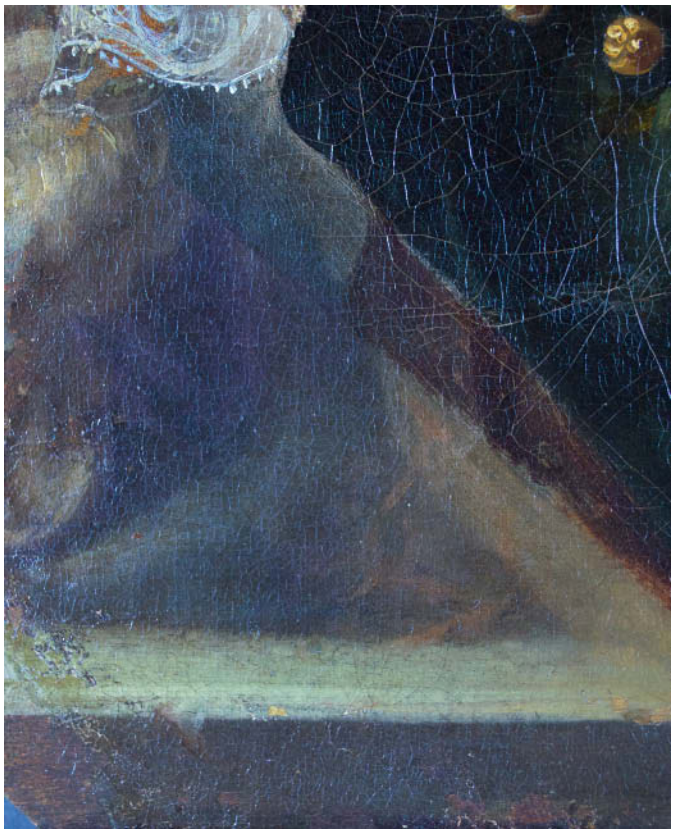

Figure 7. Detail of the lower left of the painting, with reintegrated areas from a prior state

Figure 8. Gabriel Revel, *Portrait de François Girardon*, 1683, oil on canvas, 43.8 × 35.2 in. (111 × 89.5 cm), Musée National des Châteaux de Versailles et de Trianon. Courtesy of Wikicommons.

were two fingers from a competing hand position, so that the painting simultaneously showed elements of two states (fig. 9). The reconciliation of the two formal states was unclear, especially given that the positioning of the fingers of the final hand that is ambiguous, appearing at the same time to rest on the classical head with the second, third, and fourth fingers, and to grip the statuette with the forefinger and thumb. Therefore, the statuette may have figured in more than one state: with the prior positioned forearm and hand, and with an intermediate state with the forearm and hand in the second position. The repurposing of compositional features from the previous state, such as the tabletop corner, among others, further contributed to the sense that two image states exist in a state of flux.

In its current condition, the object is far removed from its original appearance: trimmed from its original dimensions, changed in shape, and also impacted by multiple prior treatments in the past 300 years. The 20th-century theorist Cesare Brandi might have referred to a painting in such condition as *un rudere*, a ruin or what remains of an artwork, having been significantly and irreversibly altered by time and prior treatments (Brandi 1977, 39). The alterations also reflect changes in taste, such as the conversion of an oval-shape work to an octagonal one, further complicating the discussion, which becomes part of the storied discussion of the history of taste versus the history of art. Brandi affirmed that the valid approach is to conserve the material as a document, as the work of restoration was never to attempt to recover the original aspect of the work but only to improve its own expressive potential (Brandi 1977, 8). In other words, the goal was to find a balance point where the artwork's greatest potential reads more strongly than the effects of time.

4. DIAGNOSTIC IMAGING AND MICROSCOPY

Oregon Health and Sciences University (OHSU) Hospital provided valuable assistance with x-ray radiography imaging, in the hope of gaining some clarity regarding the described compositional changes. Drs. Sheven Thorsen and Thomas Griglock of OHSU's Diagnostic Imaging Services Department adapted various imaging techniques, anticipating the aluminum sheet of the relining to be a potential obstacle to the transmission of the x-rays and therefore obfuscating

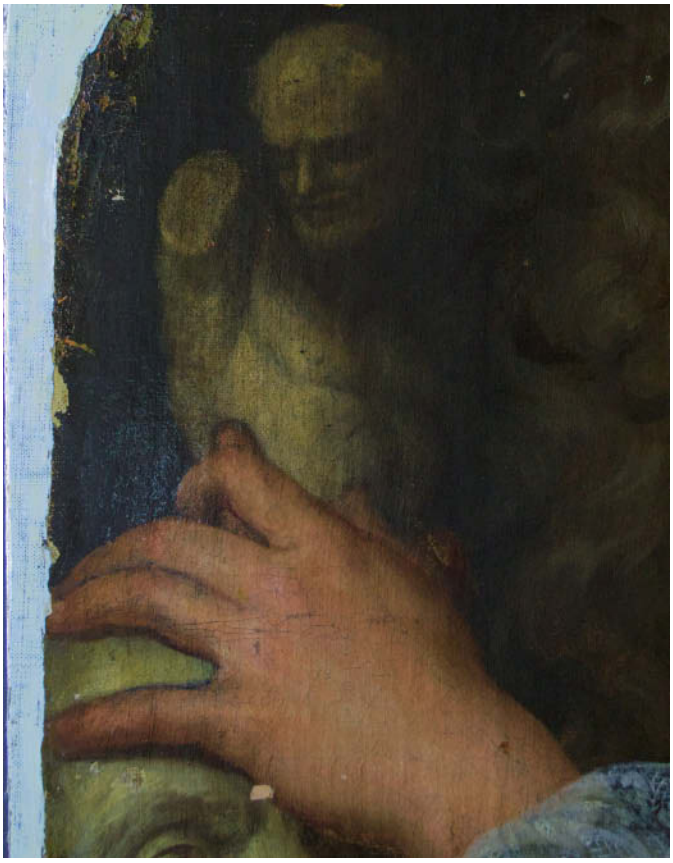

Figure 9. Detail during treatment after cleaning, showing the revelation of the statuette and fingers from a prior state

what might otherwise be a straightforward imaging process. Specific parameters for this application were not found in a conservation or scientific literature search. Using digital imaging equipment, standard transmission x-ray radiography was performed, followed by the use of a mammography device.

During both imaging techniques, all removable barrier materials between the detection plate and painting were eliminated to reduce noise from additional materials. For example, the digital film detector for the standard technique is typically placed underneath the bed that the patient lays on. For medical imaging, this provides enough detail. However, to improve clarity of the image and increase contrast, the painting was raised on foam blocks just enough so that the detector plate could be placed directly underneath the painting and avoid interference of the extra material of the bed scattering the x-rays and thus the image (fig. 10).

Further imaging with the mammography unit was attempted, because according to the doctors, in the clinical setting, mammography uses lower energy x-rays and higher resolution detectors to find early-stage cancers, small breast lesions, and micro-calcifications normally invisible when imaged with other imaging equipment. It was our hope that these same characteristics would allow us to image the hidden details within Revel's painting; typically the lower energy x-rays result in better contrast while the higher resolution detectors provide superior detail previously unseen.

It is also important to note that digital detectors are typically more sensitive than standard film and therefore need much lower exposure times.

Even with the increased contrast with the mammography unit, the overall image clarity was not improved appreciably. To gain a more nuanced understanding of the two imaging techniques, it would be necessary to conduct a comparative study based on an image quality indicator that is representative of the painting construction. This may be a subject for future study at the Portland Art Museum when access to radiography equipment will be available on a regular basis.

Although the diagnostic imaging failed to present a clear answer to questions that remained regarding the

Figure 10. The unit is set up with the x-ray source above, shooting down toward the bed, where the patient would lay. In our first attempt, the painting lay on the bed and the film cassette went under the bed. To improve the image, the cassette was moved on top of the bed and the painting raised onto foam blocks. Courtesy of Kristyna Wentz-Graff, OHSU.

reconciliation of the hand and the subject's possessions, a better understanding of the substrate arm position was acquired. An overlay of the visual light image with the contours of the two arms that appear in x-ray radiography showed that the two states share compositional lines, such as the coincidental placement of the edge of the back of the hand from the first state with the statuary head's nose profile from the second state (fig. 11). This is yet another example of the transitional flow between the first and second state.

Further investigation was conducted by cross section microscopy of the paint layer. All four of the samples taken from diverse locations showed a uniform double ground of a thick salmon-colored layer primed with a lighter cream layer. Stratigraphy of the sample taken where the two hands are superimposed revealed the application of a dark paint layer (background) covered with a colored skin tone, and on the surface a lighter-colored flesh tone (carnation) (fig. 12). A sample taken from area with the purple drapery showed the ground layers painted first with a brown layer (table top) and then the purple drapery layer composed of azurite, indigo, and a red lake (fig. 13), perhaps cochineal, which, along with indigo, was widely used for textile dying at the Gobelins tapestry factory and locally available to Revel. A fourth cross section sample was taken from the red-shaded area of the drapery of the subject's iridescent cloak. This area surrounds an overpainted loss, where the overpainting effectively protected the original surface of the loss perimeter. After removal of the overpaint, the surface appeared as a brilliant red halo around the loss (fig. 14), suggesting that the original

Figure 11. Overlay of visual light image and x-ray radiography, with a graphic showing the positions of the two forearms

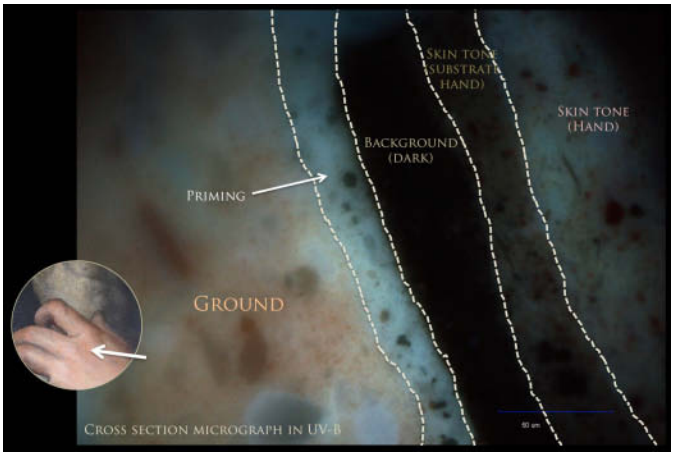

Figure 12. Cross section microscopy of a sample taken from the site of the superimposed hands

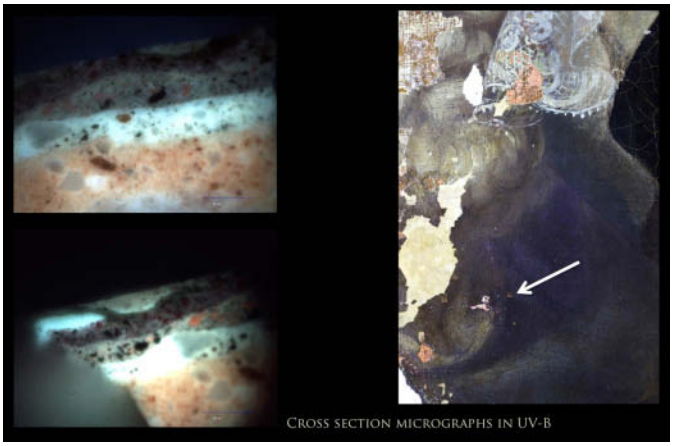

Figure 13. Cross section microscopy of a sample taken from the site of the purple drapery

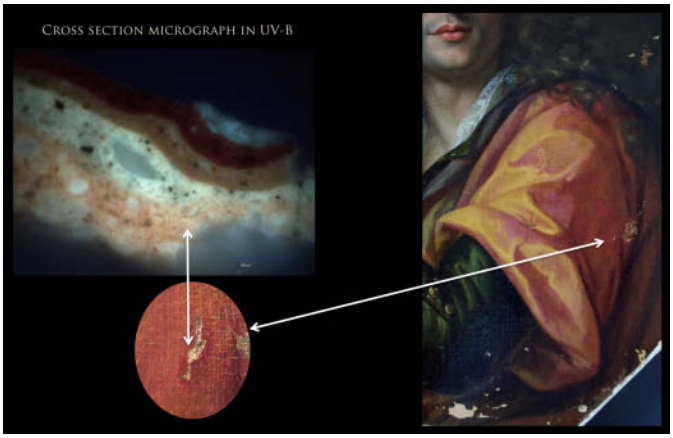

Figure 14. Cross section microscopy of a sample taken from red drapery

red glaze was protected beneath the overpaint when an aggressive cleaning took place, perhaps the same cleaning that uncovered the statuette.

5. DECISION MAKING IN THE FORMAL INTERPRETATION

Although the imaging and analytical data provided some technical insights, the decision-making process to arrive at the best formal interpretation of the painting depended heavily on the expertise and collaborative input of the curator. A step-by-step approach to the inpainting and restoration was adopted, addressing the compensation of the most visually distracting losses first, leaving the resolution of the pentimenti and the more crucial decision to leave exposed or cover the statuette to a later evaluation of the work. Reconstructions of the perimeter inlays and the area of clustered lacunae in the lower left were developed, and smaller losses were inpainted, as were the diffuse micro-abrasions of the paint surface to improve the legibility of rendered volumes. Toning and retouching of the pentimento areas then proceeded incrementally to fine tune the reading of the piece: the light triangular pentimento in the center of the composition was toned, and the table edge was glazed to attenuate a strong contrast line from the prior state that created confusion between the table and the sleeve. Eventually, the two fingers from the prior state were overpainted with conservation colors (fig. 15).

A final review of the painting's appearance was made to assess whether to leave the statuette visible or to cover it with conservation colors. The assumption was that the statuette would be covered again. Ultimately, a bold curatorial decision was made to leave the statuette exposed. The choice was to conserve the document material in the least invasive manner and to allow for further study of the previously unknown compositional feature. The clarity and visual strength of the composition without the statuette had perhaps been the motivation for masking the statuette, itself a restorer's pentimento. Therefore, the current aspect of the painting is acknowledged as potentially a transitional state, which may be informed by study and revisited in the future (fig. 16).

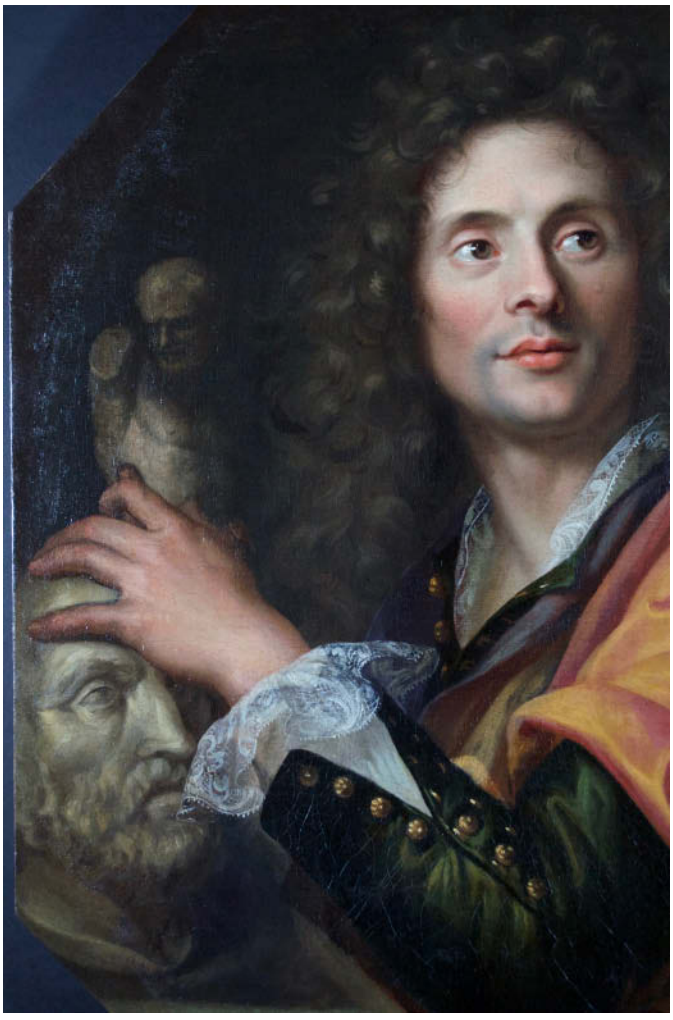

Figure 15. *Portrait of a Sculptor* during treatment, with fingers and statuette visible

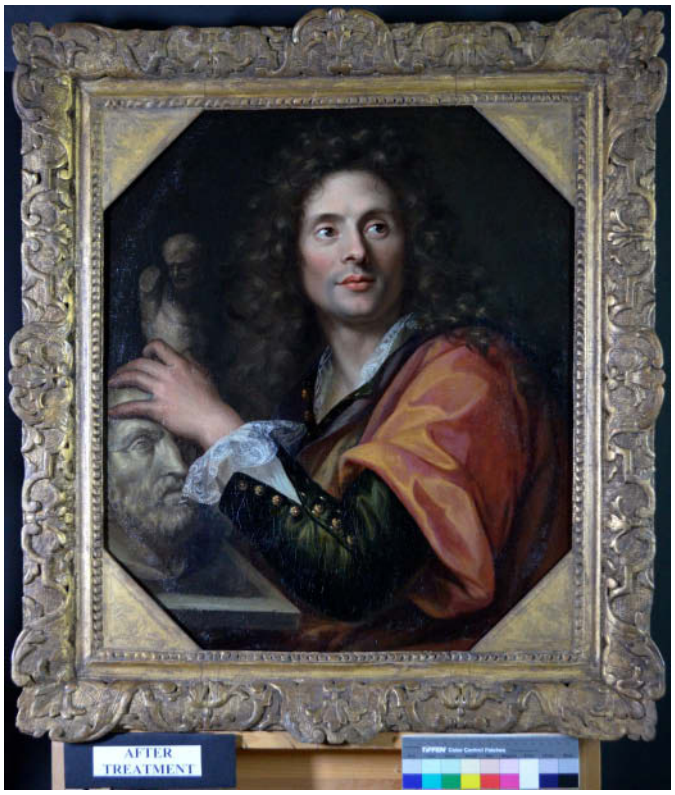

Figure 16. *Portrait of a Sculptor* after treatment

6. CONCLUSION

The case of Gabriel Revel's *Portrait of a Painter* is an extreme example of conservation and restoration decision making caught between the need to restore expressive potential in the work and the risk of creating a so-called "false historical reconstruction" (Brandi 1977, 8). Again to cite Brandi, "In order for restoration to represent a legitimate operation, it must not presume that time is irreversible, nor that history may be abolished" (Brandi 1977, 26). Beyond the problems of formal interpretation of the painting, its treatment involved the consideration of the work as a complex cultural heritage document containing multiple historical identities, relative to the artist's creative process in various stages during execution and in the natural aging of the materials. Like most cultural heritage that has survived the centuries, *Portrait of a Sculptor* is also repository of information of prior conservation treatments and has become the sum of accumulated changes in appearance over time due to impact of previous structural, cleaning, and restoration campaigns.

As conservators, we aim to preserve artworks and protect the integrity of the individuals who created them. When approaching poorly documented works of art with a complicated history, it takes in-depth research, discussion, and a holistic decision-making process that engages both the scientific and humanities disciplines. Solutions may involve uncomfortable compromises that depend on informed yet subjective aesthetic decisions. It follows that it may not be always possible to completely avoid all of the dangers related to misinterpretation of the artist's intent and condition issues. However, the discursive dialogues on material aspects, as well as aesthetics and historical context, will greatly reduce those risks. It is hoped that by bringing attention to this perhaps ephemeral state of the work, hitting a virtual pause button, that research on this painting and on Gabriel Revel will be encouraged, especially considering that he is an artist with scarce dedicated scholarship. It is also hoped that conversation will be sparked about the artistic process among museum visitors; that discussion on conservation's role in the interpretation of painted works and the history of art versus the history of taste be renewed; that knowledge of historic restoration techniques will be disseminated; and, finally, that conservators reflect on the long-term impacts that their treatments will have on artworks in the day-to-day work in the studio. Like the physical state of *Portrait of a Sculptor*, this process is in evolution—in transition toward a more informed future.

ACKNOWLEDGMENTS

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NOTES

1. E. Siriani, *Portrait of Signora Ortensia Leoni Cordini as St. Dorothy*, 1661, oil on canvas, 23.13 × 19.69 in. (58.75 × 50 cm), Chazen Museum of Art, University of Wisconsin–Madison, inv. 60.5.2. For more full information on the conservation treatment, see http://www.chazen.wisc.edu/explore-art/collections/conservation/.
2. *Portrait of an Astronomer*, 1670, oil on canvas, 43.7 × 37.6 in. (110.9 × 95.3 cm), National Gallery, London, NG2929.
3. *Portrait de Jean DuBois*, ca. 1680, oil on canvas, 35.8 × 28.7 in. (91 × 73 cm), Dijon, Musée des Beaux-Arts, inv. CA 451.

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JOSÉ LUIS LAZARTE LUNA, DOROTHY MAHON, SILVIA A. CENTENO, FEDERICO CARÒ, and LOUISA SMIESKA

Old World, New World: Painting Practices in the Reformed 1686 Painter's Guild of Mexico City

ABSTRACT

In the past decade, the Metropolitan Museum of Art has solidified its commitment to exhibit artworks from colonial Latin America, which includes those from the viceroyalty of New Spain. For 300 years, New Spain encompassed modern-day Central America, Mexico, the Western half of the United States, and the Philippines. Although technical studies of paintings produced in New Spain in the 17th to the 18th centuries are expanding, much work is needed to obtain the same level of understanding of their materials and techniques as has been revealed about those produced in North America and Europe. In 2016, the convergence at the Metropolitan Museum of Art of two recently discovered paintings by Cristóbal de Villalpando (ca. 1649–1714) and José Sánchez (active in Mexico from 1686 to 1695) was auspicious. This occasion presented the opportunity to make a detailed comparison of works from these two artists, whose close connection is confirmed in documents of the reformed ordinances of the Guild of Painters and Guilders of Mexico City dating to 1686.

Villalpando, the most recognized painter of the New Spanish Baroque, developed an individual aesthetic that distinguished him from his contemporaries (Gutiérrez Haces, 1997). The study of his *Adoration of the Magi* (1683) was carried out for the artist's first monographic exhibition in the United States that took place at the Metropolitan Museum of Art from July 25 to October 15 in 2017 (fig. 1). The creative capacity of the painter was flaunted in his staggering, 28-ft.-tall *Moses and the Brazen Serpent and the Transfiguration of Jesus*. This two-tier composition, painted for the Cathedral of Puebla in 1683, is the largest painting to be installed at the Metropolitan Museum of Art, and proved to be a spectacular and revelatory experience for many visitors. The *Adoration of the Magi*, also painted by Villalpando for the Cathedral of Puebla in 1683, has been in the collection of Fordham University in New York City since the mid-19th century. This painting has only recently been included in the artist's oeuvre (Kasl 2017). The second painting of this technical study, the *Marriage of the Virgin* (ca. 1690) by Sánchez, was acquired by the Metropolitan Museum of Art in 2016 (fig. 2). This *canvas* is one scene from an altarpiece depicting the life of the Virgin Mary, of which several exist.[1] The Louvre acquired *Visitation of the Virgin* from the Sánchez altarpiece in 2013, making it the first painting from New Spain to enter the French museum (Kientz 2013).

The Guild of Painters of Mexico City organized professions into proto-unions, in a similar manner to the guild system in Spain (Carrera Estampa 1954). The Guild ordinances of 1686 included 16 clauses that were implemented to revitalize those from 1557, which had lapsed for most of the 17th century. Ambitious New Spanish painters were responsible for initiating the reform, with the aim to elevate painting as a noble and intellectual endeavor quite separate from craft practice (Dean-Smith 2007). To achieve this, regulations establishing a very high standard of practice were instituted. In 1686, as the first elected examiners for the reformed Guild, Sánchez and Villalpando scrutinized the artistic knowledge and dexterity of aspiring master painters. Their examination included a hands-on component, in which artists primed canvases and completed a painting under the examiners' watch (Toussaint 1982). In this capacity, these artists were responsible for shaping Mexican artistic practices well into the 18th century. With this in mind, we conducted a study of the paintings. To investigate the properties of the materials and techniques, we performed microscopic examination, x-ray radiography, infrared reflectography, XRF mapping, and Raman spectroscopy and SEM–energy dispersive x-ray spectroscopy analysis of paint samples mounted in cross section.

Figure 1. Cristóbal de Villalpando, *Adoration of the Magi*, 1683, courtesy of the paintings conservation department, The Metropolitan Museum of Art, NY. After treatment.

Both paintings were treated at the Metropolitan Museum of Art, which allowed us to make technical assessments of the works free of restorations. Despite the natural riches of continental America, processed materials were scarce in New Spain. The Spanish monopolization of commerce in the Americas resulted in the prohibition of the cultivation of linen and hemp in the 17th century (Sumano 2011). Both paintings were executed on simple weave canvases made out of bast fibers. Due to the ban,

Figure 2. José Sánchez, *Marriage of the Virgin*, ca. 1690, courtesy of the paintings conservation department, The Metropolitan Museum of Art, NY. After treatment.

the supports were likely woven in European mills. The *Adoration* is composed of two pieces of canvas that are seamed selvedge to selvedge with overcast stitches, using a single bast-fiber thread (fig. 3). Although both paintings were mounted on non original stretchers, the impressions of the original strainers were visible on the versos of the supports, where the red ground had bled through. In both paintings, the imprints measured approximately 4cm in thickness. The artists' concern with structural integrity is evident in the imprint of two crossbars on Villalpando's *Adoration* and one vertical crossbar on Sánchez's *Marriage of the Virgin*. Pronounced cusping in the x-radiographs of both paintings indicated that they were secured to their original strainers with evenly spaced tacks.

A remarkable New Spanish technique, which is visible in *Adoration*, was adhering paper strips to the front of canvas seams (fig. 4). This clever aesthetic solution to disguise the canvas join also provided structural longevity of the support, as well as the overlying ground and the paint layers. The use of this technique is well known by conservators acquainted with New Spanish paintings (Sumano 2012). Indeed, paper strips have not been identified with certainty in paintings made in continental Spain, and there is no mention of this practice in historic Spanish treatises.[2] This technique has been observed in other Spanish territories in South America, however in significantly less cases than in Mexico.[3] This suggests that the smooth transition between seams is a Mexican feature that reflects a local preference. In addition, the use of rag paper to cover seams may indicate the economic importance of the commission due to the scarcity and high value of this commodity in the American viceroyalties (Medina 2007).

On both paintings, the red ground is essentially a mixture of red iron earth and calcium carbonate. However, the calcium carbonate derives not from a geological or marine source but rather from a particular form of calcite that has been identified only recently. Maite Jover de Celis and Dolores Gayo, scientists from the analytical laboratory at the Museo del Prado, confirmed that calcium carbonate within the preparations of many 17th-century paintings produced in Madrid was obtained from washed ash residues (Jover de Celis and Gayo 2014). The Madrid School tradition of using ash residues from laundering to bulk ground layers was first mentioned in the Spanish art treatises of Francisco Pacheco (1564–1644) and Antonio Palomino

Figure 3. Detail of seam of the *Adoration of the Magi* at verso, after lining removal

(1655–1726).[4] The extraction of potassium from wood ash to prepare lye has been practiced for millennia, as this was an important product for making soap and washing clothes. A significant portion of the sludge that remains after lye extraction with water is calcite. The morphology of calcite pseudomorphs obtained from washed ash has been recently identified in ground preparations (Carò et al. 2018). In cross section, the pseudomorphs have polygonal shapes with four or five sides and typically range from 10 to 30 μm in size (Brochier and Thinon 2003; Canti 2003; Garvie 2016). These crystals have a skeletal structure, with pitted faces that helps identify them even when they are fractured. The inherent characteristics of the ash-derived particles are a marker to determine with certainty the source of calcium carbonate present in a ground layer and can be specifically distinguished from fossilized particles characteristic of calcium carbonate from geological sources.

The *Adoration* has three glue-bound red ground applications, mainly composed of calcite pseudomorphs, with a higher percentage of red oxide present in the uppermost layer.[5] *Marriage of the Virgin* has two distinct ground applications: the first ground is a mixture of calcite pseudomorphs and red earth in a proteinaceous binder, similar to the *Adoration*, but the second ground is composed of red earth alone (fig. 5). In layers with calcite pseudomorphs, flaky particles of carbon black, originating from the ash itself, frequently are present. This is the first time in which calcite pseudomorphs have been identified in the grounds of Mexican painters. The geographical boundaries of this tradition, previously connected solely to Madrid, has now expanded. We

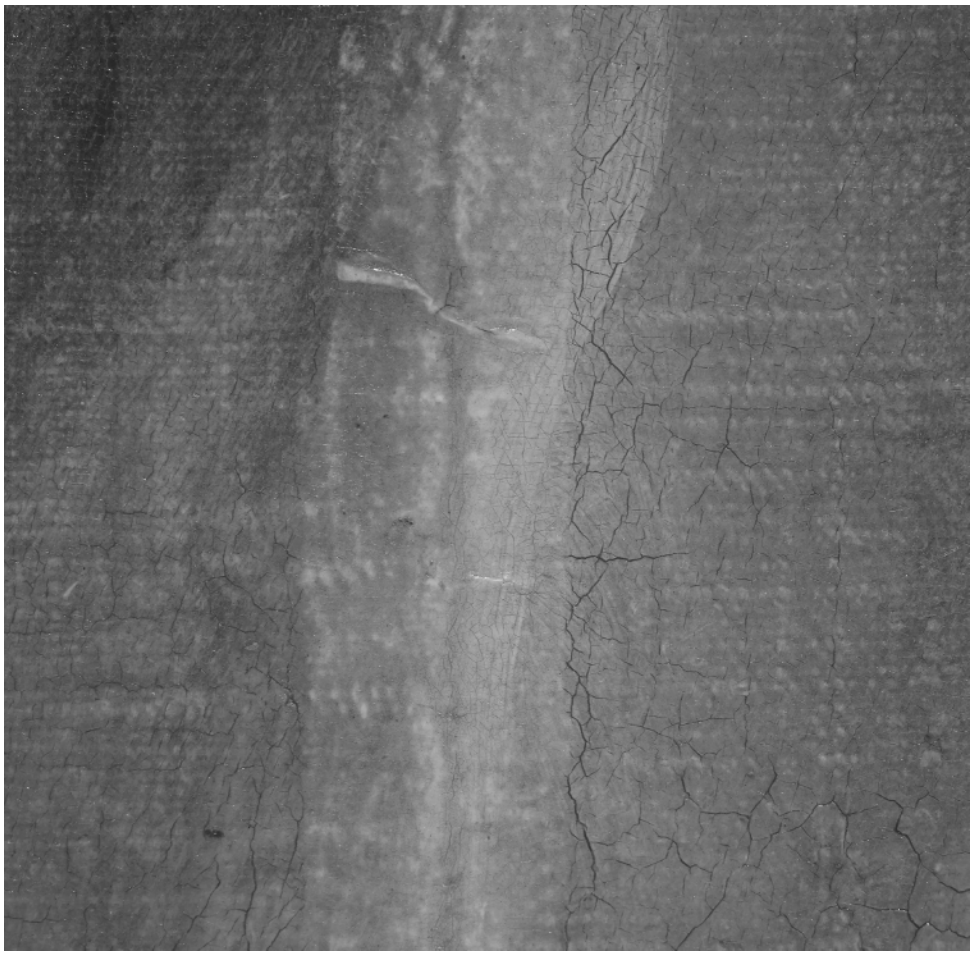

Figure 4. Infrared reflectography detail of paper along the recto of the seam in *Adoration of the Magi*

will understand the extent of the use of this material and the relationship between Madrid and Mexico City when more studies focusing on individual paintings are completed.

The palettes of the artists are characteristic of the 17th century. Pigments identified include lead white, vermillion, red lakes, verdigris, organo-copper pigments, orpiment, smalt, and a variety of earth pigments. Color is a key component of both paintings. However, Villalpando is a master of glazes, whereas Sánchez has a more robust paint application. In both works, the lack of major pentimenti suggests carefully planned compositions, likely inspired by print sources. Despite this, the artists' personal style is evident throughout. The painters dedicated a significant amount of time to garments, some of which have altered over time. To paint a lavender cloak worn by a figure behind the Virgin and Child, Villalpando adjusted the powerful tonality of the red ground with a locally applied imprimatura of gypsum. The lavender cloak was painted over the gypsum with a mixture of lead white and distinctly purple lake particles manufactured from cochineal. Finally, the folds of the fabric were accented with an organo-copper pigment. The once green folds have turned dark brown over time, and the intensity of the purple cochineal has diminished. Villalpando's intention was to represent an iridescent shot silk effect. Several areas show other, irreversible pigment changes, including those associated with smalt, the only blue pigment identified in the mantle of both Virgins. In *Marriage of the Virgin*, macro XRF showed that cobalt (from smalt) is distributed evenly throughout the mantle of the Virgin. The once blue shadows appear dark brown due to the turbidity of the degraded smalt, which has lost its color. However, the stabilizing effect of lead white helped retain a blue tonality in the highlights. This change results in a more dramatic chiaroscuro effect than originally intended by Sánchez.

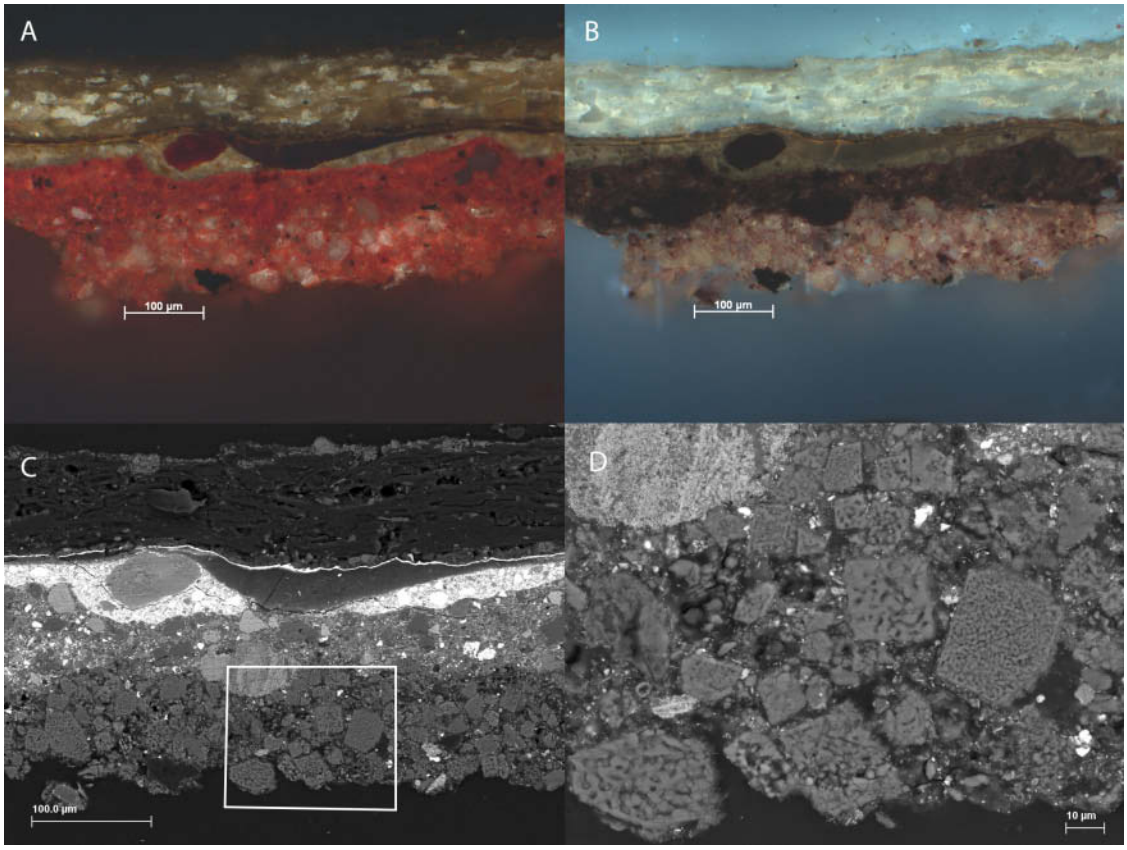

Figure 5. Sample from *Marriage of the Virgin* taken from a peripheral edge covered with framer's gum paper, applied in a previous restoration. (A) Cross section in normal light shows the brightness of the red preparation (viewed at 200×). (B) The two red ground applications are better discerned under UV light (viewed at 200×). (C) Backscattered electron image of the sample in which calcite pseudomorphs are detected only in the first ground layer (viewed at 250×). (D) Backscattered electron image of calcite pseudomorphs showing the polygonal shapes with pitted surfaces characteristic of calcite pseudomorphs in cross section (viewed at 800×).

This study has elucidated certain regional techniques by comparing paintings of two influential artists from New Spain. Research into the use of calcite pseudomorphs derived from wood ash needs to be developed. Further studies will be necessary to determine exactly when the practice began in New Spain and if it was brought by artists coming from Madrid or if the influence was indeed the reverse. Although Mexican painters had copies of the Spanish art treatises, the mention of ash preparations is so cryptic that most likely this technology was learned from master to apprentice in the studio. Focusing attention on the individual contributions of a wider selection of New Spanish artists from the 17th and 18th centuries, as well as those in continental Europe, is essential to increase awareness of their practices, ultimately creating a body of knowledge from which accurate conclusions can be drawn.

NOTES

1. The other existing paintings from the Sánchez altarpiece are the *Birth of the Virgin*, the *Presentation of the Virgin*, and the *Visitation of the Virgin*. ca. 1690.
2. See pages 261 and 290 of Bruquetas (2002) for an occurrence of paper strips in two 17th-century paintings found in Valladolid and Seville. In a personal communication, the author stated that these paintings could have been of Mexican origin.
3. Personal communication with María Villavicencio, Chief Paintings Conservator at Museo de Arte de Lima, Lima, Peru.

4. Francisco Pacheco's *El Arte de la Pintura* was published in 1649 and Antonio Palomino's *El Museo Pictórico y Escala Óptica* in 1723. These treatises, also present in the libraries of New Spanish painters, contain exhaustive technical information regarding the artistic practices in Madrid and Andalucia at the time.
5. The first ground layer is beneath the paper seam, whereas the upmost ground layers were applied over the paper.

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ANN SHAFTEL, JOHN WARD, and EMMA HARTMAN

Material Matters: Research for Rare Wall Murals Revealed at the Historic Sinclair Inn Museum

ABSTRACT

In 2014 and 2016, conservator Ann Shaftel enacted conservation treatment of recently discovered historic walls murals behind wallpaper at the 18th-century Sinclair Inn Museum, located in a former second floor function room. At least two layers of murals were found, the first comprising Masonic Lodge fluted columns painted in the four corners of the room, which may date to the late 18th or early 19th century. Subsequent layers of painting, done over the Masonic columns, comprise panoramic views on all four walls that appear to portray the Annapolis Basin in various scenes, together with a portrait of a man in Scottish military dress, believed to be painted in the 1830s or 1840s. Later painted details of Masonic iconography have also been identified. This room has written documentation as one of the oldest known Masonic meeting places in North America.

In the conservation treatment of the fragile and unique wall murals, the Canadian Conservation Institute (CCI) was requested by the Annapolis Historical Association, the local community not-for-profit owner of the museum, to research and advise on the wall paintings and the historic structure that contain the paintings both prior to and during the work. Based on this research and conservation-related advice, an understanding and appreciation of the properties of the materials of the building and its walls was developed that informed and guided the hands-on revealing and conservation treatment of the murals.

Dating back to 1710, the building itself is the second oldest extant wood frame building in Nova Scotia and Canada. It is an open-concept museum today in which layers of history are revealed, with didactic labels, audio/visual interaction, and local guides. The museum building itself is informed by materials and historic research. The conservation of the wall paintings was then prefaced by site visits, sampling, and materials research carried out in the laboratory by CCI painting conservators and scientists. This research continued through the 2 years of the conservator's involvement in the hands-on process. Historic preservation specialists from CCI were twice invited to the site to research and advise on preservation measures for the building itself, as well as for the murals once they were revealed.

The range of materials research provided by CCI was augmented by simple on-site materials research undertaken by the conservator herself before and during the conservation treatment. Augmented chemical analysis on the wallpaper and pigments was provided by those at the Saint Mary's University chemistry department, who, for example, discovered the existence of arsenic in a wallpaper color with which we were working. This presentation demonstrates the vital importance of materials research for conservation treatment of multilayered fragile wall paintings contained within an historic structure.

MELISSA GARDNER and CORINA E. ROGGE

An Obscured Beauty: Analysis and Treatment of *Dancing Girl* by Muhammad Baqir

ABSTRACT

Muhammad Baqir's oil on canvas painting Dancing Girl*, dated 1192 AH (1778 AD), was acquired by The Museum of Fine Arts, Houston in 2015 and subsequently underwent conservation treatment and complete technical analysis. The painting has been examined with x-ray radiography, ultraviolet fluorescence, and infrared reflectography. Binding media and pigment analyses were performed using x-ray fluorescence, Fourier transform infrared and Raman spectroscopies, and scanning electron microscopy coupled with energy dispersive x-ray spectroscopy. Cross section samples revealed the method of paint application, and the primary and secondary canvas supports were subject to microscopic fiber identification. Cleaning the painting was undertaken with caution, as several areas proved to be chemically sensitive. The investigation and treatment of* Dancing Girl *provide important insights into the painting materials and techniques of the late Zand period, as well as several practical methodologies for their continued preservation.*

In January 2015, The Museum of Fine Arts, Houston (MFAH) acquired Muhammad Baqir's *Dancing Girl* (fig. 1), dated 1192 AH (1778 AD)—their first Islamic easel painting. Although Baqir is primarily known for his miniature painting, this oil on canvas work is roughly 59 in. tall and 31 in. wide, with an arched top. It features a three-quarter-size portrait of a female dancer. The subject is dressed in a patterned skirt with jeweled bodice, holding castanets in both hands, with one arm raised above her head. She stands before a window open to the air, with a bowl of pears to the side. The work is signed and dated in the upper left just below the dancer's raised hand. The MFAH painting dates from the late Zand period from which surviving large canvas paintings are rare, and few of them have been studied in depth. Analysis of Baqir's materials and methods in this work contributes to a greater understanding of Persian oil painting in general.

Baqir was one of the first Persian painters to incorporate European motifs and techniques into his works; his limited use of perspective in particular shows the intersection between the painting traditions of the West and East. The bowl of pears is sitting slightly foreshortened on the window ledge, yet the carpet in the foreground is tilted unrealistically upward to better display its patterning. A light source is suggested with one side of the window ledge darkened and the other lightened, but any shadow the figure might cast is ignored. The subject is a romanticized depiction of female beauty; *Dancing Girl* being an example of the Persian trope depicting beautiful women entertaining by dancing, performing acrobatics, or serving wine. This genre of painting would become more prominent during the Qajar period in the first half of the 19th century. These "beauties" were not portraits, but idealized female representations that were created to decorate elaborate interiors (Diba 1998). Baqir's composition may be considered one of the earliest to establish this new genre. A drawing by Jules Laurens completed during his 1846 through 1848 tour of Iran of an interior room in a palace in Tehran[1] shows *Dancing Girl* installed in a wall niche near the ceiling. Thus, *Dancing Girl* was likely originally created to serve as an architectural decoration, perhaps glued or pasted to the wall, in a specially designed framework. As fashions changed and buildings were remodeled, such paintings were then sometimes removed and transferred to strainers, becoming independent artworks (Adamova 1996). Although the female figure is idealized *Dancing Girl* is notable for the meticulous and realistic representation of costume and textile details. In fact, the clearly identifiable and intricate pattern on the shawl has been used to propose a new timeline of dating shawl production in the Kashmir region (Ames 2005).

In-depth technical research began immediately after acquisition of this important painting to aid in the overall treatment. The surface exhibited a thick plastic appearance detracting from its dynamic qualities. Additionally, the

Figure 1. Muhammad Baqir, *Dancing Girl*, 1778, oil on canvas, 59 × 31 in., The Museum of Fine Arts, Houston (2015.65), before treatment.

severe yellowing of the surface coatings distorted the color relationships of the composition and obscured subtleties of shading. Baqir used thin washes of oil paint in vibrant colors, such as the rich blue of the sky, to build up the basic composition. He completed the figure with more robust brushwork adding details to draw the eye. For example, each pearl of the dancer's costume was formed with the flick of the wrist to make a circle in white paint, then a subtle shadow stroke in light gray was added around the bottom edge. The metallic golden-colored embellishments consist of a layer of metal leaf with bright gemstones, in green and red, and colorful pink flowers, painted on top. Baqir utilized the reflectivity of the metal leaf underneath to create sparkle through the thin paint layers, thus enhancing the illusion of translucent gems. The repeating flower motifs throughout were carefully completed by hand rather than by using a stencil. The dancer raises her arm, flipping part of her sleeve back, while thrusting a knee forward beneath her skirt. The liveliness of the pose together with the delicate painting technique gives an impression of both elegance and movement. These qualities were effectively obscured by the surface coating and years of overpainting.

The painting was examined with x-ray radiography, ultraviolet illumination (UVF), and infrared reflectography (IRR). The canvas had been relined sometime prior to its acquisition by the MFAH, and it remains structurally stable. The x-ray radiographs reveal a slight canvas extension of 1 in. at the top of the arch and do not show any tears or holes in the original support. Cusping is visible along all edges, suggesting that the current dimensions are relatively accurate. The broad width of the cusping arcs suggests that the canvas was painted while stretched in a loom. No conservation records are extant, but two distinct retouching campaigns visible under UVF suggest the work was treated at least twice in the past. The infrared reflectogram reveals delicate underdrawing in the figure's face (fig. 2). Baqir outlined the dancer's facial features indicating the placement of her nose, lips, eyes, eyebrows, and chin line, although these lines were not closely followed in the final composition. The IRR, when compared with the UVF image, shows that large areas of retouching are associated with relatively small areas of damage suggesting a large degree of unnecessary overpainting was present.

Materials analysis was performed using microscopy for fiber identification. X-ray fluorescence spectroscopy (XRF), Fourier-transform infrared spectroscopy (FTIR), and Raman spectroscopy were used for pigment and medium classification. Cross sectional samples revealed painting stratigraphy, and scanning electron microscopy coupled with energy dispersive x-ray spectroscopy (SEM-EDX) permitted localization of materials to specific paint layers and determination of the composition of the metallic leaf pigment[2] (Table 1). Microscopy suggests that the original and lining canvases are composed of cotton fiber. Visually, the original canvas is a thin, delicate plain weave fabric, whereas the lining canvas is a considerably heavier-weight material. It appears that the aqueous adhesive between the two fabrics is in good condition. The ground layer is applied overall and is composed of aluminosilicates and calcium carbonate, with the reddish color deriving from the presence of iron earth species.

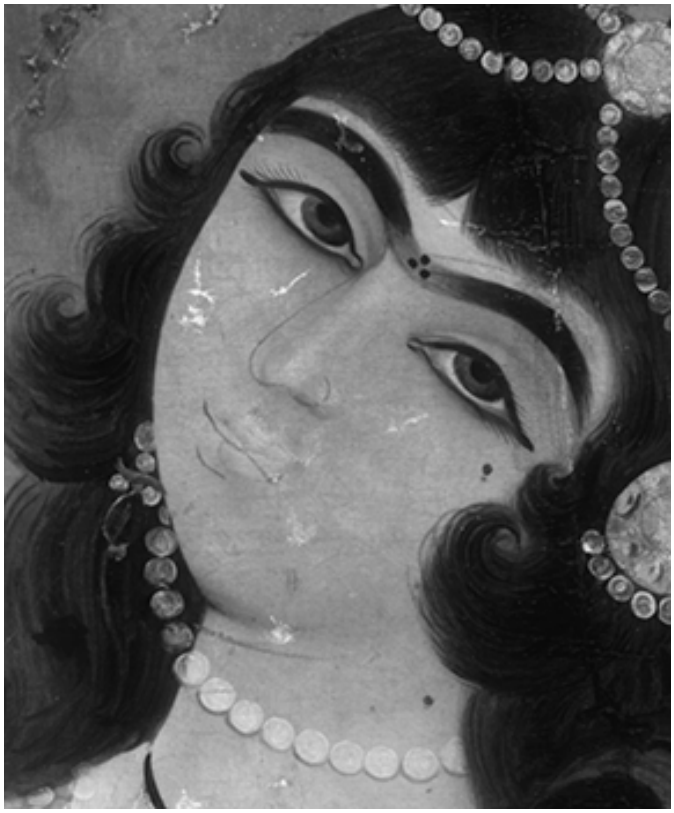

Figure 2. Muhammad Baqir, *Dancing Girl*, The Museum of Fine Arts, Houston, infrared reflectogram, detail of face.

The paint layers were completed with primarily traditional pigments in a limited palette. Baqir used lead white, Prussian blue, orpiment, realgar, copper greens, ivory black, iron earths, yellow ochre, and vermillion. The green earth pigment celadonite was identified in the green stone wall of the background, whereas all the other greens are mixtures of copper compounds. Baqir deliberately utilized the different tonalities of his two red pigments, vermillion and red ochre. The former is present in the dancer's costume and the latter in the henna on her hands and feet. A small amount of an arsenic species, perhaps realgar, was added to the iron earth pigment to mimic the distinctive red-orange of henna, whereas the other reds are nearly pure vermillion. Vermillion was also used to tone and enrich other design areas such as the deep brown hair, the orange curtain, and the flesh tones.

The metal leaf applied to the dancer's costume is composed of 85% copper and 15% zinc, characteristic of red or Tombac brass. Cross sections indicate that a thin layer of medium or resin may have been applied on top of the metal leaf, perhaps not only to help adhere the leaf but also to facilitate painting the decorative elements on top of the leaf, as well as to prevent its oxidation and discoloration (fig. 3). The FTIR spectrum of the layer of adhesive beneath the metal leaf exhibits peaks consistent with drying oils. Although gas chromatography–mass spectrometry would be necessary to confirm this, the FTIR does preclude the presence of a proteinaceous adhesive. Similarly, the paint medium has been tentatively identified as drying oil by FTIR.

The thick surface coating present throughout is composed of at least five layers of shellac. The lowest layer is visibly more oxidized (as assessed by yellowness) in cross sections (fig. 3), and a thin dirt layer is present between it and the next shellac application. The coating layers are of relatively consistent thicknesses but together are markedly substantial compared with the artist's thin paint application, which generally was completed with only one or sometimes two colored layers. The detection of chlorine in the surface coatings suggests that at least some of the varnish layers were chlorine bleached, a common practice used to decolorize the natural shellac resin (Sutherland 2010).

Initial solubility testing confirmed that the shellac layers were only removable with strong mixtures of ethanol. Further testing revealed that all design areas containing vermillion were sensitive to the ethanol. Additionally, the painted details on top of the brass leaf were physically delicate and could not withstand the prolonged swab action needed to remove all shellac layers. Cleaning the painting was therefore undertaken with caution in two phases: solvent cleaning followed by mechanical cleaning of sensitive areas. Non-sensitive areas, including the blues of the sky and skirt, the white window ledge, and the beige carpet, were cleaned using a solvent mixture of ethanol and iso-octane. The upper shellac layers adequately responded to a 1:3 solution of iso-octane:ethanol. As the age of the shellac layers increased, it was likewise necessary to increase the proportion of ethanol. This stepwise method to remove the coating by layers allowed for more control overall. The orange curtain and green architecture, although not chemically sensitive, were found to be damaged to a greater degree than the rest of the painting. The larger losses present may be a result of physical damage incurred during removal of the painting from the wall. These areas were cleaned using solvents as above, but the final shellac layer was not removed completely. The remainder of the painting was slowly cleaned mechanically. Again, the initial shellac layers were solubilized and thinned with the solvent mixture of iso-octane:ethanol. A scalpel was then used to shave the lower shellac layers to various degrees. In the red bodice and shawl of the dancer, the shellac was taken down to a partial removal of the final layer, although it was not possible to completely remove all shellac due to its extreme hardness. Areas over the metal leaf were thinned to a slightly lesser degree to ensure the glaze layer immediately on top of the brass was not disturbed. The painstaking cleaning also removed older campaigns of retouching and overpainting.

Table 1. Pigmenting and support materials identified in *Dancing Girl*

Color/Design Area	Pigment/Material	Analysis Methods
Blue skirt	Prussian blue, lead white	XRF, FTIR
Blue sky	Prussian blue, lead white	XRF, FTIR
Orange curtain	orpiment	XRF
Red shawl	vermillion	XRF
Red jewels	vermillion	SEM, FTIR
Red feet	realgar, iron earth	XRF, Raman
Flesh tones	lead white, vermillion	XRF
Green stone wall	celadonite	XRF, SEM
Dark green stone	copper green, iron earth	XRF
Green flowers	copper green	XRF
Green jewels	copper green	XRF
Beige carpet	lead white, yellow ochre	XRF
Yellow pears	orpiment, lead white	XRF
Whites	lead white	XRF
Black hair	ivory black, iron earth, vermillion	XRF, Raman
Ground layer	calcium carbonate, aluminosilicates, iron earth	SEM
Metal leaf	brass (85% Cu, 15% Zn)	XRF, SEM
Metal leaf adhesive	drying oil	FTIR
Medium	drying oil	FTIR
Surface coatings	shellac (chlorine bleached)	XRF, FTIR
Original canvas	cotton	Microscopy
Lining canvas	cotton	Microscopy

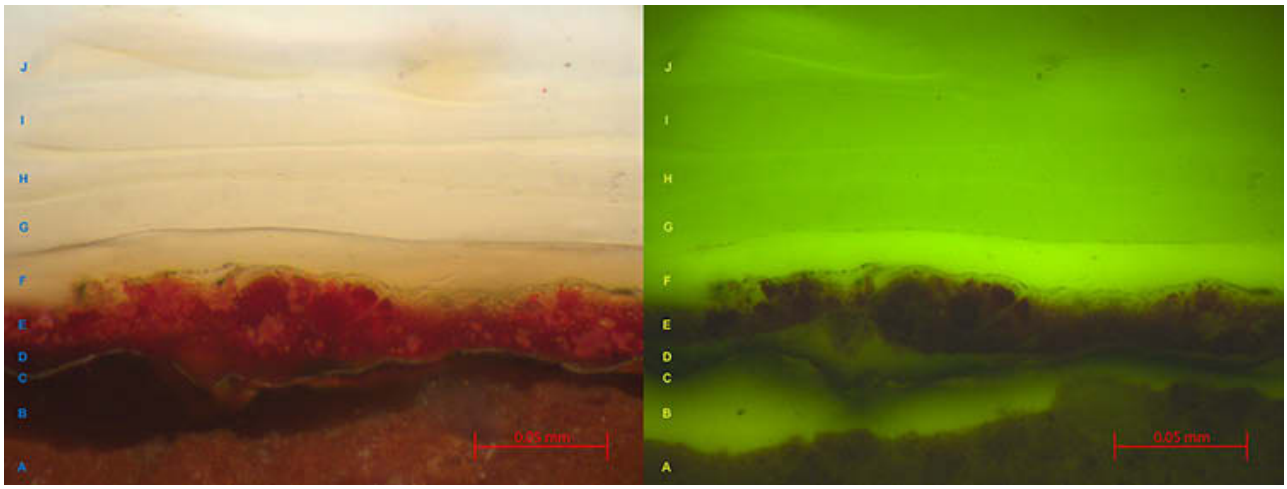

Figure 3. Photomicrograph of cross section from an area of red paint over metal leaf in *Dancing Girl* by Muhammad Baqir in reflected light (left) and ultraviolet illumination (right) showing the layer structure of ground (A), metal leaf adhesive (B), metal leaf (C), medium rich glaze (D), red surface paint (E), surface coating with layer of dirt on top (F), and additional surface coating layers (G–J).

Beautiful delicacies in Baqir's technique were revealed and much of the original aesthetic restored.

The limitations imposed on the cleaning by the sensitive original materials and the extreme oxidation of the shellac resulted in an uneven surface. An initial layer of 8% B-72 was brush applied over the surface to provide an isolating layer with a solubility sufficiently different from the sensitive paints to allow for removal in the future if necessary. Two varnish coatings of 15% Larapol A81 were sprayed several days apart but saturated the paint irregularly with several gloss and matte areas across the surface. To help mitigate this effect, the varnish surface was frictioned three separate times. To friction the surface, first dry beads of the same resin used to varnish are ground to a fairly fine dust. The resin dust is then rubbed over the painting surface using the fingertips with mild pressure in small circles. Next, a soft cotton cloth is passed over the surface to remove excess particles. The dry resin will collect in the matte areas and slowly abrade the glossy areas, overall evening out the amount of resin on the surface. The painting was then spray varnished once more with a low concentration of Larapol A81, in this case 8%, to saturate and reform the resin on the surface. Repeating this process several times incrementally leveled the surface and improved the evenness of saturation (fig. 4).

After the cleaning, several vertical drip stains became much more apparent on the surface. These appear to be a result of an unknown material spilled onto the verso of the lining canvas (fig. 5). The paint layers in these areas were discolored and darkened. Inpainting was completed using dry pigments in PVAc. In consultation with the curator, it was decided to balance the compensation with the level of damage present. Major losses and the more disturbing stains were covered, whereas subtle areas of abrasion were allowed to show through. It was desirable to maintain a fundamentally subtle approach to mimic Baqir's delicate painting technique. With this in mind, the dancer's costume was compensated more fully to uphold its more robust brushwork, whereas the thin washes of the background features were retained. Areas of complete loss and the dark stains on the brass leaf were compensated with local applications of shell gold. It was necessary to completely reconstruct parts of the dancer's headpiece, which had been damaged down to the canvas. Previous restorations had left this area vague, so a new design was conceived using comparable paintings, as well as *Dancing Girl*'s existing costume motifs of rubies and emeralds surrounded by pearls (fig. 6).

Final varnishing again proved challenging due to the tendency of the surface to unevenly absorb the surface coatings. An overall spray application of PVAc was applied to level the surface and seal the inpainting. This layer appeared to level well and mostly evenly saturate the surface. Unfortunately, when an 8% Larapol A81 was then applied to impart more gloss, this layer unevenly sank into various areas of the painting. An additional 15% solution was added to increase the solids present on the surface. Although improved, the disparity of matte and gloss remained visually distracting. A 15% B72 coating was added as a final layer, which was then buffed by hand with cotton.

Figure 4. Muhammad Baqir, *Dancing Girl*, The Museum of Fine Arts, Houston, during treatment, after cleaning.

Today, Baqir's exquisite *Dancing Girl* (fig. 7) is able to be appreciated as the artist originally intended with subtly painted details, vivid balanced colors, and an overall polished yet animated appearance. The investigation and treatment provide important insights into the painting materials and techniques of the late Zand/early Qajar

Figure 5. Muhammad Baqir, *Dancing Girl*, The Museum of Fine Arts, Houston, verso.

period, as well as several practical methodologies for their continued preservation. The knowledge gained from this project is an invaluable addition to Western conservators' understanding of this rarely encountered type of Persian oil painting on canvas.

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We thank Dr. Aimée Froom, Curator, Art of the Islamic Worlds, The Museum of Fine Arts, Houston; Janet O'Brien; Dr. David Bomford, Audrey Jones Beck Curator,

Figure 6. Muhammad Baqir, *Dancing Girl*, The Museum of Fine Arts, Houston, detail of headpiece before treatment (A), during treatment (B), and after treatment (C).

Figure 7. Muhammad Baqir, *Dancing Girl*, The Museum of Fine Arts, Houston, after treatment.

Department of European Art and Chairman, Department of Conservation, The Museum of Fine Arts, Houston; Dr. Zahira Bomford, Senior Conservator of Paintings, The Museum of Fine Arts, Houston; Matthew Golden, Conservation Imaging Specialist, The Museum of Fine Arts, Houston; Franci Neely; Sabiha and Omar Rehmatulla; The Art of the Islamic Worlds Subcommittee of the Museum of Fine Arts, Houston; and Cecily Horton; The Andrew W. Mellon Foundation.

NOTES

1. Jules Laurens, *Téhéran, au palais de la Mission de France*, 1846–1848, crayon on paper, 31.6 × 44.9 cm. Beaux-arts de Paris, l'école nationale supérieure (EBA 2179). Laurens accompanied the French geographer Hommaire de Hell on a tour of Turkey and Persia from 1845 to 1848, completing his trip in Tehran after de Hell's sudden death. Hundreds of his drawings from this journey were sent back to France and published along with de Hell's journals.
2. *Microscopy*: Cross section samples were embedded in Bio-Plastic resin (Ward's Science), coarse ground using Micro Mesh MX sheets (120 and 150 grit) (Scientific Instrument Services) and fine polished using Micro Mesh sheets (1500–12,000 grit) (Scientific Instrument Services). Images of the samples under both normal oblique and UV illumination using B-2A or V-2B filter cubes were obtained using a Zeiss AxioCam MRc5 camera controlled by Zeiss Axiovision AC software release 4.5 and mounted onto a Nikon Labophot-Pol optical microscope equipped with 10×, 20×, and 40× objectives. Scale bars were created in Adobe Photoshop using images of a micrometer scale taken using the same objective.

   XRF spectroscopy: X-ray fluorescence spectra were collected using a Bruker Artax 400 energy dispersive x-ray spectrometer system equipped with a Rhodium (Rh) target x-ray tube with a 0.2 mm thick beryllium (Be) window, operated at 40 kV and 400 mA current. The x-ray beam was directed at the artifact through a polycapillary tube. X-ray signals were detected using a Peltier-cooled XFlash silicon drift detector (SDD) with a resolution of 146.4eV. Helium purging was used to enhance sensitivity to light elements. Spectra were collected over 180 seconds (live time). Spectral interpretation was performed using the Bruker Artax Spectra 7.4.0.0 software.

   FTIR spectroscopy: Attenuated total reflectance (ATR)-FTIR spectra were collected using a Lumos FTIR microscope equipped with a motorized germanium ATR crystal with a 100 μm tip (Bruker). The spectra are an average of 64 or 264 scans at 4 cm^{-1} spectral resolution, and an ATR correction was automatically applied by the Opus 7.0 instrument control and data collection software (Bruker).

   Dispersive Raman spectroscopy: Dispersive Raman spectra were collected on an InVia Raman microscope (Renishaw) using a 785 nm excitation laser operating at powers of 384 μW through 7.51 mW at the sample as measured using a PM100D laser power meter (Thorlabs) equipped with a S120C photodiode power sensor. A 50× objective was used to focus the excitation beam on the sample supported on a glass microscope slide. The resulting Raman spectra are the average of 1 to 15 scans of 10 seconds duration. Spectral resolution was 3 to 5 cm^{-1} across the spectral range analyzed.

   SEM-EDX: Backscatter electron images of the uncoated cross-section samples were taken with a JEOL JSM IT100 SEM running under low vacuum mode with a pressure of 40–50 Pa and a probe current of 40–50.

   EDX analysis using the integrated detector was performed under the same pressure conditions, but with higher probe currents (65–75) to increase the counts.

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NANCY R. POLLAK

Symbol, Record, Object: Treating the Many Facets of Two Royal Portraits from Qajar Iran

ABSTRACT

Treatment of two Qajar Iran paintings from the Arthur M. Sackler Gallery, Smithsonian Institution, is discussed. The 1859 portrait Prince Jalal al-din Mirza, *constructed of typical European painting materials, had undergone extensive past restoration, whereas the ca. 1914 painting* Ahmad Shah Qajar and His Cabinet, *constructed of more traditional Iranian painting materials, including a pieced cotton support, had undergone limited previous treatment but had later added inscriptions. Although current treatment of* Prince Jalal al-din Mirza *followed a typical painting treatment, treatment of* Ahmad Shah and His Cabinet *was modified to address the pieced cotton support and later inscriptions.*

1. INTRODUCTION

A portrait can be both a historical record and a personal memory, reflecting artistic trends and material innovations of the time. Recent treatment of two Qajar Iran royal portraits from the collection of the Arthur M. Sackler Gallery of Art are prime examples of these ideas. The first of these paintings is the portrait of Prince Jalal al-din Mirza, the 55th son of Fath-Ali Shah Qajar (S2016.9a–b), painted in 1859 when the prince was 30 years old (fig. 1). The second is of Ahmad Shah Qajar (S2013.4), the last shah of the Qajar dynasty, painted sometime before his 1914 coronation (fig. 2). Iran's Qajar period lasted from 1797 to 1925, encompassing the reign of seven shahs. The second ruler, Fath-Ali Shah Qajar, father to Prince Jalal, was instrumental in a great literary and artistic revival that produced a wealth of dynastic imagery, including numerous life-size portraits (Diba and Ekbtiar 1998). Although not a key player in the royal courts, Prince Jalal al-din is noted for writing the *Book of Rulers*, an unprecedented history of Iran promoting a distinct Persian identity that was published in the late 1860s. The prince's portrait is painted in oil, in a classic European style, using typical materials including a commercially preprimed canvas and, most likely, a traditional stretcher, although when the painting arrived at the Sackler, it was stretched on a replacement strainer. The painting is attributed to Abu'l-Hasan Ghaffari Sani Al-Mulk, who at that time was the painter laureate in the royal painting studio. Abu'l-Hasan had spent 5 years in Italy studying the masters, and when he returned to Iran, he promoted the education of young artists by means of copying the great masterworks that he had copied while abroad. The prince's portrait reflects the influence of both the flat decorative patterns of traditional Persian art and European influences in the naturalistic rendering of the prince's face. The practice of copying paintings from copies likely contributes to the direct painting technique of the prince's portrait. The painting also reflects Abu'l-Hasan's ability to render specific, realistic likenesses, and this naturalistic painting style was considered the modern ideal for Qajar painting at this time (Diba and Ekbtiar 1998).

Ahmad Shah's portrait, although painted about 50 years later, employs materials that are more traditional to the Qajar painting studios, including the use of oil paint on thin, pieced cotton fabric with no ground layer. Ascending to the throne at the tender age of 11 years, Ahmad Shah's reign began under the control of regents until his 1914 coronation when he was 16 years old. This rare group portrait was likely used to signify the governmental maturity behind the young shah. Although the rendering of the faces reflects European modeling, highly patterned flat surfaces are dominant in the image. The artist, Master Assadollah al-Husayni, likely drew on modern aids such as photographs for rendering the likenesses. The painting is particularly significant because most images of this last shah are photographic. In some respects, it seems that this painting was treated more like a photographic document than as fine art, particularly in the

Figure 1. *Prince Jalal al-din Mirza, Son of Fath-Ali Shah Qajar* (S2016.9a-b), attributed to Abu'l-Hasan Ghaffari Sani Al-Mulk, 1859, oil on canvas, 49 × 35 in. (124.46 × 88.9 cm), after treatment

Figure 2. *Ahmad Shah Qajar and His Cabinet* (S2013.4), Assadollah al-Husayni, ca. 1910–1914, oil on canvas, 82 5/8 × 58 ¾ in. (209.85 × 149.23 cm), after treatment

later addition of inscriptions identifying the men behind the shah and his brother, the crown prince.

The materials and primary uses of these two paintings appear to have led them on two very different paths as physical objects. When acquired by the Sackler in 2016, *Prince Jalal*, painted with typical portrait materials, had suffered numerous damages that had been addressed by extensive, traditional painting restoration approaches, including full lining, thick fills, broad areas of restoration paint, and multiple layers of varnish (fig. 3). Unlike *Prince Jalal*, the portrait of Ahmad Shah had not been heavily treated. When acquired by the Sackler in 2013, its most notable problem was that it did not have a stretcher or other secondary support, and its lower edge was severely compromised (fig. 4). It may be possible that the painting of the shah, seen more as historical document, did not receive heavy cosmetic treatment, whereas the portrait of the prince had been treated primarily to maintain the perfection of the picture plane. Regardless of the previous perceptions of the paintings, the Sackler wished to return them to their original state as much as possible while respecting the effects of age and history. Each painting was addressed with the objectives of removing previous restorations, stabilizing the structures, and reducing the visual impact of damages and losses while retaining historical changes.

2. TREATMENT OF *PRINCE JALAL AL-DIN MIRZA*

The prince's painting, with its extensive previous treatments, required a full range of treatment procedures. The original canvas had been lined to a second preprimed canvas with the priming facing the original canvas verso. Although the lining canvas fabric could be easily removed, its priming layer remained adhered unevenly to the verso of the original

Figure 3. *Prince Jalal al-din Mirza*, before treatment, recto: normal light (a) and raking light (b)

canvas and had to be removed by shearing with a scalpel. Priming from the lining canvas released most easily around the edges of the painting's verso, due in large part to accumulations of dust and debris that had not been removed prior to the lining treatment. Removal of the lining residues revealed older patches of both paper and thin canvas, unmended tears, extraneous accumulations of fill or adhesive material, and the happy accident of a small corner of the original canvas that had been folded down prior to lining (fig. 5). This corner later proved very useful in guiding the removal of the thick varnish layers and restoration paint in the pink curtain. On the recto, very thick layers of restorations, seemingly from three different generations of treatment, were present at most large tears. Smooth white, chalk-based fills had been used first, primarily to fill canvas losses and tears. The next generation of fills was composed of coarse brown fibers and generally extended far beyond most areas of large canvas damage. The final layer of fills was again white chalk and seemed to be used primarily to even out distortions caused by the other fill layers. Each fill layer was covered by thick layers of restoration paint. To remove these old restorations, humidification with distilled water was used to soften the fill material so that it could be mechanically removed with a scalpel.[1] After previous restorations were removed, tears were flattened and mended, and the painting was lined to Sunbrella canvas with BEVA film.

The multiple layers of grime, discolored varnish, and old restoration paint on the painting surface were readily soluble in acetone. In most cases, removal of these layers was straightforward, except in the background curtain, where large areas of tan restoration paint obscured the character of the original paint, limiting understanding of how the background curtain was painted, and whether any glazing had been used in its creation. The small folded corner of painted canvas became very useful in understanding the original character of the curtain (fig. 6). Although the paint surface of the folded corner was grimy, it was clearly painted

Figure 4. *Ahmad Shah and His Cabinet*, before treatment, recto

with a red underlayer covered by a scumble of pale pink paint. Thus, it was possible to comfortably remove the tan restoration paint to reveal similarly scumbled pale pink paint in the rest of the curtain. Together with the fine lines of the prince's mustache and hair painted directly on the pale pink curtain (fig. 7), these clues helped in understanding the curtain as being directly painted with some scumbled layers, as opposed to having been built up with multiple layers of glazing. Overall, the prince's portrait was painted very directly with few changes, the most notable being some adjustments to the outline of his hat. After cleaning, the painting was varnished with Paraloid B-67, and losses were filled with Beckers Spackel and inpainted with pigments in acrylic or aldehyde resin, again following a typical painting treatment (fig. 8). The painting was finally varnished overall with a thin brush application of UVS varnish.

3. TREATMENT OF *AHMAD SHAH AND HIS CABINET*

The prince's portrait was confidently and directly painted; however, *Ahmad Shah* seemed to be a more intuitive process, with numerous adjustments during its early life,

Figure 5. *Prince Jalal al-din Mirza*, verso, showing a corner of the original canvas folded to the verso before previous lining

particularly in its overall dimensions. The thin fabric support was created of four pieces of lightweight, plain weave cotton fabric, seamed with tight machine stitching. The uncoated tacking edges indicated that it had been stretched on a narrow stretcher or strainer prior to painting. The face of the painting showed strong bowing along the top and bottom edges, likely due to an out-of-square, thin, or weak secondary support combined with too much tension in the stretched fabric. The earliest change in the painting seemed to be restretching to eliminate the bowed top and bottom edges. Additional folds along the top and bottom edges showed a partial fold to reduce the "wings" at the corners of the canvas, with an additional fold line that reduced the vertical dimensions to the height of the lowest points of the bowing. A final fold further reducing the painting dimensions happened later in the life of the painting (fig. 9).

Other notable changes included the black coat of the crown prince, through which the completely rendered pattern of the brown garment of the figure standing behind the crown prince was visible. Although the prince's face appeared to be directly painted on the canvas, his hat was also painted over the moustaches of the figures behind him, the texture of which remained visible on the paint surface. Finally, the crown prince's sword was moved from his proper left side to his right. The smooth green passages depicting the sword scabbard were visible beneath the brown patterned robe of the figure standing to the right of the shah, and thicker paint texture matched the positions of rosettes on the scabbard. These corrections were likely undertaken before the painting

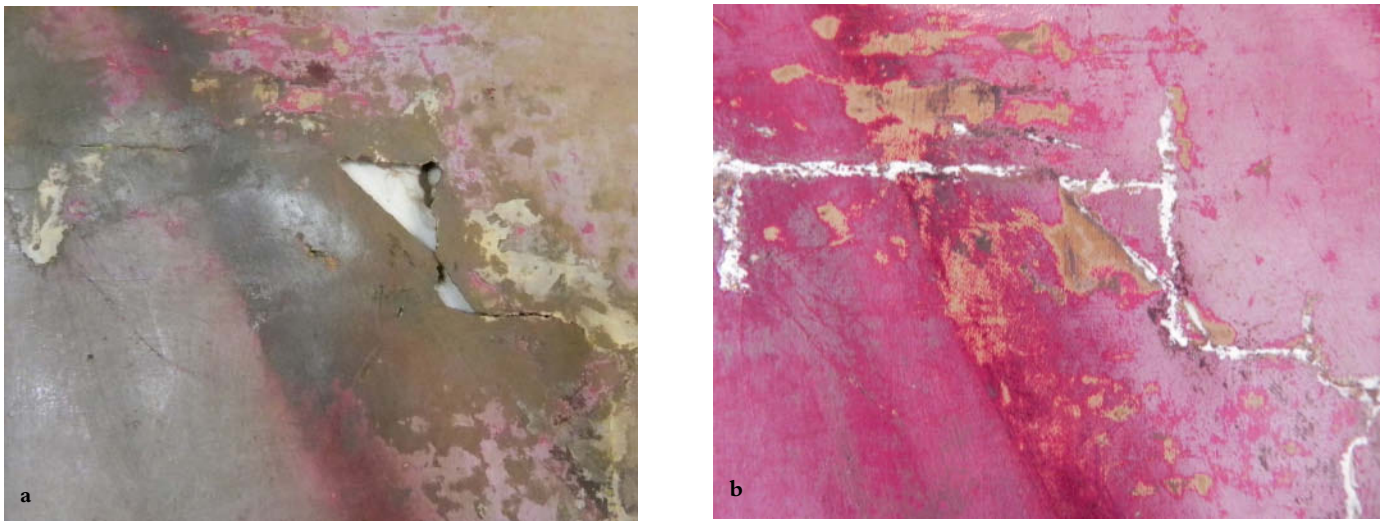

Figure 6. *Prince Jalal al-din Mirza*, recto: the area where the corner of original canvas had been folded to the verso, before overpaint removal (a) and the same area after cleaning with the corner unfolded to its proper place (b)

was considered completed. An early photograph of the painting in an elaborate frame showed the crown prince with his sword to his proper right. Other differences between the painting at this time and its current appearance were visible as well. Of particular note, this photograph showed a white inscription in the lower left corner and no inscriptions in the sky above the figures (Rettig 2014).

At some later time, the painting underwent further changes, both artist reworkings and later notations, reinforcing the idea that this painting was viewed not just as fine art but also as a document. The painting was separated from its large, ornate frame, the present location of which is unknown. The inscriptions at the top, identifying the cabinet members by name and/or position, were added, presumably from memory as opposed to documented fact, as not all of the men were in those positions at the same time in the shah's cabinet (Rettig 2014). A date was added to the lower left inscription. The major artist reworking involved the bottom flower-strewn ground, which was completely glazed over in green paint, including the flowers and the dated inscription in the lower left corner. A new inscription in white paint, differing only in the date, was added in the lower right corner.

At some time after the reworking at the bottom of the image and the addition of the inscriptions above the figures, the painting dimensions were reduced a final time. The top edge was folded through the cartouche of the center inscription, and the bottom edge was folded above the most severe canvas damages. It is possible that these damages were the impetus for this last restretching. The horizontal dimension was reduced as well and the new picture plane heavily varnished (fig. 10).

Although Ahmad Shah's painting had undergone considerable overall changes, its previous treatments were more restrained and localized. Patches, although numerous, were small and primarily of unprimed cotton fabric similar to the painting support, adhered with animal or synthetic glue. The primary instabilities were the large losses along the bottom edge and the fragile, raw fabric of the tacking edges. In the picture plane, the thin cotton fabric was saturated and largely overwhelmed by the oil paint layers. Paint damages were mostly due to creasing of the unstretched canvas or losses along tears. Overpaint was generally off-color, and additional accumulations of grime and varnish dulled and disfigured the image.

The numerous patches were removed mechanically. In many cases, the original fabric beneath the patch was intact, and it appeared that these patches had been used to counterbalance thick paint layers on the painting's recto. Other repairs mended tears, the most egregious being a long, stitched repair through a cabinet member's hat. On the verso, the stitching had been covered by a patch of preprimed canvas, and on the recto, the repair was visible through thick fill and overpaint as a pronounced suture line. After old repairs were removed, tears and weak areas of the canvas were mended individually with Japanese paper and Jade 403 adhesive. Losses along the bottom edges were compensated with inserts made from old patch fabrics that matched the original

Figure 7. *Prince Jalal al-din Mirza*, recto, detail of finely painted moustache, during cleaning

painting fabric. The inserts were held in place with paper mends. The large, previously sewn tear was mended with paper, then counterbalanced with a stiffer patch of PeCap fabric, attached with thin BEVA 371 film.

The original fabric seams, although thick and slightly distorted, appeared intact and strong. Poor sewing tension in the original seams was locked in place by the thick paint layers. The paint, which was the primary aspect of the painting construction, was flexible, but in places heavy, and needed additional support. The raw fabric at the tacking edges was weak and tattered and definitely needed support. There was no compelling need to line the painting overall. To preserve the original construction as much as possible, a hybrid panel stretcher with a padded surface was chosen to provide overall

Figure 8. *Prince Jalal al-din Mirza*, recto, before inpainting

support to the painting while accommodating the extra fabric at the seams. A heavy-duty keyed stretcher was fitted with an Alumacorr panel, composed of two thin aluminum faces with a corrugated plastic center. The edges of the back side of the panel were cut back to form a flange so that the panel could be set into the inside dimensions of the stretcher and the face metal rested on the stretcher face, forming a continuous flat support for the picture plane, but enabling the canvas tension to be adjusted by keying out the stretcher. The Alumacorr panel was fixed to the stretcher with bolts only through the stretcher cross members. The recessed bolt heads were covered with small Mylar disks adhered with BEVA to the panel face to create a smooth surface. The face of the Alumacorr support was padded with polyester felt adhered with Lascaux 498. The felt was attached in sections, leaving channels to accommodate the painting seams. A layer of Poly Suede fabric was loosely tacked over the padded panel (fig. 11). Strip linings of sheer Tergal polyester fabric were added to the painting edges with BEVA 371 film, attached far enough in from the verso edges to support all old fold lines. The painting was restretched to

Figure 9. *Ahmad Shah and His Cabinet*, recto, detail of fold lines, upper left corner. The green arrow shows the first stretching before the image was painted. The yellow arrows show the two folds to square the top and bottom edges, and the blue arrow shows the final fold before the painting surface was heavily varnished.

Figure 10. *Ahmad Shah and His Cabinet*, recto, detail top center during treatment, showing the last fold line through the center inscription and added varnish

match the original vertical fold lines, and the top and bottom folds were chosen so that the maximum area of the painted image was visible in a rectangular format. The painting was aligned on the stretcher so that the shah's eyes were level.

Understanding and treating the layers of grime, varnish, and restoration paint on *Ahmad Shah* was led primarily by physical clues, especially the generations of tacking folds and the varnish added after the last stretching. Paint on top of the last varnish was considered as not original and was removed.

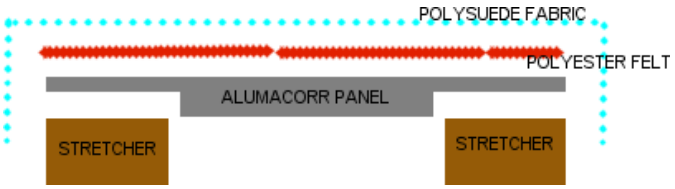

Figure 11. Cross section of the padded panel construction for *Ahmad Shah and His Cabinet*

Regardless of who added the inscriptions in the sky, they were now an essential part of this painting document and were to be retained. The partially covered inscription in the lower left was to be left as is (fig. 12). Some of the coatings and restoration paint could be addressed by solvent cleaning or mechanical removal, whereas other intractable areas had to be integrated by inpainting. Heavy black grime and two layers of discolored varnish were removed from the paint surface, along with overfill at large tear repairs and the large area of whitened overpaint in the sky (fig. 13). It appeared that the sky had been completely overpainted with a dirty gray-green color before the cartouches and inscriptions were added. Fortunately, this layer was resistant to solvents and

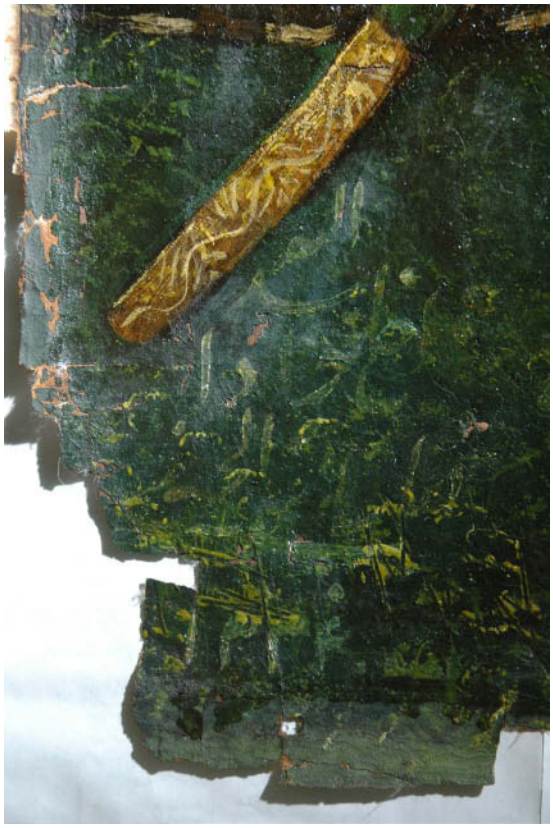

Figure 12. *Ahmad Shah and His Cabinet*, recto, detail of lower left inscription, before treatment

Figure 13. *Ahmad Shah and His Cabinet,* recto, during treatment. The right side of the painting has been cleaned.

Figure 14. *Ahmad Shah and His Cabinet*, recto, before inpainting

was left in place, along with the inscriptions on top of it. After cleaning was completed, the painting was varnished overall with Paraloid B-72, 10% in xylene, wiped over the surface with a soft pad to limit saturation of the fabric. As with the prince's painting, losses were filled with Beckers Spackel and inpainting undertaken using pigments in acrylic or aldehyde resin (fig. 14). Inpainting objectives were to limit the distractions of losses and damages rather than presenting an intact surface. For example, in areas where paint had been transferred during a time in the past when the painting had been folded on itself, the loss was not filled, but inpainting was done so that the transferred paint and corresponding loss were not visually jarring. Other areas that appeared to be later reworking included white lines added to some of the faces (fig. 15). Considering that these white lines may have been contemporary with the inscriptions, they were left in place but inpainted so that they were not as visually distracting. Pentimenti from the artist's changes in the sword and ground were not completely inpainted but only to the point where they would not confuse the image. The first inscription at the bottom left was allowed to remain slightly visible.

Figure 15. *Ahmad Shah and His Cabinet*, recto, detail of white lines in faces before treatment

4. CONCLUSION

In painting conservation, the physical aspects of the painting can become the focus, as in the portrait of Prince Jalal al-din, which required reversal of extensive previous treatment,

followed by a comprehensive retreatment. However, use of the painting through time can influence the conservation approach, as in the portrait of Ahmad Shah with its later inscriptions. It is unknown whether the identifying inscriptions in the sky and the changed bottom inscriptions were undertaken by the artist or by another hand, but their inclusion has changed the painting from solely an image to an historical document, requiring modifications to the painting treatment approach. Careful examination and documentation add the decisions which were made in the current treatments to the history of these paintings so that they may continue to have a life beyond their canvas, techniques, and treatments, bearing witness to the people of the past and connecting them to the viewer of today.

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NOTE

1. Mini humidity chambers were made with clear plastic storage bins sold as drawer organizers. A hole is drilled in the bottom of the bin to accommodate a short bolt. Pieces of blotter paper cut slightly smaller than the inner dimensions of the bin bottom are held in place with the bolt and a nut. The blotter is dampened and the container turned face down over the area to be humidified. Because the moisture source is suspended above the area to be humidified, and the blotter does not touch the sides of the bin, moisture does not drip down the walls of the chamber.

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Rettig, S. 2014. Personal communication. Assistant curator of Islamic Art for the Arthur M. Sackler Gallery, Smithsonian Institution, Washington DC.

SUPPLIERS

Alumacorr Panel
Nudo
http://www.nudo.com

PeCap Fabric
Tetko
333 S. Highland Ave.
Briarcliff Manor, NY 10510

Polyester Felt and Poly Suede Fabric
Distributed by Testfabrics, Inc.
415 Delaware Ave.
PO Box 26
West Pittston, PA 18643
Tel.: 570-603-0432

Sunbrella Canvas
Distributed by Museum Services Corporation
385 Bridgeport Dr.
South Saint Paul, MN 55075
Tel.: 800-672-1107

Tergal
Western Textile Fabric
Made in France (no longer in production)

UVS Varnish
Conservator's Products Company
PO Box 601
Flanders, NJ 07836
Tel.: 973-972-4855

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BILL WEI, MODERATOR

"Discolored. Now What?" A Socratic Dialogue

The removal of a strongly yellowed varnish, the removal of the traces of corrosion caused by pigeon droppings on a bronze statue, bringing back original color and appearance. These are decisions that professionals make every day—decisions on the conservation, preservation, and restoration of objects in the broadest sense of the word, be it museum objects, parts of historic buildings, or entire buildings. Heated discussions still occur about which objects may be treated and exhibited or not—this since the "cleaning controversy" related to the "scientifically responsible" removal of yellowed varnishes at the National Gallery in London after the Second World War. How may an object be treated, and what is an acceptable result? Has the object become what it is supposed to be?

Color and discoloration/fading play an important role in such discussions and the resulting conservation decisions. Color is an important part of the original appearance of an object, and the question is then, which color is the "right" one after restoration? What is a good interpretation of color? Thus, what is a good restoration with regard to color? Or, should the object be left in its discolored state?

Such questions are certain to continue to incite lively discussions. However, it is often useful to step back and ask what the essence of the debate is, and why such restoration decisions are so controversial. To do this, a Socratic dialogue was held during the 2018 meeting, continuing a series of such dialogues at AIC annual meetings. Working in small groups and using a form of dialogue known as the "Short Speech," participants first presented their own views on the role of color, discoloration, and fading in conservation decisions, without any immediate response from the other members of the group. They then investigated each other's experience, opinions, and concerns with color and discoloration of objects, making use of open, "nonjudgmental" questions. The goal was to listen and understand, not to convince.

The participants initially found it difficult to formulate open, nonjudgmental questions, but through the session, this became easier. This way of questioning provided a safe, open environment for participants to investigate the essence behind these issues and to understand their own points of view, as well as those of others. It provided a solid foundation for thinking about and understanding how they deal with discoloration and how this understanding might help us in making treatment decisions in the future.

At the end of the session, each participant was asked to write down in one sentence about what the essence of the dialogue was for them, what they took away from the dialogue. The list of essences follows.

ESSENCES

1. What is discoloration?
2. What is "real" color?
3. Is it really discolored?
4. There is value in discoloration, so it must be carefully evaluated prior to removal.
5. Who says what "real" color is?
6. How the digitalize makes different?
7. The client may think something is discolored while the conservator does not or does not suggest alteration.
8. It is challenging to make the right diagnosis!
9. Despite our different training backgrounds, our approach to the reduction or removal of discoloration is similar as we seek truth—whether materiality based or artist driven.
10. "Discoloration" is a term too vast, with too many meanings to be addressed in 2 hours!
11. It is difficult to ask open-ended questions. We are used to inserting biases or directions.
12. The topic of discoloration is very complex, and degrees of discoloration removal [are] dependent on the object, curators, scientists, and conservators.
13. Our group's opinions varied regarding the degree of the conservator asserting their opinions.
14. Conservators really like to go into treatment details. So this is hard.
15. There is room for more Socratic dialogue at work.

16. Each discoloration is individual, but I see a commonality in approaches. Research, consultation, decision.
17. Reconfirmed that regardless of discipline, we all approach the problem with the same basic philosophy.
18. The approaches to discoloration are philosophically similar though evolving with current technology—not conservation specialty dependent or American/European trained.
19. The future holds more options and choices for compensations of damages and changes.
20. The many questions on hanging a 3-D reconstruction in a museum inspired me on how difficult this issue is.
21. New ideas about the use of replicas, of how far you can/would go with treatment, and sometimes doing nothing is better!

ROXANE SPERBER

Deciphering Intention from Aging: The Use of Archival Material in the Study and Treatment of *Winifred Dysart* by George Fuller

ABSTRACT

The treatment of Winifred Dysart *by George Fuller (1822–1884) (fig. 1), from the collection of the Worcester Art Museum, illustrates how archival material can inform conservation treatment. The artist's technique made it difficult to distinguish intention from the effects of aging, raising questions about the appearance of the yellowed varnish, areas of abrasion, and artist's reworking. Technical analysis and archival material illuminated answers to these questions and allowed for a successful treatment to be undertaken.*

1. INTRODUCTION

The treatment of *Winifred Dysart* by George Fuller (1822–1884), from the collection of the Worcester Art Museum, exemplifies the importance of material study to conservation treatment. George was an important Massachusetts artist in the late 19th century, and his work is well represented in New England collections. However, little research about his technique has been published, and the confusing condition of his works leaves them rarely exhibited.

Several aspects of George's technique, used to paint *Winifred Dysart*, posed challenges when attempting to decipher aging from intention. Three questions in particular drove the treatment and investigation: What was the intended appearance of the varnish? How can the artist's technique of scraping the paint be differentiated from later abrasion? And last, what was the intended appearance of the artist's reworking? Technical analysis and archival material illuminated answers to these questions and allowed for a successful treatment to be undertaken.

2. BIOGRAPHICAL OUTLINE

George began his artistic career in 1841, when he traveled with his half-brother Augustus around New York as an itinerant portrait painter (Guide to the Fuller-Higginson Family Papers, n.d.). He made three trips to the Antebellum South between 1849 and 1858, where he attempted to secure portrait commissions from wealthy white patrons and drew sketches of the enslaved black community (Burns 1983). In 1859, George returned to his family farm in Deerfield, Massachusetts, where he took over operations after his father's death (Colbert 2011, 186). In 1860, he traveled to Europe for 6 months, but in the decade and a half that followed George's painting, production significantly decreased (National Gallery of Art, n.d.).

In 1876, he resumed exhibiting his work and continued to do so until his death from pneumonia in 1884. The last 8 years of George's life were prolific and marked a shift toward exploring the mystical and psychological aspects of his subject matter. It was during this period that he painted *Winifred Dysart*.

The artistic community in Boston was shocked and saddened at George's premature death (Enneking 1886). He was an active member of the community, often soliciting advice from fellow artists (Enneking 1886). He had a following of young artists who admired his work (Millet 1886a). A memorial exhibition of 175 of his paintings was mounted at the Museum of Fine Arts, Boston after his death (Flynt 1997). A volume of essays by artists was also compiled to celebrate the artist's life and works (Millet 1886b). This volume provides important insights into the artist's working practice.

George was described by prominent 19th-century art critic Mariana van Rensselaer (1884) as an artist "like whom there has never been another, and whom the future … can never reproduce" (159). However, in the years since his death, his notoriety has faded. Although represented in many prominent collections, his paintings are rarely displayed, largely due to their poor condition.

Figure 1. George Fuller, *Winifred Dysart* (1881), oil on canvas, 50 ¼ × 40 ½ in. (127.6 × 102.9 cm), before treatment, Worcester Art Museum, museum purchase, 1910.31, courtesy of the Worcester Art Museum

Figure 2. George Fuller, *Hoeing Tobacco* (1876–1884), oil on canvas, 24 1/8 × 18 1/16 in. (61.3 × 45.9 cm), Worcester Art Museum, Theodore T. and Mary G. Ellis Collection, 1940.88, courtesy of the Worcester Art Museum

3. GEORGE'S "SULFURIC YELLOW TONE"

Existing research into George's technique focuses on the altered appearance of his paintings due to the deterioration of glazes. Mayer and Myers (2013) have noted that excessive use of glazing created a stunning effect that was admired in his lifetime, but gradually deteriorated, transforming transparent layers into dark yellow, opaque films.

However, even during George's lifetime, critics and observers responded to the yellow appearance of his paintings, suggesting that this effect was not entirely a result of aging. Fellow artist John Enneking (1841–1916) wrote that George "often carried the rich, deep yellow tone to the extreme" (78). Van Rensselaer (1883) described his works as having a "soft golden hue" with "subdued yet glowing color" (231–232). A less admiring New York critic described one painting as evoking an "Ante-Chamber of Hell" due to its "sulfuric yellow tone" (Enneking 1886, 78). Although none of these comments describe *Winifred Dysart*, they illustrate George's interest in creating tonal atmosphere in his paintings.[1]

In *Haunted Visions: Spiritualism and American Art*, Colbert (2011) discusses George's growing interest in spiritualism during his late period, defined as 1876 until the end of his life. George regularly attended séances, and the eerie tone created in his paintings reflected this growing fascination (fig. 2). Colbert (2011) explains this transformation as "a shift away from the straightforward portraiture and genre of his early career toward subjects of a more poetic nature, including an array of witches and solitary damsels who enhance the mystery of the setting" (186).

George also became interested in Romantic literature and on several occasions named his paintings after characters in the literary works by George Eliot, Nathaniel Hawthorne, and Edward Bulwer-Lytton.[2] He rarely set out to illustrate these characters. Instead, he painted figures from his mind's eye and subsequently named them after Romantic heroines

(Burns 1981). Similarly, *Winifred Dysart* is not a portrait of a girl by that name. She is a creation from George's imagination with an invented title (Enneking 1886). *Winifred Dysart* confounded critics who were sure that she must be one of Hawthorne's characters but could not place from which work (Van Rensselaer 1883).

Burns (1983) has argued that the connection between George and Hawthorne is primarily a tonal one. George's pictorial effects evoke the same murky atmosphere of Hawthorne's writing. "Fuller was less interested in reconstructing colonial history than in evoking the psychological tone of the Puritan witch-hunt. The deep shadows and yellow highlights in the painting effectively serve this expressive purpose," writes Burns (1983, 128). She observes that the "somber greenish haze pervading the atmosphere is a veil that casts a suggestion of mystery over the simple scene … Looking at [*And She Was a Witch*] is like peering into a very cloudy aquarium and trying the glimpse the fish as the glide through the gloom" (1983, 126).

George's murky, yellow tones can thus be understood as a means of communicating emotion or a psychological state. The effect is uncomfortable, even irritating, to the viewer, frustrating one's ability to make sense of the scene. No doubt, discoloration of the glazes and varnish has accentuated these effects, but they are in many cases fully intentional. A comprehensive study to determine exactly how George achieved this murky hazy was beyond the scope of this project but would be an important step toward better understanding this artist and conserving these complex paintings.

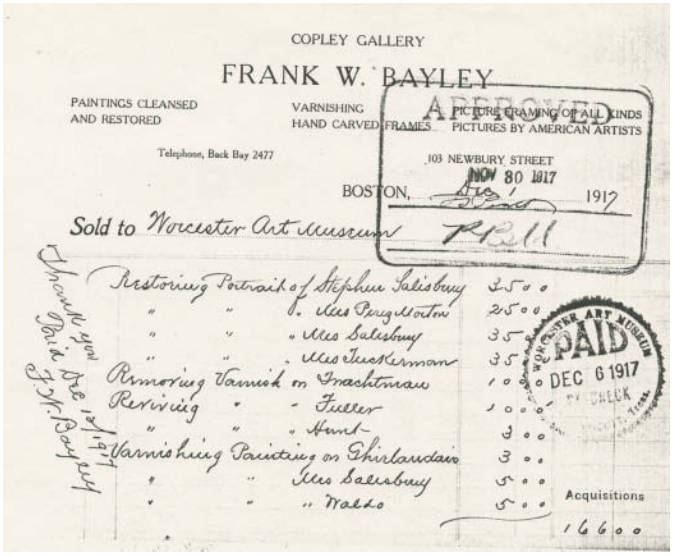
4. INTENDED APPEARANCE OF THE VARNISH: INTENTIONALLY YELLOW OR DEGRADED?

Keeping in mind George's interest in experimental tonal effects, the treatment of *Winifred Dysart* proceeded with caution. An informal survey of George's paintings in New England collections found that the degree to which this murky tone was employed varied from painting to painting. It was especially notable in his genre scenes, but in the works most closely related to *Winifred Dysart*, three-quarter-length portraits of young women painted in the early 1880s, the varnishes were evenly applied and did not appear to be tinted intentionally.[3]

Ethel Reynolds Clarke, from the Museum of Fine Art, Boston, and *Mary Chickering*, from the Yale University Art Gallery, are comparable works, both of which have original varnishes. Both pictures have distinctly yellow tones, exaggerated by degraded varnish, but the tenor of these paintings seems to belong more to the "subtle glowing color" category than the "sulfuric yellow tone." George used a limited palette, including plenty of yellow pigment, to convey a soft muted tone. But there is little indication that the evenly applied, saturating varnish was designed to enhance this effect.

It is impossible to know exactly how George would have reacted to the aging of his paintings. However, a description of *Winifred Dysart* from 2 years after its completion confirms that the painting originally had a "delicate grayish harmony" and that Winifred's frock was a "pale greyish-lilac" color (Van Rensselaer 1883, 229, 232). In fact, *Winifred Dysart* was praised for being "the most delicately and rarely colored" of George's paintings (Van Rensselaer 1883, 232). The aged condition of the varnish, which had become dark, murky, and dull, masked the cool gray tones of the figure that were intended to contrast the golden hue of the sunset.

Further archival research found that the varnish on the painting was not George's original varnish. A receipt from Frank W. Bayley to the Worcester Art Museum, dated 1917, states that the varnish was "revived" in that year (fig. 3). Although it is difficult to know exactly what is meant by "revived," cleaning abrasion is also present that was not visible in a photograph of the work taken between 1900 and 1912. This suggests that the varnish was probably removed and the glazes abraded at this time. The varnish present on the painting before the recent treatment was likely also applied at this time.


COPLEY GALLERY

FRANK W. BAYLEY

PAINTINGS CLEANSED AND RESTORED

VARNISHING HAND CARVED FRAMES

PICTURE FRAMING OF ALL KINDS PICTURES BY AMERICAN ARTISTS

Telephone, Back Bay 2477

103 NEWBURY STREET

BOSTON, 1917

APPROVED NOV 30 1917

Sold to Worcester Art Museum

Restoring Portrait of Stephen Salisbury 35 00

" " " Miss Pengilly 25 00

" " " Miss Salisbury 35 00

" " " Miss Tuckerman 35 00

Removing Varnish on Frachtmann 10 00

Reviving " " Fuller 10 00

" " " Hunt 3 00

Varnishing Painting on Thirlandais 3 00

" " Miss Salisbury 5 00

" " " Waldo 5 00

Acquisitions 166 00

PAID DEC 6 1917 BY CHECK

Figure 3. Receipt from Frank W. Bayley to the Worcester Art Museum (1917), courtesy of the Worcester Art Museum

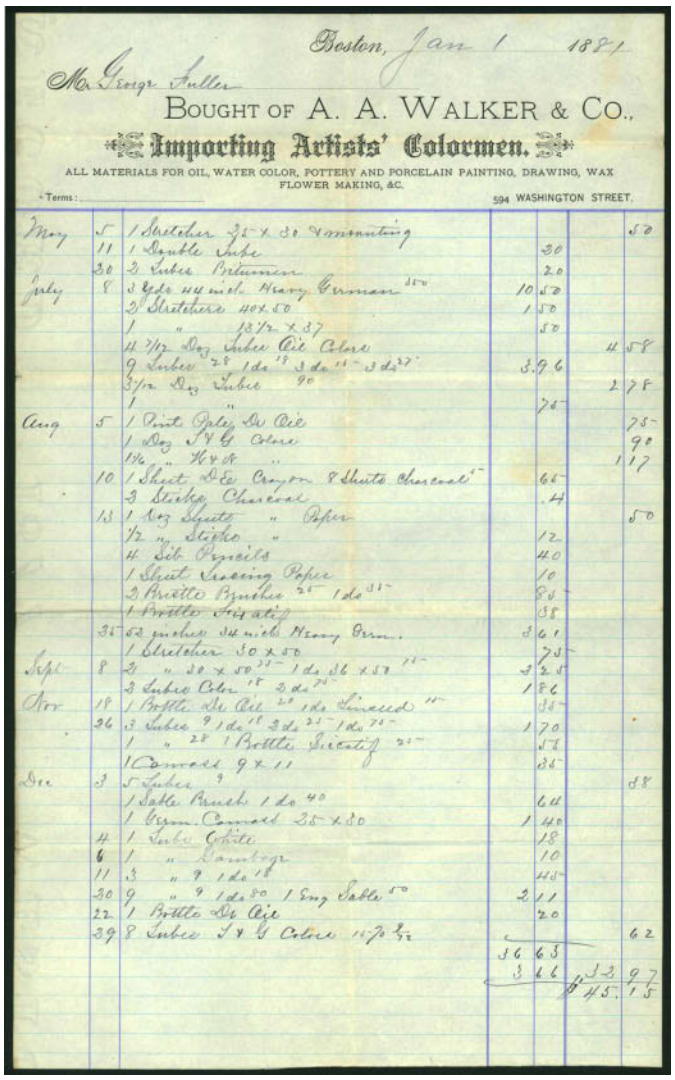
Given the primary source documentation of the intended appearance of the painting, and the presence of a discolored, nonoriginal varnish, the decision was taken to carry out a varnish removal using carefully tailored solvent gels to remove the varnish without disrupting George's glazes. Visual examination of a cross section sample showed that there was a clear interface between the varnish and paint layers. The paint layers did not fluoresce under UV illumination, suggesting that they were not resinous in nature. After varnish removal, the color shift was subtle but restored the gray balance the painting was praised for when first exhibited.

5. INTENDED LEVEL OF ABRASION: ARTIST'S TECHNIQUE OR CLEANING ABRASION?

Another aspect of George's painting technique is his use of layering, scraping, and scribbling to create texture. From early in his career, George was interested in texturing his paint. There are numerous examples in which he scraped partially dry layers of paint, sometimes all the way to the ground. In other cases, he used a coarse bristle brush to create texture in the flesh or scribbled vigorously into the paint with the back of a brush.

George procured materials that aided him in creating texture. A painting, now in the collection of the Memorial Hall Museum in Deerfield, is on the rough verso of an early linoleum tile. A receipt from George's account with Boston colorman A. A. Walker, dated January 1, 1881, documents purchases made between May 5 and December 29, 1880 (fig. 4). On July 8, the artist purchased 3 yd. of "Heavy German canvas" at the same time as a stretcher that matched the size of *Winifred Dysart* (50 × 40 in.).[4] Coarse canvas was integral to George's technique, as it allowed him to utilize the topography of the canvas weave to create texture in his paint.

George seems to have reacted viscerally to the image before him, practically sculpting his creations from paint. Enneking (1886) wrote of his process: "[W]hen he got too realistic an expression of what he had before him he would take the end of his brush and soften all too strongly defined lines by rubbing back and forth over them until the face grew into something veiled and suggestive" (77). George himself was quoted as saying, "I am much controlled by the work before me, being greatly influenced by suggestions which come through much scraping off, glazing, scumbling, etc." (Van Rensselaer 1883, 231). This interest in texture and the materiality of paint foreshadows the work of 20th-century artists who were driven to explore paint's materiality as an entity in and of itself.



Boston, Jan 1 1881

Mr George Fuller

Bought of A. A. Walker & Co.,

Importing Artists' Colormen.

ALL MATERIALS FOR OIL, WATER COLOR, POTTERY AND PORCELAIN PAINTING, DRAWING, WAX FLOWER MAKING, &C.

Terms:

594 WASHINGTON STREET.

May	5	1 Stretcher 25 × 30 & mounting			50
	11	1 Double Tube		30	
	30	2 Tubes Bitumen		20	
July	8	3 Yds 44 inch Heavy German	300	10	50
		2 Stretchers 40 × 50		1	50
		1 " 18½ × 37			50
		11 ½ Doz Tubes Oil Colors			4	58
		9 Tubes 28 1 do 15 3 do 11 3 do 37		3	96
		3/4 Doz Tubes 90			2	78
		1 "		75	
Aug	5	1 Pint Poly De Oil			75
		1 Doz 1 & 1 Colors			90
		1¼ " ½ & 8 "			1	17
	10	1 Sheet Dec Crayon 8 Sheets Charcoal 50		65	
		3 Stubbs Charcoal		4	
	13	1 Doz Sheets " Paper			50
		½ " Stubbs "		12	
		4 Sit Pencils		40	
		1 Sheet Tracing Paper		10	
		2 Bristle Brushes 25 1 do 35		85	
		1 Bottle Sicatif		38	
	25	52 inches 54 inch Heavy Germ.		3	61
		1 Stretcher 30 × 50		75	
Sept	8	2 " 30 × 50 25 1 do 36 × 50 75		3	25
		3 Tubes Color 15 2 do 24		1	86
Nov	18	1 Bottle De Oil 20 1 do Linseed 16		36	
	26	3 Tubes 9 1 do 18 2 do 24 1 do 75		1	70
		1 " 28 1 Bottle Siccatif 21		52	
		1 Canvas 9 × 11		36	
Dec	3	5 Tubes 9			88
		1 Sable Brush 1 do 40		64	
		1 Prim. Canvas 25 × 30		1	40
	4	1 Tube White		18	
	6	1 " Lamblack		10	
	11	3 " 9 1 do 18		45	
	20	9 " 9 1 do 30 1 Eng Sable 50		2	11
	22	1 Bottle De Oil		20	
	29	8 Tubes 1 & 1 Colors 1½ 3/4			62
				36 63	
				3 46	
					32 97
					45 15

Figure 4. George Fuller account receipt from A. A. Walker & Co. (1881), courtesy of Pocumtuck Valley Memorial Association Library, Deerfield, Massachusetts

It is clear that George reveled in the use of scribbling, scratching, and scraping on *Winifred Dysart*. He created texture in the skin and dress by scribbling with the back of a paint brush (fig. 5) and scraping with a palette knife (fig. 6). However, areas of the work, including the cheek and background, were abraded in a way that was inconsistent with the composition. The texture made it difficult to distinguish intentional scraping from abrasion. Additionally, there were dark spots in the arm and neck that looked like they may have been a result of scraping but did not make sense with the composition.

An early photograph taken between 1900 and 1912 by the Detroit Publishing Company (fig. 7) was helpful in

Figure 5. George Fuller, *Winifred Dysart*, detail of flesh paint

differentiating between intended scraping and accidental cleaning abrasion in areas such as the cheek and background where abrasion did not correspond to compositional elements (fig. 8). This photograph shows the painting in the condition before the 1917 treatment that abraded the paint. Further, the photograph made clear that dark spots on the neck and arm of the figure were not an underlying layer that was revealed through scraping but the effect of ground staining[5] (fig. 9). The early photograph, as well as an engraving of the painting by W. B. Closson (1848–1946) (fig. 10), guided the retouching and allowed intentional scraping to be clearly distinguished from abrasion.

Figure 6. George Fuller, *Winifred Dysart*, detail of dress

Figure 7. Detroit Publishing Company, *Winifred Dysart, Full-Length Portrait* (1900–1912), photographic print, 6.5 × 8.5 in. (16.5 × 21.6 cm), Deerfield Memorial Museum, courtesy of the Pocumtuck Valley Memorial Association, Memorial Hall Museum, Deerfield, Massachusetts

6. INTENDED APPEARANCE OF THE ARTIST'S REWORKING

The process of painting *Winifred Dysart* was not a simple one. The work was first exhibited in New York at the National Academy of Design's 56th annual exhibition in 1881. The work is described as one of a "dreamy picture, full of twilight haze, out of which looks a sweet-faced girl" (Kurtz 1881, 46). Included in the exhibition notes is a rough sketch of the painting by George.

Given that George frequently spent the summer in the Deerfield countryside, he almost certainly painted the work in the summer of 1880. The receipt for the canvas and stretcher matching the dimensions of *Winifred Dysart* were purchased July 8 of that year, suggesting that he purchased his supplies in Boston before traveling west to Deerfield.[6]

According to Enneking (1886), George started the painting on his farm in Deerfield and brought it back to his studio in Boston "nearly completed." Once back in Boston, he

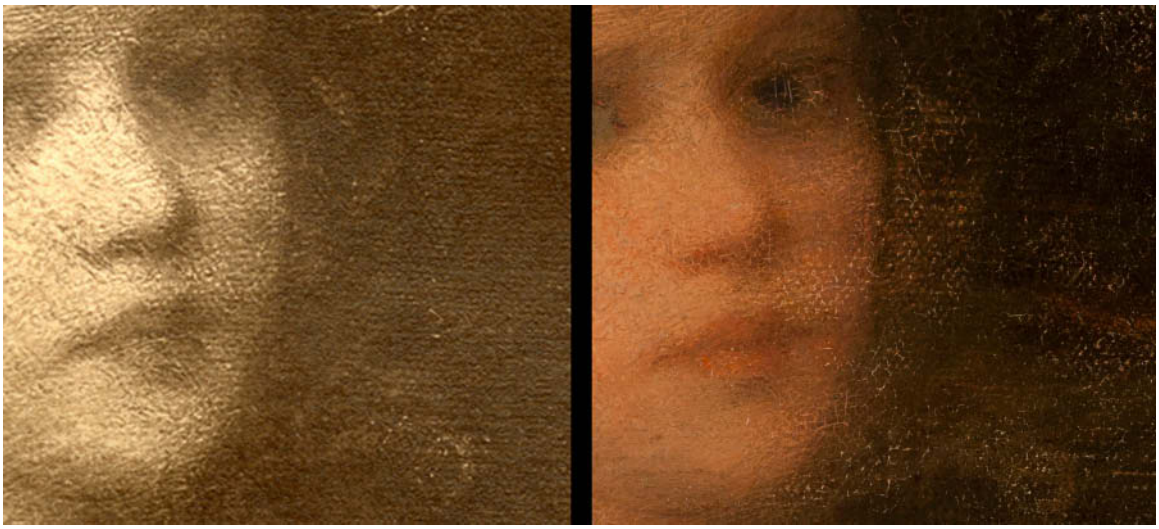


Figure 8. *Winifred Dysart, Full-Length Portrait*, photographic print, detail of face (left); *Winifred Dysart*, oil on canvas, detail of face (right)

consulted fellow artists and made changes to the work. The description by Enneking (1886) of George's practice is illuminating with regard to his working process, as well as to the intended appearance of the reworking on *Winifred Dysart*:

> [W]hen he brought the then unnamed picture, nearly completed, from Deerfield, th e girl held lilies in her hand, somewhat stiffly and awkwardly. His friends admired the lovely face, which was finished and never afterwards changed, but were not satisfied with the position of the hands and the importance of the lilies. Some time after, when they were again criticized, Fuller asked what he should do with the hands, for he said he had had them in almost every position imaginable. It was then suggested that he had better cut them off, for the Venus of Milo must have gained immensely by losing hers. Fuller, who always

Figure 9. *Winifred Dysart, Full-Length Portrait*, photographic print, detail of arm (left); *Winifred Dysart*, oil on canvas, detail of arm (right)

Figure 10. William Baxter Palmer Closson after George Fuller, *Winifred Dysart* (1880), wood engraving on Japanese paper, 7 7/8 × 6 1/8 in. (20 × 15.5 cm), Worcester Art Museum, Charles E. Goodspeed Collection, 1910.48.675, courtesy of the Worcester Art Museum

> had a box of crayons handy, took a few pieces and painted out the arms, hands, and lilies. The change produced was great. The face, which before had shared attention, now beamed forth in all its innocent sweetness and rustic beauty. But what next? Was the question. After various propositions and considerable discussion, one of the artists had a brilliant idea. He procured a bit of drapery, tied it around his waist, and tried to impersonate a timid you girl pulling and twisting the ends of her apron. Fuller considered the idea a capital one, and at once put it on the canvas, making the artist pose. We had little faith that this change would be adopted, but he was so much pleased that he developed it until he succeeded in working out the graceful and natural movement the figure in the picture now possesses. (74–75)

This passage beautifully illustrates George's dynamic, even performative, process. He was constantly reacting to shifts in his compositions—be it to the discoveries made through the scraping of paint or to the impulsive reworking at the suggestion of his fellow artists. An x-ray radiograph of *Winifred Dysart*

Figure 11. George Fuller, *Winifred Dysart*, x-ray radiograph, courtesy of the Worcester Art Museum

(fig. 11) confirmed that the changes described by Enneking were made to the arm and lilies, although it does not appear that George had the hands "in almost every position imaginable."

More pertinent for the treatment was Enneking's description of George's use of "crayons," most likely oil crayons, to make hasty adjustments while his fellow artists critiqued the composition. This explained the confusing appearance of the right side of the image, where *pentimenti* had been blocked out with a mismatched color (fig. 12). The distracting effect of the mismatched color was exacerbated by the 1917 treatment that endeavored to remove the reworking, leaving it abraded. Although it is understandable that a conservator may have mistaken the hasty reworking for later retouching, the partial removal left the area confused.

The recent treatment addressed this damage, referencing Enneking's description and the historical photograph, to reintegrate the abraded reworking through retouching (fig. 13). The retouching aimed to reconstruct George's reworking, however mismatched, thus integrating the area to appear as it would have looked before the cleaning abrasion in the early 20th century.

Figure 12. George Fuller, *Winifred Dysart*, detail of the artist's reworking

7. CONCLUSION

The treatment of *Winifred Dysart* restored the cool tones of the figure that contrasted the warm sunset, retouched abraded areas, and reintegrated the artist's reworking (fig. 14). This treatment would not have been possible without the guidance of archival material that clarified the physical history of the object and informed the decision-making process. Although caution is necessary when deciphering the intended appearance of such complicated paintings, the reward of returning his works to museum walls is gratifying.

Figure 14. George Fuller, *Winifred Dysart*, after treatment

Figure 13. George Fuller, *Winifred Dysart*, detail of abraded reworking, before treatment (left) and after treatment (right)

NOTES

1. Examples of works that obviously exhibit this effect include *Bringing Home the Geese* (Yale University Art Gallery), *Hoeing Tobacco* (Worcester Art Museum), and *And She Was a Witch* (Metropolitan Museum of Art).
2. Examples of this are *Nydia* (Metropolitan Museum of Art) after a heroine from Edward Bulwer-Lytton's *The Last Days of Pompeii*; *Fedalma* (Smithsonian American Art Museum) after the heroine of George Eliot's poem, *The Spanish Gypsy*; and *Priscilla Fauntleroy* (Lyman Allyn Art Museum) after a character from Nathaniel Hawthorne's *The Blithedale Romance*.
3. *Mary Chickering* (1883), 50 × 36 in., Yale University Art Gallery and *Ethel Reynolds Clarke* (1883), 44 × 30 1/8 in., Museum of Fine Arts, Boston.
4. Fuller-Higginson Family Papers Archive (n.d.) (box 16, folder 8).
5. Similar ground staining was also observed on *Ethel Reynolds Clarke* (Museum of Fine Arts, Boston). I am grateful to Charlotte Ameringer for drawing my attention to this.
6. George's account with A. A. Walker, receipt dated January 1881, which documents purchases made from May 5 to December 29, 1880. Fuller-Higginson Family Papers Archive (n.d.) (box 16, folder 8). From existing receipts in the Fuller archive, it appears that the artist purchased most of his supplies at specialized colormen in Boston, where he had accounts. However, occasional receipts from A. G. Miner in Greenfield, Massachusetts, just north of Deerfield, suggest that he would go there to restock his pigments, medium, turpentine, and brushes.

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Back to Blakelock: Casting New Light on Historic Technical Studies of Paintings by Ralph Albert Blakelock

ABSTRACT

Ralph Albert Blakelock was an American landscape artist (1847–1919) famous for his paintings of moonlit Western landscapes painted in the late 1880s and early 1890s. Prices for his paintings soared, and forgeries quickly multiplied after he was institutionalized with mental illness in 1899. In the present day, his works are seldom exhibited due to condition issues and concerns about authenticity. Beginning in 1969, Norman Geske, former director of the Sheldon Memorial Art Gallery at the University of Nebraska, and his team worked toward resolving the latter problem. They supplemented provenance research and documentation with systematic examination of the paintings, including neutron-activation autoradiography of several dozen works, a technique that was first applied to the study of paintings just a few years earlier. The Yale University Art Gallery's acquisition of *Moonlight* (ca. 1888), a Blakelock painting studied by Geske's team and considered to have excellent provenance, represented a unique opportunity to revisit the examination and analysis of this painting and Ralph's mature oeuvre.

Based on detailed examination of painting technique and materials of *Moonlight* and two moonlit landscape paintings from the Brooklyn Museum and the Metropolitan Museum of Art, as well as close observation of other paintings from these and other collections, we propose new criteria for attributing paintings to Blakelock and begin connecting condition issues to material choice and use. To convey depth and subtle tones, Blakelock alternated numerous medium-rich transparent and pigmented translucent or opaque paint layers. The aging of the natural resin component in the paint layers contributed to the darkening of *Moonlight*, although the degree to which Blakelock may have anticipated and desired this is difficult to gauge. In addition to contributing to darkening, the resin content of the paint films has impacted the films' mechanical properties, resulting in brittleness. The presence of resin-rich top layers also has important implications for solvent-based varnish removal or thinning treatments.

This paper utilizes a suite of imaging and instrumental analysis techniques (multispectral imaging, x-ray radiography, x-ray fluorescence spectroscopy spot measurements and large area mapping, Raman and infrared spectroscopies, pyrolysis–gas chromatography–mass spectrometry, and scanning electron microscopy–energy dispersive x-ray spectroscopy) to study *Moonlight* comprehensively, in the spirit of Geske and his team. Large-area elemental mapping using micro-x-ray fluorescence spectroscopy, motivated by the desire to visualize a newly identified female portrait under the landscape, also helped clarify the paint application sequence in the landscape, especially at the boundary of the sky and tree foliage. The many thin layers used by Blakelock for his compositions, however, complicate the inference of specific pigments from nondestructive elemental analyses; as a result, cross sections have proven highly valuable for visualizing layer stratigraphy, as well as for enabling pigment identification. These results, in combination with large-area elemental maps, can now serve to revisit neutron-activation autoradiography results from the 1970s and reinvigorate scholarship and presentation of Blakelock's moonlit landscapes.

ESTHER VAN DUIJN

An American in Amsterdam: The Relevance of the Louis Pomerantz Papers for the Conservation History of the Paintings Collection at the Rijksmuseum in Amsterdam

ABSTRACT

During her 3-year research project into the conservation history of the paintings collection of the Rijksmuseum Amsterdam, the author discovered that the American restorer Louis Pomerantz (1919–1988) received training in the paintings restoration studio of the Rijksmuseum in Amsterdam between October 1950 and August 1951. At that time, Henricus Hubertus Mertens (1905–1981) was head of the studio. Even though Mertens's career as restorer at the Rijksmuseum would eventually span 40 years, we know little about the methods and materials he employed for his treatments; he documented very little. However, Pomerantz, during his training, kept an extensive and lavishly illustrated notebook that is now part of the Pomerantz Papers in the Smithsonian Archives of American Art in Washington, DC. This notebook provided invaluable information for the study of conservation history of the Rijksmuseum.

1. INTRODUCTION

Between 2016 and 2018, two masterpieces that Rembrandt painted in 1634 were studied and treated in the paintings conservation studio of the Rijksmuseum in Amsterdam: the *Portraits of Marten Soolmans* and *Oopjen Coppit*, jointly owned by the Rijksmuseum and the Musée du Louvre since 2015 (Noble et al. 2018, 309–345). At that time, the author of this work was carrying out a research project, studying the conservation history of the paintings collection of the Rijksmuseum.[1] Considering that both paintings had already been restored at the Rijksmuseum by chief paintings restorer Henricus Hubertus Mertens in April–May 1956, the author focused part of her research project on Mertens and the materials and techniques that he had employed during his career.[2] The results would aid the conservators working on *Marten* and *Oopjen* to better understand the condition of the paintings. It would also help the conservation scientists with their interpretation of analytical data and the art historians in their visual understanding the paintings. Considering that Mertens's career spanned 40 years, this research focus would provide important information about the conservation of other works in the collection as well; he worked on or supervised the treatment of the majority of the Rijksmuseum paintings.

2. HENRICUS HUBERTUS MERTENS (1905–1981)

As a young artist, Mertens traveled from the south of the country to Amsterdam to complete his artistic career with training at the State Institute for the Training of Art Teachers (*Ryks Instituut tot opleiding van Teekenleeraren*).[3] This institute was located in the so-called Drawing School (*Teekenschool*), a building situated in the gardens of the Rijksmuseum. For unknown reasons, but possibly fueled by the economic depression, Mertens applied for the position of paintings restorer that became available in the summer of 1930, when former restorer Pieter Nicolaas Bakker (1882–1940) left the museum, officially on account of his mental health but in reality under incriminating circumstances (Van Duijn 2018, 354–355). It is unknown if Mertens had previous experience as a restorer; he did not receive training from Bakker, as he had left months before Mertens, who started on September 15 (fig. 1). We know that Rijksmuseum director Frederik Schmidt-Degener (1881–1941) was very happy with Mertens's work. In November 1930, after a 2-month trial period, he wrote to the minister, "Based on the restorations in the Rijksmuseum assigned to him, I could repeatedly appreciate his taste, insight and diligence, so that I would regard his presence at the Rijksmuseum as an asset."[4]

Figure 1. Rijksmuseum staff photo of Mertens. ©Rijksmuseum Amsterdam.

Mertens was responsible for the "artistic" work on paintings. Usually, he carried out the (partial) removal of varnish layers and old overpaint, as well as the application of new varnish layers, fillings, and retouchings. His colleague Christiaan Hendrik Jenner (1896–1977), originally a carpenter, carried out structural work on paintings, such as wax-resin linings or structural work on panels (Van Duijn 2017, 4–5). Until well after the Second World War, the paintings restoration studio of the Rijksmuseum consisted of these two men. They quietly and conscientiously did their job behind the scenes of the museum and received very little public attention. This changed when in 1945 Rembrandt's iconic masterpiece, *The Night Watch* (1642), was restored. Coming back from a 6-year wartime evacuation, the painting needed extensive treatment (Van Duijn and Filedt Kok 2016, 117–119). Jenner carried out a wax-resin relining between October and December 1945, and over the next 2 years, Mertens removed many of the multiple degraded varnish layers (figs. 2, 3). By then, the restoration studio was supervised by curator Arthur François Emile van Schendel (1910–1979). Van Schendel's interest in restoration and the technical examination of paintings had gradually grown since he started working in the museum in 1933, but it strongly increased in 1945, after meeting with the Belgian chemist Paul Coremans (1908–1965), who would become a lifelong friend (Filedt Kok 2019, 253–267). Coremans and Van Schendel became very active in the international field of conservation. Van Schendel was co-founder of both the ICOM Commission on the Care of Paintings (the forerunner of ICOM-CC) and the IIC.

The 1946–1947 treatment of *The Night Watch* consolidated Mertens's reputation as a Rembrandt specialist. Over the following decades, he would treat every Rembrandt painting in the museum, as well as various Rembrandt paintings from other collections.[5] In 1956, an international Rembrandt exhibition commemorating his birth on July 15, 1606, brought many Rembrandt paintings to the museum.[6] Several made a stop in the restoration studio, either before or after the exhibition. Among these were the *Portraits of Marten Soolmans* and *Oopjen Coppit*, owned by the De Rothschild family. The treatment may well have been part of the conditions for lending the paintings to the museum. Mertens treated the pair only a month and a half prior to the exhibition (Noble et al. 2018, 309–314). Now jointly owned by the Rijksmuseum and the Musée du Louvre, *Marten* and *Oopjen* were treated again in the Rijksmuseum conservation studio between November 2016 and February 2018. For this treatment, it was important to learn more about the methods and materials that Mertens had used 60 years before. Unfortunately, Mertens did not keep much documentation, apart from occasional black-and-white photographs taken before or during treatment with a few handwritten words underneath (fig. 4). Despite this apparent lack of data, it turns out that it has been possible to uncover a lot of valuable information on the materials and methods employed by Mertens and his staff during the 1950s.

3. THE SOURCES

For this study, the author used a variety of sources. Considered on their own, these sources are often incomplete, subjective, or difficult to interpret; however, when they are combined, they give a remarkably consistent picture of Mertens's practices. Although this type of research in itself is anything but revolutionary, conservators generally do not have—or are not given—the time to collect such detailed information about conservation history. It is time consuming because the information is often fragmented and at times difficult to trace. This section discusses the various sources used for this study, because knowledge of them may be relevant for anyone studying the history of conservation.

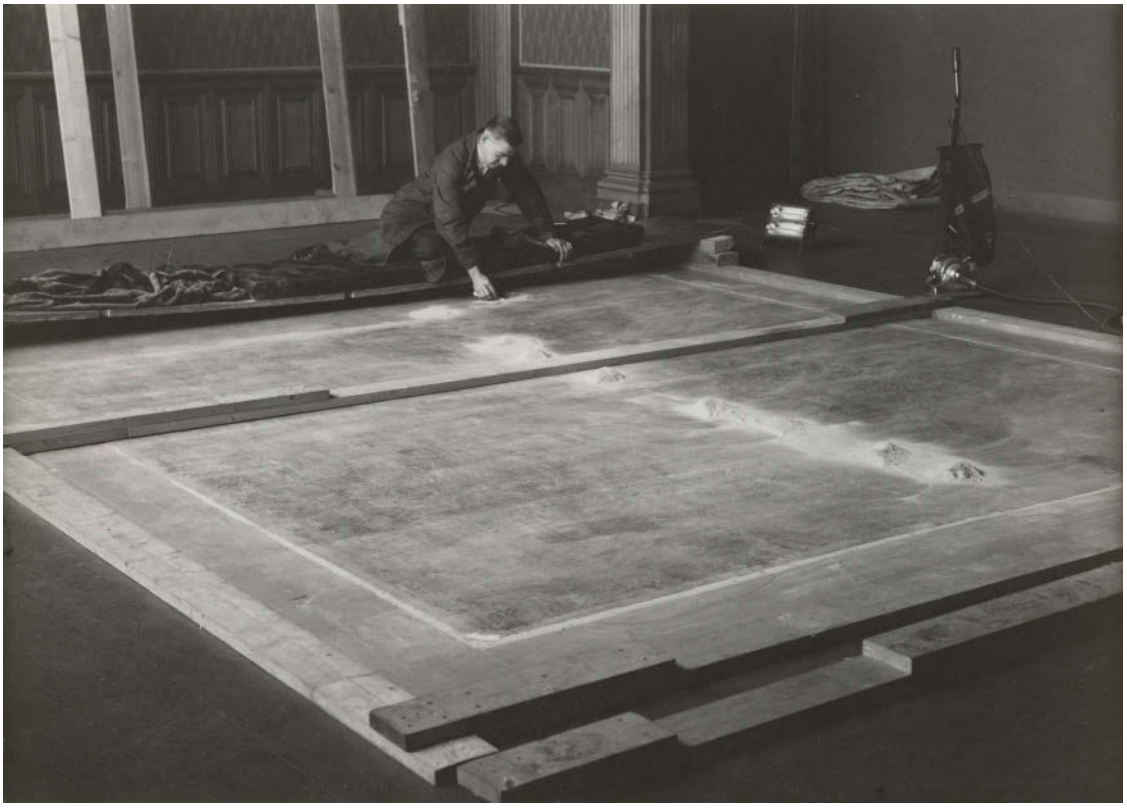


Figure 2. Jenner removing the 19th-century wax-resin lining of Rembrandt's *The Night Watch* in 1945. ©Rijksmuseum Amsterdam.

The first source type falls under the category of Oral History. In 1995 and 1998, Rijksmuseum conservator Hélène Kat carried out interviews with two former restorers and a curator.[7] The restorers were Hendrik Plagge (1905–1998) and Dick Middelhoek (1926–2001) (fig. 5), both of whom had worked under Mertens during the 1950s and 1960s.[8] Curator Bob Haak (1926–2005) had worked closely together with Mertens as his supervisor between 1954 and 1963.[9] After their recording, the interviews remained untranscribed and unused for a long time.[10] All three interviewees had passed away by the time the author of the current work found the tapes; she digitized and transcribed the interviews in 2015, during the first months of her research project. Because all three interviewees were elderly when interviewed—Plagge was 90 years old—it was initially difficult to assess how reliable their memories had been. But it turned out that most of what they told was consistent with—or could be related to—the other sources.

The second source is a series of questionnaires that were sent out by the ICOM Commission on the Care of Paintings to international museums and institutions between 1949 and 1957. The questionnaires were one of the practical solutions of the commission to gather much-needed knowledge on the practices of restoration treatments in different places. One of the commission's decrees during the second annual meeting in Rome in December 1949 was that "each year the Commission would study a single general problem of conservation; that for this purpose a questionnaire should be sent to each delegate, and the answers studied at the following meeting."[11] The first two questionnaires—on the cleaning of paintings and on the general care of paintings—had been distributed earlier in 1949.[12] Other questionnaires focused on the delamination of paint layers (1950), on the care of wooden supports (1952), and on the care of canvas supports (1957).[13] All questionnaires were gathered per subject and turned into a report or article that was published in the UNESCO journal *MUSEUM International*. The Rijksmuseum filled in all questionnaires.[14] They give detailed information on treatment choices, methods, and materials, and even occasionally on ethical considerations.

The third source are the conservation files of the Rijksmuseum. It has already been stated that Mertens generally did not keep written reports.[15] However, restoration treatments for paintings outside the Rijksmuseum collection were documented by describing the treatment in a letter to the owner.[16] In addition, in the late 1940s, an attempt was made to

Figure 3. Mertens working on Rembrandt's *The Night Watch* in 1946–1947. Photograph by W. van de Poll. ©Nationaal Archief, The Hague.

document restoration treatments on a standard two-page printed form, which could be filled in by hand during the course of a treatment (fig. 6). For unknown reasons, this form was only used a handful of times and was abandoned soon after its introduction. The Rijksmuseum conservation files do contain numerous treatment photographs—or technical photographs as they were called—that Mertens had made by the photographic department from 1947 onward. These photos were taken before or during treatment, whenever Mertens felt that photographic documentation was important, which means regularly, but definitely not on a systematic basis. Generally, prints of these photos were pasted onto cardboard and a few words or a sentence concerning the treatment were/was written underneath[17] (see fig. 4).

The following sources are less specific in their information but still cannot be ignored. A fourth source are historic photographs, such as those of Mertens at work on *The Night Watch* in 1946–1947 within the museum galleries (see fig. 3). Equally significant are the different views of the paintings restoration studio that was located in the attic of the museum (fig. 7, see figs. 4b and 5). They provide visual information about how Mertens worked and how the studio was arranged. As a fifth source of information, several archives

a

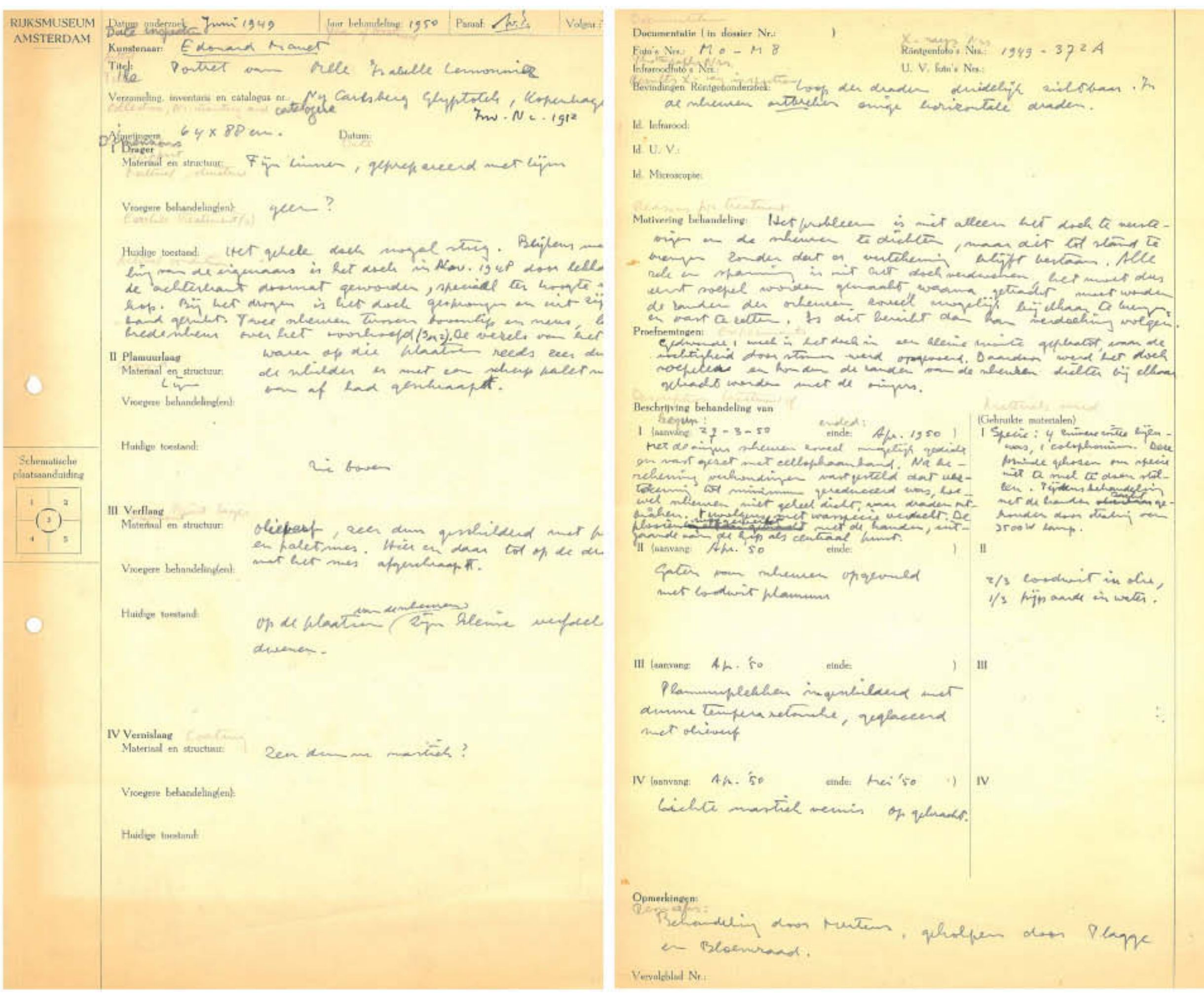
b

Figure 4. (a, b): Two treatment photos of Rembrandt's *Portrait of Oopjen Coppit* taken in April–May 1956. ©Rijksmuseum Amsterdam.

Figure 5. Middelhoek at work in 1963. ©Rijksmuseum Amsterdam.

were relevant for this research: the Rijksmuseum Archive (Noord-Hollands Archief, Haarlem), the Archive of the Committee of Supervision and Advice on the paintings of the City of Amsterdam (Stadsarchief Amsterdam), and the Van Schendel Archive (Rijksmuseum Amsterdam). These archives hold more general information about the conservation history of the museum, often fragmentary and hidden within the overall correspondence of directors or curators or minutes of meetings. Although they rarely contain technical data on specific materials and methods, they are valuable for a general overview and tell us who worked when and what (important) paintings were treated; and how directors, curators, and other specialists valued restorers or treatments.

The sixth and final source is literature. The annual reports of the museum hold significant, although generally not very detailed, information.[18] Their function is similar to the



RIJKSMUSEUM AMSTERDAM

Datum onderzoek: Juni 1949 — Jaar behandeling: 1950 — Paraaf: — Volgnr.:

Kunstenaar: Edouard Manet

Titel: Portret van Mlle Isabelle Lemonnier

Verzameling, inventaris en catalogus nr.: Ny Carlsberg Glyptotek, Kopenhagen Inv. Nr. 1912

Afmetingen: 64 x 88 cm. — Datum:

I Drager
Materiaal en structuur:
Vroegere behandeling(en): geen ?
Huidige toestand:

II Plamuurlaag
Materiaal en structuur: Lijm
Vroegere behandeling(en):
Huidige toestand: zie boven

III Verflaag
Materiaal en structuur:
Vroegere behandeling(en):
Huidige toestand:

IV Vernislaag
Materiaal en structuur:
Vroegere behandeling(en):
Huidige toestand:

Schematische plaatsaanduiding

Documentatie (in dossier Nr.:)
Foto's Nrs.: Mo - M 8 — Röntgenfoto's Nrs.: 1949 - 372 A
Infraroodfoto's Nrs.: — U. V. foto's Nrs.:
Bevindingen Röntgenonderzoek:
Id. Infrarood:
Id. U. V.:
Id. Microscopie:
Motivering behandeling:
Proefnemingen:
Beschrijving behandeling van
I (aanvang: 23 - 3 - 50 einde: Apr. 1950) — (Gebruikte materialen) I
II (aanvang: Apr. '50 einde:) — II
Gaten van scheuren opgevuld met loodwit plamuur — 2/3 loodwit in olie, 1/3 krijt aarde in water.
III (aanvang: Apr. '50 einde:) — III
IV (aanvang: Apr. '50 einde: Mei '50) — IV
lichte mastiek vernis opgebracht.

Opmerkingen:
Behandeling door Mertens, geholpen door Plagge en Bloemraad.

Vervolgblad Nr.:

Figure 6. The standard treatment report, filled in for the *Portrait of Isabelle Lemmonier* by Edouard Manet, that Mertens treated for the Ny Carlsberg Glyptotek in Copenhagen in June 1949. ©Rijksmuseum Unfortunately it was only used a few times.

Figure 7. Mertens working on Rembrandt's *The Jewish Bride* in the restoration studio in 1960. ©Rijksmuseum Amsterdam.

archival sources discussed earlier; they are parts of the puzzle that gives us the larger story of the conservation history in the museum. One article that *does* contain detailed information on the treatment of a painting is the article that Van Schendel and Mertens wrote for the Dutch art history journal *Oud Holland* in 1947: "De restauraties van Rembrandt's Nachtwacht" (Van Schendel and Mertens 1947, 1–52). It is divided into three sections that discuss the conservation history, the treatment, and the painting technique of *The Night Watch*, respectively. It is unique as the first—and for many decades the only—Dutch article with such technical information, as well as the first to emphasize the importance of the conservation history of a painting (Van Duijn and Filedt Kok 2016, 117–128).

The sources described previously gave much valuable information, but it was still very much disconnected. One discovery united these fragments in a connected overview and provided additional details. In old notes by Hélène Kat, the author found two inventory numbers, scribbled down on a piece of paper.[19] The conservation files of the two paintings connected to these inventory numbers held two detailed, typed treatment reports from 1950. This came as a surprise, because by then it was clear that Mertens had not kept extensive written documentation. The word *Pomerantz*—handwritten on the reports—led to the name of the American restorer Louis Pomerantz. He had worked both for the Art Institute in Chicago and as a private restorer for numerous important collections (fig. 8). It turned out that between October 1950 and August 1951, he had received training as a restorer at the Rijksmuseum. During those months, he kept an extensive and well-illustrated notebook, which has survived and is now part of the Pomerantz Papers in

Figure 8. Louis Pomerantz working on a painting. ©FAIC Oral History File housed at the Winterthur Museum, Library, and Archives.

Washington.[20] The notebook turned out to be an absolute treasure trove of information on the methods and materials used by Mertens and colleagues in his studio.

4. LOUIS POMERANTZ (1919–1988)

Louis Pomerantz was born on September 26, 1919, in Brooklyn, New York.[21] Trained as an artist, after his return from the Second World War, he got a job at the Downton art gallery in New York, led by Edith Halpert.[22] Here he became acquainted with and interested in pursuing restoration work; however, the American specialists he met in the field seemed reluctant to help him. He decided to travel to Europe on a G.I. stipend (G.I. Bill education benefits) to receive education. In 1949, he trained under Tito Satinover, a Paris art dealer and restorer, for a year. In New York, he had become acquainted with Willem Sandberg (1897–1984),

director of the Stedelijk Museum in Amsterdam. With his help, Pomerantz met Van Schendel and Mertens at the Rijksmuseum in Amsterdam and got permission for a training of 1 month with Mertens.[23] After a 3-week summer course with Helmut Ruhemann (1891–1973) and Stephen Rees Jones (1909–1996) in London, Pomerantz arrived in Amsterdam and started working on October 2, 1950.[24]

Apparently, he and Mertens got along well, because 1 month soon became more, and Pomerantz even declined training positions with Cesare Brandi (1906–1988) in Rome and with Ruhemann in London.[25] In the fall of 1951, he went back to America, with his Dutch wife Elisabeth (Elsie) C. Picard (1917–2006), whom he married on October 5, 1951.[26] One wonders if his decision to decline the prestigious training positions in Rome and London may have had something to do with this relationship. By then, a lifelong friendship had grown between Pomerantz and Mertens, and they—and their wives—kept in touch over the decades.[27] When the Pomerantz couple returned to the Netherlands on several occasions to visit Elsie's family, they always stopped by the Mertens's home.[28] Pomerantz also used these weeks in the Netherlands to expand his education. In 1954, he spent 3 weeks at the Central Laboratory of Belgian Museums in Brussels to learn specifically about panel treatment and the use of the "microscope in examination and analysis procedures."[29] In 1956, he spent 10 days in the prints and drawing department of the Rijksmuseum to learn about paper restoration.[30] He also periodically wrote to Mertens for his expertise on x-raying and Rembrandt paintings.[31]

In a 1967 letter to Mertens, Pomerantz remembered his time at the Rijksmuseum: "Every once in a while memories of my wonderful student days with you are stirred up and I remember very vividly how I made a nuisance of myself with questions after questions and how wonderfully patient you were with me."[32] Ten years later, during his Foundation of the AIC (FAIC) interview, he said, "This was the most exciting part of my education because I learned the wonderful techniques the Dutch had—the Dutch method was a routine thing—like breathing. Their methods of cleaning . . . their methods of retouching . . . their methods of maintaining the collection." In the same interview, Pomerantz described Mertens: "[H]e was a man who was very shy; he didn't like the publicity so he always stepped back, and Van Schendel was the one who did all the writing and talking . . . about the work that was done in the conservation lab. He was the 'scholar' you might say. Mr. Mertens never appreciated the importance of using TV and publicity." On restoration documentation, he said,

> Their records were not as exacting as the kind that I later learned were really necessary, but they were useful—you could refer to something. [Mertens] was very keen on photography. They had the museum photographer there all the time photographing different things . . . processes and stages of important work. He X-rayed almost everything . . . he had a fantastic collection of radiographs which were very valuable. Every exhibition that came through he would X-ray for his study collections. It was really exciting. He gave me prints of some of these X-rays . . . so I have a collection of my own.

The focus on photographs rather than on written documentation matches with what was described in the previous section on sources (see fig. 4).

5. POMERANTZ'S TRAINING AT THE RIJKSMUSEUM

Studying the 121 pages of his notebook gives a good insight into the type of training that Pomerantz received at the Rijksmuseum.[33] He was clearly included in the daily routine of the studio. This is confirmed by a statement he made in the FAIC interview: "Their first one hour every day, each one would take a gallery, and we would go around with a brush in a jar—the brush had been soaking in turpentine—and we would squeeze it out. Any painting that was blooming, we would take the brush with the turpentine and brush over the painting with the turpentine. Of course this only solved it temporarily, so this was a regular affair." Before climate regulation in the museum, blooming of the varnish had always been a big problem, not only in the Netherlands but in many museums containing old master paintings.

In the studio, Pomerantz must have witnessed numerous treatments. The output of the Rijksmuseum studio was large, especially compared with present-day criteria.[34] He probably assisted with many of them, but he clearly also treated several paintings by himself. The notebook mentions the treatment of 14 paintings.[35] Remarkably, only half of these paintings were owned by the Rijksmuseum; the rest came from other (museum) collections. Rijksmuseum restorers had always been allowed to work on objects from outside the collection to complement their relatively low civil servant salary, but the Pomerantz notebook makes clear that this happened on a larger scale than was previously assumed. The 14 paintings give a diverse overview of oil paintings from the 16th to the 20th century, with supports of canvas, panel, and even one of copper. Combined, these paintings made an interesting selection of different treatment problems. Of four of the paintings, the notes clearly suggest that Pomerantz carried out their treatment by himself, undoubtedly supervised by Mertens.[36] The notes on these 4 paintings are detailed and

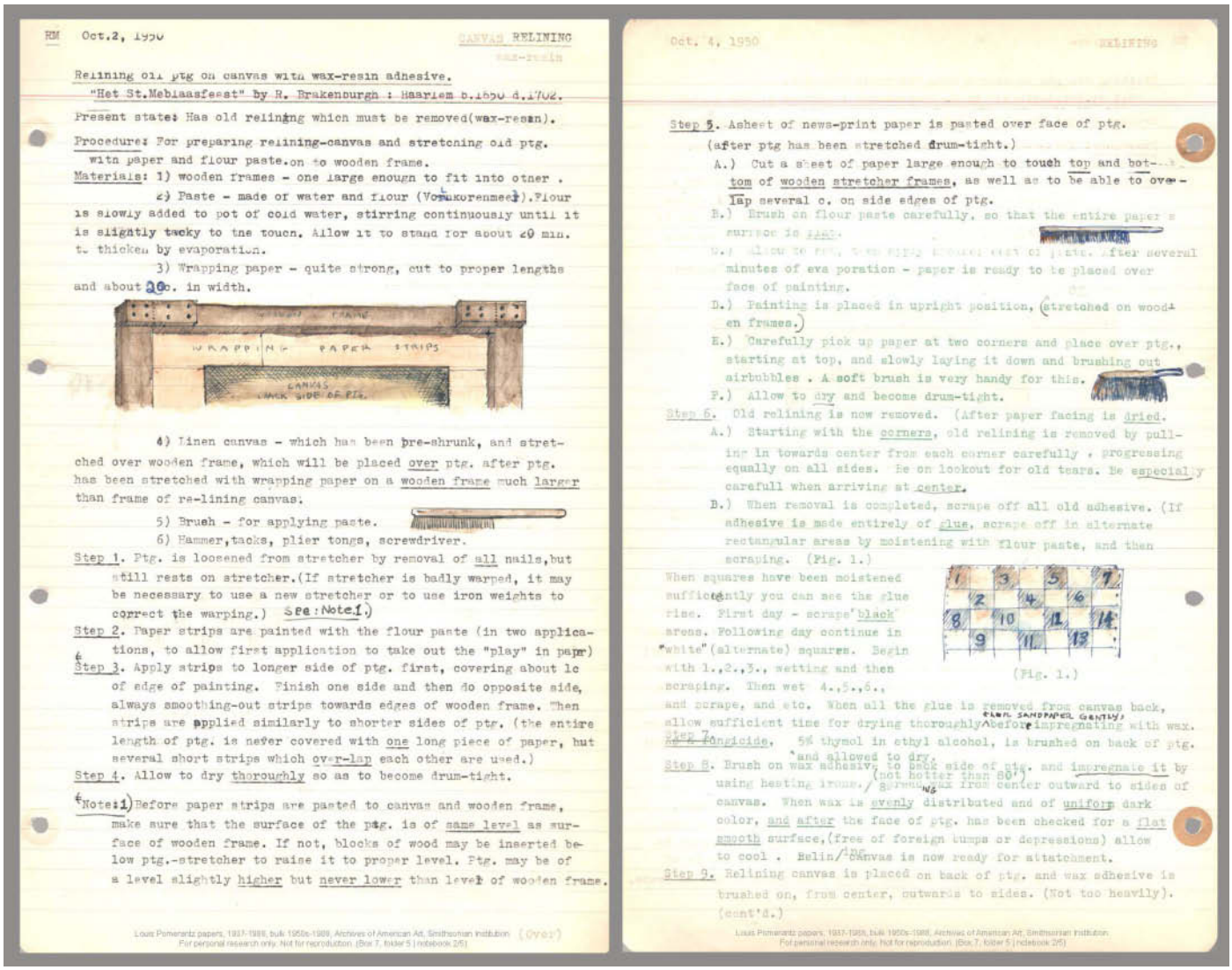


Figure 9. Two pages from the Rijksmuseum notebook describing and illustrating the first part of a wax-resin lining. ©Louis Pomerantz papers, 1937-1988. Archives of American Art, Smithsonian Institution.

give a day-to-day account of the proceedings. They also contain the most photographs to illustrate the text.

Over the course of 11 months, Pomerantz got acquainted with most, if not all, aspects of the restoration profession as practiced at the Rijksmuseum in those years. Some he described in more detail than others, which may have been the result of pre-existing knowledge from his stay with Santinover in Paris in 1949 and 1950 and his weeks at the Courtauld Institute in London in September 1950. For example, he wrote in great detail about the wax-resin lining method, also called the *Dutch method*, which must have been new to him[37] (fig. 9). One of the most challenging treatments must have been the removal of a 17th-century canvas from a (not original) panel followed by a wax-resin lining to strengthen the original canvas. This was the treatment of the last painting he was entrusted with: *Borg Scheltkema Nijenstein Near Zandeweer.*[38] He also described other methods in detail, often as part of the treatment of a specific painting: restoring wooden panels using various techniques (including a new backing of plywood,[39] regluing of separate boards, impregnation of the reverse, or a "simple treatment" against warping), gluing and flattening paint blisters, removing old varnish layers and overpaint, the Pettenkofer regeneration treatment, surface cleaning of gold leaf, applying new varnishes, fillings, and retouching.

Pomerantz also wrote down many ingredients and recipes, not only for the treatment of paintings but also for other disciplines, which indicated that he visited other restoration

departments during his stay.[40] These recipes include (wax) varnishes, wax-resin mixtures, various glues, filling material (called *putty*), mold remover, wax polish, and fixative for pastels. Other notes concern the melting points of various waxes and resins,[41] which were especially important for wax-resin lining, and the different colors of oil paint needed on a restorer's palette.[42] Remarkably, this palette mostly consists of stable pigments and is quite close to the modern conservator's palette, even though today conservators employ more stable binding media than oil.[43] Additionally, Pomerantz learned to develop x-ray films. On November 24, 1950, he assisted in making x-rays of Rembrandt's *The Anatomy Lesson of Dr. Nicolaes Tulp* (1632) owned by the Royal Picture Gallery Mauritshuis, and of Aelbert Cuyp's *Landscape with Cows*, which was a new acquisition at the Rijksmuseum.[44]

Throughout the notebook, professional literature is referred to or (partly) copied: an article by Pease (1948) on the treatment of wooden panels and the PhD dissertation of De Wild (1929) on the study of pigments, as well as books about paintings materials by Gettens and Stout (1942) and about paintings restoration by Toch (1946). He also tested two different synthetic varnishes—PVA and PBM[45]—in various different solvents to "determine surface/nonchangeability qualities" by applying it to white paper. The synthetic resins were tested on works on paper rather than paintings, because they were tested over water color, ink drawing, and charcoal. Unfortunately, Pomerantz does not elaborate on the results of his tests other than two OKs while the rest gets an N.G., which presumably means "not good."[46] Remarkable too is a one-page warning on the restoration of paintings by the French artist Henry Fantin Latour (1836–1904), who apparently worked with mixed media and combined oil paint with watercolors, pastels, and/or pencil. The Rijksmuseum acquired five paintings by Fantin Latour in 1922; this warning may have been based on Mertens's own experience. Alternative treatments for his paintings are given to both cleaning and relining.[47]

6. THE RELEVANCE OF THE NOTEBOOK

The relevance of the Rijksmuseum notebook by Pomerantz lies not only in the general descriptions of the materials and methods employed by Mertens but also in very concrete cases. One such example is an account of the application in 1951 of a wax coating on Rembrandt's *The Night Watch*, which—as has been stated before—had been extensively treated by Mertens in 1946–1947.[48] This 1951-campaign was never reported, even though—in terms of conservation history—*The Night Watch* is one of the best documented paintings in the Rijksmuseum (Van Duijn and Filedt Kok 2016, 117–128). The notebook page describes in detail how to make a wax paste using four parts carnauba wax, six parts bleached beeswax, and sufficient turpentine to make a paste. The application is as follows: "A shoe polish applicator (brush) may be used, applying the wax over a small portion of surface at a time, in thin, even coats, and allow a few minutes for hardening. Then polish with a soft shoebrush until desired degree of shine is attained." The notes then describe how care must be taken in the dark areas to avoid the appearance of a gray film, as well as how to prevent dust from accumulating in the wax layer during drying, before it is sufficiently polished. Although this whole page describes a general procedure, at the top of the page it says "as applied to "Night Watch" in April 1951." In the 1977 interview, Pomerantz referred to this incident and wrote, "[It] took three of us on ladders to do that. I was very excited about the idea of having touched *The Night Watch*."

As mentioned earlier, Pomerantz wrote meticulous descriptions of the wax-resin lining technique: a method that must have been relatively new to him. The very first week of his training was dedicated to the wax-resin lining of the Brakenburg painting *The Feast of Saint Nicholas*, which he not only described in detail but also illustrated with beautiful little drawings[49] (see fig. 9). Additionally, on October 10, 1950, he explained and illustrated stretching a painting on canvas with a hole, prior to a wax-resin lining.[50] He described a wax-resin lining again on November 14, 1950, when reporting on the treatment of *A Hunter's Bag* by d'Hondecoeter. This seems to have been the first painting he worked on by himself.[51] These accounts confirm and solidify what had already been found in other sources on the wax-resin lining technique of the Rijksmuseum. Although it would be impossible within the scope of this article to discuss every detail of the procedure, the following are some important aspects:

- Facings were applied using white silk paper and flour paste, specified by Pomerantz as whole-grain flour.
- The lining canvas was chosen for each painting individually to match the original canvas as closely as possible.
- The wax-resin lining mixture consisted of three fixed ingredients: colophony, beeswax (unbleached), and Venetian turpentine. Proportions would vary according to the need of the painting: more resin meant more adhesive strength, and more Venetian turpentine meant more plasticity.
- The wax-resin lining procedure was carried out in two steps. First, the reverse was covered with the melted wax-resin mixture, then ironed to impregnate the original canvas, ground, and paint layers. Second, the lining canvas was put in place behind the original canvas and covered with the melted wax-resin mixture, which was then ironed as well.
- The temperature of the irons was kept between 70 and 80 °C (158 and 176 °F), and ironing took place without

Figure 10. Twenty-five photos from the Rijksmuseum notebook demonstrating the sequence of a wax-resin lining. ©Louis Pomerantz papers, 1937-1988. Archives of American Art, Smithsonian Institution.

extra pressure, apart from the weight of the iron itself. To keep a closer control on the process, hot tables or electric irons were not used.

- After lining, the facing was removed with water, whereas excess wax resin was removed with turpentine and cotton wool.

At least as important as the written descriptions and drawings is a sequence of 29 photographs that were made of Pomerantz himself carrying out every step in the wax-resin lining procedure during the treatment of *The Judgement of Trajan*[52] (fig. 10). They show many small but significant details that are difficult to capture with words alone, often simply

because the person carrying out the procedure felt that they were too obvious or seemingly insignificant to mention.

Varnish removal was generally carried out after the lining procedure, although this could vary according to the needs of a particular painting. Varnish removal was most often done with either acetone or ethanol, or occasionally a mixture of both.[53] To stop the dissolving power of these solvents, the restorer would hold a wad of cotton wetted with rectified turpentine in his other hand. The active solvent (ethanol/acetone) and the stopping solvent (always turpentine) would be applied alternately. The notebook describes varnish removal in much more detail than any of the other sources. The active solvent was applied with a brush, whereas the stopping solvent would be applied with a cotton wad. Even the directions of the brush are given: first up and down, then from left to right, then in little circles—all this over the same area of about 4.7 × 4.7 in. (12 × 12 cm) (fig. 11). Looking at various historical photos of Mertens at work, it is clear that he used this method at least since the 1946–1947 treatment of *The Night Watch* (see fig. 3). Remarkably, a notebook photograph of Pomerantz doing a varnish removal shows him using a cotton swab instead of a brush (see fig. 10, last photo of the sequence). Possibly, this was something he had learned during his earlier visits to Paris or London.

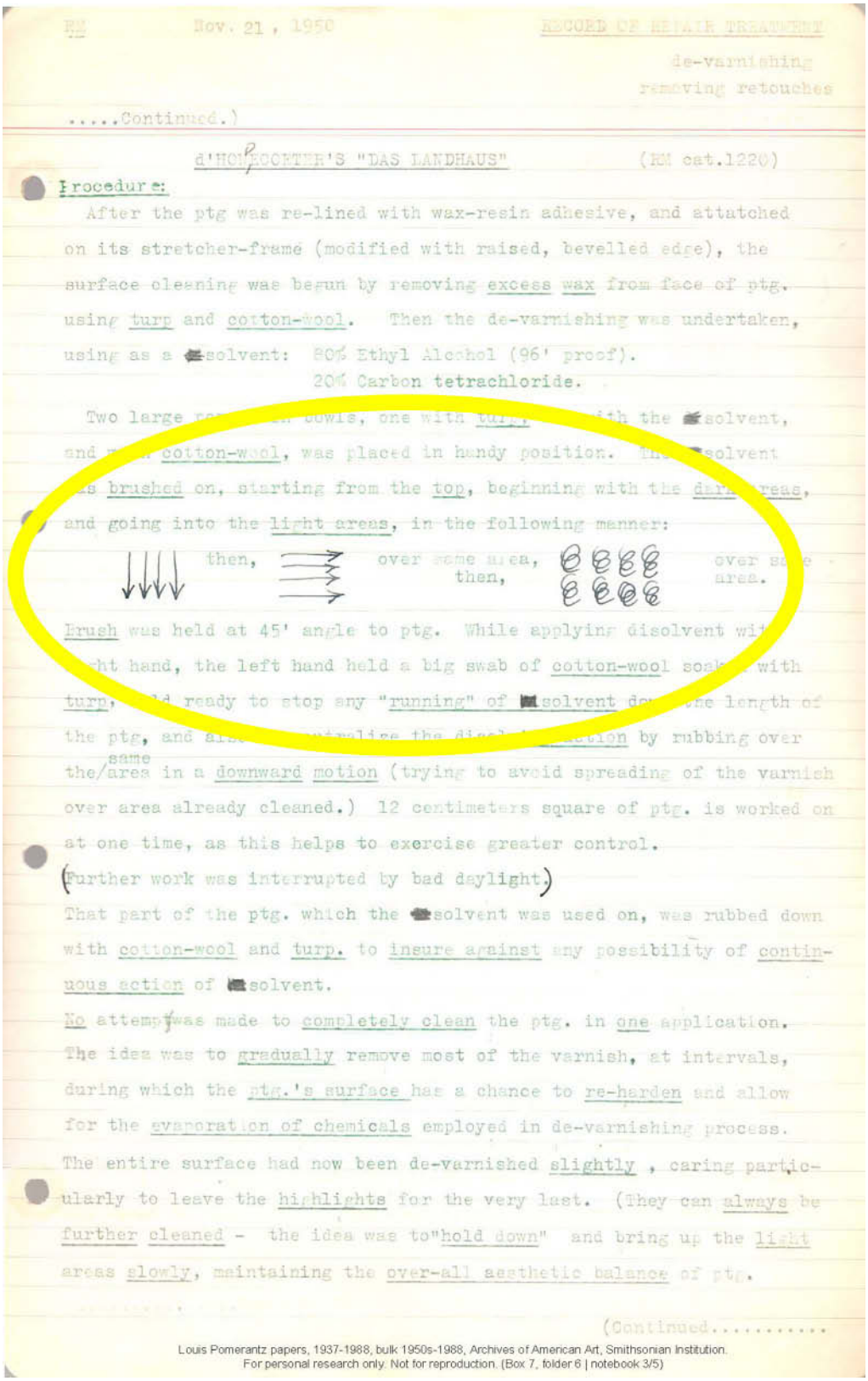
In all of the sources, only one recipe is described for filling material: a paste of two parts lead white in oil and one part pipe clay in water. The notebook again provides most details: the oil is specified as poppy oil, whereas a layer of lead white paint could be applied underneath for better adhesion. If the damages were deep, the filling would be built up in multiple layers with sufficient drying time in between. Retouchings consisted of a first layer of aqueous paint—either commercial water color or egg tempera—then the retouching would be finished by applying a final glaze of (commercial) oil paint. The oil paint was left on blotting paper for at least a week to absorb excess oil.

Even though retouching materials were commercially bought, Mertens would make his own varnishes, using dammar, mastic, or a combination of both, dissolved in rectified turpentine. In the Rijksmuseum, as well as in most other museums before climate control, there were always problems with blooming of varnish. In 1935, Mertens felt—after several tests—that mastic provided the best remedy against blooming, but in a manual for other Amsterdam restorers, he wrote in 1952 that a 1:1 mixture of dammar and mastic worked best.[54] Apparently, he kept evaluating his experiences throughout his career. The natural resin would always be put in turpentine, after which the jar would be left in the sun for between 2 and 6 months for the resin to slowly dissolve.[55] It was important not to speed this process by heating the mixture: this would result in a much more yellow varnish. Pomerantz wrote in his notebook, "Mr. M.—bottle was kept in a dark closet after having been bleached this way in 1944, and varnish had not darkened yet."[56] In his own practical way, Mertens kept testing his own materials.

As a source, the notebook lacks *one* important aspect of the profession: ethical considerations. From all of the sources, these are only touched on briefly in the two ICOM questionnaires of 1949. For example, when in one of the ICOM questionnaires the issue is addressed about how far to go in the application of retouches, the answer is this: "As much as is necessary for the harmony of the picture not to be disturbed."[57] This is obviously quite subjective and dependent on the opinions of the restorer working on the painting and the supervising curator. Similarly, the answer to the degree of varnish removal was that this "depends entirely on the individual case."[58] However, when describing the possibility to go back to the original state of a picture, the writer shows himself to be quite sensitive: "It is an illusion to want to bring a painting to its original state, but we can try to give it an aspect as close as possible to the original state. In any case, it must be observed that elements of taste and subjective judgment remain present both in the 'scientific' cleaning method and in the 'artistic' method."[59] Although the writer of these answers—all of them in French—may very well have been Van Schendel, it would be reasonable to assume that they still reflect the practices by Mertens, with whom Van Schendel in those years still had one-to-one contact on a daily basis. We can regard Mertens—like so many of his contemporaries—as a highly skilled but very pragmatic practitioner. He worked from experience, learned from past mistakes, and generally was not very open to innovations. For example, he tested and retested which varnishes worked best in the Dutch climate but only stuck to natural resins. We know from various sources that he kept well away from synthetic resins. It may have been that his relationship with Van Schendel challenged him to think beyond practical matters, more than he would otherwise have done, but that is a theme to be explored in another work.

7. CONCLUSION

This article has shown how the study of the materials and methods used by Henricus Hubertus Mertens, who worked for 40 years as a paintings restorer at the Rijksmuseum in Amsterdam, has yielded a wealth of information, despite the fact that Mertens himself documented very little. The one source that tied the fragmented bits of information together was discovered almost by chance: a detailed and illustrated notebook that the American restorer Louis Pomerantz kept



RM Nov. 21 , 1950 RECORD OF REPAIR TREATMENT

de-varnishing
removing retouches

.....Continued.)

d'HONDECOETER'S "DAS LANDHAUS" (RM cat.1220)

Procedure:

After the ptg was re-lined with wax-resin adhesive, and attatched on its stretcher-frame (modified with raised, bevelled edge), the surface cleaning was begun by removing excess wax from face of ptg. using turp and cotton-wool. Then the de-varnishing was undertaken, using as a solvent: 80% Ethyl Alcohol (96' proof).
20% Carbon tetrachloride.

Two large [illegible] bowls, one with turp, with the solvent, and [illegible] cotton-wool, was placed in handy position. The solvent was brushed on, starting from the top, beginning with the dark areas, and going into the light areas, in the following manner:

Brush was held at 45' angle to ptg. While applying disolvent with right hand, the left hand held a big swab of cotton-wool soaked with turp, and ready to stop any "running" of solvent down the length of the ptg, and also [illegible] the direction by rubbing over the same area in a downward motion (trying to avoid spreading of the varnish over area already cleaned.) 12 centimeters square of ptg. is worked on at one time, as this helps to exercise greater control.

(Further work was interrupted by bad daylight.)

That part of the ptg. which the solvent was used on, was rubbed down with cotton-wool and turp. to insure against any possibility of continuous action of solvent.

No attempt was made to completely clean the ptg. in one application. The idea was to gradually remove most of the varnish, at intervals, during which the ptg.'s surface has a chance to re-harden and allow for the evaporation of chemicals employed in de-varnishing process. The entire surface had now been de-varnished slightly , caring particularly to leave the highlights for the very last. (They can always be further cleaned - the idea was to "hold down" and bring up the light areas slowly, maintaining the over-all aesthetic balance of ptg.

(Continued.....

Figure 11. Page from the Rijksmuseum notebook describing and illustrating varnish removal. ©Louis Pomerantz papers, 1937-1988. Archives of American Art, Smithsonian Institution.

during his training under Mertens in the Rijksmuseum from October 1950 to August 1951. Not only has it confirmed the data from various other sources, but it also has complimented these results in many ways. The Pomerantz notebook is not only a very valuable source of information for the study of the conservation history of the Rijksmuseum but also for the field of conservation history in general.

The paintings that were treated by Mertens and Pomerantz reflect the training that Pomerantz received, as well as different aspects of paintings restoration practiced at the Rijksmuseum in the 1950s. Some of these, especially the wax-resin lining procedure and the use of varnishes, turned out to be significant for the conservation and research project of the two Rembrandt *Portraits of Marten Soolmans* and *Oopjen Coppit*, the pendant paintings that initiated this specific study in the first place. The importance of this study extends beyond these two portraits to every painting treated by Mertens or under his supervision. This information not only allowed conservators working on these paintings to make better decisions about their treatment but also helped art historians understand what they saw, and it aided conservation scientists in the interpretation of their research data.

With the 2018 AIC theme "Material Matters" in mind, it is a sad truth that in studying the material side of paintings, or any art object for that matter, conservation history is often forgotten or discarded as insignificant. However, the materials and methods used in past treatments often play a crucial role in the current appearance of paintings, as well in degradation processes of the original materials. When we say "Materials Matter," we must realize that this includes restoration materials from the past. The author hopes that this article will play an important role in heightening the awareness of all specialists working in this field on the significance of the study of conservation history.

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This article could not have been written without the valuable help of many people. First, the author would like to thank Professor Joyce Hill Stoner, who suggested the Pomerantz topic in 2017 in Copenhagen and helped with information and photographs. The author is also indebted to the following people: Jan Piet Filedt Kok (emeritus professor of the University of Amsterdam/formerly Rijksmuseum Amsterdam [RMA]), Suzan Catucci-de Groot (Cultural Heritage Agency [RCE]), Hélène Kat (formerly RMA), Katrien Keune (RMA), Robert van Langh (RMA), Petria Noble (RMA), Mandy Prins (Gemeentemuseum The Hague), Susan Smelt (RMA), Gwen Tauber (RMA), Abbie Vandivere (Royal Picture Gallery Mauritshuis/University of Amsterdam), and Ige Verslype (RMA).

NOTES

1. This project, financed by the Luca Fund, was carried out between 2015 and 2018.
2. For clarity's sake, throughout this work, the word *restorer* will be used for past practitioners; Mertens, for example, would never have referred to himself as conservator. The word *conservator* will only be used to describe academically trained practitioners, even though the word *conservator* was already becoming more common in America around the time of Pomerantz.
3. Mertens was born on June 13, 1905 in Roermond. His father was Johannes Mertens, a contractor and slater, and his mother was Maria Anna Hubertina Passage.
4. "Bij de hem opgedragen restauraties in het Rijksmuseum kon ik herhaaldelijk zijn smaak, inzicht en werklust waardeeren, zoodat ik zijn tegenwoordigheid aan het Rijksmuseum als een aanwinst zou beschouwen." Archive of the Paintings Conservation Studio Rijksmuseum Amsterdam, folder on Mertens, letter of November 15, 1930.
5. The most important examples: *Landscape* (Collection Philips, Eindhoven) in 1946; *Family Portrait* (Herzog Anton Ulrich Museum, Braunschweig) in 1949; *Portrait of Jan Six* (Collection Six, Amsterdam) in 1956; *A Monk* (Ateneum, Helsinki) in 1956–1957 and *The Finding of Moses* (Johnson Collection, Philadelphia Museum of Art) in 1961.
6. It ran from May 18 to August 5, 1956.
7. The interviews were recorded on audio tapes, which are currently kept in the paintings conservation studio.
8. Plagge worked as paintings restorer in the studio between 1950 and 1970. Middelhoek—whose first named is alternatively spelled Dirck—worked there as liner between 1955 and 1964. Both were interviewed in 1995.
9. Haak was appointed especially for this role, when Van Schendel had less time for it. In 1950, Van Schendel had become director of the paintings department, and in 1959 he was appointed general director of the museum. Haak was interviewed in 1998.
10. Kat unfortunately became too ill to continue working shortly after the last interview.
11. Rome, Istituto Centrale del Restauro, December 12–15, 1949. The minutes of the Rome meeting are in French. The English translation of the resolution comes from a report on the first 2 years of the Commission on

the Care of Paintings, dated June 5, 1950, which was presented during the general ICOM meeting in Paris, July 17–22, 1950. Noord-Hollands Archief, Haarlem (NHA), archive no. 481 Rijksmuseum en rechtsvoorgangers te Amsterdam 1946–1995, inventory no. 3020.

12. As a result of the National Gallery Cleaning Controversy shortly after the Second World War, the subject of cleaning or removing varnish layers from paintings was regarded as most pressing. It was clearly also a complex subject: the questionnaire on the general care of paintings had 37 replies from 14 countries, whereas the questionnaire on the cleaning of painting yielded a mere 14 responses from 10 countries. NHA, Rijksmuseum archive no. 481, inventory no. 3020.
13. A questionnaire on the subject of climate conditions in museums (1955) was less relevant for this research. Examples of the questionnaires are in the archives: NHA, Rijksmuseum archive no. 481, inventory nos. 3020 to 3022.
14. Rijksmuseum Amsterdam, paintings conservation studio and NHA, Rijksmuseum archive no. 481, inventory nos. 3020 to 3022. The fact that most Rijksmuseum questionnaires are filled out in French seems to suggest Van Schendel as the writer. Van Schendel, as a member of the ICOM Commission on the Care of Paintings, was of course one of the driving forces behind the questionnaires.
15. According to oral tradition, Mertens kept notebooks describing treatment details during his career. After retirement, he supposedly took the notebooks home and, out of dissatisfaction with the museum, eventually burned them. Even if this story was never proven, it is a fact that one notebook still exists for Rembrandt's *Jewish Bride*, describing the 1960 treatment. It is currently kept in the conservation file of the painting.
16. Unfortunately, we do not have such a letter for the *Portraits of Marten Soolmans* and *Oopjen Coppit*.
17. The glass negatives of the technical photos are kept in the photographic depot of the museum. After Mertens's retirement in 1970, making technical photos as documentation become more systematic.
18. Annual reports of the museum have appeared since 1877 under various names.
19. The notes by Kat are in the archive of the paintings conservation studio. The inventory numbers referred to the following paintings: workshop Roelant Savery, *Elijah Fed by the Ravens*, 1634, oil on copper, 15.9 × 19.4 in. (40.3 × 49.2 cm), inventory no. SK-A-1297; Richard Brakenburg, *The Feast of Saint Nicolas*, 1685, oil on canvas, 19.3 × 25.4 in. (49 × 64.5 cm), inventory no. SK-A-54.
20. Louis Pomerantz Papers (LPP), 1937–1988, bulk 1950s–1988. Archives of American Art, Smithsonian Institution. The Pomerantz archive was given to the Archives of American Art by his widow Else Pomerantz in 1988, assisted by the conservation archives coordinator of the AIC. *Museum Archivist*, vol. 4, no. 2, September 1990: 10.
21. His father was Jacob Pomerantz and his mother Gussie Watnick (Evory 1982). In an interview conducted in 1977 (see note 22), Pomerantz stated that his parents had come from Russia to America in 1910.
22. Unless stated otherwise, all information in this section comes from the interview that Joyce Hill Stoner conducted with Louis Pomerantz in 1977. The FAIC Oral History File is housed at the Winterthur Museum, Library, and Archives.
23. The reason behind the short period of 1 month was that Mertens had been very ill shortly before.
24. Monday October 2 is also the first entry in Pomerantz's notebook. (LPP, box 7, folder 5 | notebook 2/5.)
25. The Rijksmuseum annual report of 1951 describes Pomerantz as follows: "His diligence, dedication and expertise made him a welcome guest in the department." (Zijn ijver, toewijding en bekwaamheid maakten hem tot een welkome gast op deze afdeling.) *Verslagen 's Rijks Verzamelingen van Geschiedenis en Kunst 1951*, The Hague 1952: 11.
26. Although the last date reference in the notebook is July 12, 1951 (LPP, box 7, folder 8), the annual report of 1951 states that Pomerantz worked in the Rijksmuseum until the end of August. Two handwritten pages with notes seem to suggest that Pomerantz visited scientist Ian Rawlings at the National Gallery in London in September 1951, probably on his way back to the United States. (LPP, box 7, folder 8.)
27. Although Mertens's full first names (Henricus Hubertus) were known, it is from his correspondence with Pomerantz that we learn how he was called by friends and family: Har. Equally enlightening is a letter from Mertens to Pomerantz (December 4, 1969) on his upcoming retirement and his strong dissatisfaction with the museum—already referred to in a previous section—during those final years. (LPP, box 3, folder 38.)
28. This is clear from the correspondence with Mertens, Van Schendel, and Sandberg. (LPP, box 2, folder 38; box 3, folder 38; and box 4, folder 16.)
29. See correspondence with Paul Coremans and René Sneyers. (LPP, box 2, folder 38.)
30. See correspondence with Van Schendel and paper restorer W. P. van Oort, as well as a letter to K. G.

Boon from December 3, 1969. (LPP, box 4, folder 16 and box 3, folder 38.)

31. Correspondence of October 2, 1957, November 18, 1966, and April 25, 1967. See also a letter of October 13, 1970, which shows that after his retirement Mertens visited Washington, DC, for a week to advise the National Gallery on the state of their Dutch paintings. (LPP, box 3, folder 38 and box 2, folder 53.)
32. LPP, box 2, folder 53.
33. The pages of the notebook—or possibly there existed several notebooks—have become separated in the past and were reorganized more thematically. It is unknown who did this and when. The pages are now divided over various boxes and folders in the archive. They are not numbered, but considering that most are dated, it has been possible to digitally put them in chronological order again for this research.
34. Treatments generally took much less time to complete than they do now. This is confirmed by looking at the annual reports in the 1950s and comparing them to those of the 2010s. Moreover, not every painting treated in the studio in 1950 and 1951 is mentioned in the annual reports of those years. Only a few of the paintings in the Pomerantz notebook are mentioned, for example, in the annual reports; most were just not significant enough.
35. In order of appearance: Richard Brakenburg, *The Feast of Saint Nicholas*, Rijksmuseum, inventory no. SK-A-54 (LPP, box 7, folder 5 | notebook 2/5); workshop of Roelant Savery, *Elijah Fed by the Ravens*, Rijksmuseum, inventory no. SK-A-1297 (LPP, box 7, folder 6 | notebook 3/5); Melchior d'Hondecoeter, *A Hunter's Bag Near a Tree Stump with a Magpie, Known as the Contemplative Magpie*, Rijksmuseum, inventory no. SK-A-170 (LPP, box 7, folder 6 | notebook 3/5); Melchior d'Hondecoeter, *A Hunter's Bag on a Terrace*, Rijksmuseum, inventory no. SK-A-171 (LPP, box 7, folder 6 | notebook 3/5); Anonymous, *Russian Icon*, unknown collection (LPP, box 7, folder 6 | notebook 3/5); Corneille de Lyon, *Yves d'Alegre*, owner unknown (LPP, box 7, folder 8); Moritz Calisch, *Two Women in Italian Costume*, Rijksmuseum, inventory no. 4181 (LPP, box 7, folder 8); Copy after Delacroix, *The Judgement of Trajan*, Museé de Picardie, Amiens, France (?) (LPP, box 7, folder 6 | notebook 3/5, and box 7, folder 8); Nicolaes Maes, *Three Children in a Landscape*, Slot Zuylen, Oud-Zuilen (Maarssen), inventory/catalog no. S 43 (?) (LPP, box 7, folder 8); Kaspar Karsen, *The Courtyard of the Old Stock Exchange in Amsterdam*, Amsterdam Museum, inventory no. SA 7526, on loan to the Rijksmuseum in 1951 (LPP, box 7, folder 8); Hendrik de Clerck, *Suzanna and the Elders*, Rijksmuseum, inventory no. SK-A-1461 (?) (LPP, box 7, folder 8); Jules Pascin, *Claudia with Flowers*, Stedelijk Museum Amsterdam, inventory no. A 6436 (LPP, box 7, folder 8); Anonymous, *Borg Scheltkema Nijenstein Near Zandeweer*, Groninger Museum, inventory no. 1951.0220 (LPP, box 7, folder 8); Paulus Potter, *Equestrian Portrait of Diederik Tulp*, Collectie Six, Amsterdam (LPP, box 7, folder 8).
36. These paintings are Melchior d'Hondecoeter, *A Hunter's Bag on a Terrace*; Anonymous, *Russian Icon*; Copy after Delacroix, *The Judgement of Trajan*; and Anonymous, *Borg Scheltkema Nijenstein Near Zandeweer.*
37. In France, the prevalent lining technique was aqueous.
38. Treatment on this painting was carried out in intervals between April 26 and July 1951.
39. This describes a type of transfer where part of the original panel was preserved but reinforced with plywood. This was only carried out by exception when the original panel was badly degraded, such as through insect infestation.
40. He wrote down recipes but never treatment details, suggesting that he did not visit other departments for longer periods or assist in treatments there. At that time, there were at least three other restoration studios: furniture, tapestries, and prints and drawings.
41. LPP, box 7, folder 5 | notebook 2/5 (March 20, 1951).
42. LPP, box 7, folder 5 | notebook 2/5.
43. The colors are blanc d'argent, cad (cadmium) yellow, yellow ochre, red ochre, raw umber, burnt umber, burnt sienna, cad (cadmium) red, alizarin crimson, ivory black, cobalt blue, ultramarine blue, vert emeraud, stil de grain Bruin (brown).
44. Inventory nos. MH146 and SK-A-3754 (LPP, box 7, folder 8). Developing x-ray films he had learned on October 25, 1950 (LPP, box 7, folder 8).
45. PVA likely refers polyvinyl acetate, although technically it could also refer to polyvinyl alcohol. PBM probably refers to polybutyl methacrylate (Piqué and Stulik 2005, 44).
46. LPP, box 7, folder 5 | notebook 2/5 (April 20, 1951). The used solvents were ethyl alcohol, xylene, and toluene.
47. LPP, box 7, folder 5 | notebook 2/5 (no date).
48. LPP, box 7, folder 8 (April 1951).
49. LPP, box 7, folder 5 | notebook 2/5 (October 2, 4–5, 1950); LPP, box 7, folder 8 (October 4, 1950). At that point, there was no liner in the studio; Jenner had left the museum on May 1, 1950, whereas his successor

A. J. H. Vorrink (1931–2004) started on October 23, 1950. *Verslagen's Rijks Verzamelingen van Geschiedenis en Kunst 1950*, The Hague 1951: 67. Mertens probably lined the painting himself. We know from the 1995 interview with Middelhoek that Mertens occasionally carried out linings.

50. LPP, box 7, folder 5 | notebooks 2/5 (undated).
51. LPP, box 7, folder 6 | notebook 3/5 (November 14, 1950).
52. LPP, box 7, folder 6 | notebook 3/5 and box 7, folder 7 (undated, although the individual photos are numbered).
53. Other solvents mentioned are toluene, xylene, ammonia, butyl alcohol, ether, and carbon tetrachloride. These were used in exceptional cases.
54. *Verslagen omtrent's Rijks Verzamelingen van Geschiedenis en Kunst 1935*, The Hague 1936: 16; NHA, Rijksmuseum archive no. 481, inventory no. 3085.
55. The difference in time can probably be explained by the season in which the varnish was made. During the summer, the bottle with resin and turpentine would get many more hours of sunlight than during winter months.
56. LPP, box 7, folder 8.
57. "Autant que nécessaire pour que l'harmonie du tableau ne soit pas troublée."
58. "Le degré de dévernissage dépend entièrement du cas individuel."
59. "Il est illusoire de vouloir retrouver un tableau dans son état original, mais on peut essayer de lui donner un aspect aussi proche que possible de l'état original. De toutes façons, il faut bien observer que des éléments du goût et du jugement subjectif restent présents dans la méthode de nettoyage 'scientifique' aussi bien que dans la méthode 'artistique'."

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The Use of Modern Paints by the Concrete Artist Ivan Serpa in Artworks of the Early 1950s

ABSTRACT

This paper presents the experimental and innovative use of modern paints by the Brazilian concrete artist Ivan Ferreira Serpa (1923–1973) during the early 1950s as a way to explore constructivism principles in paintings. Three aspects will be discussed: Ivan's historical context and the artist's opinion about his own work, the availability of modern paint in Brazil, and two paintings produced in the early 1950s: Forma em evolução *(1952—Shape in Evolution) and* Quadrados em rítmos resultantes *(1953—*Squares with Resulting Rhythms*). This presentation aims to discuss the material alternatives that were available to Serpa during the early/mid 1950s.*

1. HISTORICAL ASPECTS

Ivan Serpa was born in Rio de Janeiro in 1923 in Rio de Janeiro, and died early in 1973 when he was only 50 years old. Despite his short life, the artist went through different artistic stages: *Fase Concretista* and *Fase Negra* or *Crepuscular* to *Op-eróticas*, *Geomântica*, and *Objetos surpresas*. All of them were characterized by an intense freedom in the use of different techniques and materials (paintings on canvas and paper, ink drawings, collages, engravings, and sculptures).

Many different factors guided the artist directly or indirectly to a personal journey of greater organization of colors, shapes, lines, and planes. The interaction with George Bernanos during the period when Serpa attended the *Comitê da França Livre* in Brazil was important to confirm in him the artistic feeling of freedom and autonomy (Ferreira 2004). The classes with Professor Axl Leskoschek in the *Curso de Desenho de Propaganda e Artes Gráficas da Fundação Getúlio Vargas* (1946–1948), however, updated and introduced the young Brazilian artist to European abstract artistic tendencies, the use of line in composition, and harmony of colors (Ferreira 2004).

In 1951, Serpa won the Young Painter Prize in the First São Paulo Biennial. One year later, he founded an art school for children and adults in the Modern Art Museum of Rio de Janeiro (MAM-RJ). Two years later, he created the vanguard movement *Grupo Frente* (1954–1957). In this group of artists, he taught geometrical forms but also autonomy in the use of colors, in opposition to rigid principles created by the *Grupo Ruptura* (1952–1959) in São Paulo.[1] Serpa's experience as a graphic designer in the advertising course at *Fundação Getúlio Vargas* and as a teacher in MAM[2] probably granted him the precision and skills to build his constructive forms. Beside all those initiatives Serpa also worked as a designer of books and magazines like the Esfera (1947-49) and as a restorer in the National Library in Rio de Janeiro (BN-RJ/1950-1964)[3]. The artist would even affirm that the work as a restorer influenced him on "making a work well done" (Morais 1973, n.p.).

Serpa played a key role in the artistic practice of the *Grupo Frente*, as he was the leader and the professor of the group. However, this movement lost its strength throughout the year 1956 and concluded its activities when its leader won the *Prêmio de Viagem do 6º Salão Nacional de Arte Moderna* (1957) and moved to Europe, returning to Brazil only in 1959. When Serpa arrived, he was already convinced that "it is impossible to make an art like Concretism in the world in which we live" (Hollanda 1961, 73). Six years later, he concluded that "Concretism did not correspond to our reality, because we did not yet have the technical means necessary for an ideal concrete art... The phase was the result of a misunderstanding... we intended to make a highly technical art in an underdeveloped country" (Santarrita 1966, n.p.).

2. THE ARTIST'S INTENTION AND THE USE OF INDUSTRIAL MATERIALS

We will focus our analysis on Serpa's short Concretism Phase, defined by us as the period between 1951 and 1957. This temporal delimitation has didactic objectives since the

artist did not openly identify himself in the 50s with the concrete movement (only later in the 60s). According to Pontual, Serpa was mainly interested in the possibility of experimenting (Correio do Povo 1974). Nelson (2006), in turn, defended that the artist had a paradoxical relation to Concretism once he avoided definitions like "concrete" and "abstract artist".

In 1952, Serpa affirmed that his painting was mathematical but that in the use of colors he "composes with sensitivity" (Correio da Manhã 1952, n.p.). Two years later, in 1954, he reported that art "is not mass production." His job was a time-consuming one: first, the "primitive idea" was adapted "to a system of size analysis," then a series of drawings was executed "to find a perfect solution in which repetition would figure as a structure but would not appear," to finally perform the painting (Massena 1954, n.p.). After that, he completed that his "constructivism" derived from his own logic, with "numerical spaces that resulted from a personal order." In addition, "A work of art must have some surprising features. Otherwise, we would not have a work of art, but rigid and cold mathematical theorems, the virtuosity of the technique for the technique" (Morais 1968, n.p.). In this sense, it is clear that for Serpa, the technique was a tool to obtain the desired form, and the replacement of one technique for another happened when the artist arrived in a perfect domain of it (Auler 1975).

The critic and friend Mário Pedrosa (1900–1981) analyzed some moments of Ivan's career and his works as well as his technical solutions. In 1952, Pedrosa stated that Serpa exhausted "the possibilities of oil in the field of concrete art research" (1952, 8). Pedrosa explained to the Brazilian public, who were still initiated in the abstract and geometric forms, that oil paint presents "specific limitations" that impede the concrete painter to achieve a differentiated finishing. The painting that Serpa proposed to produce demanded the use of "new materials" because it explored "a perfect smoothness of surface," the absence of reflex, and a color vibration that should be more pure and precise than other types of paint. Pedrosa then explained the possibilities that the artist had : the use of Ripolin paints,[4] the ruling pen, the aerographer, and the wood panel. Later, Ferreira Gullar, another Brazilian critic, said that Serpa desired to "sensitize the surface" and to explore more the attentive gaze on the details rather than the dynamic movement of forms (1957, 20).

Again in 1952, Serpa recounted a meeting at his residence with artists and intellectuals to present a work executed with Ripolin paints and to exchange ideas. The use of the new technique was known to Sepra—a product "for car painting, and always used on solid surfaces" (rigid materials, e.g., plywood, Eucatex, and Nordex). The reason for choosing this material was its durability. According to the artist, unlike oil paint, Ripolin did not change color after drying, and it did not crack, fissure, or chip away. In addition to this, there were qualities in the aesthetics of the material that interested the artist: the paint forms "uniform surfaces without stains" (Correio da Manhã 1952, 17). Subsequently, Serpa stated the following: "I experienced Ripolin, and it responded to the new demands of my painting. If, however, I rediscover in oil new expressive possibilities, I will return to it" (Correio da Manhã 1953, 11).

It is important to remember that after experimenting with house paints, Serpa experimented with hot glues on paper. The process was completely unusual from a technical point of view, but it was a continuation of his aesthetic process. It continued the search for "purity" and "color density" that oil paint did not allow. The compositions' bonding allowed the "melting of materials" and the fusion of colors, whereas with oil the colors could only be superimposed. The technique extended the possibilities of new "texture types" and different "spatial planes" (Correio da Manhã 1954, 11).

3. THE AVAILABILITY OF MODERN PAINTS

The binder used in *Forma em evolução* (1952—Shape in Evolution) and in *Quadrados em rítmos resultants* (1953—Squares with Resulting Rhythms) was analyzed with pyrolysis gas chromatography mass spectrometry. In both paintings the presence of alkyd resins was found.

According to Standeven (2011), alkyd resins in house paints were only available and marketed in the UK and Europe in the mid-1950s. However, in the United States the product was used even before World War II. Such modified oils are polyesters made from co-esterification reactions between a polyhydric alcohol (e.g., glycerin or pentaerythritol) and a polybasic carboxylic acid (phthalic anhydride). A cross-linked thermoset resin, a monobasic fatty acid, is added to decrease the occurrence of cross-linking (Learner 2004). Similar to oil-resin paints, the proportion of oil in the resin of alkyd paints is responsible for imparting different properties to the coating; in domestic paints the most common type of alkyd resin to be found is the long alkyd oil (Learner 2000).

The drying process of alkyd resins occurs either through solvent evaporation or through a combination of evaporation and further oxidation and polymerization with air. The main

difference between the gloss generated by this material and that produced by the nitrocellulose lacquers is that the alkyd resins do not require polishing. The main difference between this binder and artistic oil paint was a considerably shorter drying time. The film presents good brightness and good spreading but is prone to the formation of cracks. The main characteristics that ensured the popularity of modified alkyd oils were fast drying, good color retention, and excellent gloss and durability. In addition, the material was inexpensive, odorless (although it needed solvents to dissolve the resins), and easy to apply (by brush, roller, or spray) (Standeven 2011).

The French Ripolin brand was initially a ready-mixed paint with polymerized oils, high-quality pigments, and high gloss that were formulated to be applied as an interior or exterior architectural paint, as a marine paint, in the automotive industry, and for others uses (i.e., painting bicycles, furniture, and toys). Ripolin-based alkyd paint appeared at least after 1936 but was only widely distributed in the mid-1950s (McMillan et al. 2013).

In Brazil, Ripolin was imported first to São Paulo and Rio de Janeiro during the end of the 19th century and in the first decades of the 20th century. In São Paulo, stores imported Ripolin enamels in various colors through advertisements in popular newspapers. In Rio de Janeiro, enamel paint was sold in the 1910s in small establishments and for the Navy. The product was sold in the 1930s in hardware stores of small size and announced int the local newspaper *Jornal do Brasil*. Moreover, it was constantly in demand from the Purchasing Committee of the City Hall of Rio de Janeiro, particularly for the painting of school furniture. In copies of the Rio de Janeiro magazine *Vida Doméstica* in the 1940s, the paint was recommended for domestic use on walls and furniture, and there were instructions on how to dilute and apply it.

The first importation of alkyd resins to Brazil is registered by the Brazilian government in many newspapers from Rio de Janeiro dating from the beginning of the 1940s. However, the ease of obtaining such materials would have been reduced in the first half of 1952 when the Brazilian government restricted their importation.

The first reports on the production of alkyd resin in Brazil occur in the early 1950s. However, the feasibility of obtaining this material would only happen concretely from 1954. The production of polybasic carboxylic acid (phthalic anhydride) was encouraged through the establishment of *Indústria Química Produtos Ftálicos S.A.*, founded in 1950. The initiative started from the catalytic oxidation of naphthalene and started production in 1953 with the importation of Italian equipment (Tintas & Vernizes 1959).

If the manufacture of alkyd resins occurred in the early 1950s, then alkyd paints have only been identified since the mid-1950s, when ads for domestic paint purchases became prevalent. In the description of alkyd paint labels it is common to find words like "matte paint for interiors" (Rocha 1962), "glossy" or "alkyd-based paint". In this decade, the term *enamel* identified a paint based on alkyd resins (Neto 1953).

Exceptional cases of Brazilian production of alkyd resins occur in the manufacture of *Tintas Renner* products (1927) in 1951. The company began after a trip to the United States made by Hugo Hermann Filho. The product was made with fatty acids of vegetable oils (linseed, tung, and castor oil), and the resins were made with the glycerin of the oils (polyhydric alcohol), which, by hydrolysis plus phthalic anhydride, would result in alkyd resins (Neto 1953). These were later used in oil paints and enamels (Lobello 1997). At the end of 1951 the industrial alkyd resin Glyptal, made by General Electric S.A. (1921) for industrial use in engines, was also available. In 1956, Tintas Coral S.A. (1954) launched Coralit enamel, possibly with a composition based on dehydrated castor oil, alkyd resin, and thinners that had a total drying time of approximately 3 hours without polishing for glossy surfaces (Tintas Coral 1961).

4. *FORMA EM EVOLUÇÃO*

The painting *Forma em Evolução* was painted by Serpa in 1952 and was donated by him to the MAM-RJ in January of 1953, according to the museum's documentation (Modern Art Museum of Rio de Janeiro 2014). It measures 87.5 × 72.5 cm, and the labels on the verso describe the use of "industrial paint on eucatex" and also "Ripolin paint on wood fiber"; the analyses identified the use of alkyd resin.

The composition uses blue, red, and a neutral color. It can be divided into two rectangular areas: the first is larger and has a blue figure projecting onto a black background; the second area is smaller and presents the inverse movement of the first. In the second one, the black figure moves away on the red background. The two figures represent organic forms and are generated in relation to each other.

The structure used by the artist consists of the application of a blue background and over it the black layer in some places and the red layer in others. This procedure allowed greater tonal richness (superposition of the red over the blue). The three layers are thick, smooth, and glossy, but the black areas

appear more rigid and brittle. The work was probably painted horizontally with a brush due to the formation of thick layers and the flowing of paint at the edges. The procedure was performed on the smooth face of a Eucatex board.

Forma em Evolução was stored in the MAM-RJ during an unfortunate fire that happened in 1978. The damages caused by the disaster, however, were indirect: sprinklers and the direct action of the water formed broad spots and whitish drainage on the top of the blue figure. The pictorial surface also suffered microlosses, abrasions, and cracks. The piece was restored between 1999 and 2000 (MAM-RJ 2014). In its current condition, cracks and whitish stains remain visible.

5. *QUADRADOS EM RÍTMOS RESULTANTES*

The work *Quadrados em rítmos resultantes* was produced in 1953, was exhibited in the Second São Paulo Biennial and currently belongs to a private collector in Rio de Janeiro. On the back of the work, there are labels identifying exposures, dimensions (100 × 100 cm), and the use of oil paint. Chemical analyses also indicated the presence of alkyd resin.

This work presents greater complexity than the previous one. It is composed of a square subdivided into four quadrants with equivalent dimensions but with different representations. The artist seems to take advantage of the idea of symmetry/asymmetry, as he represented the upper left and lower right square with the same colors (dark green) but the upper right and lower left forms with distinct colors (magenta and black). Within these squares the artist included lines (blue and yellow) and triangular shapes (red, blue, yellow, and black). Each quadrant of the square has one or two triangles of different colors. The movement implied by the title of the work is obtained by the contrast between the colors of the triangles with the background and also by the representation of the angles formed by the union of triangles with right angles.

The general aspect of the work is a smooth surface without the brush marks. Successive layers of color were used for the composition of the bottom of each quadrant. The painting was probably painted horizontally, as there are slides of applied paints. To outline lines and triangles, which are simplified geometric shapes, there are remnants of masking tape at the edge of the frame. At the ends of the lines and triangles, there are grooves that indicate the cutting of the masking tape with a sharp tool.

This painting does not have as much historical or conservation documentation. It is known to have been restored at least twice. Its current condition includes whitish and dark spots, as well as a network of horizontal and vertical cracks.

6. CONCLUSION

If in *Forma em evolução* Serpa was interested in bright, pure, and translucent colors, as well as in flat surfaces without brushstrokes, in *Quadrados em rítmos resultantes* the artist used opaque, multiple colors and a rough surface. Alkyd paint offered Serpa the advantages of fast-drying, pure colors and glossy and self-leveling surfaces.

Because of the fluid surface, the production of organic forms in the first painting posed challenges in creating outlines and precision. In the second painting the artist seemed to be in better control of the consistency of the paint, and he was able to use adhesive tape to outline the areas of color. The first composition was probably the beginning of many tests with alkyd paints. (At least five other paintings were produced in the same period with similar forms and structures.)

The historical research helped us understand that in the early 1950s, alkyds were common as resins, and a paint could have been made if the artist mixed the resin, pigments, and solvents by himself. However, the homogeneity in the mixture of the paints used suggests the use of a product already mixed and ready to be applied. According to our historical research, such mixture would not be available in the Brazilian market in that period, and it is possible that the artist used imported paints. In *Quadrados em rítmos resultantes* the many colors used to obtain a final color would not have been available in Brazil.

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NOTES

1. The distinction between the Grupo Ruptura (São Paulo) and Grupo Frente (Rio de Janeiro) artistic proposal is analyzed by several scholars; there is a general consensus that the artists from São Paulo were concerned with visual dynamics and the artists from Rio were interested in the pictorial layer—that is, color and matter (Gullar 1957).
2. According to Herkenhoff (2007), Hélio Oiticica's first *Metaesquemas* pieces followed Serpa's strict guidance on geometry, precision, and cleanness. Serpa demanded massive production between classes. Producing a lot of work would indicate professional choice. This explains why in 2 years, Oiticica painted about 450 *Metaesquemas* divided in series usually painted in a week. Serpa stimulated the focus (Herkenhoff 2007).
3. Beside an art teacher for children and adults, Serpa was also a French teacher. He produced panels for the brazilian bank *Caixa Econômica* in 1951, graphic design projects for books during the mid-late of the 1950s and fabric print for industrial companies like Rhodia in the 1960s (BARCINSKI; SIQUEIRA; FERREIRA, 2003, p. 163).
4. Ripolin paint was created by the Dutch chemist of Prussian origin Carl Julius Ferdinand Riep in Norway in the early 1890s. The brand was born of a partnership between Riep's Dutch paint company Briegleb with the French artistic brand LeFranc. The first factory to be opened by the company was in France in 1897 (Standeven 2013). The product was based on high-gloss oil-resin paints ready for mixing, formulated to be applied as an interior or exterior architectural paint, as a marine paint, in the automotive industry, and for others uses (i.e., painting bicycles, furniture, and toys). The product, at the end of the 1940s, was so successful that the word Ripolin began to identify all enamel paints (Casadio 2011).

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ANETA ZEBALA and DEBRA BURCHETT-LERE with Scientific Analysis by CATHERINE DEFEYT, LYNN LEE, JOY MAZUREK, and ALAN PHENIX

American Abstract Expressionist Painter Sam Francis (1923–1994): Techniques and Materials Inform Conservation Treatment in the 21st Century

ABSTRACT

The presentation by Aneta Zebala at AIC Houston provided an overview of 10-plus years of research undertaken by the authors as part of the collaborative efforts between the Sam Francis Foundation and the Getty Conservation Institute. This research on the artist's paints and studio practices is the subject of a February 2019 publication by the Getty, the fifth in a series on modern artists. Other books in the Getty series to date have focused on Willem de Kooning, Lucio Fontana, Hans Hofmann, and Jean-Paul Riopelle. Sam Francis: The Artist's Materials *elucidates through several case studies some of the different techniques and materials employed by the artist over five decades of his career.*

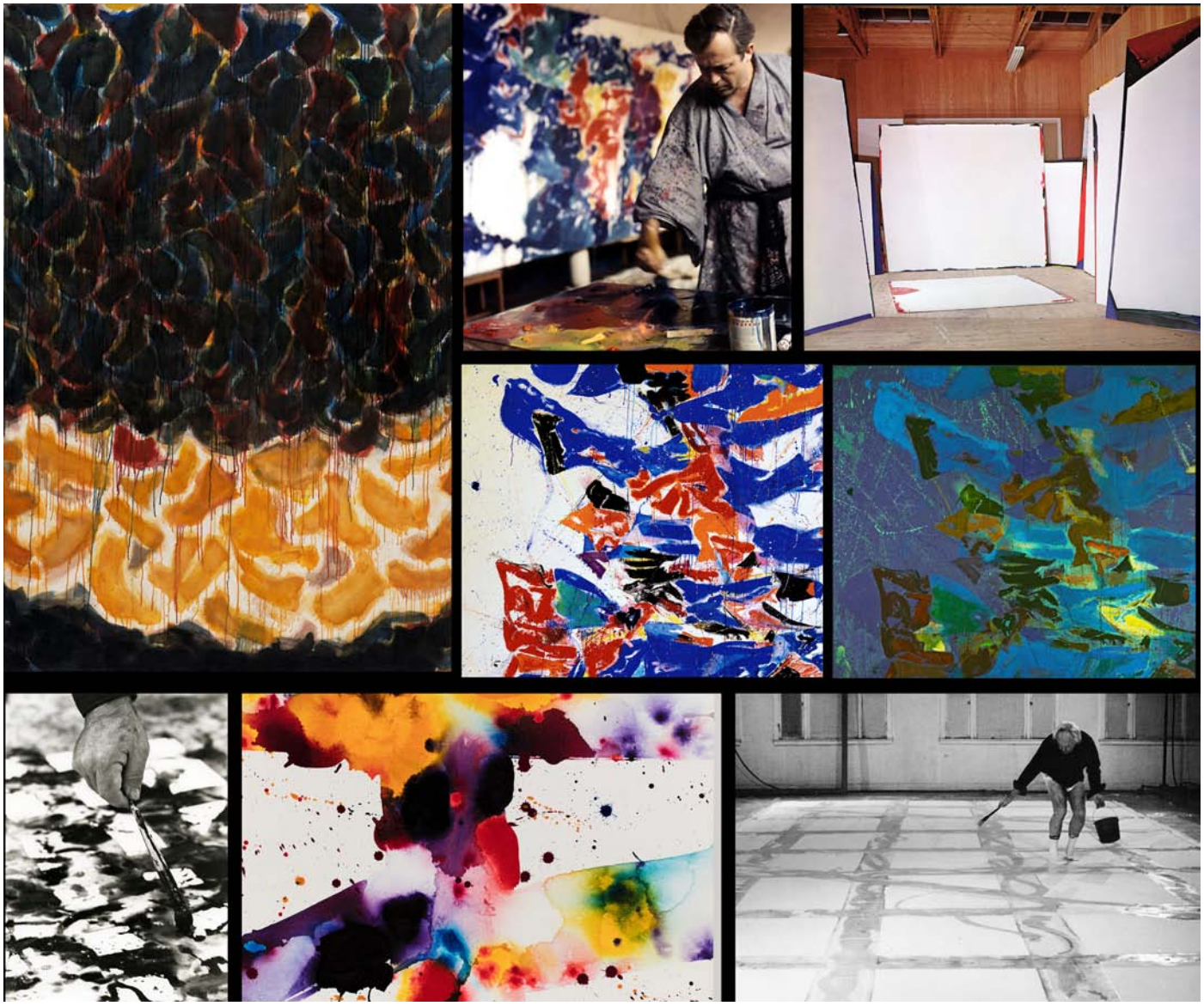
Color is a pattern that plays across the membrane of the mind.
—Sam Francis (1985)

1. ANALYSIS OF PAINTINGS FROM THE 1940S TO THE 1990S

The study of Francis's paints and studio practices was undertaken by scientists at the Getty Conservation Institute and Aneta Zebala's conservation team, with the coordination and archival research by Debra Burchett-Lere and the Sam Francis Foundation. Most of the research was based on extensive surface examination of 37 paintings on canvas and paper from public and private collections, as well as systematic analysis of hundreds of paint samples taken from these works and from paint pots in the artist's studio in Santa Monica, California. The researchers gained insights into Francis's exploration of a variety of media without regard to the compatibility of the materials. They documented how the artist experimented with new commercial materials as soon as they became available and, with the help of Dan Cytron, his studio assistant and paint maker, developed a unique color palette including a variety of custom-made printing inks and dispersions. As the Getty publication reveals, Francis also used gesso as an integral color and "active ground" in his compositions. In addition, the researchers clarified some of the ways Francis manipulated oil and acrylic emulsions to achieve the fluid visual effects of watercolor.

This AIC text spotlights a few observations from the Getty findings and augments the data with additional illustrations and information. The 37 works tested, including paintings from collections of the Fondation Beyeler, Riehen/Basel, the Eli and Edythe L. Broad collection of the Broad, Los Angeles, and the Berkeley Art Museum, Berkeley represent only a small selection of the thousands of paintings created by the artist, so it is important to mention that the pigments identified do not necessarily represent all of the paints Francis used from the late 1940s through the early 1990s. Of the works tested, five paintings, representing key transitions, styles, and techniques in the artist's oeuvre, are featured in the book and discussed in depth, some with cross sections illustrating binder and pigment identification (mosaic fig. 1).

In addition to the testing, the study relied on examinations of some of the artist's materials in his various studios at the time of his death. Additional knowledge of materials used was culled from interviews and an oral history archive with most of the artist's assistants, documentary records, including sales receipts from art supply stores and studio photographs. Michael Skalka, of the National Gallery of Art, Washington, DC, conservation department, assisted in the identification and notation of different materials supplied through documentary images from the artist's studios in Bern, Switzerland; New York, San Francisco, and Santa Monica in the United States; Paris, France; and Tokyo, Japan. One image from 1960 of Francis working in a Paris studio is



Mosaic Figure 1. Left to right, top to bottom:

- Francis, *Blue and Yellow*, 1954–1955 (see fig. 3)
- Francis in his Mita studio, Tokyo, Japan, painting *Tokyo Mural*, 1957. Photo by Francois-René Roland, Paris.
- View of Francis's West Channel Road studio, Santa Monica, California, with large-scale Edge paintings, late 1960s. Photo by Frank J. Thomas.
- Detail of a section of *Round the World*, 1958–1959/1960, acrylic and oil on canvas, Fondation Beyeler, Riehen/Basel, Switzerland, in visible light
- Detail of same section of *Round the World* under UV showing the layering of different whites
- Detail of Francis painting in his Santa Monica studio, ca. 1970s. Photo by Meibao D. Nee.
- Detail of Francis, *Untitled*, 1973, acrylic on canvas, private collection, Monaco
- Francis working on *Dynamic Symmetry*, 1978, in his Ashland studio, Santa Monica, California. Photo by Meibao D. Nee.

Figure 1. Francis in his Arcueil studio in Paris, 1960

annotated to illustrate some of the different materials identified (fig. 1).

2. EXPLORATIONS OF COLOR AND TECHNIQUE

Before 1960, the artist experimented with oil paints, using an abundance of a viscous linseed oil and dammar-based medium. He began to use acrylic paint in the late 1950s, at times combining oil paint with acrylic and other water-borne media in one painting. He was not following a structured system of experimentation; rather, he willed his paints to coexist on the surface regardless of original medium, merging the opposites of oil and acrylic, along with gouache, watercolor, dry pigments, and inks—sometimes using all at the same time, especially in his monoprints.

The research confirmed that Francis's palette in the early 1950s included a priming layer of both lead white and titanium oxide (rutile and anatase). For his oil paintings, titanium oxide was always blended with at least one other white pigment, such as zinc oxide, chalk, or barium sulfate. The presence of lead was not found as frequently as initially believed—indicators for lead white were found in only two of the canvas works studied: *#3 Blue* (fig. 2) and (fig. 3 detail). It thus appears he did not use lead white very often (probably because of his health concerns). Francis's expansive use of blue paint created a misconception that he used many blue pigments, and although he did use a variety colors including ultramarine, cobalt, and phthalocyanine blue, the study has revealed an

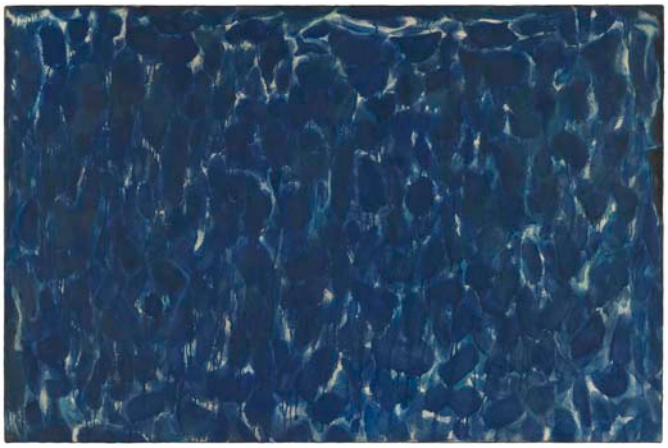


Figure 2. Francis, *#3 Blue*, 1952, oil on canvas, 38 1/4 × 57 1/4 in. (97.2 × 145.4 cm), University of California Berkeley Art Museum and Pacific Film Archive (1995.51.4)

Figure 3. Detail of *Blue and Yellow*, 1954–1955, SFF.166, oil on canvas, 76 3/4 × 51 in. (195 × 129.5 cm), the Eli and Edythe L. Broad Collection (B-FRAN-2P98.11), showing paint brushstrokes applied liquid and dry with drips in both directions

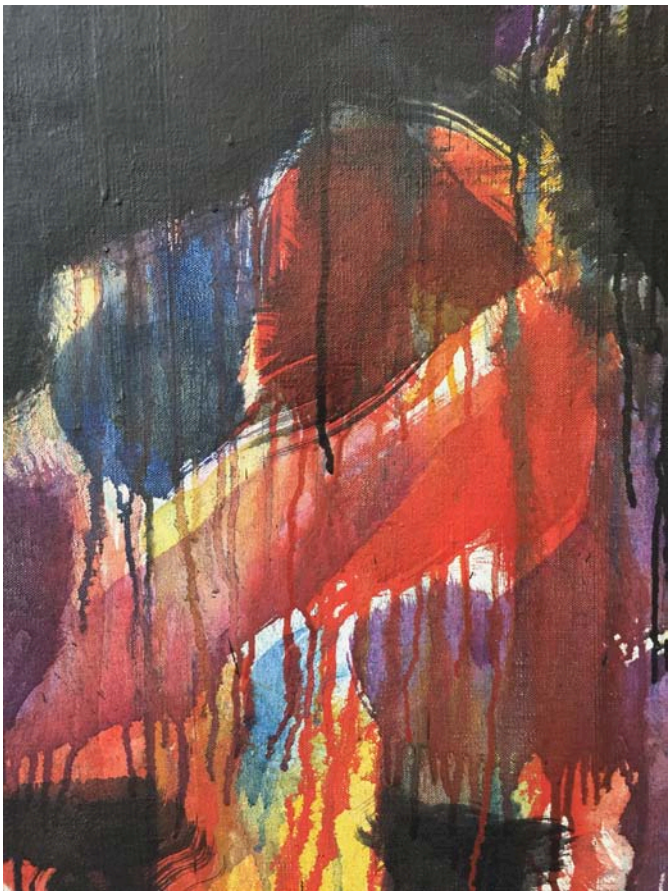


Figure 4. Detail of Francis, *Deep Orange and Black*, 1953–1955, oil on canvas, 146 1/16 × 122 13/16 in. (370.99 × 311.99 cm), Kunstmuseum Basel, Switzerland, showing variations of brushstrokes applied liquid and dry, gesso variations, drips, and reds

unexpected 21 different reds (fig. 4 detail). In addition, the study examined Francis's use of tinted gesso (beginning in the late 1960s), Kodak Photo-Flo (especially in the 1970s and 1980s), and a variety of unique inks and paints developed by Cytron (1970 through the early 1990s) that were of very high quality. As Cytron noted "the addition of the Photo-Flo applied by brushes, sponges, or hand-pump spray bottles increased the flow of paint so the strokes of color have a lush richness."

3. CELLULAR PAINTINGS (EARLY 1950S)

Francis's cellular works created in Paris in the early 1950s began primarily as investigations of individual colors, resulting in a series of saturated and seemingly monochromatic paintings such as *Grey* (fig. 5). His comment that "Paris light is a beautiful cerulean gray" comes to mind when looking at this painting. In this composition, he used a wide range of whites, from the application of white primer to the addition of white paint in different layers.

Viewed up close in oblique light, the color and the grain of the canvas are still quite apparent, as the artist often thinned his paint with turpentine for a watercolor-like effect. The variable sheen of the white paint marks, from matte to shiny, opaque to transparent, increases the work's complexity. With continued inspection, the viewer begins to see the artist's intricate layering of color in the cell-like shapes, including spatters of red (center, right perimeter) and a delicate weave of pale yellow (bottom edge). In Francis's broad, cellular compositions like *Grey*, at first it seems as if the forms of color are created with sponges, but they are actually created with three- to four-inch-wide brushstrokes. His technique of achieving the overall whiteness (or grayness) comes not from brushed gray paint but from mixing thin shades of white and

Figure 5. Francis, *Grey*, 1951, SFF.100, oil on canvas, 90 1/8 × 68 7/8 in. (228.9 × 175 cm), Museum of Contemporary Art, Los Angeles (93.28)

earth colors or yellow into multilayered compositions. There has been some confusion as to whether the fluid, soft cellular forms of his early 1950s canvases were also painted with sponges rather than brushes. From the works studied it has been determined that after the gesso layers were applied, Francis did *not* use sponges to achieve his subsequent layering of the thin watery layers of paint (details of his techniques are further illuminated in the paint study). In fact, Francis's frustration in how his early painting techniques were described was noted in a letter from Kenneth Sawyer to the artist Claire Falkenstein (Paris–May 23, 1954) where Sawyer states that Francis was 'furious' about an article in *Art Digest* by Michael Seuphor commenting that Francis›s cellular paintings were executed with a sponge.

When binding medium analysis was carried out on three different white paints, sampled from matte and shiny passages, all three were, to our surprise, identified as drying oil in chalk-based white paint. The red paint was identified as a plant gum based (possibly watercolor or gouache paint). The yellow paint was identified as polyvinyl acetate (PVA) based. Francis's extensive use of chalk in this painting was likely influenced by Léger, as he attended the Atelier Fernand Léger in Paris from the fall of 1950–1951.

4. THE ROLE OF WHITE

In two paintings from 1960—*Blue 3* (fig. 6) and *Composition in Blue and White* (fig. 7)—Francis combined a limited palette of white in the center with light blue orbs and more saturated darker forms that hug the rectangle's perimeter. The works, with an overall matte finish, have a three-dimensional appearance, as the darker forms hugging the edges are more in focus than the inner blue forms. The white priming layer is applied unevenly, showing striations and fluorescent outlines in some forms. A few smears in the blue splatters suggest a wet-on-wet application of thin white over blue forms. In these paintings, Francis used white not simply as a primer layer

Figure 6. Francis, *Blue 3*, 1960, SFF.332, oil on canvas and possibly other unconfirmed binding media, 39 3/8 × 31 15/16 in. (100 × 81 cm), private collection, Switzerland

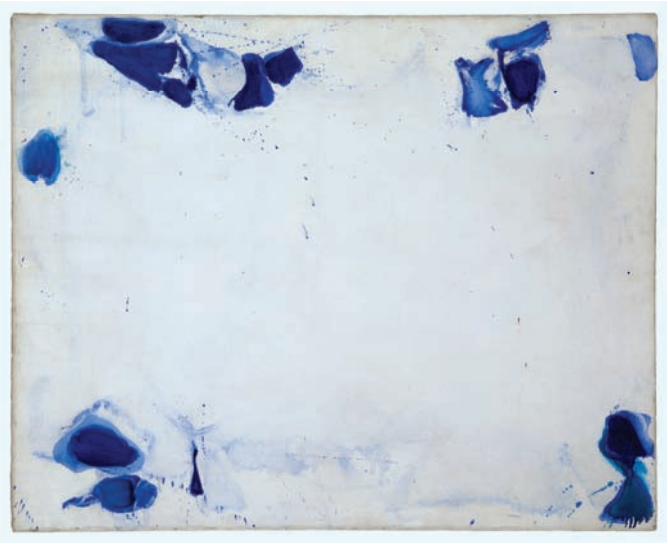


Figure 7. Francis, *Composition in Blue and White*, 1960, SFF.1861, oil and PVA on canvas and possibly other unconfirmed binding media, 28 3/4 × 36 1/4 in. (73 × 92 cm), Jonathan Novak Contemporary Art, Los Angeles

but also more emphatically as "paint," achieving subtle shades of white that become as integral to the composition as the blue forms.

Examination of these works in daylight and UV light, as well as microscopically, reveals that the blue forms do not float across the white gesso surface. As noted, the artist applied thin washes of white selectively over the inner blue shapes, adding layers and complexity to the white center, as well as augmenting the blue shapes' amorphous qualities. Two domains (layers) were perceivable in the white under UV light, but it was not possible to distinguish two separate layers in cross section. As both *Blue 3* and *Composition in Blue and White* were painted in 1960 in the same Paris studio, it is not surprising that the materials identified are very similar. The white layer in both paintings contains chalk, aluminosilicates, and lithopone ($BaSO_4$ + ZnS). The blue paint is ultramarine with zinc white. The binder was confirmed to be linseed oil in both works, and there was one PVA-based paint in *Composition in Blue and White*.

5. MIXING OF MEDIA

As indicated in the Getty study, the importance of identifying the binding medium prior to conservation intervention of any Sam Francis work cannot be stressed enough. The artist's drive to experiment with a variety of paint binders, sometimes mixing materials that are not compatible, becomes

Figure 8. Francis, *Untitled*, 1973, SF73-063, mixed media on paper, 22 ½ × 31 1/2 in. (57.2 × 80 cm), private collection

a clear thread throughout the decades. For example, a 1973 work on paper, *Untitled*, includes red, fluorescent pink, and orange in shellac (possibly inks) and/or gum; unidentified yellow in protein and oil; black that is animal glue based; and green, blue, and purple Magna acrylic solution paints (fig. 8). Considering that only a small percentage of the artist's paintings have been analyzed, it is not fully known to what extent he used multiple media in a single work, but it seems likely that this was not an isolated case. In documenting his work, the following questions often arise: Is the work an acrylic painting, or a watercolor or gouache, or mixed media?

After the artist started introducing acrylic emulsion paints in his canvases and works on paper in the late 1950s, he favored acrylic-based synthetic organic pigments. Yet he continued to cycle back to the traditional artists' materials such as ink, oil, tempera, and watercolor. Assigning paint type by purely visual means is often attempted but can be extremely unreliable, as each medium can produce a broad range of finishes, or sheen, making it difficult to spot the differences, especially between watercolor, gouache, and acrylic. PVA emulsion paints contain all of the same additives as those listed for acrylic emulsions. In this study, visual inspection was verified by analytical tests. Sixteen works were identified as acrylic based, nine as mixed media, six as oil paintings, one as egg tempera, and one as watercolor. Three paintings contained a previously unknown mix of PVA and acrylic resin. Among the seven works on paper, five that were previously classified with a group of works thought to have a variety of paint media were reclassified as pure acrylic emulsion paints as indicated on the pie chart (fig. 9).

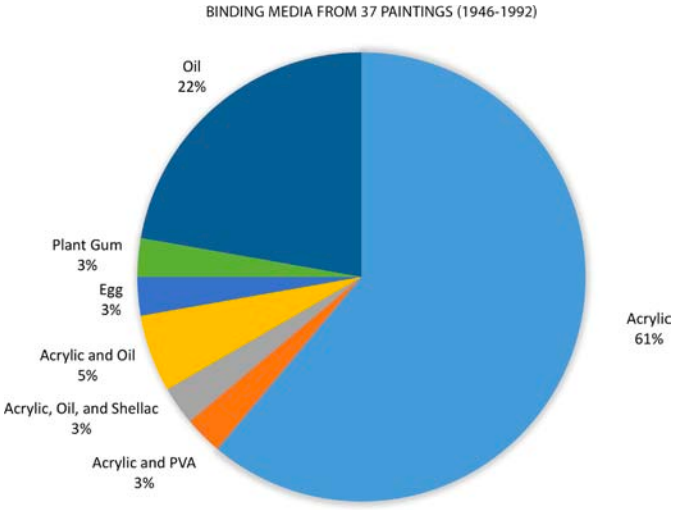


Figure 9. Pie chart summary of the binding media found in 37 paintings from 1946 to 1992 tested through the Getty study. Image by Joy Mazurek, Getty GCI scientist.

6. CREATION OF CUSTOM DISPERSIONS

The artist's use of custom dispersion paints formulated by his studio assistant Dan Cytron, is an important aspect of Francis's unique color palette (fig 10). Although Francis continued to use commercially available paints and inks, most of his works from the late 1970s and early 1980s were created with Cytron's custom-made colors. These dispersions offered intense, shiny, or velvety colors––qualities that the artist favored. These paints were usually available at each of the studios, grouped together in gallon buckets by hue (all of the reds together, all of the blues, and so on) and placed next to gessoed canvases or a variety of papers of different sizes spread around the studio floor.

Many of Francis's paintings exhibit highly chromatic surfaces, where chameleon-like colors show metameric color changes, depending on the light sources. Additional atypical effects such as bronzing, opalescence, and fluorescence present in some works add to a challenging task of color matching.

7. USE OF FLUORESCENTS

Francis's use of fluorescent colors remains to be examined, as none of the colors mentioned in the Getty's appendix were identified by traditional analytical methods. It is known that he used fluorescents (mostly yellow, orange, and some reds), and fluorescent colorants were identified in three works, with a bluish-purple rhodamine (PR173) in an intriguing work on paper from about 1958, acrylic perinone

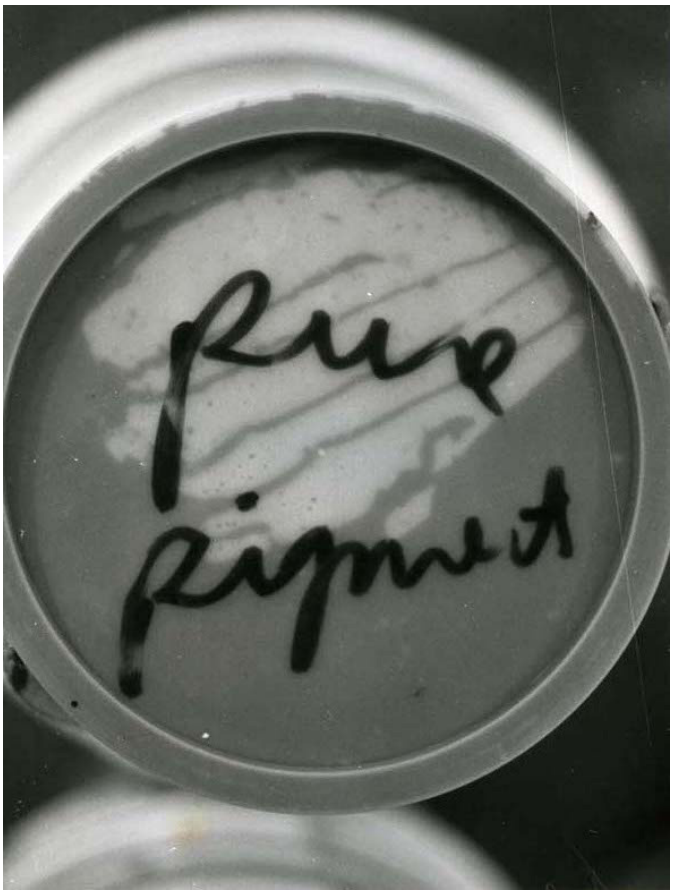


Figure 10. Image of "pure pigment" paint bucket in Francis's studio. Photo by Kurt Blum, Praz, Switzerland.

red (PR194) in a 1965 canvas painting, and an unidentified bright pink shellac in the 1973 work highlighted earlier (fig. 11 detail). Pink and orange colorants in some of his works appear as bright fluorescence when viewed under UV light. The color fastness of these colorants relative to conservation concerns is important to understand with Francis's works, as Stefanie De Winter (2010) pointed to the limited time that fluorescent pigments are at their maximum intensity.

8. FADING COLORS

Faded or fugitive colors—a ubiquitous problem in paintings—have been found in some of Francis's works on paper from the 1950s and in later works from the 1980s, especially in some reds and blues and, most prominently, violets. The fading of a violet colorant, for example, was observed in a Francis acrylic on canvas from 1986 (illustrated in the Getty book), briefly viewed and photographed, but not available for analysis. The fading of

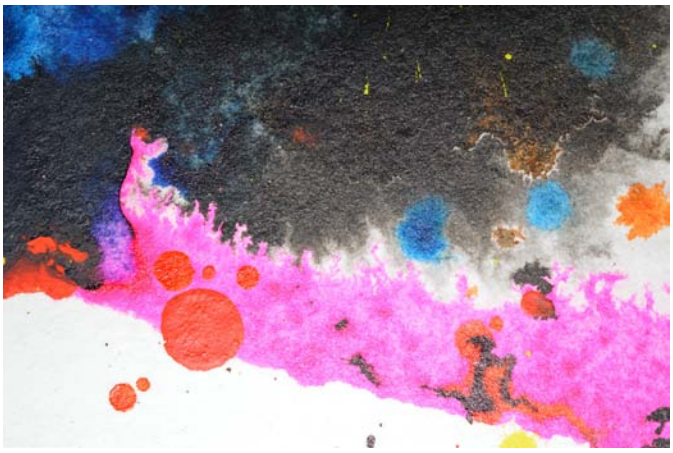


Figure 11. Detail of *Untitled*, 1973 (see fig. 8), showing bottom edge detail of black, red, blue, orange, and pink paint with variable sheen and paint consistency

this paint, possibly a fugitive synthetic dye, is permanent. Through his attraction to inks and synthetic dyes that offered brilliance, Francis may have introduced some fugitive colors to his color palette. In this regard, organic pigments and dyes used by the artist require further investigation and identification.

9. GESSO COMPLEXITY

Francis usually treated the entire canvas surface with multiple layers of gesso, sometimes brushed and later sponged, often with specific tints beginning in the mid-1960s.

The variations of the gessoed surfaces (including 4 to 6 layers in his Edge paintings of the late 1960s) continues to be a subject of further study as these gesso layers may be more complex than the authors have currently determined (fig. 12). In addition to the tinted gesso layers discussed in the Getty study, especially highlighted in the two 1960 canvases discussed earlier, it has been found that there are multiple layers of gesso with variable fluorescence in his canvases from the late 1980s.

10. DATING OBSERVATIONS

Using the knowledge of manufacturing timelines in our identification of paints expands our ability to pinpoint more succinctly the completion dates of Francis's works, especially the hundreds of works that he left undated. Moreover, it is known that the artist, on more than one occasion, returned to modify or "revisit" works from years past or created paintings at a later date in the "style of" earlier works (e.g.,

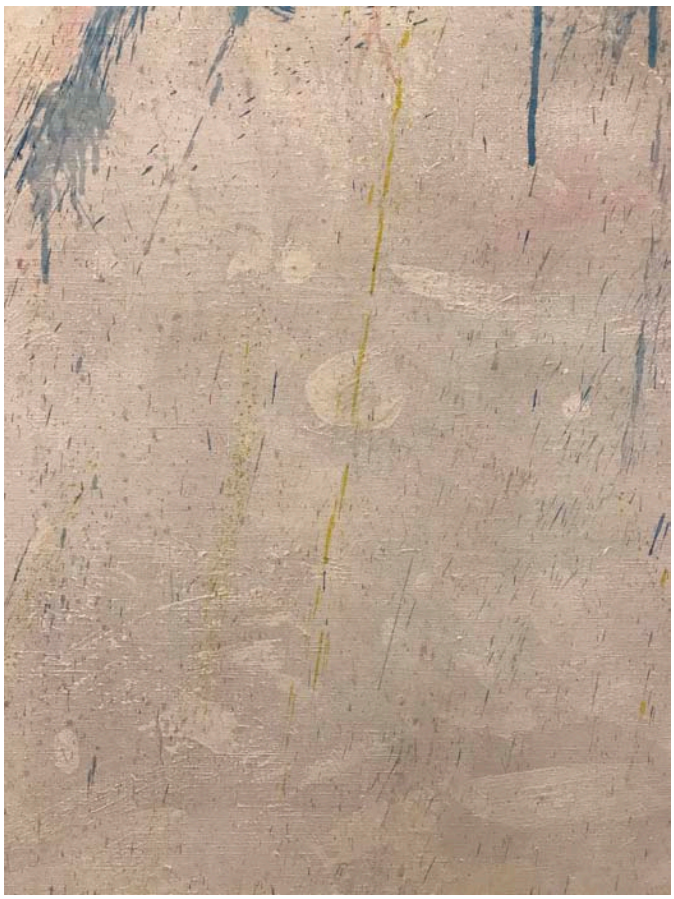


Figure 12. Detail of variable gesso application seen in Francis's *Towards Disappearance*, 1957–1958, oil on canvas, private collection, Seattle

1956/1988). Sometimes he would inscribe dual dates, or he might simply assign an earlier date from the period, or a later date. He did not adhere to a systematic signing and/or dating procedure, nor was he consistent in documenting or dating his works throughout his career. In documenting his oeuvre, it is helpful to understand these variations in dating, as an analysis of a work dated from 1956 may confusingly reveal paint samples of materials manufactured at a later time, such as from the late 1960s or 1970s.

This scenario is exemplified in *Blue Balls VIII* (fig. 13, fig. 14 detail), another work from the collection of the Museum of Contemporary Art, Los Angeles. Here the composition is now identified with a combination date designated with a slash between two dates to indicate that the work was not continuous but was executed during one or both of the span of years designated. Overall, the paints sampled in *Blue Balls VIII* were identified as acrylic emulsions; however, interestingly, analysis revealed the green, purple, and crimson red contained acrylic emulsion copolymer p(n BA-MMA), which only became available around 1967. This identification

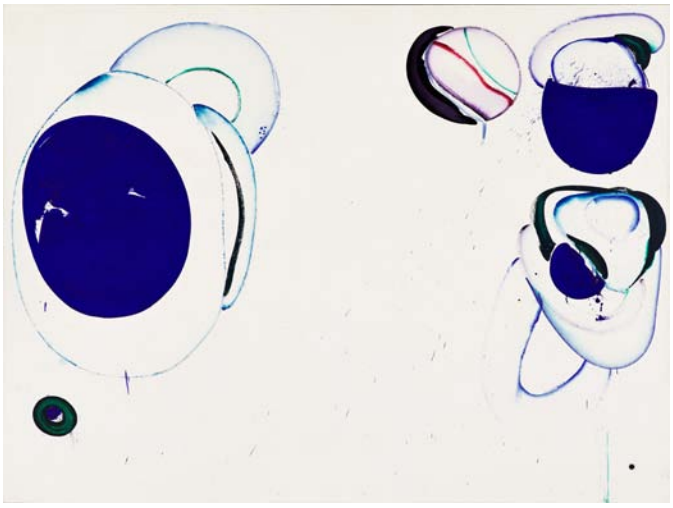


Figure 13. Francis, *Blue Balls VIII*, ca. 1961–1962/1968–1972, SFF.328, acrylic on canvas, 73 × 98 in. (185.4 × 248.9 cm), Museum of Contemporary Art, bequest of Marcia Simon Weisman (99.24)

of additional paint added at a subsequent date confirmed that the artist enhanced his 1962 painting by adding more green paint, purple, and red sometime after 1967 and likely before his 1972 solo show at the Albright-Knox Art Gallery in Buffalo.

The Sam Francis Foundation and Aneta Zebala continue the research in this area by sampling and analyzing other works where Francis likely added paint at a later date to paintings started in the 1950s and 1960s. At times it is difficult to confirm a date, as he revisited imagery from different periods of his career, creating what he considered homage works as a way of deepening his exploration of color, content, and form. Moreover, it was not uncommon for Francis to move back and forth between compositions during a particular period. There are several works documented in the artist's catalogue raisonné, where he inscribed both dates on the verso of the paintings, such as "1954 to 1988/finished 1988" or "1957/1988 overpainted." Conversely, there are many works that are not dated or designated with any dual dates, and some with mistaken earlier attribution dates to works created later, so these require additional study, especially if early provenance, studio documentation, or exhibition history is not readily available.

Working with the artist's Foundation and the Getty in the research and organization of the paint study data, the authors have sought to confirm the information presented, but it is important to note that some artworks have sanctioned data, whereas others are subject to change as new facts are revealed with continued scholarship. The study includes anecdotes as well as other documentation of methods obtained by first-hand testimony of Francis's studio assistants, photographs, conservation studies, as well as the scientific testing. The information gathered should not be construed as an absolute accounting of the artist's oeuvre but as a chronicle of information discovered at this time (mosaic fig. 2).

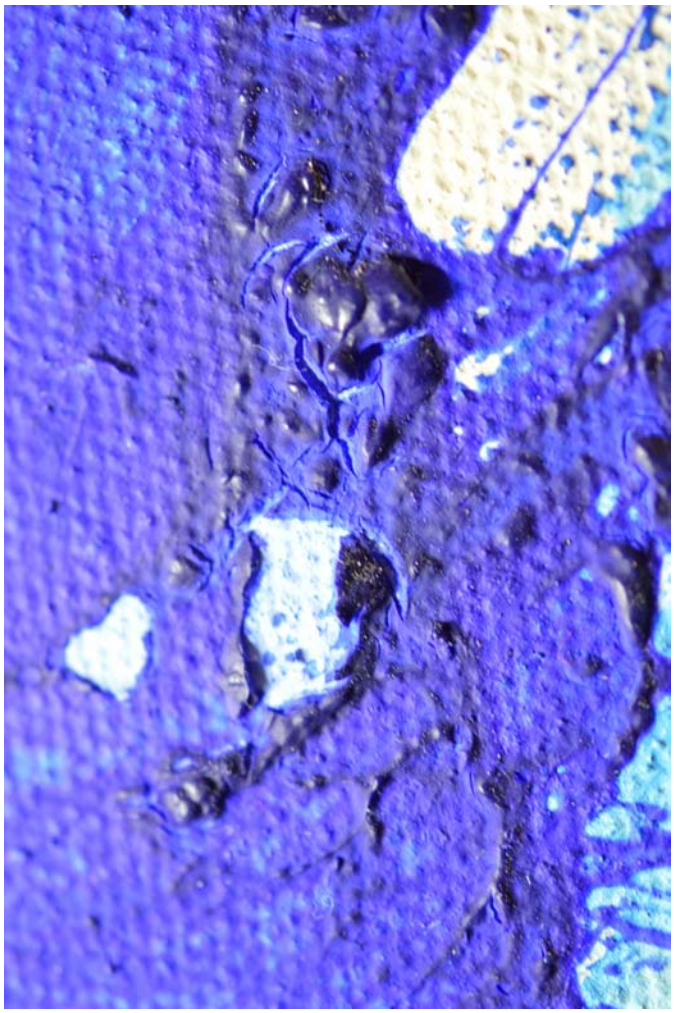


Figure 14. Detail of *Blue Balls VIII* (see fig. 13)

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The authors would like to acknowledge the following conservators and scientists who were part of the research team spanning over 10 years from the Getty Conservation Institute and UCLA; the Centre Européen d'Archéométrie at the Université de Liège; the Centrum Konserwacji, PWSZ, in Nysa, Poland; Longevity Art Preservation, LLC, in Miami; Foundation Beyeler, in Basel; and the National Gallery,

Mosaic Figure 2. Left to right, top to bottom:

- View of paint tubes on a table in Francis's Santa Monica studio, including alkyd and Shiva colors, ca. after 1976
- View of Francis's Akasaka studio, Tokyo, Japan, with Fresh Air paintings in progress
- View of work table in Francis's Broadway studio, New York, New York, ca. 1961, with Liquitex paints
- View of Francis's studio in Venice, California, with paintings in progress, 1990. Photo by Jerry Sohn.
- Photo of buckets filled with paint readied for painting session in Francis's studio, ca. late 1980s or early 1990
- Close-up of paint brushes and inks on Francis's work table, ca. 1970s
- Example of specially produced fast-drying alkyd oil paint tubes used by Francis designed by Winsor & Newton in 1976, which commissioned artists to create labels for the different paint colors in the "style of" famous artworks

Washington DC—Michael Bouchard, Catherine Defeyt, Cynthia Godlewski, Markus Gross, Pawel Karaszkiewicz, Emily McDonald-Korth, Lynn Lee, Joy Mazurek, Carrie Ann Menke, Suzanne Morris, Vanessa Muros, Alan Phenix, Rachel Rivenc, Catherine Schmidt-Patterson, Adam Romcio, Megan Salas, Michael Shilling, Michael Skalka, Friederike Steckling, and David Strivay. A special thank you to Timothy Whalen, Tom Learner, and Cynthia Godlewski of the Getty Conservation Institute for green lighting the Francis project, and to the Sam Francis Foundation's board of directors and staff for valuable assistance and support over the years.

NOTE: Quotations, unless otherwise annotated, are sourced from the artist's archives at the Getty Research Institute.

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NAOMI MEULEMANS, STEFANIE DE WINTER, and GIOVANNA TAMÀ

Split Infinity, Herbert Aach—The Integrated Inpainting Method for Fluorescent Paint Layers

ABSTRACT

In this paper, we discuss the progress of finding a new method for the integrated inpainting of fluorescent paint layers. During the conservation of the fluorescent, monochrome paintings of Herbert Aach's (1923–1985) Split Infinity series (1976–1977), standard retouching methods led to negative results. Although we were able to simulate the fluorescent color under stable light conditions, as soon as UV light increased, the inpainting became more disturbingly visible. Besides these color-matching difficulties, its material structure differed strongly from the original paint layer. Aach was an artist who made his own pigments and paint media. The fluorescent paint layers in the series appear very dry and fresco-like, and the saturation of the fluorescent pigment in the acrylic medium is much higher than in the fluorescent paints sold in art supply stores.

Valuable research by Stefanie De Winter (doctoral researcher, PhD art history, KU Leuven, Belgium) describes the material-technical and the specific visual differences between fluorescent and conventional pigments. Three significant characteristics became apparent during this empiric comparison. First, fluorescent pigments age much faster; after 10 years, they start to lose their intensity. Second, they are very transparent, due to their organic pigment composition, which makes mixing them with other colors not possible. Third, there are limits in binding fluorescent pigments with media, as because of their high transparency, they require a very clear medium.

In this study, we want to find a new retouching method that considers these specific characteristics and that enables inpainting with fluorescent pigments in the monochrome, fresco-like paint layers of Aach's works. We are currently investigating the specific pigment used in Split Infinity paintings through pigment analysis (Raman spectroscopy). The results will be compared with the spectra on fluorescent paints researched by Wim Fremout and Steven Saverwyns (KIK, Royal Institute for Art Patrimonium Belgium) and further analyzed with the help of specialized chemists of the University of Antwerp. We are also testing artificially aged pigments to simulate the original age of the fluorescent paint layer to ensure reduction of the fluorescent intensity that is causing the disturbing effect on the total image. For the retouching media, we are testing dry-looking mixtures, such as pastel, gouache, and acrylic combined with structuring techniques. In a next phase the acquired information will be used for the case studies on inpainting of these monochrome paintings. We expect to provide new insights in the understanding of fluorescent paint. This highly needed new method for retouching fluorescent paint layers will assist conservators to better restore and preserve these very bright, highly sensitive, and fast-degrading paint layers.

MAREIKE OPEÑA

Oxidized Fingerprints on Golden Metallic Paints Containing Leafing Pigments

ABSTRACT

This work aims to present the basic understanding of leafing pigments in metallic paints, which give Rudolf Stingel's Carpet Paintings *their distinct metallic surfaces. This enamel paint is sensitive to local corrosion after being touched without gloves, developing into brown, dull fingerprints. A conservation strategy was developed to restore the highly reflective character. After a brief introduction of Rudolf Stingel's* Carpet Paintings*, inherent appearances will be distinguished from actual damages. The characteristics of leafing pigments will be outlined. With three subsequent conservation treatments, the refining of the strategies and options are explained—each heavily relying on the knowledge gathered from the previous case.*

As a whole, this article aims to represent an example of knowledge accumulation for conservators in private practice, where quick turn-around times often prohibit extensive research periods prior to a treatment.

1. INTRODUCTION

This article aims to present the basic understanding of leafing pigments in metallic enamel paints, which give Rudolf Stingel's *Carpet Paintings* their distinct metallic surfaces. These paintings circulate in the top echelon of the art market,[1] which in turn raises the collector's expectations for a pristine material condition. Meanwhile, this paint is extremely sensitive to corrosion. A conservation strategy was thus developed to restore the highly reflective character of the surfaces, not only to eliminate the undisturbed experience of these works but also to meet the art market's expectations.

At Contemporary Conservation Ltd., a private practice conservation studio in New York City, there is often limited time to execute research about an issue in an artwork in need of treatment. Instead, with time constraints and tightly calculated treatment schedules, one relies on previously collected experience and knowledge within the studio. Time and again, these become the point of departure for further investigation (Müller-Wüsten and Moretto 2019).

The cases of three selected conservation treatments will outline the self-reflexive observations during each research period (Stigter 2016). Together, they describe how basic chemical knowledge combined with close observations of material behavior during testing, as well as confidence in our treatment from clients and the artist, and the persistence of the team of conservators for more than a decade, led to the development of a complex conservation strategy—each treatment heavily relying on the knowledge gathered from the previous case.

It is important to point out that even though this is a series of artworks—in principle, produced in the same manner—no painting is identical in its formulation. Furthermore, the current physical condition of each is influenced by the artwork's environment and handling history. This in turn will influence the exact inpainting recipe, which needs to be determined anew every time. For this reason, it is not recommended to follow recipes of this article; it is rather the intention of the author to disclose the characteristics of the artistic materials used in these paintings, as well as the conservation approach and the resulting strategy. It is hoped that a general understanding will be useful to other conservators dealing with leafing metallic pigments on either a painting by Stingel or on any other work of contemporary art.

2. THE *CARPET PAINTINGS* BY RUDOLF STINGEL

Rudolf Stingel (b. 1956) is an Italian American artist based in New York City and Merano, Italy. Central to his oeuvre is the expansion of the vocabulary of painting and its perception, which is traceable and reflects in the artist's constant development of a series of paintings, usually untitled, but often referred to as *Carpet Paintings*: from the

Figure 1. Rudolf Stingel, *Untitled*, 1993, oil and enamel on canvas, 40 × 48 in. (101.6 × 121.9 cm), private collection

abstract tulle silver paintings of the 1990s to the latest golden canvases that bear the traces of time and action in the studio (Gagosian Gallery 2018).

The first textured paintings were executed with metallic silver paint and undertones of white, red, or blue in 1987 (fig. 1). In 1989, the artist published the paintings' technique in a small booklet, *Instructions*, in which the materials and each step are disclosed with photographs and instructions in five languages (Stingel 1989). The basic technique is as follows: a primed and stretched canvas is covered with a rather thick layer of oil paint, applied by squeegee. A tulle fabric is loosely spread across the wet surface and worked into the oil paint using the same tool. With a spray gun, enamel paint ATTIVA Silveral Alluminio is applied to this surface. Finally, the tulle fabric is pulled out of the two, still-wet paint layers. This creates a delicate textured surface, an iridescent interplay between the oil paint and the silver paint (fig. 2).

Over the ensuing years, Stingel expanded the parameters—sometimes using two different-colored oil paints or golden enamel paint (ATTIVA Silveral Oro). He began to use patterned lace–textured tulle, which marked the beginning of what is now generally referred to as *Carpet Paintings*.

By the mid-1990s, the artist had added two extra steps to this basic technique: rolling out a layer of metallic paint over the primed canvas and placing the tulle onto the canvas before applying oil paint. This tulle was stretched over work frames, which allowed him to transfer more defined patterns similar to silk screen techniques. Initially, he used fairly simple geometric patterns (large net-like structures or vertical striped patterns). The versions developed became increasingly complex, reaching into baroque stucco-style decoration, perspectival play of geometric shapes, or abstractions of actual oriental carpets (fig. 3).

For the past 10 years, the artist has continued to develop the technique further, interrupting his own precision by layering various patterns or disturbing them with large brushstrokes. By reducing either the amount of applied oil or metallic paint, the

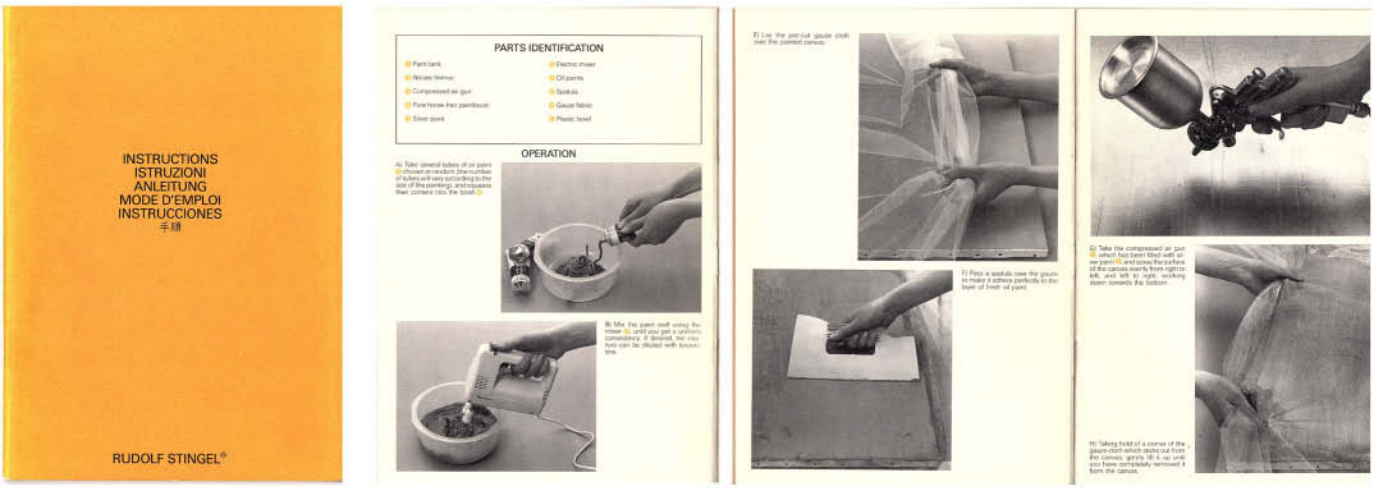

Figure 2. Rudolf Stingel, *Instructions*, 1989. The small booklet discloses each step of the artist's technique.

Figure 3. Rudolf Stingel, *Untitled*, 2007, oil and enamel on canvas, 95 × 78 in. (241.3 × 198.1 cm), private collection

topography of the patterns vanishes or the metallic character fades away to give room for the underlying color of the oil paint.

All paintings are characterized by their highly reflective golden or silver surfaces combined with the fine weave pattern of the tulle and a delicate texture of the manipulated oil paint. The paintings look different from every angle of observation.

3. TYPICAL VISUAL EFFECTS VERSUS AGING APPEARANCES ON CARPET PAINTINGS

Often clients point out areas of concern in *Carpet Paintings* that are in fact inherent to the artist's technique. Linear accumulation in the oil paint layer is created by the movements of the squeegee, which remains visible through the tulle-textured metallic appearance. Folds in the tulle, or attenuations from pulling it, create equally linear irregularities in the patterns (compare with fig. 1). The artist's tools sometimes leave scrapes in the wet paint, often marked through both metallic and oil paint layers. Similarly inherent to the process are topographical imprints of tools or fingerprints in the wet paint along the painting's edges as an index of the artist's handling or marks of the aluminum frames of the silk screen. Other fingerprints, visible as dark smudges or even of different-colored paints on the unprimed tacking edges are equally records of the artist's handling at his studio.

Oftentimes, Contemporary Conservation has been called for a general evaluation of the condition. Although the areas mentioned earlier are not of concern as they are inherent to the work, damages from handling or accidents often accompany them. Most common are handling marks along the vertical edges of the painted front, slightly below eye level (fig. 4). These are most visible in the solid golden, untextured areas (fig. 5). Dried droplets of liquids in the lower third of the paintings' surface appear frequently, although their origin and substance is harder to define (fig. 6). Finally, the mark of entire hand prints, usually in the center of a painting, mark the uncontrolled urge of a curious viewer for textural exploration of these paintings (fig. 7).

Generally, faint handling marks and fingerprints along the edges of a painting are usually tolerated as long as they are

Figure 4. Oxidized fingerprints on the vertical edge of a *Carpet Painting*

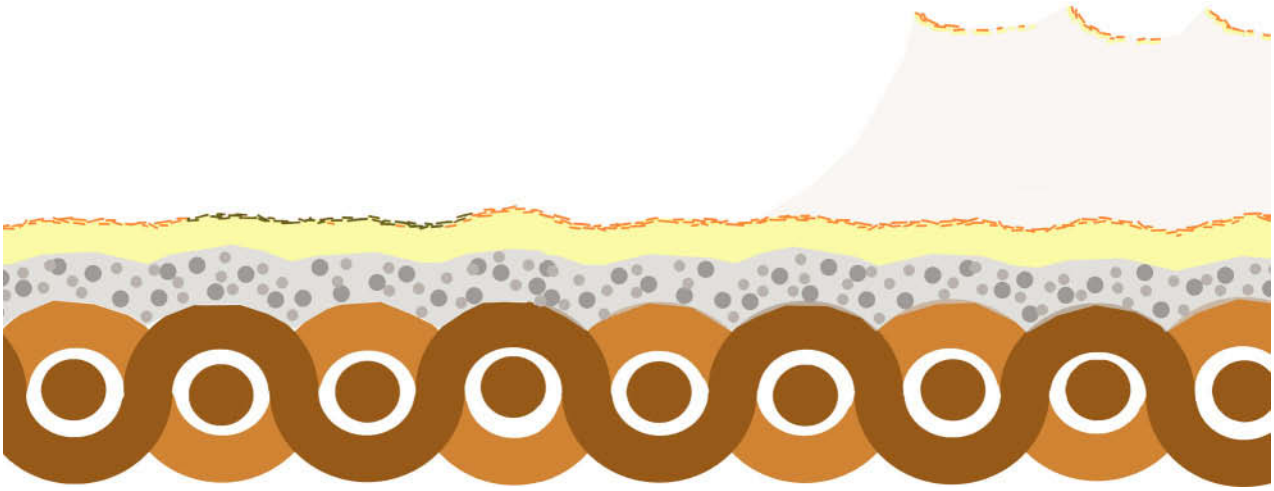

Figure 5. Schematic drawing of an oxidized area of the solid golden layer in close proximity to the ornamental, tulle-textured "islands"

invisible from most angles. They become an issue when oxidation has further proceeded, and the marks appear dull, brown, or even green. On these highly reflective surfaces, they appear much darker.

In the mid-2000s, the artist became interested in protecting the sensitive surfaces by sealing a painting with a layer of sprayed varnish. Two conservators from Contemporary Conservation had communicated with him about this issue and suggested several varnishes.[2] Stingel, after testing these varnishes on several paintings, abandoned this protective approach because it was interfering with his creative process. Any coating had a dulling effect on the reflective surface. Furthermore, the test panels showed a weak bond between the varnish layer and the metallic surface, chipping off easily. It was instead decided to improve the handling crates the artist's studio provided when a new painting was released from the studio to be exhibited or sold.

4. LEAFING PIGMENTS IN THE SILVERAL ORO PAINT SYSTEM

The metallic paints used in Stingel's *Carpet Paintings* were originally developed to seal and protect industrial metal parts from their environment. Therefore, not much attention was paid to the longevity of their optical appearance. They are composed of "leafing pigments" in a low-molecular-weight binder, soluble in aromatic and some other, nonpolar solvents.

The pigments are produced by ECKART Special Effect Pigments, a German company now owned by the American

Figure 6. Dried drops of liquids create advanced local oxidization.

Figure 7. Trace of a hand brushing over the surface in the center of *Carpet Painting*

Figure 8. Three different shades of golden tones are produced by ECKART Germany: Reichbleichgold, Bleichgold, and Dukatengold.

company ALTANA. The pigments are at their core flat aluminum discs that are coated with a copper-zinc alloy. This gives them their golden tone. The zinc ratio in the alloy determines the coolness of the golden tone (fig. 8). Three different shades of golden tones are produced: Dukatengold, Reichbleichgold, and Bleichgold. In commercially available paints, the pigments are mixed to create various shades of gold and are now widely advertised for decorative home improvements.

The "leafing" character describes a pigment's ability to float on top of a solution due to repelling forces. This is created by a layer of stearic acid bound to the discs.[3] This effect is achieved most intensely in xylene-based solvent systems. The polar part of the stearic acid (the carboxyl rest) attaches itself to the equally polar metal pigments, whereas the nonpolar chain functions as a connection point to the solvent.

Considering that the coating is, according to ECKART, not 100% tight, the metal pigments are repelled from the nonpolar solvent and float toward all interfaces of the film. The result is a dense layer of pigments on the surface on top of a film that itself remains practically pigment free (fig. 9). With such a paint system, gold or silver leaf can be imitated, almost recreated. Just like silver or gold leaf, the layer of pigments on top of the film is exposed to its environment without a protective coating.

Generally speaking, due to the particular leafing character of these pigments, the golden tone on a painted film tends to oxidize gradually, shifting from a pale gold toward a warmer hue, until one day it may turn a tarnished greenish brown. This process is expedited by induction, whether by sweat, grease, dirt, liquids, or excessive sunlight exposure.

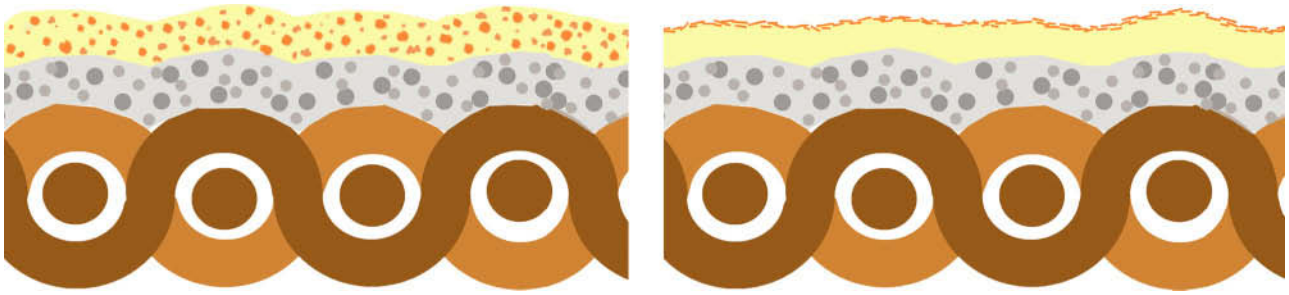

Figure 9. In a common paint layer, the pigments are dispersed and surrounded by the protective binding medium (left), whereas in a film of leafing pigments, the layer of binding medium stays mostly pigment free (right).

5. CONSERVATION OF *CARPET PAINTINGS*

Despite the more durable crates in which the paintings are shipped and handled, damages like oxidized fingerprints or liquid splashes continue to occur. Generally, the silver *Carpet Paintings* are less prone to develop corrosion stains from handling. The aluminum pigments are coated with stearic acid for the leafing character, but not with the copper-zinc alloy. A silver painting's surface is far more stable than its golden counterpart. Hence, the former is not the focus of this work.

5.1 Case Study 1 in 2008

In 2008, a small golden painting with red oil paint and a tight baroque pattern was treated by Contemporary Conservation Ltd. very locally along the edges. The paint used originally was collected from the artist's studio (a long relationship already existed through Christian Scheidemann). The areas of fingerprints on solid gold were removed with solvents, and a thin layer of fresh paint was applied with airbrush. This led to higher gloss through a diminished surface texture due to the solvent-based removal of the original paint. The golden tone was slightly cooler, as the fresh paint had not yet aged. Yet it was considered a successful treatment at that time. The slight difference in tone and texture was evaluated as less distracting than the corroded fingerprints. It was assumed that the tone difference would adjust to its surrounding with time through gradual aging.

5.2 Case Study 2 in 2014

In 2014, a large golden painting with white oil paint and a dense, wallpaper-like pattern came to the studio. This painting exhibited 13 areas of corroded fingerprints along the edges. The painting was otherwise in very good overall condition. The client was eager to have the areas treated/reintegrated. The fingerprints occurred in the solid, untextured areas and had heavily corroded over the course of approximately 1 month. After communicating the limited conservation possibilities and the likelihood of the treatment remaining visible to the client, a research period of 4 weeks was agreed to, with the caveat that a positive test result was not guaranteed. With the approval of this test phase, several routes of investigation began simultaneously.

6. APPROACHING INPAINTING

Treating an undesired appearance on an artwork's surface is possible through several principles:

1. The first principle is inpainting/covering a diminished area with additional material (ideally following conservation standards of reversibility, stability, minimal intervention, etc.).
2. The second principle is covering an area with the same material used by the artist. In contemporary art, the notion of inpainting with chemically identical paints is accepted in some cases (the recoating of outdoor sculptures, monochromes, or industrially fabricated surfaces etc.)
3. The third principle is removing the affected material itself, such as through polishing, reducing, or reversing a chemical process.
4. The fourth principle of investigation is understanding the aging of a paint system. Although this is part of any conservation strategy investigation generally, it is not necessarily used for interfering with the paint system itself as the route of solution development for a conservation treatment. At this point of departure, such an endeavor seemed far-fetched.

The first three preceding principles are discussed in the following sections.

6.1 Conservation Inpainting

Initially, a great number of gold-imitating colors in various binders was gathered to develop an overview of gold-imitating

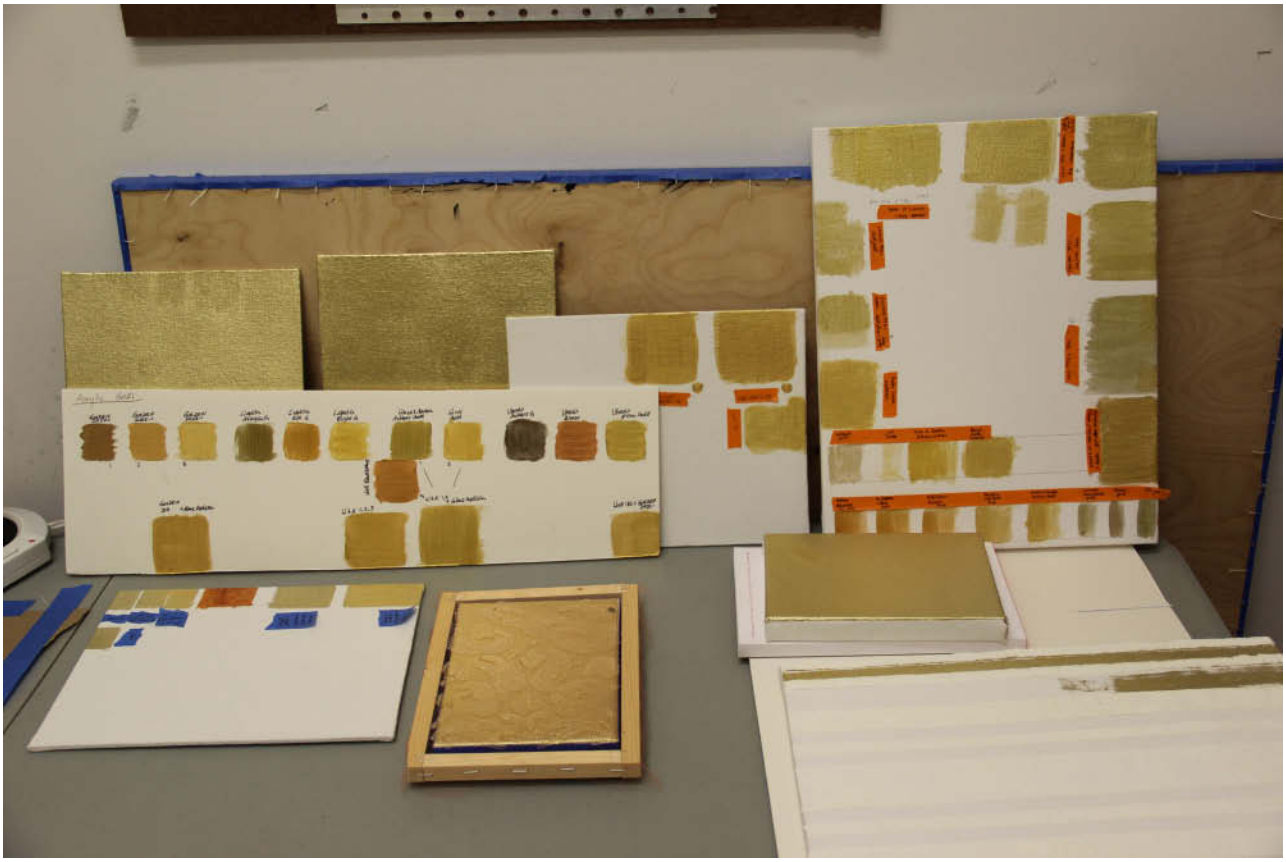

Figure 10. Sample boards of a vast number of gold imitating materials

possibilities available at art supply stores. Acrylics, oils, outdoor colors, and watercolors, as well as plain pigments or metal leaf in various binding media, were applied in different ways (rolling, brushing, and spraying) on cardboard (fig. 10).

None of them came close to the reflective, bright character of the original for two reasons. First, the physical buildup of a homogeneous distribution of "normal" pigments in a binder is fundamentally different from the top layer pigment density within a film of leafing pigments. In addition, commercially available gold-imitating pigments mostly consist of coated mica pigments that are granular shaped. Not even shell gold or gold leaf was bright enough after application onto the boards. All surfaces remained too matte, and polishing options would be inapplicable on a canvas support.

6.2 Inpainting Using the Artist's Paints

The artist's studio was contacted to gather further information beyond the published *Instructions* and to investigate possible changes in the artist's choices of materials since 1989. We learned that Stingel still uses the same paints. Because ATTIVA, the paint supplier, changed the recipe of both Gold and Silver around 2002, the artist had acquired a large stock of cans from the old recipes and expressed his preference for them because they appear to be easier to work with. We received samples of both golden paints, before 2002 and after.

Both paint samples were rolled onto store-bought, pre-primed canvases. It was quickly evident that even the texture of a sample canvas needed to be chosen carefully, as the weave and thread thickness, as well as the layer of the primer, determined the degree of reflection and, consequentially, the appearance of the gold. If the difference was too far from the original texture, the golden tone could not be evaluated accurately. With a canvas close in texture, the original tone could finally be compared with the two sample paints. For the first time, it was noted that the artwork had developed a significantly warmer golden tone and that the samples would not be suitable for possible inpainting on the artwork (fig. 11). Furthermore, the paint samples of the old and new recipes, although identical in tone, behaved differently during application.

Figure 11. The freshly applied film on the sample board (left) is cooler in tone.

The former seemed to stay open slightly longer and thus were easier to work with and build a more even film with a smoother surface. It is assumed that the change of recipe in the manufacturer's paint system is related to new regulations for the use of volatile organic components within the European Union.

Even with the compromise of giving up reversibility and the difference in tone between original surface and samples on almost identical canvases, the tests revealed several other issues:

1. A local, brushed-on application on a solid golden surface leaves an inpainting edge and creates a less textured surface with irregularities in the density due to brushstrokes.
2. Removing an "affected" area with solvents is possible (acetone, ethanol, and a variety of aromatic solvents). Yet solvents also affect the primer by dissolving it, as well as abrading its texture.
3. A sprayed application with an airbrush requires masking of the intact surrounding area: the tested masking tapes (of approximately 20 different kinds) either did not adhere to the surface sufficiently or adhered so well that the layer of golden pigments detached on removal.

Meanwhile, a mock-up *Carpet Painting* was created following the artist's *Instructions* and his later techniques, with an initial layer of solid gold and the linear stencils. The mock-up was made to possibly execute future, more complex tests on a sample closely resembling an original, with the protection of textured areas being an obstacle to overcome as well.

6.3 Removing Material/Reversing Corrosion

On the sample canvases with solid, rolled paint layers, only fingerprints and dried drops (water, coffee, and soda) were created to execute tests on the affected paint layer itself: Brass cleaning techniques, polishing pastes, and rust removers/converters were tried. Again, none of these options were successful, either by polishing right through the superficial layer of gold or by oxidizing the corroded areas even further rather than reversing them.

Because all approaches described previously were unsuccessful, only the final route of investigation, of understanding the chemistry and aging of the paint system and its pigments, remained to explore possibilities for modifying/developing an artificially aged paint system in situ. In literature of special effect pigments (compare with Pfaff 2008, 112ff., or Buxbaum and Pfaff 2017, 253ff.), no information was found on the aging behavior of leafing pigments. The pigment producer and supplier for ATTIVA paints, ECKART Germany, was contacted directly. Although very responsive to our inquiries about the paints and pigments, the company was unable to precisely answer questions on aging, treatment options, or reversibility of oxidation. Instead, they kindly offered samples of all produced pigments and a can of the pure binder dissolved in the solvents used in the paint system. It might be possible to match a paint to the current tone on the artwork by mixing the three shades of pigments to the desired tone.

7. ARTIFICIAL AGING OF LEAFING PIGMENTS

During the waiting period for the pigment samples to arrive from Germany, the aging reactions were further explored on the sample canvases. Simple approaches of accelerating aging such as exposing them to light (sunlight, UV lamp) were unsuccessful within the limited time frame. However, when pointing a heat spatula at the samples, a promising result appeared within 10 minutes (fig. 12). The spatula was regulated to 120°C. At the center of the targeted area (½ square in.), the tone shifted toward a warm gold, similar to the original. Contrary to this promising result, a halo of a cooler tone developed simultaneously. On the complex mock-up, it appeared impossible to restrict the targeted area of aging to either solid or textured gold only. Protecting the surrounding areas with a cardboard stencil trapped the heat

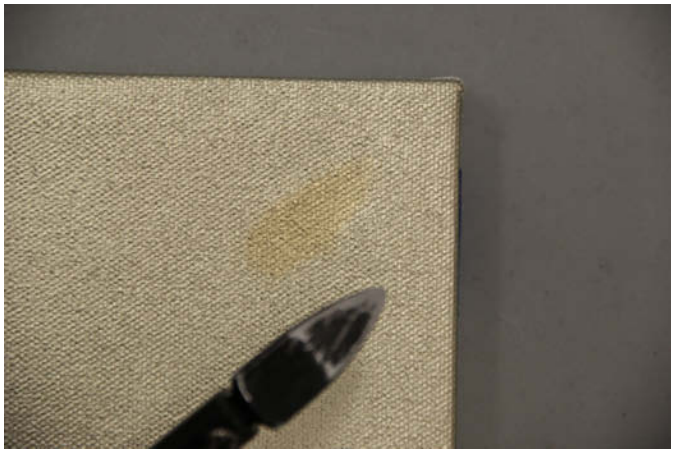

Figure 12. Pointing a heat spatula at 120°C to the surface of the sample led to a local shift in tone.

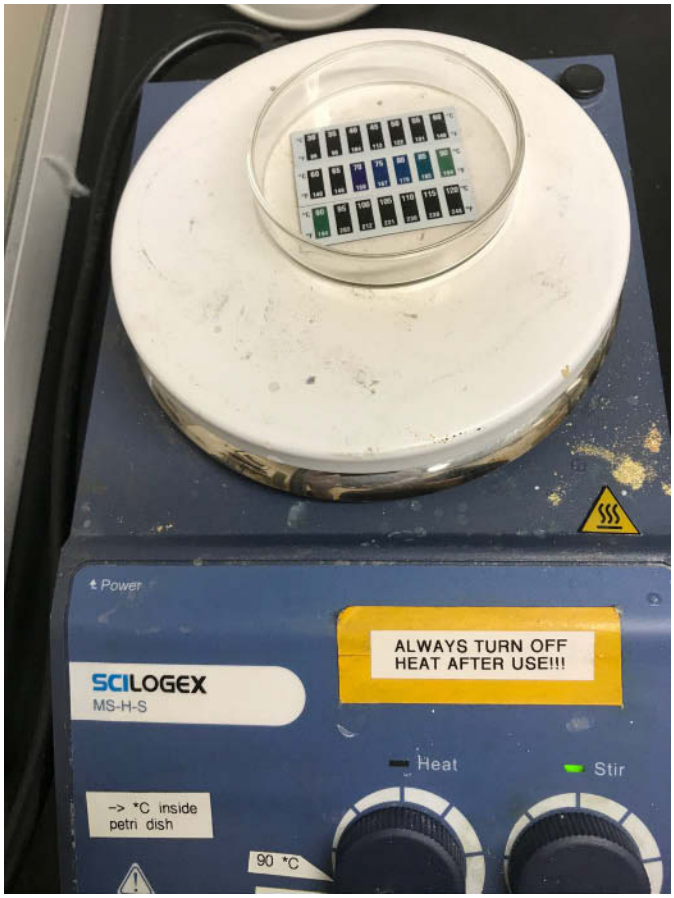

Figure 13. To control the heat exposure inside the petri dish on the heat plate, sticker thermometers were adhered to the floor of one dish.

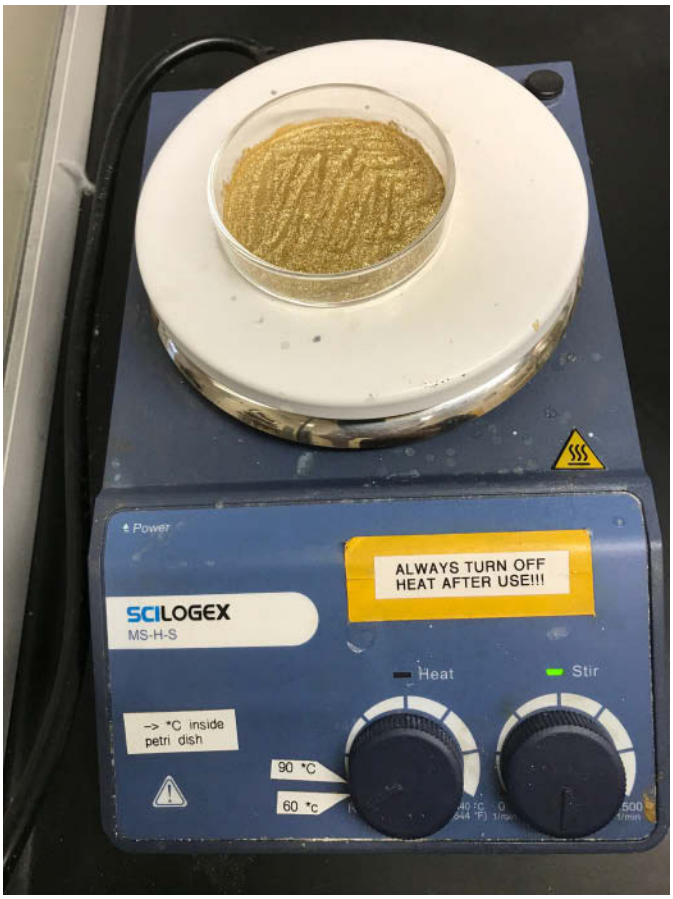

Figure 14. The pigments were exposed to heat at various temperatures for different times.

and aged the covered areas more than in the targeted zone. Applying heat from behind the canvas caused the oil paint to bubble and the canvas to toast on the verso. Aging the liquid paint samples appeared too dangerous, leading to strong evaporation and a change in consistency.

When the pigments arrived, the current tone on the artwork could not be mixed with the three available shades. Yet because using radiant heat created exactly the desired appearance, the loose pigments became the focus for exploring artificial aging with heat. Reichbleichgold and Bleichgold seemed similar to the unaged paint samples. To control the heat exposure inside the petri dish on the heat plate, sticker thermometers were adhered to the floor of one dish so that the exact temperature could be determined (figs. 13, 14). The pigments were toasted in petri dishes in 2-g portions at various temperatures (60, 90, and 120°C) for several time periods (10, 15, 30, and 60 minutes). During their exposure, the pigments were constantly stirred with a small spatula. A waxy smell was noticed during the toasting at high temperatures (fig. 15).

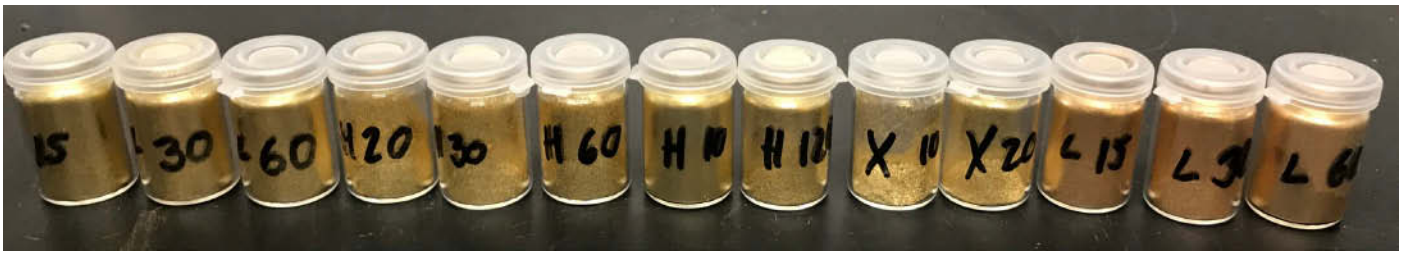

Figure 15. The samples of pigments after heat exposure

7.1 Development of the Recipe

The testing resulted in gradual shades of gold, from a rather pale to a deep bronze. The closest matching samples were transferred into 1 g of xylene before being transferred into the 2 g of the binder solution (ratio of 2:2:1, as recommended by ECKART). Because none of the paint samples in their pure version seemed to match the original, a mixture of slow-toasting pigments at various time ratios was tested on samples until the following recipe was achieved that matched the naturally aged original (fig. 16). This recipe was developed to only match this particular painting and will most likely not match any other *Carpet Painting* due to their inherent differences and individual history of exposure:

1 part untoasted Bleichgold
1 part untoasted Reichbleichgold
1 part Reichbleichgold, 60°C, 15 minutes
1 part Reichbleichgold, 90°C, 10 minutes
4 parts binder solution
2 parts xylene

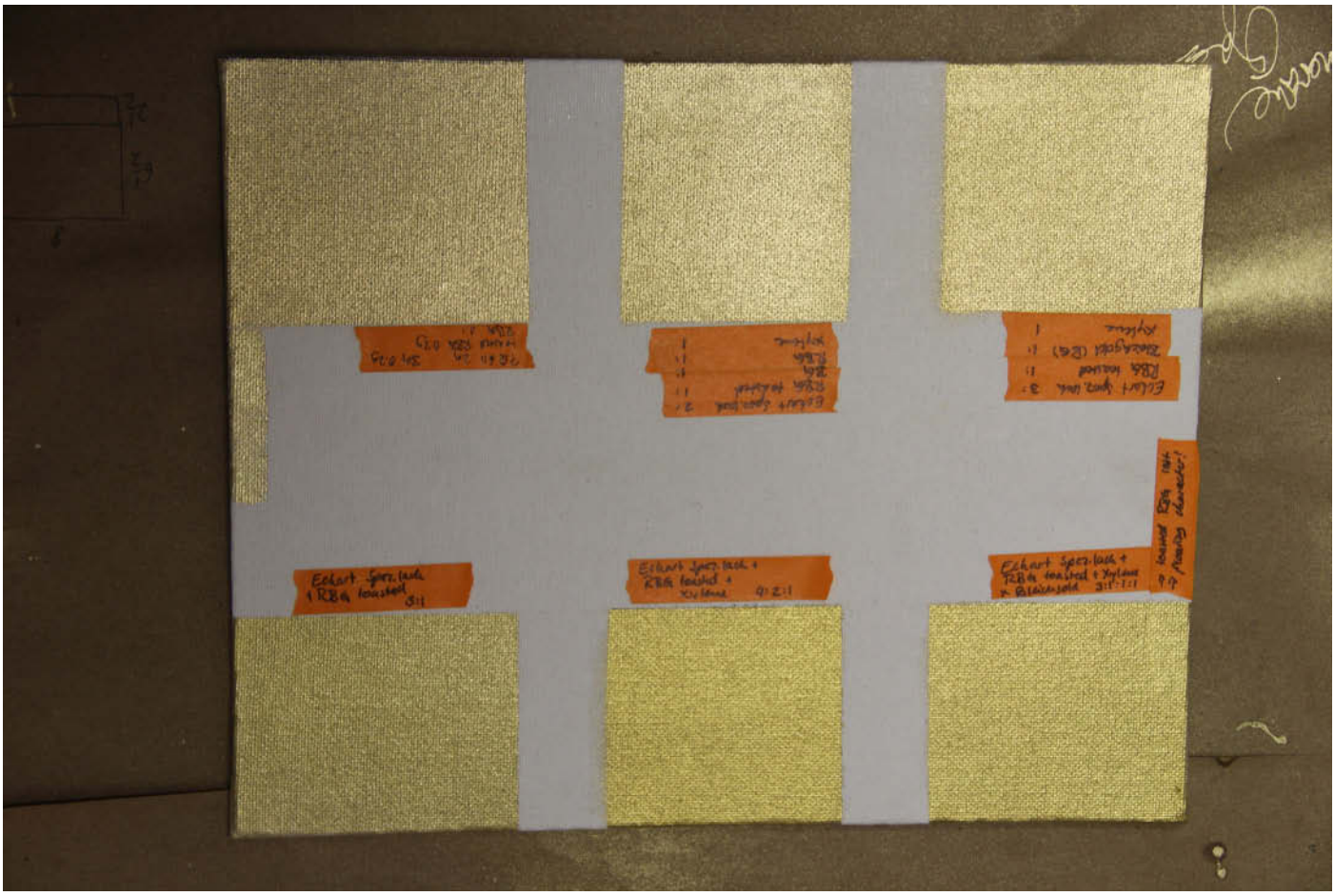

Figure 16. Sample board of various aged pigment ratios to match the tone on the artwork

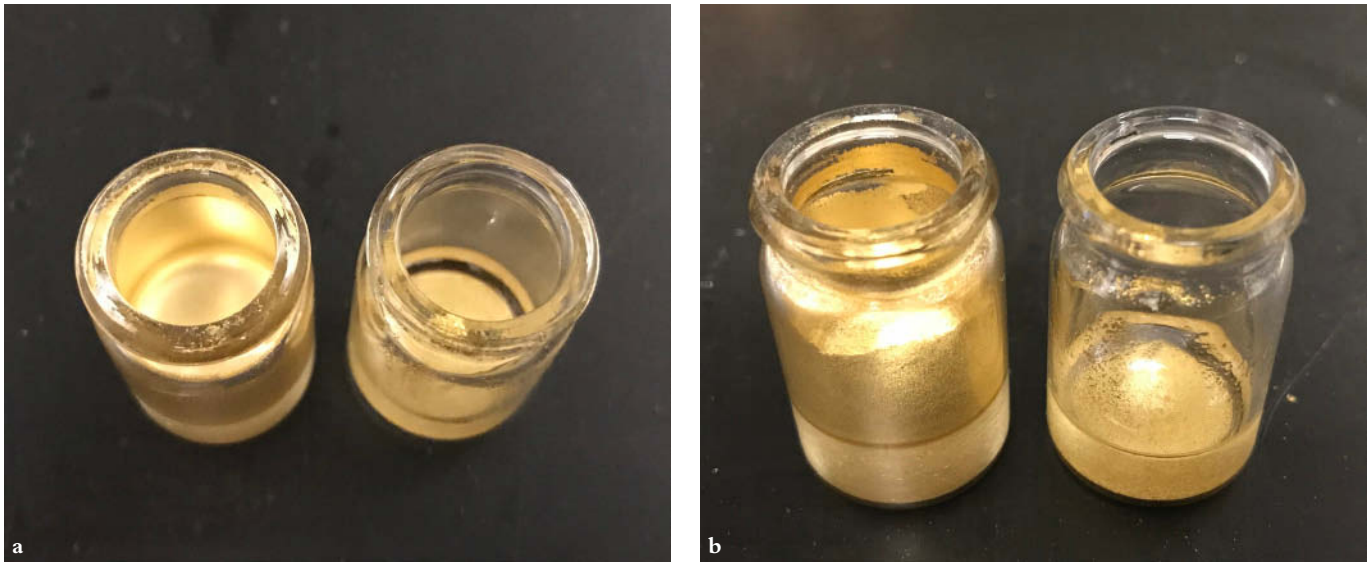

Figure 17. Two samples of aged pigments at different temperatures, with xylenes added. The left sample in both images (a and b) still has the leafing character, while the right sample as lost it and the pigments sank to the bottom.

A small area of corrosion on the solid golden area of the artwork was inpainted with this recipe. The tone and surface sheen matched perfectly, although it appeared that the high-toasted component within the mixture did not show in the brushed-on sample. This observation corresponded to the pigments' behavior during their transfer into solvents after aging: The high-toasted pigments partially sank down and collected at the bottom at 5 minutes and lost their leafing character entirely at 7 minutes. The decrease of leafing was not as significant in the low-toasted pigments. However, by the end of the 15 minutes, they were no longer floating either (figs. 17a-b).

It is assumed that the pigments lose the stearic acid layer in high temperatures very quickly. This equally occurs during lower but longer heat exposure. The odor of wax mentioned previously appears to stem from the degrading and sublimating stearic acid components during aging reactions of the pigments. The loss of leafing character in the far-aged pigments did not have an impact on the conservation treatment of the project at that time, as the oxidation of the original golden tone had not progressed very far.

7.2 Application Method

The final step to conclude the test phase was the mode of application on a larger area of the solid gold with an airbrush (approximately 2 × 4 in.). Therefore, the surrounding intact areas, the islands of ornaments, were masked off. The complex pattern of the floral wall paper had many curves and organic shapes for which elastic tape seemed necessary to follow their outlines. Borrowing from a previous, entirely unrelated project where similar curvy stencils needed to be created, an array of Japanese polyvinyl (therefore flexible) tapes developed for spray paint application were tested (Tamiya, Item #87177★★460, 2 mm, #87179★★460, 5 mm). These tapes were easy to remove from solid golden sample boards without lifting gold pigment.

The entire painting was covered with a sheet of Mylar into which a window was cut to uncover the targeted area of a fingerprint on solid gold (approximately 3 × 5 in.). This window was secured to the painting on the center surfaces of the ornaments with fairly wide tape (2 cm). Working toward the edges of the textured islands, finer and slimmer tapes (2 and 5 mm) were used to follow the outlines exactly. Despite their elastic character, the tapes were not flexible enough to follow the curves of petals and leaves. Additionally, as they are designed to stick to smooth surfaces, they did not adhere well to the topography of the islands. The method was quickly abandoned.

A more successful result was achieved with artist tape (3M 2090 Scotch Blue Painter's Tape). Therefore, the surrounding ornaments of the affected area were traced onto Mylar with permanent marker. Short pieces of artist tape were cut into the exact shape of ornaments drawn onto the Mylar. This created a puzzle of tape pieces holding together as one stencil that was then retransferred onto the

painting. This stencil was gently adhered to the island, where it held surprisingly well on the tips of the tulle-textured areas only. The artist tape was bendable enough to be gently pushed down along its cut edges to cover the "shores" of the islands down to the solid golden "floor" (figs. 18, 19).

To apply the solution onto the test field on the artwork, the airbrush IWATA ECL4500 was used with the IWATA Studio Series Compressor. The pressure was adjusted to three bars. On pulling the trigger, the paint flowed through the nozzle at two bars with a pressure of two bars. The airbrush was held at a 90-degree angle to the painting's surface. A cardboard piece was held between the airbrush and the painting to catch the possible irregular paint droplets in the beginning of the paint flow and to check the spray cone immediately before application.

Figure 18. Detail during treatment. An area of solid gold was masked with 3M 2090 Scotch Blue Painter's Tape.

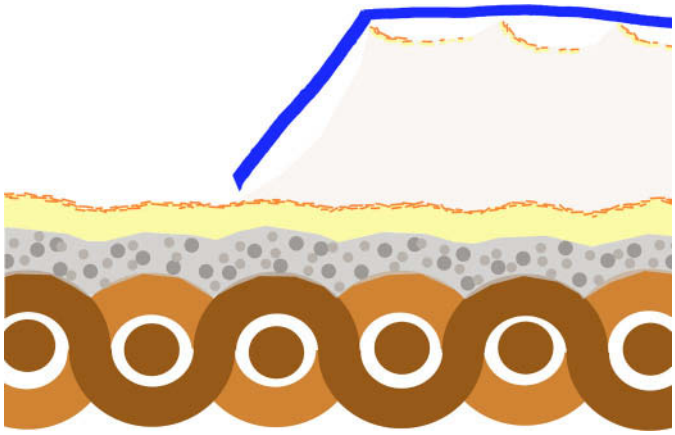

Figure 19. Schematic drawing of an affected area masked with 3M 2090 Scotch Blue Painter's Tape

Once the paint flow appeared even and regular, the cardboard was removed and the spray cone hit the targeted surface. The airbrush was moved evenly and fairly quickly. The entire application process lasted approximately 2 seconds (fig. 20).

The treated area was left to dry for about an hour before the stencil was carefully removed with a skewer. Removing the stencil from the painting's surface showed minute gold particles on the verso of the stencil. The conservators considered these

Figure 20. Detail during treatment, after the spray application of the aged pigments in binder

acceptable, as they were undetectable on the paint layer. The artist's studio and client were informed on the results of the testing. The client inspected the tested area, and the treatment proposal was approved immediately. The treatment was executed in the manner described previously on all 13 areas.

7.3 Evaluation and Discussion of the Conservation Treatment

All stakeholders were provided a map of the painting where the treated areas were clearly marked. The client's insurance had the painting inspected by an art adjuster who did not lower the value of the painting. The tone matched the original both from far away and up close, and it blended in very well. The surface sheen was the same as the original, due to the dilute solution and very thin application (fig. 21).

The following aspects were marked for improvement: some edges of the artist tape had lifted off the shores along the ornaments. This caused partial overspray on the white shores of the islands. These were removed with fine cotton swabs in ethanol (fig. 22). Equally, although invisible to the clients and the artist's assistant, the team was not satisfied with the sharp edges of the cut stencils. These were visible as minute, yet clear "steps" in the paint topography on close examination.

The unusual benefit of this project was the research period, which allowed for a solid investigation. This is very unusual for private practice conservation. By adjusting the pigments and mixing the paint system manually, it was possible to create the aged tone and to thin down the mixture to avoid building up the layers. Finally, the treatment was restricted to affected areas only, as the islands of the baroque pattern allowed for very local treatments.

Figure 22. Detail during treatment, the blue tape masking had slightly lifted off the shores of the ornamental islands in some areas, causing dark-appearing overspray.

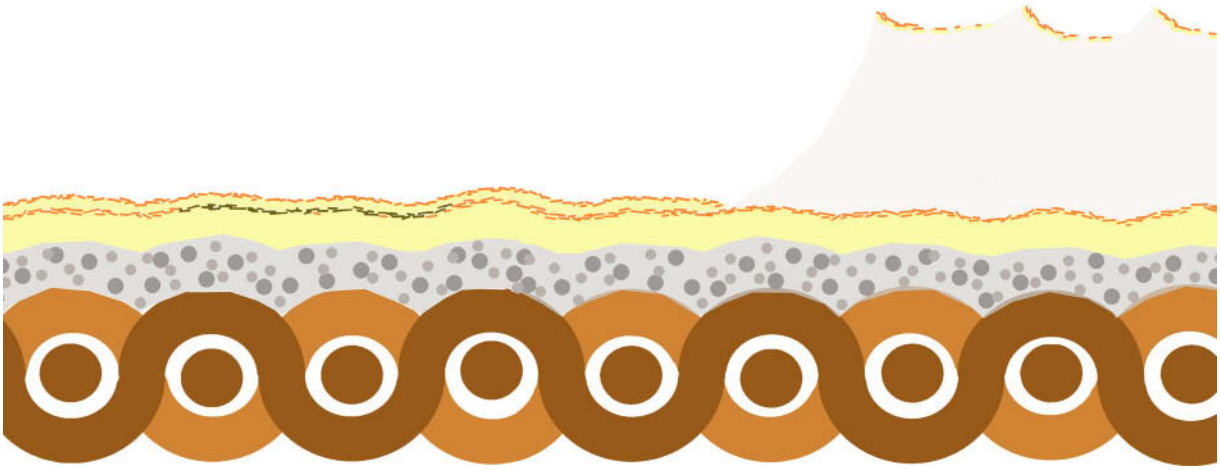

Figure 21. Schematic drawing of an affected area after treatment

Yet the conservation team continued to discuss this treatment by addressing ethical issues such as the justification of nonreversibility, questioning the line of when an invasive treatment becomes too invasive, or what the unknown, long-term behavior of the aged pigments would be. Furthermore, the health concerns were pressing. On top of the general health concerns of using xylene for a conservation treatment, at the time of treatment the studio's manager was pregnant, and others were particularly sensitive to solvents. Therefore, the treatment could be executed only on weekends when the studio was empty. A body suit and a gas mask (3M, with organic P100 filters) were worn by the executing conservator. The treatment room was sealed from the rest of the studio with an isolated ventilation system to the outside. It was agreed that a treatment of this scale could not be repeated under such working conditions.

Over the following years, several other *Carpet Painting* projects followed. All of these projects required treatment along the edges only. These were executed at a nearby spray facility with a professional spray booth (ULTRA XS CTOF by the company Global Finishing Solutions). Inside the booth, a system of underpressure confined the spray dust within its volume. Constant air ventilation exchanged the entire volume of the booth four times per minute (fig. 23).

During these treatments, the masking technique was improved. A Japanese rice paper tape (Nichiban #251) was used. It could be torn to a desired shape easily, adhered well to the shores of the islands, and did not remove gold particles. In this meticulous process, the tape was ripped following the contours of all surrounding ornaments (fig. 24). The treated areas were further reduced by creating bridges between two islands. Spraying in slight angles pointing at 80 degrees toward and away from the bridge created a smooth transition between covered and treated areas.

Figure 23. View of the spray booth, ULTRA XS CTOF, by Global Finishing Solutions

8. THE FINAL PROJECT IN 2017

In 2017, a *Carpet Painting* was delivered to the studio in fairly poor condition. Generally, the golden tone had aged significantly beyond the stage of the previously treated paintings by having shifted into the orange-bronze scale of the golden pigments. The painting exhibited pronounced wipe marks along the entire bottom edge that left the paint corroded to a black-greenish degree on both the solid and the textured areas (fig. 25). Aside from a number of equally advanced corroded fingerprints along the edges, a "hand mark" spanned over several areas of solid gold in the center.

Because of the unprecedented case of advanced natural aging, severe local corrosion, and the location of the affected areas

Figure 24. The Japanese rice paper tape, Nichiban #251, proved to be much more fitting for masking the ornaments around affected areas.

Figure 25. Detail of a wipe mark along the bottom edge of *Carpet Painting* that had corroded both the solid golden and the tulle-textured ornamental surfaces

(fig. 26), the need for testing time was communicated again with the client before the outcome of the prospective treatment could be defined. The client agreed to 1 week of research.

Knowing that the degree of toasting necessary to match this very aged bronze tone would eliminate the leafing character entirely, the pigment fabricator was contacted again. The aim of the week-long research period was to understand whether the stearic acid could be retransferred onto the pigments *after* artificial aging. Again, the fabricators were very helpful yet hesitant in their estimation. Most likely, if the stearic acid (0.5%) were to be added to the aged pigment-solvent mixture,

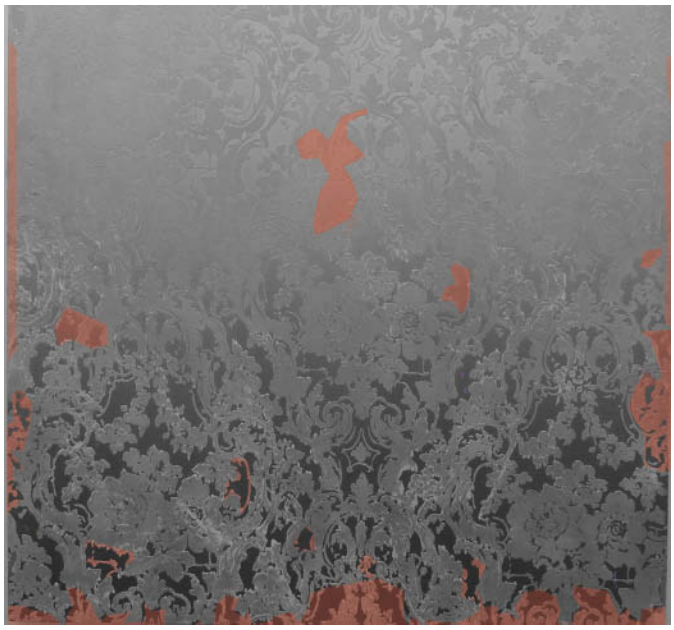

Figure 26. Partial map of the work's affected areas located along the entire bottom edge, both vertical edges, and the center

a temporary leafing character might be reestablished. This turned out to be true. After long aging in high temperatures (90°C for 2 hours) and then transferring the pigments into the stearic acid–prepared solvent, they began to float on the surface (compare with figs. 17a-b). Yet the moment the binder was added, the pigments sank down; it is assumed that a rearrangement of the stearic acid component takes place from pigment solvent to binder solvent.

Spray tests of these solutions resulted in a "normal paint film" with pigments dispersed throughout the medium. The paint film looked grainy from clustering pigments and wet like a plastic film (fig. 27). Both aspects were considered unacceptable for the overall reflective character of the painting—metallic, brilliant, and solid despite its advanced aged condition.

Tests resumed to explore an application in two steps. Could the pigments remain on the surface of an already applied pure film of binding medium? The first layer was sprayed thinly (binder solution thinned down with xylene 20%). It was realized then that the original layer of pigments would sink into the original film, as the repelling layer stearic acid was no longer effective. The second layer of aged pigment in a stearic acid–infused solvent followed after various drying times of 15, 30, and 60 minutes. The best results were achieved when the film had dried to the touch, varying between 15 and 30 minutes. The drying time depended on the outside climate, as the air constantly pushed through the spray booth was temperature controlled only. Thus, on a day of high humidity, the drying time was closer to 30 minutes, whereas on dry days, 20 minutes seemed ideal. The time was determined by touching the surface and not leaving a gloved fingermark. During both the test phase and during the final execution, the drying time was evaluated on a new sample every morning. This time was recorded and referred to throughout the day (fig. 28).

In the second solution carrying the pigments, a solvent with low affinity for the binder (Shellsol T) was added to further

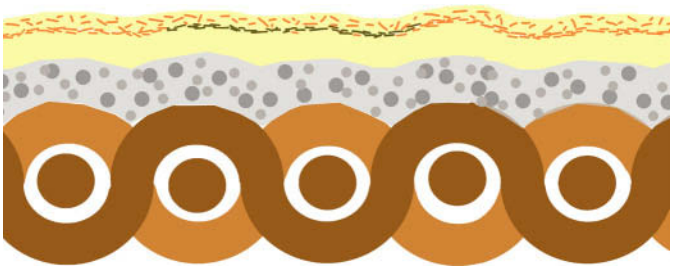

Figure 27. Schematic drawing of an inpainting application with aged pigments that had lost their leafing character

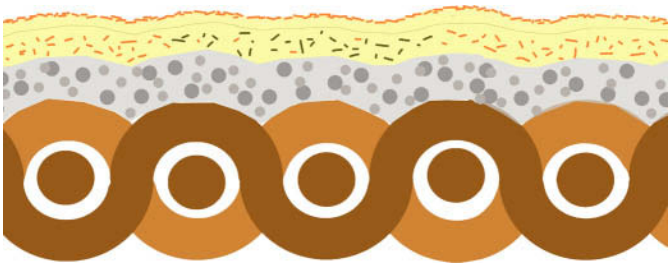

Figure 28. Schematic drawing of a treated area in which the original layer of pigments had lost its leafing character, presumably because of the deterioration of the pigments' repelling coating

limit a redissolving of the binder film. The ratio of this solution was as follows:

2 parts Reichbleichgold, 90°C, 2 hours
1 part xylene
1 part Shellsol T

This seemed to create a balance of reactivating, and thus facilitating adhesion between pigments and binder, without swallowing the pigments.

The durability of the double-layered samples was tested on the following day in several steps, first with soft brushes. If no gold adhered to the soft brush, sturdier brushes were used to wipe across the test field. This was followed by a microfiber cloth and finally by rubbing with a gloved finger.

Meanwhile, in a moment of sheer curiosity, pure xylene was sprayed onto a sample of canvas created in 2014. The old paint film redissolved into the expected, plastic-like wet surface, as the original pigments sank into the film. The second solution (aged pigment/xylene/Shellsol T) was applied over the same area. The results did not differ visually from the two-step application described earlier. This, in theory, would even further reduce material added to the surface texture of the paintings (fig. 29).

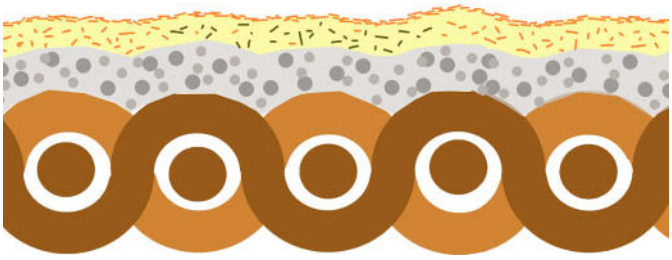

Figure 29. Schematic drawing of redissolving the original binder, causing the original pigments to sink into the film, with a second application of pigments only to cover the treated area, imitating a "leafing" layer

The period between testing and actual execution of a treatment was a few weeks, which allowed us to observe the durability of both versions of the two-step application. At the time of treatment, although both versions were still durable, we did not feel comfortable "skipping" the application of additional binder. However, a year later, both sample boards showed that the pigments still adhere equally well.

The treatment was executed successfully on the solid golden areas only. This way, the dark wipe mark across the bottom edge was interrupted by treated areas, which, from a distance, blended well with the still darker-textured areas (figs. 30a–c).

9. CONCLUSION

Every treatment of fingerprints or other corrosion stains on *Carpet Painting* requires enormous efforts and poses many risks. The amount of preparation and testing, the delicateness/sensitivity of the surface, and the health risks require a conscious decision every time a painting needs treatment. The extra costs (rental of the spray facility and testing phases) impose extra expenses for the clients. In several cases, requests for conservation had to be declined—for example, if the corroded areas were too exposed, if the ornaments were too far apart, or if the corrosion occurred within the tulle-textured areas. However, there are several possibilities that could be further improved or explored, which might allow conservation for paintings with the issues mentioned earlier:

1. It would be extremely helpful to explore the possibility of changing the binder and solvent system to eliminate the health risks. It seems that the Italian paint supplier changed the recipe around 2002, responding to the European Union's ban of xylene in paints. It would be very beneficial to test other conservation-grade polymers soluble in nonpolar solvents that are significantly less hazardous. It might even be possible to reverse the repellent principle entirely into a polar, water-based system.
2. It would be beneficial to test the longevity of the two-step application approach without adding binder. It is of undeniable advantage to dissolve the original paint layer to "reuse" its binder instead of applying new medium. The amount of added material would be reduced significantly, as would the risk of building up thickness, which in turn would decrease the difference in surface sheen.
3. Further, with this same approach, it might be possible to treat tulle-textured areas on the ornaments and

Figures. 30 a–c. Detail of the bottom edge before (a), during (b), and after (c) treatment

shores. Here, where the tulle had lifted through the oil paint layer, the gold layer was inconsistent. This means that the binder was also inconsistent. In theory, if a tulle-textured area had to be treated, one could apply xylene to the textured area to reactivate the binder and then spray the adjusted pigments in a stearic acid–infused solvent. Theoretically, such a textured surface would bind the added pigments only where the old binder was sufficiently present. Superfluous material could be brushed off after complete drying (24 hours).

As a final note to the durability of the treatment, a complex *Carpet Painting* mock-up was made in spring 2013. Unaged gold from new paint samples was used to create textured and solid areas. Fingerprints and liquid stains were added on this mock-up, and the paint was aged partially with radiating heat from front and back. All final conservation tests were executed on the mock-up, and each issue was treated as if it were on an actual artwork. The mock-up was installed next to a kitchen window between each testing phase. Today, it has aged to a similar degree as the last painting treated. The inpainting treatments on the mock-up show neither differences in aging nor a loss in pigment adhesion. There is only one area where one can see a slightly higher degree in gloss, which stems from the very first tests of 2015 with undiluted, original paint. This mock-up *Carpet Painting* has probably had the most turbulent history of all, and yet it is holding up very well (fig. 31).

Figure 31. The mock-up that endured all damages and treatments since 2013 has aged equally and evenly.

ACKNOWLEDGMENTS

The author would like to thank Christian Scheidemann for his encouragement and continuous trust in exploring new routes in conservation, and the entire team at Contemporary Conservation Ltd. for their input and brainstorming. The first treatment in 2008 was executed by Claartje van Haften at Contemporary Conservation. The investigation of silver leafing pigments and treatment possibilities, as well as the varnish recommendations, were executed by Johanna Hoffmann at Contemporary Conservation.

A special thanks to Rudolf Stingel and his assistant, Becket Chambliss, for providing materials and inside knowledge, and to Daniela Glück from ECKART Germany for providing pigment samples and sharing her knowledge, interest, and supporting thoughts on the development of contemporary art conservation procedures with the company's products.

NOTES

1. In May 13, 2015, during Christie's, New York, Post-War and Contemporary Art Evening Sale, an artwork by Rudolf Stingel, *Untitled*, 1993 was sold for $4,757,000. https://www.christies.com/lotfinder/paintings/rudolf-stingel-untitled-5896067-details.aspx?from=salesummary&intObjectID=5896067&sid=e4344778-311d-4fd1-9e56-f0b588298d6a.
2. The artist tested various varnishes based on recommendations by Contemporary Conservation: Laropal A81 (12.5%) in Ethanol/Shellsol D38 (1:9); Paraloid B72 (10%) in isopropyl alcohol/Shellsol A (3:2); MS2A (15%) in isopropyl alcohol/Shellsol A (1:3); unpublished written communication, Contemporary Conservation Ltd., New York.
3. The exact process was not revealed by the manufacturing company, ECKART Special Effect Pigments. However, a pyrotechnical patent of 1958 discloses the basic principle of increasing a moisture resistance based on the same principle: Coated Pyrotechnic Metal Powders and methods of their preparation, United States Patent Office, Patent #2,832,704; April 29, 1958.

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SUPPLIERS

2090 Scotch Blue Painter's Tape
3M
https://www.amazon.com/Scotch-2090-Blue-Painters-Tape/dp/B01KQQOHSI/ref=sr_1_5?ie=UTF8&qid=1528550499&sr=8-5&keywords=3m+blue+tape+1+inch

ATTIVA Silveral Oro, produced before 2002; Silveral Oro, produced after 2002
Courtesy of the artist

ECKART Metalleffekt Bleichgold #84003, Metalleffekt Dukatengold #06131220F, Bronzepulver Mischlack #85004, Metalleffekt Reichbleichgold #84013
Restaurus
Bauerngasse 33
90443 Nürnberg
Germany

Stearic Acid, Triple Pressed, 16 oz.
Luxuriant
https://www.amazon.com/Luxuriant-Stearic-Acid-Triple-Pressed-16-ounces/dp/B07B436DQQ/ref=sr_1_1_a_it?s=hi&ie=UTF8&qid=1528550722&sr=8-1&keywords=luxuriant+stearic+acid

#251-12 Architectural Masking Tape
Nichiban
https://www.amazon.com/NICHIBAN-architectural-masking-volumes-containing/dp/B002P8YG5K/ref=sr_1_1?s=hi&ie=UTF8&qid=1528550579&sr=1-1&keywords=nichiban+251

Masking Tapes for Curves, 2 mm
Tamiya America, Inc.
https://www.amazon.com/Tamiya-TAM87177-Masking-Tape-Curves/dp/B00VTDYTR2/ref=sr_1_2?s=hi&ie=UTF8&qid=1528550642&sr=1-2&keywords=tamiya+masking+tape

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E-mail: Mareike@contemporaryconservation.comentirely, the pigment fabricator was contacted again. The aim of the week-long research period was to understand whether the stearic acid could be retransferred onto the pigments *after* artificial aging. Again, the fabricators were very helpful yet hesitant in their estimation. Most likely, if the stearic acid (0.5%) were to be added to the aged pigment-solvent mixture, a temporary leafing character might be reestablished. This turned out to be true. After long aging in high temperatures (90°C for 2 hours) and then transferring the pigments into the stearic acid–prepared solvent, they began to float on the surface (compare with figs. 17a-b). Yet the moment the binder was added, the pigments sank down; it is assumed that a rearrangement of the stearic acid component takes place from pigment solvent to binder solvent.

Spray tests of these solutions resulted in a "normal paint film" with pigments dispersed throughout the medium. The paint film looked grainy from clustering pigments and wet like a plastic film (fig. 27). Both aspects were considered unacceptable for the overall reflective character of the painting—metallic, brilliant, and solid despite its advanced aged condition.
Tests resumed to explore an application in two steps. Could the pigments remain on the surface of an already applied pure film of binding medium? The first layer was sprayed thinly (binder solution thinned down with xylene 20%). It was realized then that the original layer of pigments would sink into the original film, as the repelling layer stearic acid was no longer effective. The second layer of aged pigment in a stearic acid–infused solvent followed after various drying times of 15, 30, and 60 minutes. The best results were achieved when the film had dried to the touch, varying between 15 and 30 minutes. The drying time depended on the outside climate, as

DALE KRONKRIGHT, VIKRANT PALAN, and AREND VON DER LIETH

Vibration-Induced Mechanical Damage in the Canvas Paintings of Georgia O'Keeffe as a Result of Road and Air Transport

ABSTRACT

In 2012, the Georgia O'Keeffe Museum concluded a year-long, three-venue touring exhibition of 75 canvas works of art by Georgia O'Keeffe. Despite the clear evidence from courier logs and temperature, humidity, and shock data loggers that no harmful shock or environmental extremes had occurred in transit, postexhibition examinations and imaging revealed that several works had suffered both new and existing crack and interlayer cleavage propagation.

Although museum conservators understood that physical and mechanical damage to art in transit is cumulative, existing literature suggested that repeated exposure to low amplitude, randomly generated vibration accelerations commonly encountered in fine art transport trucks and airplanes should pose little danger to works of art. Yet conservators discovered a strong correlation between the number of miles of motor transport with historic and contemporary crack and cleaving propagation in its paintings. Because the museum was traveling its collection far more frequently each decade than it had previously and because that it had no data on the natural frequency of the paintings in its collections, nor an understanding of the vibration frequencies transmitted by art transport vehicles or attenuated by fine art crates, it began a study to use calibrated three-axis accelerometers, laser displacement meters, and laser vibrometers to gather a more complete understanding of the mechanics of vibration-induced damage in art transit. The museum used acceleration measurements, displacement measurements, discrete cosine transform, and fast Fourier transform to understand the power distributions of both facsimile paintings and, ultimately, collection paintings, as well as truck beds, walls, and various crating and cushioning methods. The findings fundamentally changed the museum's understanding of vibration-induced damage to canvas paintings, the vibration spectral power distribution of fine art transport vehicles, and the successes and failures of framing, backing, crating, and loading methods to attenuate vibrations across damage-sensitive frequencies.

The presentation will summarize the methods, results, canvas movement visualizations, and conclusions of the 5-year study. The tendency of traditional foam-cushioned wood crates to generate additive interference and amplify canvas displacement excursions at frequencies surrounding the natural frequency of the paintings suggests the need for new engineering approaches for the protection of canvas paintings during transit. Likewise, the vibration damping effects of sealed frame backings and glazing in frames will also be described.

RUSTIN LEVENSON

STUDIO TIP: Weight Source

Antique shops are a great source for all sizes and shapes of weights to use during treatments.

Figures 1-3. Examples of various weights

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DESIRAE PETERS

STUDIO TIP: The Canvalok Klikstretch: Stretching Large Paintings Gets Easier

Invented by Brian Grisham, the Canvalok Klikstretch is a stretching system that consists of two canvas pliers, one that is attached to a strap and one that is attached to a ratchet. The strap is threaded through the ratchet; the pliers are attached on opposite sides of a canvas, equidistant from the corners; and the canvas is stretched by ratcheting until the desired tension is achieved. The system can also include an additional handle strap, which can be fitted around the stretcher edge to provide more lateral pull during stretching (although this part of the system has not been used by the author). Married to an artist, Brian developed the system in an effort to make stretching his wife's canvases easier.

Figure 1. The Canvalok Klikstretch system, made by Brian Grisham.

The Canvalok Klikstretch was used on a painting from 1970, measuring 10 × 10 ft., owned by the Menil Collection. The work was in overall good condition, with a washy acrylic paint layer and a robust cotton duck canvas. The tacking margins were 4 to 6 in. long. For reasons related to preparation of the painting for loan, the stretcher had to be fitted with wooden beams, which made using canvas pliers impossible because there was no way to torque the pliers against the stretcher for tension. Stretching the large canvas by hand did not achieve enough tautness and resulted in distortions. The Canvalok Klikstretch achieved planarity through adequate tension while eliminating the need to leverage pliers against the stretcher.

The pliers are self-locking, so there is no need for someone to hold the pliers once they are secured to the tacking margin, and they feature 6-in.-wide jaws. As sold, the strap adjusts from 2 to 8 ft., although Brian provided a longer strap on request to accommodate the painting mentioned earlier.

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BIRGIT STRAEHLE

STUDIO TIP: Aiming High: 55% Regalrez 1094 Varnish Application, an Experimental Use

ABSTRACT

At the Worcester Art Museum, a large-scale Italian Baroque painting was successfully brush varnished using a 55% solution of Regalrez 1094. Originally, the surface of the painting would have been varnished with a natural resin such as mastic to achieve optimal color saturation and a rich, glossy finish. In an attempt to mimic the aesthetic properties of a natural resin, while also enhancing the aging and reversibility properties of the new varnish application, an experimental use of a synthetic resin was carried out successfully.

Tests using swatches of three different resins were applied to the painting surface, and their visual differences were evaluated on the basis of an aesthetically pleasing surface appropriate for the time period. Regalrez 1094 stood out as having the greatest potential for further experimentation. Ultimately, the decision of which synthetic varnish to use was based on its favorable visual appearance, as well as its desirable handling and aging properties.[1]

1. EXPERIMENT

In 2017, a privately owned work by Giovanni Procaccini, depicting the *Adoration of the Maggi*, was conserved at the Worcester Art Museum. Measuring 1.5 × 2.5 m, this oil on canvas painting, dated about 1618, featured a dramatically lit scene with multiple life-size figures surrounding the mother and child. Using a dramatic range of colors from bold and bright hues to deep and dense shades, the artist created a spatially dynamic and complex three-dimensional illusion.

After removing multiple layers of discolored natural resin varnish using gels containing a polar solvent, the aged paint film was revealed to be slightly bleached, making it difficult to read the picture. The question arose as to which of the many varnishes available to conservators would serve the painting well for the next generation of viewers. A rich glossy varnish providing optimal color saturation would be essential for affecting a successful treatment.

The choice of the natural resin, mastic, that would essentially guarantee a successful aesthetic outcome was considered and then, after some discussion, withdrawn. Having just removed a thick natural resin from the already abraded and porous painting using a polar solvent, there was a strong desire to devise an alternative method by employing a synthetic resin that would be acceptable aesthetically and, at least in theory, be more readily reversible in the future.

Based on the author's experience and familiarity, the following resins were chosen for testing: MS2A, Regalrez 1094, and Laropal A 81. Regalrez seemed to be an unlikely choice due to its low viscosity. However, after testing 30% (30 g /100 mL) solutions of each of the three resins on several different areas of the painting, although not completely satisfying, Regalrez produced the best results. In increments of 5 g, the concentration of Regalrez was increased up to 55%. The ratio of 55 g of resin to 100 mL of solvent provided good color saturation, even gloss, and ideal working and leveling properties.

Encouraged by the visual success, one-third of the painting was brush varnished and observed for 3 weeks to monitor potential changes or unwanted phenomena, such as an increased attraction to dust. The tested area met all expectations, and the 55% Regalrez was eventually used for brush coating the entire surface. There was adequate time to apply the varnish, as it remained workable long enough to evenly cover a challenging surface, even on such a large painting.

Hand-ground pigments bound in 30% MS2A diluted with Shell Sol D38 that were used for final retouching integrated seamlessly into the Regalrez layer. After a period of time, a spray coat of 30% MS2A dissolved in Shell Sol D38 was applied. Standing at a short distance from the painting and with a wide-open spray valve, a rich, glossy sheen was achieved to simulate the look of a natural resin.

After treatment the painting was returned to the owner, and it subsequently traveled overseas. More recently, the author has inspected the painting in person, and the surface is unchanged after several months.

To conclude, a 55% solution of Regalrez in mineral spirits provided an even, saturated, and glossy surface, appropriate for a Baroque painting. Regalrez has desirable aging properties, such as solubility in non-polar solvents and remaining reversible and clear in color over time. How it will age at a thicker than previously prescribed concentration remains to be seen. In the meantime, when searching for a synthetic resin to rival the aesthetics of a natural resin varnish, Regalrez 1094 at a high concentration is shown to be a viable candidate.

2. FUTURE

Further testing is in progress using Regalrez 1094 in the range of 40% to 55% for a brush coat application on a 19th-century American panel painting. Tests with a high percentage of Regalrez spray coat varnishes will also follow.

NOTE

1. These tests and conclusions are based on years of practical experience as a paintings conservator, as well as an awareness of many, but certainly not all, publications about varnish.

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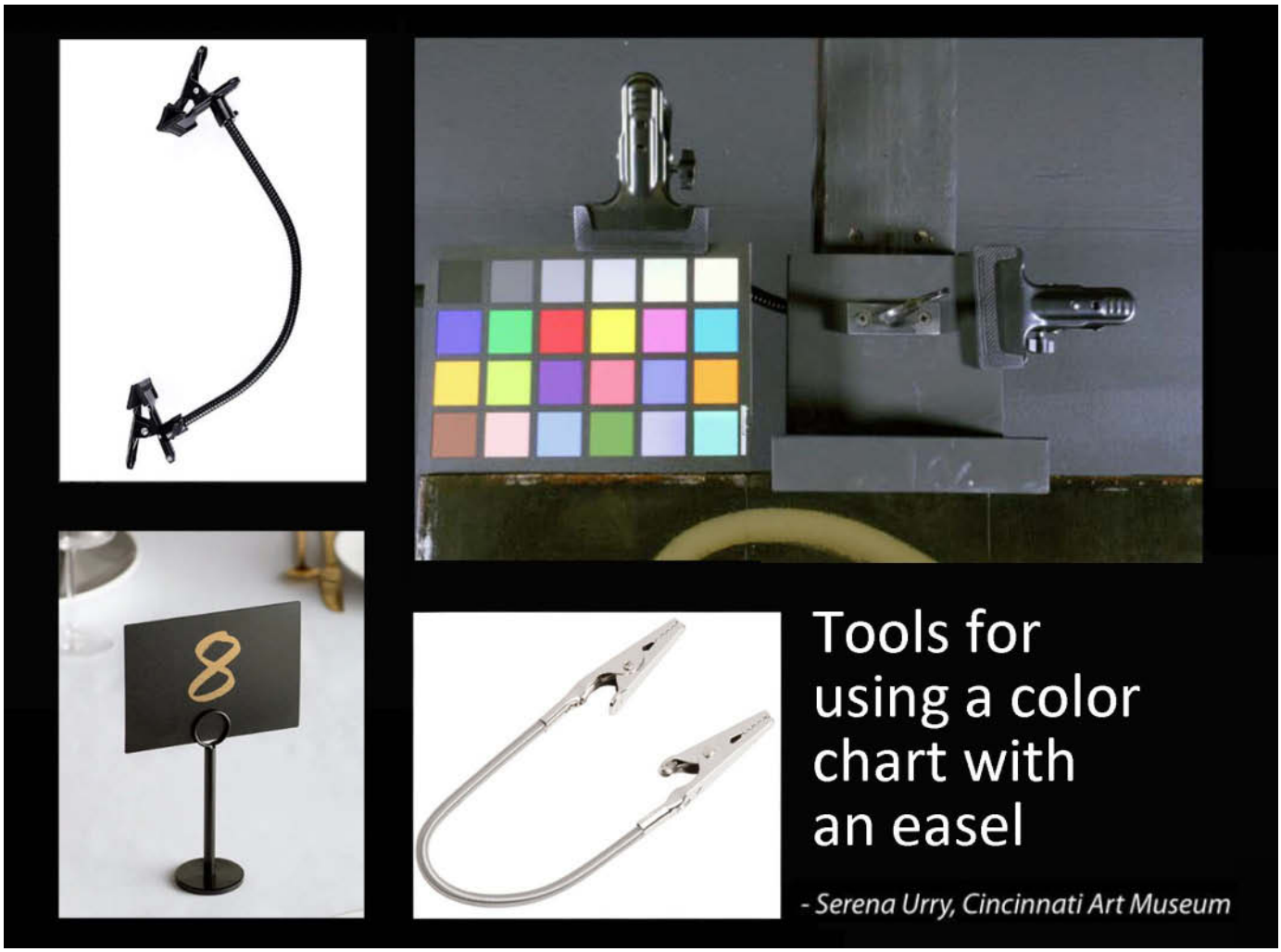

There are several sources for inexpensive items to hold a color chart during imaging. Shown here are two from an online restaurant supply company (at lower left, a 6″ Black Menu/Card Holder and at lower right, an 8 ½″ Double-Sided Steel Alligator Clip Card Holder) and one from an online imaging supply company (at upper left and on the easel, a Photo Studio Lighting Light Stand Clamp).