AIC PAINTINGS
SPECIALTY GROUP
POSTPRINTS

Papers Presented at the Thirty-fifth Annual Meeting
of the American Institute for Conservation of Historic & Artistic Works
Richmond, Virginia
April 16 - 20, 2007

Compiled by Helen Mar Parkin
Volume 20
2008

The American Institute for Conservation of Historic & Artistic Works
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“THE BIG ART COVER UP”
Mural Conservation Efforts with High School Students in Wauwatosa, Wisconsin

Tony Rajer

ABSTRACT – In 1975, Wauwatosa, Wisconsin High School was expanded and modernized at the expense of the original Art Deco structure. Hundreds of beautiful arts and crafts tiles as well as WPA New Deal murals were covered up or destroyed. This was done in order to make the old structure homogeneous with the new addition, which resembled a white box. It was the age of Aquarius and vinyl wallpaper was the rage.

In 2002, a group of high school alumni began an effort to restore significant areas of the original 1930’s building. A feasibility study was commissioned and indicated that the murals and a significant percentage of original Art Deco tiles and moldings existed under three inches of plaster and drop acoustical ceilings in the old main lobby.

The high school alumni association and local historical society undertook the restoration project with the support of the Wauwatosa School Board. The community jumped on board and within two years over $125,000 was raised solely through donations. Proceeding the conservation effort was the engineering portion of the project to relocate HVAC, electrical and plumbing mechanicals. That took place in the fall of 2003. Art conservation work began in January 2004 and went on for ten months. Conservators, university interns, community volunteers and dozens of high school faculty students put in an estimated 2000 hours in order to conserve the WPA murals by Myron Nutting, the arts and craft tiles and plaster molding decorations. Hundreds of fabricated replica tiles were hand made by the high school students in the art classes. We attempted to integrate the new work with the old without faking condition or patina. In addition, a time capsule with messages to the future was prepared by the students and sealed to be opened mid century in 2050. After all the conservation was completed, the local historical society installed an exhibit on the high school’s history and purchased replica lighting for the lobby which now serves as the heritage hall for the high school. The project was dedicated in March 2005.

Postscript: During the project the architect who had worked so hard to destroy the original lobby in 1975 came to the school and confessed to his errors, saying, “I only did what I was told, I’m sorry.” In addition, media services of the public school system created a CD-rom of the entire effort and the students in chef foods class catered our dedication events.

GOALS OF THE WAUWATOSA RESTORATION PROJECT

The goal of the restoration project was to restore and reinterpret the architectural space of the lobby and to get students, faculty and volunteers involved. In addition, a long-term goal was to utilize the lobby as a place for public events and as a centerpiece for alumni activities, as well as to preserve the memory and traditions of Wauwatosa High School.
We did all that. Most importantly, we tried to continue the tradition of using art and architecture to inspire present and future generations of students. In essence, it created a Heritage Hall in the Wauwatosa East High School, where the traditions of the high school can be kept and brought alive, like the ancient Greek tradition of...
treasuries where Olympic trophies, statues, tablets and documents were kept and honored.

The lobby, which is the original entrance to the high school, tragically remodeled in the 1970’s, has been brought back to life again for everyone to enjoy and to take pride in. This was a true community based project that brought together dozens of individuals. For example, we had alumni from the class of 1938 up to students who will graduate in the class of 2006 at Wauwatosa East High School helping on the project.

BACKGROUND TO THE WAUWATOSA PROJECT

President Roosevelt, in his New Deal Program, promised quality education for all Americans. He delivered on that promise in Wauwatosa, Wisconsin. Between 1931 to 1934 the community undertook the construction of a new high school, modern in all aspects in the Art Deco style, with later additions completed around 1937. The noted Milwaukee architectural firm of Herbst and Kuenzl and Associates designed the building.

This new educational edifice was designed to inspire and instruct the children of Wauwatosa. The Art Deco style lobby remained essentially unchanged until 1972-74, when the new addition on the east side of the building was constructed and the original lobby remuddled to make it look like the new east wing, thereby losing through misguided effort what was once the focal point of the school, the Art Deco lobby. At the same time tragically the school’s stately Art Deco tower was torn down, a significant architectural loss for the community. In September 2001, the Wauwatosa Historical Society presented a proposal to the Wauwatosa School Board to install a permanent Wauwatosa High Memorial in the original school lobby, as a result of alumni Ray Py’s initiative. Enthusiastically received by the School Board, the memorial tells the story and displays memorabilia from Tosa High, which was split into Wauwatosa East and Wauwatosa West High Schools.

PILOT PROJECT, FEASIBILITY STUDY

Before the restoration project began, a pilot project was conducted in May, 2002 and murals from the New Deal era and trophy cases were discovered in the lobby behind many layers of plaster and wire mesh. Using funds generously donated by John and Tisha Morgrige and the Class of 1951, the Wauwatosa Historical Society conducted the pilot project to investigate whether the murals could be restored and to assess their condition. The pilot project went on for a few days and was supervised by Tony Rajer. The results of the pilot project were encouraging, though damaged the murals and tiles could be restored. This lead to the preparation of a master plan for the restoration of the space. During the pilot project community volunteers assisted, while students looked on.

THE CONSERVATION / RESTORATION PROJECT

The lobby is actually composed of three distinct architectural spaces: the front lobby, with access to the street, the center lobby, where the murals are located and the corridor lobby, which links the stairwell, first floor fire doors and basement. Originally, the corridor lobby spaces were open, but the revised 1970 fire code obliged the school to enclose the stairwell, landings, and install fire rated doors to block off the space. (see plans and photos in this report) During the 1972 lobby remodeling,
the beautiful set of three oak doors with leaded glass windows was removed between the front and center lobbies. The doors are believed lost. Two additional new side doors, one in the front lobby, the other in the center lobby, were chopped through the Art Deco tiles for access to the new School Board Room, which had been the school’s main office. Several inches at the base of the north mural were cut away for the Board Room door. This area may have contained the artist’s signature. In addition, the three streamlined Art Deco light fixtures were removed and discarded from the ceilings. (see drawing and photos in the report) Uncovering the murals, tiles, mosaics, and moldings was an exciting part of the lobby restoration project, which took place between January to October 2004. Like above ground archeology, every day brought a new and interesting discovery, such as the day we opened the stairwell alcove in the corridor lobby. Like an ancient Egyptian tomb, it had been sealed for decades, layered in dust, the portrait bust of George Washington long gone.

The High School yearbooks contained many photographs of the building and even one of the murals. In the 1938 yearbook there is a photograph of WPA artist Frank Unger, who also created large paintings for the High School. These are now lost. The lobby’s New Deal murals are from the Public Works Art Project (PWAP) and were directly commissioned by the Milwaukee PWAP for the Wauwatosa High School. The two murals were painted in 1934 by Myron C. Nutting (1890-1972) with possible assistance by others.

One of the most tedious and time-consuming aspects of the project was uncovering the murals, which are located in the center lobby. We removed nearly 1000 pounds of plaster and wire mesh from the walls, held in place by hundreds of staples and nails put right through the tiles and the murals. The staples, to hold the mesh, had been put right through the mural during the 1972 remodeling and in turn were covered with wet plaster, which caused the staples to rust. We had to cut each staple in two with a power towel and extract the pieces with pliers. This process was repeated hundreds of times and we could only reveal a small section per day, around 3 square feet. We thought, “Will this ever end?” This part of the project took several months. The corroded and oxidized staples and wire mesh literally burned a quilt pattern into the murals. The murals were left with rust stains, which could not be removed and had to be carefully inpainted at a later stage in the project.

Cleaning the murals was another complicated task. They had rust stains and embedded dirt which was removed with scalpels and a mild dilute Vulpex soap as well as Ammonium Citrate and then rinsed with water. Every week we could see the progress. We moved cautiously, reattaching the canvas to the wall where it had come loose with Beva 371, consolidating the flaking paint and cleaning. At times, all three operations went on simultaneously. We were faced with major challenges such as the inpainting. After cleaning the murals, we then applied a thin layer of varnish to isolate the original mural from the modern retouching. We used Acryloid B72 as the varnish and filled the losses with white putty and began inpainting the damaged areas with Maimeri restoration Paints and also glazed over those areas that had the severe quilt pattern. We also applied a final matte varnish to even out the surface and reduce glare. Our guiding philosophy throughout the project was to make the murals look not new, but old and well cared for.

Unfortunately, the mural on the north wall was missing about three inches from the bottom right area which had been chopped off when the wall was altered to make way for a new doorway that has since been closed off. This area may have had the artist’s signature. Despite all of our care and attention to detail in uncovering the murals, we did not find a signature. Local New Deal era archives were searched as well as the high school yearbook. It was through the efforts of Tosa alumni Ray Py that we now know the artist. He discovered that it was Myron Nutting. It was under the Public Works of Art Project (PWAP) that artist Myron Chester Nutting (1890-1972) was commissioned to produce two murals for Wauwatosa High School. Wauwatosa
school administrator William T. Darling had requested decoration for the high school lobby on January 17, 1934 to Miss Charlotte Partridge. He had suggested “a local landscape, or scene of old Wauwatosa.” Project director Partridge selected Nutting, probably because of his training in Paris, where he would have been acquainted with the French technique called marouflage, which is a method of creating murals on canvas, then attaching them to a wall, like wallpaper. Nutting used the marouflage technique in Wauwatosa. He began work on the project immediately and by February 17, 1934 had produced the required sketches for the two murals, which he titled “Recreation, Music, Art, Sculpture, and Drama” and “Farm, Science and Industry”.

Nutting probably chose his themes because he knew they could have an educational message—modern professions in science, industry, business, arts and agriculture are shown, along with other related topics. What better place to celebrate an optimistic view of labor than with people looking towards the future. The High School students could see these figures as role models. Nutting was familiar with the current Mexican mural movement and its emphasis on a simple, straightforward didactic style. In fact one of the first major mural commissions in Mexico was through the Ministry of Education at the National Preparatory School in Mexico City, where labor and professions of all types is celebrated.

By April 1934 the murals were sufficiently far along that photographs were taken of them in the studio before their installation in the high school. We know from the PWAP payment slips that Nutting was paid approximately $38.25 per week for his effort, which included the Wauwatosa murals, as well as a large painting or mural for the Beaver Dam High School. He completed the Beaver Dam mural by April 28, 1934. He also painted several murals for the Milwaukee Public Museum. Because his style is quite diverse, we suspect that he may have had assistance painting the murals. At the same time that Nutting was working for the PWAP painting murals, he was also teaching at the Layton School of Art and possibly utilized student help on his projects. The north mural, which is titled “Professions: Farming, Science and Industry,” is painted in a style in which the artist has blended the paint to create soft contours, not unlike his easel paintings. The south mural, with the exception of the bathing party, is executed in a much more broken, angular, and painterly brush stroke, and seems to indicate the hand of a different artist.

The Wauwatosa murals were painted in the artist’s studio at the Layton School of Art, and brought to the high school where final touches were done in situ in the lobby. It was a combination of both methods—studio creation and completion on site.

The two murals are identical in size, 4’ high by 16’ long. The south mural, which is titled “Recreation, Music, Art, Sculpture, and Drama.” The north mural, titled “Farm, Science and Industry.” There are abundant examples throughout both murals of artist pentimenti. (rethinkings in Italian) This is an indication that the artist was painting and repainting many areas of the composition, to either satisfy a committee or his own desire to refine the murals. Almost every figure in the two murals has some alterations. The pentimenti might also indicate an artist unaccustomed to mural painting, trying to perfect the work.

THE PLASTER MOLDINGS
The ornate Art Deco moldings from the 1930’s were covered up with white drop acoustical ceilings in the 1970’s, typical of the taste from that era, with a total disregard for history. This was done in order to run dozens of utilities, including pipes and conduits through the ceiling. The installers deliberately punched dozens of holes through the Art Deco plasterwork, smashing major areas. Beginning in September of 2003, the Wauwatosa School District began to reroute all the utility lines so that the molding could be repaired and the ceilings brought back to their original height. Mr. Henry Schmalz (1889-1935) was the plaster craftsman who created the original Deco moldings. Reproductions of the moldings were made for the new soffit in the corridor lobby.
Within the new soffit are the utilities lines that connect one section of the building with another.

Restoring the ceilings was a major task, as the damaged moldings had to be replicated, molds made and replacements installed to match the originals. The entrance lobby starburst molding was the hardest part to restore, as it required structural reinforcement and complicated replication of many areas. The plaster relief is deep, with varied textures and painted in colors of green and deep reddish beige. Many of the Art Deco moldings were also painted with shadows to make them stand out and to accent them. Another important feature of the plasterwork in the lobby is that the walls have a textured sand finish, but the ceiling does not. We examined paint samples under the microscope to determine the original colors of the walls and ceiling. It appears that there is strong evidence to suggest that the ceiling colors are closely related to the color scheme of the murals. There was a unified sense of design to the lobby, with color and texture harmony achieved between the tiles, plasterwork, and murals. This would account for the rainbow of hues and subtle tones found in the ceilings first color scheme, immediately above the white primer. Between 1931-1934 the ceiling was probably just painted white, but after the murals were installed the rainbow of hues was introduced. We reproduced this complex color scheme, respecting the past and the artist’s and architects original intent.

THE LOBBY MOSAIC TILES
Conserving, restoring and replicating the lobby tiles were another huge undertaking. Two people stand out for their efforts to help us: Wauwatosa East High School art teacher Ms. Barbara Murray and Dorothy Vande, Tosa Class of 1943. Without them we could not have accomplished our tasks. The lobby’s beautiful tiles are a subtle combination of two decorative art styles: the Arts and Crafts movement and the Art Deco style. The tiles were designed to last forever and are made of durable ceramic materials. Six different types of tiles are found within the lobby and reinforce the notion that the building’s architect, Herbst and Kuenzl, truly wanted this space to be special. They used many of these tile types throughout the high school building. Unfortunately, nearly all had been covered up or were removed, but remnants remain in the water fountain areas on the school’s second floor.

After uncovering the tiles, a task that took many months, we assessed damage and began cleaning the tiles. Many tiles had nail holes; we counted over 700 in total, which we filled with a colored industrial epoxy. Unfortunately, many of the ceramic tiles near the floor were gone, brutally chopped away in the 1970’s remodeling to make the new plaster walls flush to the floor. Hundreds of them were replicated. After much discussion and prompting, Wauwatosa East High School art teacher Barbara Murray and school alumni Dorothy Vande (Class of ’43) agreed to replicate the missing tiles sharing the task, making them by hand, literally hundreds of them. Barbara, with her students, and Dorothy at home spent nearly six months replicating the hundreds of tiles. What an incredible labor of love for their high school. Installing the tiles was another matter. Setting the pieces, grouting, toning, all required a special skill, but also a special attitude. Many of the people we interviewed laughed when
we told them the tiles were being made by hand, one at a time. After interviewing many tile setters, we chose a small firm that was willing to work with our students and us. Kim Burton set hundreds of these tiles and made the lobby mosaic walls complete and whole again. In addition, the corridor lobby walls were new because it had to meet fire code and the original open areas now had doors. We covered this area in tiles to make them match the original walls. In addition, the original open staircase was completely enclosed in 1974. The alcove landing, where the bust of Washington stood was originally open to the staircase. It was also enclosed in 1974, when the steel Art Deco railings were removed and trashed. In 2004, the plasterboard that covered this area was removed and the space remodeled into a large walk in display case, thereby recapturing additional original space within the lobby for display purposes. Now the whole lobby has a unified look of the 1930’s as it did originally.

EDUCATIONAL COMPONENT

Education was an important component within the project. It was an exciting opportunity for the Wauwatosa Historical Society, the Wauwatosa High School alumni and others to be involved and to help the community as a whole. We had numerous occasions where the art conservators, the technicians, and the students and alumni were able to mingle and help and work together, thereby promoting the cause of local heritage.

For example, the school district undertook the production of a video, the students took photographs, and wrote articles for the school newspaper, students helped to produce the technical reports, and, of course, helped to replicate the lost tiles. We had many wonderful community volunteers who worked on the project. Their names are listed at the end of this document. We encouraged and I designed aspects of the project specifically geared for the volunteers so that they could take possession of the project, so that they could be involved, and so that the volunteers, be it the students, alumni, community participants, could better understand our restoration effort and how they could participate in a heritage project. This project engaged students and the public in an exciting exploration and discovery, finding Wauwatosa East High School’s history, its architectural and artistic heritage.

During the restoration of the lobby I lectured in various high school classes and gave presentations not only about the restoration project but other related topics as well. I participated actively in the 2004 foreign language fair and got involved in community life at Wauwatosa East High School by attending sports events and open house.

Early on within the project, an opportunity arose where we engaged the students in an interesting aspect to produce a high school and community time capsule. Two vacant heating ducts were uncovered during the removal of the plaster walls. These had been disconnected many years ago and were lined in metal, which I thought would be perfect for making a time capsule that all students and faculty could contribute to. I invited students, faculty, literally anyone who was interested in the project to submit a letter to the future, to be addressed to the future, with hopes that the time capsule will be reopened in 2050 in mid century. We received many dozens of letters and clippings and photographs and material from dozens of individuals, including the students. This truly helped to give the project a special quality and spread the participation to a broader audience.

Another area where we utilized student help in a dynamic way was related to the original Art Deco lighting for the lobby. The original chandeliers were lost and had been lost for many years, but we did have one photograph of the chandeliers. With student help we replicated in cardboard and hung the copies in the lobby to give students, staff, and other interested people an idea of what the original light fixtures were like, and to stimulate more public interest in the project and discussion.

Copies of the conservation report were placed in various locations including the High School archives, local historical society archives, Wauwatosa Public Library, and Museum of Wisconsin Art Archives along with copies of the project DVD.

PROFESSIONS REPRESENTED IN THE PROJECT


Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
NEW DEVELOPMENTS IN FLUORESCENT STAINING OF OIL AND PROTEINACEOUS BINDING MEDIA WITHIN PAINT CROSS SECTIONS

Stephan Schäfer, University Professor,
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ABSTRACT — There is an ongoing discussion in conservation science about cross-section staining and its reliability with respect to certain binding media, stains as well as staining procedures. Many people in the field actually apply staining, but with broadly varying methodology and different levels of confidence. Lately, more concrete questions have been raised again as to the reliability of staining techniques, for example, lead fatty acid soaps, frequently encountered in lead-tin yellow and red lead paint may produce false positive results when protein stains are applied. Also, fluorescent stains for drying oils are known to produce quite ambiguous results, partly due to the complete alteration during ageing.

As a continuation of previous work, it is the aim of this study to contribute to a more in-depth knowledge of oil and protein staining processes of dry, heterogeneous paint systems and demonstrate the development of more standardized labeling protocols and procedures as is common in the bio-medical field. In modern histochemistry and proteomics applications, selective protein conjugation of fluorescent labeling agents is carried out with much success according to highly standardized protocols. Of course, the tissues, cell components or extracted proteins to be labeled in these fields are of more predictable composition and commonly react in aqueous environments, thus allowing to be more easily standardized, however much can be learned and applied to cross-section staining of paint samples.

Initially, this paper will discuss the history and current state of binding media identification by cross sectional staining techniques and subsequently describe some new developments towards higher selectivity and reproducibility in labeling oils and proteins. Staining results will be compared to imaging analytical results and new labels will be introduced.

Several case studies of a wide variety of samples will demonstrate the applicability and selectivity of new stains when employed according to specific protocols.

Stephan Schäfer, University Professor
New University of Lisbon, Faculty of Sciences and Technology,
Department of Conservation and Restoration

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
THE CRADLE AND ITS MAKERS

Rikke Foulke, Conservator of Paintings

ABSTRACT – An interview with Herr Wolfgang Kneisel, an assistant in the studio of William Suhr in the 1960s, provides a detailed description of the construction and processes of transfers and cradle-making. Kneisel learned the craft of transferring paintings from original panel supports to ones constructed of cradled Masonite® from Valentine Gavelek, an assistant of Suhr who trained in the Detroit automobile industry. The cradles, a construction ubiquitous in American and European collections, were applied during a time when prominent museums and collectors were aggressively acquiring works of art from foreign sources, and passed then through studios of conservators/restorers in Detroit, New York City, and Vienna.

INTRODUCTION

For the conservator, cradles are familiar constructions found throughout American museums on the verso of an Old Master or European painting. During a few decades in the middle of the 20th century, restoration studios were active in carrying out transfers and cradle treatments for newly formed American collections. William Suhr and his employees represented one studio carrying out such structural treatments ubiquitous in the American collections. The following material introduces some of the figures involved in the museums and the market, as it pertains to William Suhr and his studio. Then, given so many developments in structural treatments in the 18th and 19th centuries, this investigation is limited to a summary of the history of the transfer and the cradle as it led to the design used by Suhr. Keep in mind, however, that not all cradles found on the old masters come out of Suhr’s studio. Other studios are known to have employed cabinetmakers as well; but this essay focuses on the Suhr designs because of the fact that Wolfgang Kneisel, a former employee of Suhr, is still working and generously shared his story and his skill with his American colleagues. The information on the technique and construction of the transfer and cradle supports are provided by Kneisel whose craft represents two centuries of development of skill and attitude towards panel paintings.

Dr. Joyce Hill Stoner’s interview with William Suhr, biographies, the writings of and personal interviews with Dianne and Mario Modestini, proceedings from symposia, and an interview in 2005 with Herr Wolfgang Kneisel contribute to this description of a period in the mid 20th century. Kneisel is a Viennese restorer who worked in William Suhr’s studio in New York in the 1960s and carried out transfers for clients in the United States. His observations while working in Suhr’s studio in the middle of the twentieth century provides a context for his work and constructions of his cradle supports. Wolfgang Kneisel, with the enthusiasm of a young and curious engineer, documented his experiences in the studio on film and this documentation proved to be a valuable resource for conservators in the new millennium.

THE PEOPLE

The introduction of a few characters helps establish circumstances leading to the transfer and cradle treatments carried out in the United States in the 20th century. A key figure in American arts is William Valentiner. Valentiner arrived in New York in 1908 at the suggestion of the great German art historian Wilhelm von Bode to accept an appointment as Curator of Decorative Arts at the Metropolitan Museum of Art. At that time, the collections were not yet organized and the position was to be defined by the efforts of its new curator. Due to his restlessness in Berlin, his acknowledgement that it was “impossible to live, however modestly, on the stipend of an assistant in the Berlin Museums,” and other personal uneasiness, Valentiner accepted this offer to work with the Metropolitan Museum, founded only a few decades earlier. At the time of his arrival in America before World War I, Valentiner described the American scene as a generation of capitalists who were competing with one another in the acquisition of great works of art. The situation was exemplified by figures such as J. Pierpont Morgan, Joseph Widener, Henry Clay Frick, Benjamin Altman, and Paul Mellon. A couple of decades later, the motivation to form art collections by these prominent figures was described by H. G. Dwight, assistant director of the Frick Collection, by the words “the stormy human equations of collecting, the gnawing obsessions, stealthy pursuits, crushing disappointments, and
intoxicating triumphs... lie in the background of the most beautiful things." Dealing such as Knoedlers, Wildenstein, and Sir Joseph Duveen were able to pull old masterpieces out of private European holdings and acquire entire collections for their American clientele to guarantee for the magnates a sense of immortality that their money alone could not purchase. Duveen is credited as "the great English art dealer who probably did more to create American collections than anybody else."

Duveen had a significant amount of influence; he and others helped the clients secure great works of art from European collections. Valentin's impact was also far-reaching in the United States: he directed and consulted for numerous museums, including the Metropolitan Museum of Art, the Detroit Institute of Art, the North Carolina Museum of Art, the J. Paul Getty Museum, and the Los Angeles County Museum. He also founded the periodicals Art in America in 1913 and Art Quarterly in 1937. Born in 1880 in Karlsruhe, Germany, he studied art history at the University of Heidelberg and found a position at the Kaiser Friedrich Museum working with Max Friedlander and Wilhelm von Bode. As already mentioned, his sense of restlessness in Berlin and the paltry salary offered in Berlin Museums made the proffered position of Curator of Decorative Arts at the Metropolitan Museum look very attractive. His American career began in New York, but in 1924 he accepted the position of director at the Detroit Institute of Art.

Valentin identified the need for a new restorer at the Detroit Institute of Art. He observed that the current restorer at the museum was constantly drunk and could not be trusted with the restoration of paintings. Valentin's biographer acknowledges the odd charge of this statement, since it was made during the Prohibition years. There are two accounts of the initial contact between Valentin and William Suhr. According to Margaret Sterne's biography of Valentin, it was Eduard Plietzsch, the director of the Gallery Van Diemen who recommended the work of William Suhr to Valentin. But in Dr. Joyce Hill Stoner's summary of the career of William Suhr from 2005, Suhr was already enjoying great international success as a restorer in his studio in Berlin. The Detroit collector Ralph Booth acquired paintings through the English art dealer Colin Agnew and visited Suhr's studio in Berlin to have works treated. In 1927 Valentin wrote a letter to Suhr to lure him to the Detroit Institute of Arts to replace the current restorer. Valentin assured Suhr that Detroit was artistically developing and lured him with the promise that it would be very interesting.

William Suhr was born in Kreuzberg, near Bonn, Germany, in 1896. He studied painting at the Akademie der Künste. The Viennese art historian Max Deri introduced him to the restoration of paintings. By his mid 20s he established his restoration studio in Berlin and had already earned international respect for his skills. Beyond his recognizable treatments, Suhr is probably best-remembered as having launched open dialogue about conservation with his international colleagues; he was a pioneer in implementing today's standard of ethics, and he trained Helmut Ruhemann who became the chief restorer at the National Gallery in London.

Suhr accepted Valentin's offer. Ultimately, it was hard for Valentin to convince the Arts Commission in Detroit to provide enough funds to support a full-time restorer and Suhr was able to find work elsewhere. But Suhr did not abandon Detroit entirely; he set up studios in Detroit and New York City treating works for other museums and collections. In Detroit, Suhr became familiar with the damages the old world paintings commonly faced in their new surroundings. The paintings were accustomed to high humidity in European churches and palaces, but were destined for dry and centrally heated interiors of American homes. The woodworm tunneling, warping, blistering and lifting of paint and ground layers, and the splitting of the panels were already familiar problems, and were widely observed on the new acquisitions. Duveen aggressively sold the works to his clients, but had little understanding of the structural changes the paintings experienced in their trans-Atlantic crossings. He was aware that the new climate could harm the works and, as preventive measures, he had groups of works transferred to canvas in Parisian studios. Paris was known, after all, for its structural work on paintings.

Duveen was not fully aware of the loss of important character and texture unique to the original surfaces. Suhr had also carried out transfers of panels to canvas for Duveen, but he found the altered surface unsettling. While still in a contract with Detroit, Suhr expressed the need to hire a cabinetmaker to carry out more complex structural treatments, "such as transferring a large picture." Suhr found his cabinetmaker in Valentine Gavelek, a man who migrated from Poland in the 1920s. He spoke English perfectly, but with such a heavy accent that, if you were in the next room, it still sounded as if he were speaking Polish. Suhr described him as a very good craftsman formerly working for General Motors. The City of Detroit Directories of 1934 and 1935 housed in the Burton Historical Collection of the Detroit Public Library list Valentine Gavelek as an autoworker. He specialized in "farmers body"
cars with wood veneer siding, such as the popular models 1950 Dodge Coronet and the 1950 Buick Roadmaster. Gavelek applied his skills to the structural needs of damaged panels. With Suhr’s discerning eye, years of experimentation, and numerous transactions with Duveen, Suhr and Gavelek became experts in the transferring of paintings to his unique constructions with cores consisting of the 20th century material - Masonite®. This manufactured fiberboard was much less susceptible to the changing climate conditions than wood and could better preserve the craquelure distinctive to panels.14

THE HISTORY OF THE TRANSFER AND THE CRADLE
The practice of transferring paintings originated concurrently in Cremona and Naples between 1711 and 1725. It was introduced into Lorraine in 1740 and into France between 1747 and 1750. The transfer of a painting was intended to remedy the numerous problems associated with panel paintings: tunneling by woodworms, warping, splitting, and cleavage of the paint layers. In a transfer, the damaged wooden panel was replaced with a material considered to be more suitable and stable. At the time, it meant canvas, which was preferred since it provided a flat support, was not subject to the attack of woodworms, was a lighter material than wood and believed to be less sensitive to climatic changes. However, after a few decades of the practice, restorers became more discerning in the subtle yet undesirable changes in the surfaces of works. In a 1799 report on the restoration of paintings, a French restorer, Robert Picault, concluded that a new support should be the same as the original support “to conserve the purity of the design, the honesty of the stroke and their enamels which the grain of canvas takes away from them.” Writings on transfers by the French restorers were widely translated and known throughout Europe and ultimately influenced the transfer process.15

The French also take credit for the 18th century cradle design with fixed members of the cradle adhered with glue in the direction of the grain support and free-moving crossbars, which ensured the real security of the panel. Structural work on panel paintings was then carried out throughout Europe in the 18th and 19th centuries. In 18th century France, restorers were known to contract professional cabinet-makers to make custom designed auxiliary supports. By the 19th century in German-speaking regions, most major museums were employing professional cabinet-makers and authorities on restoration strongly recommended leaving the structural treatment to specialized joiners who worked on panels under the supervision of experienced restorers.16 The restorers applied the temporary facings prior to letting the joiners handle the structures. In the past, the paint layer was regarded as the only authentically artistic element of the painting, not the support, and this position led towards the positive attitude towards cradling so pervasive in the 20th century.

Mario Modestini observed in Gilding the Lily: Memoirs of a Restorer that, despite the invasive nature of these treatments, the cradles caused surprisingly few damages in the original wood panels. Some panels, however, developed splits along the edges of the fixed members and, in a few instances; panels with pronounced convex warps developed flaking, especially along the original joints.17 An example of a painting with damages that arose from an excessively heavy cradle is found in Giulio Romano’s The Birth of Bacchus, at the J. Paul Getty Museum. Andrea Rothe published an image of the paining in his contribution to the proceedings of the symposium The Structural Conservation of Panel paintings.18 Taking these damages into consideration, Suhr’s design used a Masonite® core and eliminated the problems described by Modestini. Modestini remarked as well, that, apart from stability offered by the new constructions, it was also part of an aesthetic: this was the machine age, and American taste was for flat, mechanically smooth surfaces.19 Coincidentally, Gavelek, the cabinetmaker who came directly out of the auto industry, operated the heavy equipment of the painting press in the studio. However, the aesthetics evolved. The clients, the trustees of museums, and the dealers requested that the restorer then apply a veneer of wood on the back and edges to conceal the artificial Masonite® construction. Furthermore, a superficial cradle was to be applied to the reverse to give the appearance of an established provenance. No one wanted to see non-traditional material.20 The dealer might not have been able to sell the work if it had so obviously been tampered with and the construction appeared to look more complete with the superficial cradle on the reverse.

THE CONSTRUCTION
Kneisel documented the transfers of three works in his films from beginning to end: a Jan Gossaert, a Franz Franken, and a Raffaelino del Garbo, with additional stills of other paintings he treated.21 He demonstrated the Suhr construction, which included the steps to remove the original wooden support, to apply the new support, and to aesthetically modify the structure with veneers and a false cradle.
The process began by facing the painting to be treated with Japanese tissue to stabilize any fragile and lifting paint. The tissue was applied with a methacrylate dissolved in turpentine. To better secure the surface for the structural work on the back, a second layer of heavier paper was adhered with a water-soluble wallpaper paste. At this point the painting was placed face-up into the large mechanical press. The press consisted of a heavy, wooden boxy frame with a broad flat surface in the bottom of the frame. (Figure 1) Numerous metal press points were controlled with a crank mechanism on the top side of the frame. By rotating the crank the restorer controlled the pressure applied by lifting and lowering the press points. The painting was placed in the level of the flatbed and heavy felts were placed on the surface to act as a cushion. Numerous layers of flat boards were laid over the felt to evenly distribute the pressure applied by the metal pressure points. The restorer adjusted the pressure on the painting by rotating the cranks and the pressure was applied to the numerous layers of boards. After a few days the painting was removed and placed facedown on a worktable. Using clamps on the painting to steady it, the original panel was thinned to approximately 2 mm with a hand-held planer. Because the painting was now very thin and fragile, a piece of 5 mm Masonite® was temporarily adhered to the face of the painting with the wallpaper paste. As this new “package” the painting was returned to the press with the felt, the boards, and the pressure. After a week it was removed and turned facedown again and the rest of the original panel was carefully removed with a scalpel.

The original paint surface was presently adhered to a piece of 5 mm Masonite®. Any losses in the gesso and paint layers were filled from the back and leveled by hand with a scalpel or sand paper. The ground and paint layers were ready for their new permanent support, which consisted of 8 mm thick Masonite®. The new support was measured to dimensions larger than the original painting. Excess 8 mm thick Masonite® was present along the whole perimeter. Rabbit skin glue was warmed and applied to the surfaces of the back of the original gesso layer and the new Masonite®. The original panel and the new support were then sandwiched together and placed again in the press. Invariably excess glue was squeezed out under the pressure. After two weeks the construction was dry.

With a hand held plane the 5 mm thick temporary Masonite® support was removed from the face of the painting. As the layers of paper were neared a scalpel was used to remove the remaining traces of the temporary support. The heavy white paper was then removed by moistening the surface with water; it peeled away easily. Turpentine was used to lift the initial layer of Japanese tissue.

With the successive applications of adhesive and pressure, the paint and gesso layers were successfully stabilized onto the new support. With a hand held jigsaw, excess Masonite® around the perimeter was removed. Then a layer of wood veneer was applied to the reverse and the edges with adhesive. The superficial cradle was applied. The design first constructed by the French in the 18th century was copied: first the fixed members are glued to the reverse, in the direction of the grain of the veneer. Then the perpendicular un-fixed members were slid into place and the surfaces were toned/stained to make them appear old.

In the documentary film footage, Kneisel also demonstrated an example of a similar treatment of a painting transferred to a new construction with a paper honeycomb core. In the transfer of a Raffaelino del Garbo, the original engaged frame was cut away with a jigsaw and the pieces were saved. The original wooden structure was planed down to the back of the original gesso layer in the same manner described above. With rabbit skin glue a core of paper honeycomb was attached and a thin veneer of wood encapsulated the construction. The original frame members were re-attached to the perimeter. The constructions with the paper honeycomb cores were very light in weight compared to the original constructions because the paper honeycomb weighed much less than the wood.
SUHR'S STUDIO IN NEW YORK

Since the late 1920s, William Suhr was dividing his time between Detroit and New York City, spending most of the time in New York in his studio located in a narrow brownstone at 50 East 50th Street. His clients were located across the United States and Europe and included Albert Barnes, Walter Chrysler, The Clark Collection, the Cleveland Museum of Art, Chester Dale, the de Young Museum in San Francisco, Edsel Ford, William Randolph Hearst, Samuel H. Kress, Robert Lehman, Paul Mellon, the Metropolitan Museum of Art, the Nemours Collection, Duncan Phillips, John D. Rockefeller Jr., the Taft House, the Toledo Museum, the Thyssen Collection, Georges Wildenstein and others. In 1937 Frederick Mortimer Clapp, the first Director of the Frick Collection in New York, hired Suhr as the “permanent restorer of the collection, with the freedom to accept any outside work he pleased.” With this generous invitation and the amount of work, Suhr found skilled staff to increase the efficiency of the studio. Valentine Gavelek was only doing structural transfers of paintings in the studio. For assistance with retouching, Suhr hired a Swedish woman named Miss Katerine Wagner. She was not a trained restorer, but was a very good retoucher. Suhr also hired Miss Schulmann, the sister of Suhr’s wife, to work in the studio.

The spaces in the studio were rather small to comfortably house the employees. The workspace filled many floors of the brownstone, but had narrow stairwells and a narrow passenger elevator. While working, while moving around in the rooms of the brownstone, the restorers had to practically crawl over one another and their work stations with large paintings in their arms to gain access to the storage spaces and their easels. Restorers at their easels were also required to develop the deft skills in dodging the paintings and colleagues who were on the move.

The Viennese restorer Eduard Kneisel arrived and joined the others in the studio. Eduard Kneisel was born in Vienna in 1900. Gifted in painting and drawing as a child, he was immediately accepted into the Akademie der bildenden Künste in Vienna. He trained as a restorer with the Akademie’s director, Prof. Dr. Robert Eigenberger. As a student he spent a year in Paris at the Academie des Beaux Arts. By 1925 he was restoring paintings at the Kunsthistorisches Museum in Vienna and launched a private practice. This prosperous period ended abruptly in 1938 when he received papers and was ordered to Krakow and report to Dr. Kajetan Mühlmann, the State Secretary for the Arts of the Nazi Party. He acted as a connoisseur of painting and restored works for the Nazi Party.

After the war, around 1948, he traveled to the United States and visited the Frick Collection in New York City. He was surprised when on the wall of the gallery he saw a painting that he had only recently treated in Vienna. A guard took notice of his proximity to the painting and asked him to step away. Kneisel responded, slightly bewildered and told the guard, “But I restored this painting in Vienna!” The guard remarked, “That’s impossible, because - here - Mr. Suhr is coming and he is our restorer,” just as Suhr was entering the galleries. Based on some of the details of the picture and its provenance, it is likely that the Georges de la Tour Education of the Virgin was the painting Kneisel had been observing in the gallery of the Frick. The two restorers became acquainted and Kneisel senior was invited to start working for Suhr. The studio was very busy and, after a couple years the studio urged Kneisel to enlist his son, Wolfgang, who was enrolled in engineering classes at a technical institute in Vienna, to join the studio.

Wolfgang was born to Eduard Kneisel and Paula Schäffer in Vienna on the 25th of December 1939. In the 1950s he moved to Caracas, Venezuela with his mother to apprentice in his uncle’s Renault car body shop. Exhibiting natural talents and interests in engineering, he went to a technical high school and then onto a technical institute to study communications engineering. He joined other engineers in trying to perfect the vacuum tubes of the transistor, which had been recently invented. On receiving the letters from New York he dropped out of the engineering program, enrolled at the Akademie der bildenden Künste and completed the program of study in two years.

He then joined his father and Suhr in his studio on E 50th Street in New York City. Because Gavelek was getting along in years, and no one knew how long he could continue to work in the studio, it was he who taught Wolfgang Kneisel how to transfer the paintings. The erection of a skyscraper around 1961 blocked the natural light in the East 50th Street studio, forcing Suhr to relocate. The restorers moved to a loft at 63rd Street and 3rd Avenue with a space three times larger than the previous brownstone. The larger quarters brought an end to the ballet of carrying paintings through obstacles of easels and work stations.

After working for about two and a half years in Suhr’s studio, Kneisel junior was drafted in the early 1960s to fulfill obligatory military duty in Austria, and serve his homeland as a guided missile engineer. This was a problem for
Suhr because Mr. Gavelek was aging and the young man being groomed to replace the craftsman was being asked to leave the country. In an attempt to solve his problems, the well-connected Suhr, as well as some of his clients and museum institutions, wrote letters to the Austrian draft board on behalf of Kneisel, to request a pardon for him from the military service or at least postpone it a couple years. The letters were ineffective. Despite being drafted, the clients sent their paintings across the Atlantic to Vienna to be restored by him, especially if they needed to be transferred. Sometimes the trustees from foundations or the leading managers from a museum would personally bring the paintings to him. By the early 1970s Kneisel senior also returned to Vienna and the two men worked together. Wolfgang often carried out structural treatments while his father did the surface restorations.

According to Kneisel, his clients explained that the reason they preferred to send their works to Vienna was that the American conservators were introducing new synthetic materials to the treatments. The collectors and museums neither cared for the appearance of the new materials nor did they trust the performance of modern synthetics. Since Kneisel was still using traditional materials such as rabbit skin glue, paste, and natural varnishes, the American clients preferred to send their paintings across the sea for him to treat because they trusted him and his materials.

THE PRESENT
Kneisel still uses traditional materials, but he has updated some of the methods first introduced to him by Gavalek. In the 1960s he was using hand planes, but he adopted electric tools for some of the procedures. The adhesive is still rabbit skin glue, with a small percentage of casein, 5% or so – it is soluble in water. He still uses wallpaper paste, but the temporary adhesive he originally used was a paste called Adhesium. It was advertised at the time as “the stickiest thing on the planet.” Instead of using normal paper as in the past, his first layer of facing is Japanese tissue that he adheres with methacrylate in turpentine, followed by a heavier weight paper applied with the paste.

CONCLUSION
We often lament the transfers and the presence of these cradles on the backs of paintings; we wish we could find an old collection label, customs label, or wax seal to confirm the provenance or authorship of a work of art. When we find them, we appreciate the original constructions and roughhewn marks of the unadulterated panels. The practice of transferring paintings has occurred and probably no museum is without a few examples of the treatment. Transfers are fortunately no longer routinely carried out on paintings. Today we have more sophisticated control over our collections’ climate conditions and alternative methods for addressing structural problems in supports to better preserve the original surfaces. But some of these cradled works were damaged in war if not neglected in attics and basements. I am convinced that the structural treatments indeed rescued many works.

I would like to express my gratitude to Herr Wolfgang Kneisel and his wife, Hannelore, for generously sharing the film footage, experiences, and the histories of our late colleagues. Herr Wolfgang Kneisel still works as a restorer in Vienna.

ENDNOTES
1. Magister Wolfgang Kneisel copied the 8mm film onto DVD for his American colleagues. The DVDs are in the archives of the Oral History Project at the Winterthur Library in Delaware.
4. S.N. Berhman, Duveen. New York, 1951, p. 243. Although Berhman quotes this statement in the biography of the dealer, the author has not been able to find the original quotation from the Art News source.
7. Stern, p. 158.

11. Mario Modestini, in unpublished "Gilding the Lily: memoires of a restorer" mistakenly identified the Viennese restorer as Gavelik. Kneisel is the Viennese restorer whom he contracted for the transfers. Gavelek is Polish and died in the United States.


13. In correspondence with Romie Minor, Archivist for Special Collections, Detroit Public Library. 2007. City of Detroit Directories, 1934 and 1935. Valentine Gavelek is listed as an autoworker and he rented at 3134 Farnsworth Avenue. He is not listed in any other directory in the 1930s.


21. DVDs of Kneisel’s documentary footage of his work is archived in the Oral History Project directed by Dr. Joyce Hill Stoner at the Art Conservation Department of the Winterthur Museum in Winterthur, Delaware.


24. Two Gainsborough paintings entered the collection in 1946, a Portrait of Mrs. Elliot (46.1.153) from 1778 and a Portrait of Richard Paul Jodrell (46.1 154) of 1795. Both works were acquired through Duveen and both were medium-sized canvases, measuring roughly 30 inches by 25 inches. The Frick Collection: An Illustrated Catalogue. Vol. I Paintings. New York. 1968, pp.45-46, 54. Georges de la Tour’s Education of the Virgin (48.1.155) entered the collection in 1948. The catalogue identifies the condition of the painting: “The painting was lined and cleaned before it entered the Frick Collection in 1948. With the exception of a few slight abrasions along the edges, it is in very good condition.” The dimensions of the canvas are slightly larger than the Gainsboroughs, measuring roughly 33 inches by 40 inches. The Frick Collection: An Illustrated Catalogue. Vol. II Paintings. New York. 1968. pp. 147 – 151.

25. Kneisel remembers the words of the advertisements. Adhesium is made by Muralo, est. 1894, and more information can be found at the website http://www.muralo.com/products/.
THE EVOLUTION IN THE LINING OF PAINTINGS,
TO LINE OR NOT TO LINE: A PRELIMINARY STUDY

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ABSTRACT – This investigation of the appropriateness of lining considers the structural stabilization of mechanically damaged or inherently unstable paintings. It includes a literature search and correspondence with international painting conservators. Interpretive and ethical aspects of varied approaches to lining alternatives include: finding a treatment that is reversible and compatible with the original artwork which does not interfere with or change the original artwork’s materials, choosing an adhesive that does not increase the risk of deterioration of the original, and guaranteeing treatment that does not interfere with the esthetic appearance. The overview of present practice and scientific research will be useful for painting conservators facing these challenges.

The current trend in the conservation of paintings is tending towards minimum treatment, away from the lining of paintings, and this presents a challenge for the practicing paintings conservator. While thinking about the topic for next year’s IIC conference in London, “Accessibility and Conservation”, it occurred to me that this was also part of the topic of this paper. That is to say, the goal of a remedial structural conservation treatment on an object is to increase its accessibility for display, for study or for traveling loans and prolong the time it may be accessible in the future. A stable painting can be actively used. At the same time we are professionally responsible to preserve the availability of the cultural significance of an object and its original composition of materials for posterity.

Miriam Clavir, retired senior conservator of the Museum of Anthropology in Vancouver, Canada, referred to ethnographic conservation when she stated that we need to maintain this professional responsibility within our decision making process for any act influencing the object. We can apply her observation more generally to fine art conservation. To enable complete accessibility to the object, we cannot mummify the artifact through the process of our treatments, but nonetheless must try to retain it in the most untouched condition as possible. Direct accessibility to the object’s original materials is something conservators must strive to maintain through minimum treatment now and in the future. This paper will look at minimum treatment and how it effects our decision making process.

Conservation was once an artisan’s discipline. The “old school” practices, including lining, were developed by trial and error, practices developed over centuries through pragmatic artisan application, evolved from what worked, what didn’t, what fell apart— a line of inquiry not backed by science until this past century. Some traditionally painted works are more “forgiving” than others with regards to visible damage from heat sensitivity, solvents, or moisture. The response of the artwork to materials and treatment technique (impregnation, heat, and pressure) may give a temporarily acceptable superficial appearance and structural quality resulting from the treatment, but may show failing results over time. For some time, these paintings of the traditional academic style were lined with some aesthetic success. Conservators once had confidence with the materials and were convinced about the lasting quality of their treatments. Stephen Hackney, Head of Conservation Science at the Tate Gallery in London, recalls that in the 1970’s, lining was regarded as a preventive treatment. Some types of paintings at the Tate, especially the modern works, were more problematic and displayed changes caused by the lining. The insensitivity to the resulting damage, such as weave interference and flattening of the paint brush stroke on the surface, was evidence of the acceptance by the Tate and widely in other museums of such damage being a normal side effect of lining. By 2003 however, linings were rare and there now existed a generation of conservators who did not have, nor required practical lining experience, except perhaps theoretically, to understand the lining process enough to knowledgeably reverse a lining. Paul Ackroyd, conservator at the National Gallery in London has extensively reviewed changes in lining practice and the attitude in the conservation community. Today there is a cautious conservatism, sometimes fueled by scientific proof and other times influenced by practical experience.

If one compares the findings of a 2001 survey of British colleagues, by Acroyd and the late Caroline Villers, lecturer at the Courtauld Institute in London and a 1984 survey by the late Gerry Hedley and Villers, one finds evidence of current trend of conservators who are not as convinced about the safety of the properties of any of their materials and some, if not all, of their treatments as were the conservators in the earlier survey. The revolutionary changes in conservation practice in the 1970's had provided the field with synthetic substitutions for certain “traditional” natural
materials, selected because the synthetics promised long-term stability and predictable reversibility and avoided the obvious side effects of the aging characteristics of the traditional materials.

This may explain the confidence that my generation displayed in the 1980's when using synthetics with great bravado, assured that we had the magic elixir! But, as usual, time will tell, and the proof is in the pudding. We have been assisted to a great degree by quantitative scientific research, on the mechanical properties and chemical deterioration of canvas, size, ground layers, paint layers, the effects of lining, humidification, de-acidification, environmental conditions, and evaluations of natural and synthetic adhesives. These have given theoretical insight into the problems, but bench conservators are far from satisfied that we have the practical solutions. Have practicing conservators really benefited from the results of scientific investigation, or are these findings somewhat lost in translation and not being applied effectively in practical conservation?

There seems to be some aesthetic forces at work in the materials selection process. A significant trend noted by Ackroyd and Villers in their 2001 survey was the movement away from synthetic backing materials because they were white in colour and had a “sterile” aesthetic quality. Linen has become the fabric of choice, with other natural materials for backings, even though research has already indicated that synthetics such as polyester are more stable in both physical and chemical properties than are the natural fibres. From ecological reasoning, the conservators surveyed chose natural glues such as isinglass, starch paste and sturgeon glue, especially for more interventive procedures such as consolidation, because it was felt that they were more compatible with the original materials of the painting, even though these materials have proven to show highly hygroscopic behavior and are susceptible to mold, with problematic aging characteristics. An argument for this reasoning, is given by Don Murcheson, conservator at the Glenbow Museum in Calgary, Canada. The added natural materials remain re-workable over time, and that characteristic does allow future treatment, because in this application total reversibility of the added adhesive is impossible.

The 2001 survey also found that there was a general rejection of lining as a treatment, but that 75% of respondents used an impregnating adhesive overall, claiming overall consolidation was less invasive than a non-penetrating lining treatment. I personally find this to be counter intuitive. Consolidation is one of the major problems in painting conservation that requires further research. All our treatments are only temporary, so accepting the fact that consolidation materials are not reversible, there is choice for materials with re-workability, so that the painting, once treated, can be treated again. We have come around to the realization that a “climax” treatment that will preserve the artwork forever is an impossible goal.

Nevertheless, the movement away from the lining of paintings has been a shift in approach, and a necessary one, in order to reduce the risk of change and damage that both the introduction of added materials and the damage that their proximity and the method of their application could impose on the painting. Also, this has evolved together with a general shift in attitude towards, in the words of the late Westby Percival Prescott, Conservator of the National Maritime Museum at Greenwich, London;

“... how a painting is to be seen and valued, not only for the image on its face, but as an integral object which should be protected and enjoyed in its entirety.”

It was Westby who proposed the moratorium on lining at the Greenwich Conference on Comparative Lining Techniques in 1974.

As Ackroyd and Villers state in their paper “The Problem with Minimalism”, we are obliged to perform some level of intervention, to rise above “benign neglect” in order to make the paintings more accessible to everyone, and of course, the question is, to WHAT level, and with what method, and with what material? I believe that we, as bench conservators, have refined our sensitivity in the last three decades, but we still require more collaboration with investigative scientific research backed by quantitative data, to assist us in our applied work, particularly an examination of the array of materials and methods that we have at our disposal for carrying out the physical repair of paintings, thereby allowing us to perform preservation without adulteration. This method hopefully takes us beyond the “hit and miss” approach of the pragmatic artisan.

Conservators around the world practice structural stabilization of mechanically damaged or inherently unstable paintings, the goal being to preserve the paintings from disintegrating. Conservators also perform aesthetic “improvements” such as cleaning away grime layers, the removal of discoloured varnishes and gross overpaint, the filling of lacunae, retouching, and revarnishing. As Sarah Stanisforth, Advisor for paintings conservation at the
The role of conservation is to manage change. Preventive conservation measures slow down the rate of deterioration, but a point is reached at which so much change has occurred that the significance of an artifact is lost.10

Here she alludes to the process of natural deterioration, and the point at which we give up trying to preserve an object, but her remarks also bring up an interesting thought. Why should we not include the remedial acts of the conservator as an agent of change? Ian Hodgkinson, retired professor of Queens University in Canada, does just this in his paper “Man’s effect on Paintings” presented at the 1989 the Shared Responsibility seminar in Ottawa. He gives an example of a painting by Van Gogh restored by Gauguin. The decision was made to retain the overpaint and thereby the historic significance of the Van Gogh/ Gauguin relationship. He states “In this case, preserving the acquired historical significance was preferred to returning the work closer to its original aesthetic significance.”11 We can go further with this line of thinking. The debate continues over an irreversible act such as the removal rather than retention of the original varnish on a painting. In this context, Gerry Hedley presented a valuable discussion of judgments and relativities in cleaning at the same Ottawa seminar.12 So too, the question of the historic authenticity of retaining the original stretcher, no matter how structurally unsound it might be, is now raised, and with the minimalist approach, treatment without removing the painting from the stretcher at all, is becoming the ideal. We are held immobile by the fear that an irreversible act upon any artwork will forever disrupt its intrinsic historic being. Our hands are tied! Just pay me the treatment fee, and I won’t do anything!

Robert Proctor, Texas Conservator, when he joined the panel discussion at the Paintings group session at the 2002 AIC meeting in Miami, reminded us that minimum treatment usually means local treatment that often takes more time and care than a traditional lining.13 We treat each individual object with an increasingly cautious custom approach, and believe what we are doing is ultimately the best, within the dilemma of budget restraint.

The ancient Irish O’Failbhe clan was famous for their bardic storytelling, always managing to insert themselves into an epic or two. Who am I to interfere with my family’s tradition, and not insert my own story into the saga of 20th century conservation history? My own approach onto the on-ramp of the time-line of “the history of the lining process” occurred in 1974, at the time of the groundbreaking Greenwich conference on comparative lining techniques. It was a time of philosophic extremes, when both cautious conservatism and a growing mood for dramatic change existed side by side. I quote Dickens, “It was the best of times, it was the worst of times.” As an apprentice in painting conservation at the Dutch government’s Central Research Laboratory in Amsterdam Holland, now renamed Instituut Collectie Nederland (ICN), I was assistant to Vishwa Raj Mehra, a pioneer in the current minimal approach. For him intervention is only justifiable if it is inevitable. In a world where science was becoming more and more reductionist, he pursued a holistic approach and invited interdisciplinary exchange between art history, conservation science, ancient material science and engineering.14 He applied dynamic observation to an artwork as a process, constantly in motion, undergoing plastic deformations, changes in RH and temperature. He worked in collaboration with scientists and engineers, seeking out appropriate industrially available adhesives, fabrics and equipment. The applied research in which I was involved, lead to the introduction of the low pressure cold lining table and its use in treatment of paintings at the Greenwich conference and the ICOM -CC 4 th triennial conference in Venice.15 The research involved the choice of adhesives, not excessively strong but characteristically compatible with the original, with long term stability and a nap bond adhesion that was readily reversible, not penetrating the original support. He avoided all forms of heat in his treatment. His approach may seem commonplace to today’s generation of conservators, but in that era it was regarded as absolute heresy.

At that time, Gerry Hedley’s research was finding problems with wax impregnation of canvas over time.16 This was disturbing to those who were convinced that wax lining was the ultimate treatment. It is hard to imagine if you didn’t live through that era, how prevalent wax resin lining and the use of the vacuum hot table was at that time. My introduction to wax lining and the vacuum hot table was at the Canadian Conservation Institute in 1977, and the process disturbed to me, since I had been immersed in lining alternatives with Vishwa. In fact, it was becoming painfully clear that common treatments were causing irreparable changes to the artworks and that the conservation community needed to put a moratorium on that kind of lining. The resulting side effects that were generally uneasily accepted as “the lesser of two evils”, that is, weave interference, flattening of brushwork, and darkening from the saturation of absorbent grounds with irreversible resinous adhesives, were esthetically unacceptable and they were avoidable using cold lining.
As a student of Vishwa’s, I attempted to introduce my mentor’s low pressure treatment, synthetic materials and nap bond lining to the Canadian Conservation Institute, although just like all new techniques in our field, it was met with due skepticism at that time. Patrick Legris, then a fellow conservator at CCI, now a private conservator in Canada, built the first cold table at CCI, using a discarded squirrel fan and petty cash. Don Murcheson, now Conservator at the Glenbow Museum, Debra Daly Hartin who is still at the CCI, and I worked independently of our supervisors. In time, Puccio Sperroni, conservator from the National Museum in Denmark visited CCI, and asked about our low-pressure research. Suddenly, with his support, the resistance to this emerging new concept was overcome. I have heard from Debra Daly Hartin and she is planning the next stage of the CCI lining project in 2007 and 2008, continuing the examination of the effects of lining, following on the excellent work already done with Michalski and Pacquet. 17

There have been some investigative inroads into the understanding of the variability of the elements in the composite of a painting, some elements examined alone and in relationship with other components in the painting.

The research on the moisture treatment of paintings has been significant, and I am limited with the time allotted here to discuss it in depth as much as I would like to. The moisture treatment of deformations, both in the support, and in the paint layer, is gradual, with restraint in the form of working strainers and used with the suction table. Moisture treatment is particularly well received with positive results by conservators with a background in glue linings, in Italy, Scandinavia and Britain. A further investigation of potential damage to the paint layer and minimizing risks of shrinkage of the canvas is necessary. Hedley has looked at the effect of moisture on actual paintings 16 and Rhona MacBeth, conservator at the Museum of Fine Arts in Boston, has made a very promising evaluation of moisture treatment on the composite of the painting when she was working on a collaborative research project at the Courtauld. 18 Mikkel Scarf, Head of the school of conservation at The Royal Danish Academy of Fine Arts in Copenhagen, relates in a recent email that “in many cases badly cupped or flaking paintings can be treated gently by controlled use of 1) humidity, 2) heat, 3) pressure, perhaps in combination with proper use of a consolidant. This is usually done on a suction table where the cupping can slowly (sometime over a number of gentle treatment steps) be leveled out and brought to adhere to the original canvas support.”

We have a long way to go with understanding the biodegradation deterioration mechanisms of the painting composite, and how consolidation can successfully meet the challenge. Matteo Rossi Doria, Italian private conservator, using microphotographs comparing untreated and consolidated paint layers, has illustrated that consolidation introduces major changes to the microstructure of the painting and is not reversible, in his paper at the CESMAR congress in Milan in November 2006. 19 The Milan meeting concerned many aspects of consolidation. Marion Mecklenburg, the Senior Research Physical Scientist for Conservation Research at the Smithsonian Center for Materials Research and Education, has continued to address the relationships of the mechanical behavior and chemical degradation of the painting’s composite in fluctuating environmental conditions as significant factors in the failure of structural integrity since his early research in 1982. 20 More recently he has been considering structural failure mechanisms in paintings to develop protocols for consolidation. 21

Christine Young, Conservation Scientist and her colleagues at the Courtauld Institute have studied the interactions introduced by the way a canvas is attached to a stretcher. 22 In Italy, some very good designs are available for re-mounting canvases on adapted original stretchers using rounded low friction profiles and unrestrained tension along the length of the stretcher. These designs resulted from applied research in attachments for canvas paintings at the Oreficio delle Pietre Dure in Florence by Ezio Buzzegoli and his colleague, Antonio Iaccarino Idelson. 23

With more interventive treatments, it is, of course, essential to consider compatibility and reversibility of the introduced materials for any artwork. But contemporary artworks present unique problems with stabilization. In the early research of Vishwa Mehra, the cold lining method was developed to problem solve for the treatment of damaged contemporary paintings and artworks with highly absorbent and unconventional materials. Unprimed canvases, paints sensitive to solvents, resin saturation and heat could not be approached with the same considerations as the more traditionally painted historic paintings for which conventional lining had been developed. Vishwa Mehra’s approach asks two significant questions that I believe have not yet satisfactorily been answered, What are the benefits of lining? And should we be lining at all? I will add the questions how appropriate is the lining process in our treatment of paintings today? Is it an option, or should we discard it completely? Mehra and many others, continued to question the practices and materials of the time, the use of heat, pressure and impregnating materials in the treatments of paintings, and the effects of external environment on the composite of paintings. Although an immediate result of the conventional lining resulted in a condition that appeared to stabilize the work, there was growing evidence of continuing longer-term problems.
Conservators continually address the challenge to find a treatment that is reversible and compatible with the original artwork, one which does not interfere with, or change the original artwork’s materials. There is a general trend towards doing the least intervention, to stabilize the condition with preventive conservation replacing remedial treatment.

What are the minimum treatment alternatives to lining?

There is the preventive approach such as using microclimate, there are moderate treatments such as strip lining, loose and insert linings cami linings, tear repair and de-acidification and there are interventions that stabilize with an assortment of stretchers including panel stretchers,

In uncontrolled environments the use of microclimate package framing has provided a non-invasive stabilization to the artwork since before the 1930’s, but also reduces the availability of the surface for study or examination. The recent traveling exhibit of Stubbs paintings at the Frick Gallery in New York City is a point in case. No matter how subtle the non-reflective glass is there is always the glazing barrier between the observer and the work. Perhaps this can be regarded as “the lesser of two evils” in our contemporary philosophy. How ever, the microclimate of the frame does reduce the rate of change in RH and temperature and holds the painting in a buffered physical environment, reducing the strains of fluctuations during a traveling loan. Mikkel Schiff, writes in a recent email, that there is a current EU funded research program called “ProPaint” measuring the possible preventive effect of microclimate cases protecting paintings from air pollution. Results of the program will not be available until two or three years from now.

A very good step-by-step procedure for strip lining is laid out in an article from the “Alternatives to Lining” conference in London by Simon Bobak, British private conservator. Rustin Levenson, American private conservator, published strip lining methods in 1978 in the Zagreb ICOM preprints. Also, at the 2002 AIC Painting Specialty Group panel discussion, Rustin described a number of alternatives to linings in order to address various problems. She gave names to her strip lining, such as the “pie crust” where the stretcher is removed, but the tacking margin is not flattened, and the “shirt tail”, where the new strip is attached on the outside of the original, and can then be removed after the painting has been reattached to the stretcher. Rustin suggests using the trampoline loose lining, an elasticized edge loose lining that can adjust because the tension is transferred to the original canvas on the stretcher. Rustin also describes pillow top insert linings with polyester batting for transit. Cami linings with fabric placed behind stretcher bars and attached to the back of the stretcher have been practiced for a number of decades.

Attaching removable panel insert backing boards passively to stretchers was suggested by Stephen Prins in 1989 at the AIC Cincinnati meeting after he observed the excellent condition in 19th C paintings with panel stretchers that had survived extreme storage conditions. The Paintings Specialty Group is just now completing the chapter on stretchers for the Painting Conservation Catalogue. Karoline Beltinger, a conservator from Zurich, Switzerland, collaborated with Dutch colleagues in a number of case studies from the Stichting Collectief Restauratie Atelier in Amsterdam. Their goal was to preserve any unlined paintings that came for treatment without lining, so they carried out stretcher bar linings without removal from the stretcher and used auxiliary support materials without adhesive, including panel stretchers. With regards to the tear repair of canvas, Christina Young, Conservation Physicist at the Courtauld Institute, has examined the mechanical requirements of the ideal tear mend. The late Gustave Berger gave a classic procedure of tear repair with two part epoxy. Winfried Heiber, professor at the Academy of fine arts, Dresden, has described the thread by thread method of tear repair and given international workshops. Robert Proctor was his student in Germany and has promoted and enhanced the local tear repair technique introduced by Heiber in the US. Lascaux products offer a textile welding powder, Polyamide 5060, which is used worldwide for tear repair on paintings. The temperature at 80°C (176° F) is excessive, so caution is necessary, the material should be used only on paintings that can resist the local use of heat, and with heated micro tips. There is also a time lapse in the cooling setting time for the powder, so Mylar should not be lifted from the area until the powder is fully set.

Steven Hackney recommends the de-acidification of canvas and has proposed alkaline reserves as a preventive measure for painting preservation. All these procedures are alternatives to lining and an attempt to maintain minimum treatment.

How can an adhesive for consolidation be safely chosen that will not increase the risk of deterioration of the original by the subsequent degradation of the adhesive itself, introducing inherent aging by-products? Now, with regards to adhesives research, a wide range of synthetic dispersions have been tested by Eddy de Witte, Conservation Scientist in Brussels, Belgium, and colleagues were particularly interested in the effect of the additives of internal plasticizers and thickeners. The authors suggest all commercial products should be tested for suitability for conservation before use. Rachel Howells, private British painting conservator, in collaboration with conservation scientists at the
Courtauld Institute, researched twelve dispersions including acrylics, PVA's and EVA's. One EVA, Vinamul 3252, showed no change in the aging tests. Michael Duffy, conservator at the Museum of Modern Art, in 1989, tested five polymer dispersion for the properties of peel strength, flexibility and swelling of dried films. The aging tests with high heat and light provided poor results with yellowing and decreased reversibility of many of the adhesives. The temperatures were higher than those a painting would ideally be exposed to. Duffy also noted the useful resource of adhesives research from outside conservation literature.

Stefan Michalski discussed the model of the consolidation process last November at the Cesmar group meeting in Milan. There is complexity bordering on chaos in the investigation of consolidants, particularly in the intervention of biodeterioration. Results in the examination of behavior of consolidating adhesives are dependant on, as Stefan Michalski calls it, the mystery of the complication in variables. The rate of swelling in the paint layer, the timing, skill and craft of the conservator, even the temperature of the room, must be in the equation. Adhesives will behave differently, their penetration differing with the varied drying times of various solvents, concentration ratio of solid resin to solvent, viscosity and molecular weight of the solvent and the resin. The porosity of the paint layer will effect the action of the consolidant, depending on varied properties of individual and mixtures of pigments and mediums in paints that exhibit high or low absorption factors.

Conservation needs scientific method applied to resolve complex influences on composite materials that are unpredictable, both in the internal changes with in the complex and from the external environment outside of the more controlled museum conditions. These results have to be interpreted with understanding of the unpredictability of the physical and social environment in which the painting is expected to function.

With respect to historic artworks that have had little or no former treatment, and are in a fragile aged condition, minimum treatment may have a drawback in that the vulnerability of this kind of untreated painting may reduce it's availability for use. Loans and travel may be out of the question, and the structural flaws in the aesthetic appearance may restrict the display of these paintings in exhibition. However, as time goes on, our attitude to that may also evolve, just as weave interference was once accepted as part of the lining result, and we may already be more comfortable with the flaws more obvious in minimally treated paintings, overlooking the blemishes, content that the painting remains in a more original state. I have often thought that if we could photo shop a life-size reproduction of the original we could show the artist's intent as assumed in the style of our relatively current aesthetic fashion, and leave the original painting intact for the next generation. They can mess with its virtual image in their own fashion.

The availability of the metaphorical intention is made easier with a physical manifestation materially representing it. We attempt, in the short time afforded to us in our generation, to prolong this availability by preserving the artifact and its representation of a concept for as many generations as possible: the preservation of culture of the past into the future. "To Line or Not to Line" is a challenge in decision making we must face daily in private conservation, especially dealing with works that are displayed and stored in uncontrolled environments, in both private and under-funded public collections. Many times I hear the argument, that we can line this (otherwise sound, but brittle and aged painting) as a precautionary step, as the owner has the opportunity for treatment now, and may never have it again, therefore we may as well line it now, as it will have to be lined eventually! I believe we need to have as many options as possible to refute this argument. I encourage you to revisist the history, research and goals of lining as you contemplate options to your next interventive treatment path.

In this respect, a longer-term research proposal is in the works guided by the result of this literature search and by correspondence with practicing conservators. This preliminary study will be followed by applied research assessing comparative studies of the cold lining technique compared to other adhesive systems in current use in lining and non-lining options. Hopefully, in collaboration with conservation scientists, the testing will proceed of samples of naturally aged lining adhesive mock-ups that exist from the West Lake Conservators' former research during the years 1980-83. The results of such testing will make more information available to practicing conservators to facilitate their selection of appropriate materials and methods for remedial treatments.

So in conclusion, I hope that I have shed some light on the change of attitude we have witnessed with regards to lining over the last few decades. I have found that I am not alone in having caution with regard to dealing with the complexity of the study of conservation materials and that this caution is shared with conservators concerning the immediate effect and the aging side effects that introduced materials may have on artworks.

"Every decision is a moment of madness"
Søren Kierkegaard
REFERENCES


ABSTRACT — Hardboard served as a common and popular support for many modern and contemporary paintings. Some artists considered hardboard to be a stable, light and economic alternative to solid wood panels and other rigid supports, whereas others rejected the processed and compressed wood fibre boards as an inferior industrial construction material of low aesthetical value.

From the conservator’s critical point of view, the many disadvantages to be found in this material, such as high acidity, hygroscopic character, tendency of warping, and the flaking of certain painting materials in the case of tempered hardboard, outweigh by far the positive aspects of this material as support for paintings.

A very characteristic damage found on acrylic colour and other porous painting media on hardboard is the formation of stains, which may manifest itself in a variety of ways, including ligneous residues, bleeding extractives, and microbiological growth.

This contribution aims to describe and differentiate such characteristic stains, and provides a practical treatment proposal to reduce, neutralize and disinfect stained acrylic paintings on hardboard through the application of an alkaline absorber.

1. INTRODUCTION

In a humid environment, the combination of acrylic paint and hardboard, and the physical and chemical properties of both materials may result relatively fast in the development of characteristic stains on the surface of a painting. Those stains are generally caused either through a phenomenon called Support Induced Discolouration, commonly known as ‘SID’, or due to a microbiological infestation of support and painting.

The term Support Induced Discolouration can refer to the extractive bleeding of natural components of the hardboard, and also to the off-gassing of certain artificially added coatings and impregnations. The materials concerned may include oils, resins, waxes, tannins, lignin and formaldehydes, which under certain climatic conditions tend to bleed through porous painting layers. Microbiological growth on the acrylic painting medium and hardboard can occur through fungal infestation, bacterial colonization or the development of moss and algae, if the available quantity of water is high enough (≥ 65%) (Warscheid, 2003). In some cases, a combination of microbiological growth and extractive bleeding, may both exist side by side, as well as in a symbiotic-like relationship. Another source of staining that has been observed, is the extractive bleeding and efflorescence of original painting components such as Polyethylene-Oxides. As this aspect was not included in the research project, it cannot be discussed in detail here, but shall at least be mentioned.
Image 3.
Metabolization of carbonic pigment contents through mold infestation
Noemi Ruiz, "Origen Antillano" (1960's), Acrylic painting on hardboard,
Approx. 91.2 cm x 122 cm (Vertical format),
MAC Cons. File #019405, N. Ruiz

Image 4.
Combination of SID and microbiological infestation ('side by side')
Noemi Ruiz, "Arbol", (1967), Acrylic painting on wooden composite board,
Approx. 73 cm x 202 cm (Vertical format),
MAC Cons. File #022505, Noemi Ruiz

Image 5.
'Symbiotic' combination of extracts from the hardboard (SID) and mold
Noemi Ruiz, 'Trayectoria luz' (no date), Acrylic painting on hardboard,
Approx. 122 cm x 91 cm (Horizontal format),
MAC Cons. File #019505, Noemi Ruiz

Image 6.
Detail, extractive bleeding of painting components / Poly-Ehtylene-Oxides (PEO's?)
Noemi Ruiz, "Floral" (1960), Acrylic painting on hardboard,
Approx. 45 cm x 59 cm (Vertical format),
No Reg. #, N Ruiz
The two characteristic kinds of stains described, develop extremely well and fast in humid tropical conditions, but may also occur to a lesser and slower degree in moderate climatic environments. Due to their visual similarity, stains often happen to be confused and described indifferently as ‘fox-spots’. The lack of examination and classification, however, can easily lead to inappropriate conservation treatments, that rely on strong bleaches, leaching acids and toxic fungicides.

This article tries to establish a classification of the staining and microbiological infestation of acrylic paintings on hardboard (see ‘Table Stains’), and provides case samples of stain-reduction by means of an extraction method through neutralizing poultices that contain Sodium Bicarbonate.

Most of the paintings that are included in this project, date back to the 1960’s, and belong to the Puerto Rican heritage. Many had been stored in uncontrolled and excessively humid conditions above 85% relative humidity, prior to entering the Conservation Lab of the Contemporary Art Museum in San Juan, to undergo examination and conservation treatment. Usually, paintings were found to be applied on ‘no name - hardboard - products’, that were made in Brazil, Spain and the U.S.

2. HARDBOARD
To understand the phenomenon of ‘Support Induced Discoloration’, which includes the two subordinated groups of ‘Extractive Bleeding’ and ‘Off-Gassing’, we will have to take a closer look on the basic properties of hardboard. At the same time, we would have to put the characteristics of acrylic colour systems into context, and take into consideration any possible interaction under certain climatic conditions.

Hardboard consists to over 99% of heat-compressed and inter-felted wooden fibres, which are held together through the natural polymer lignin. Hardboards are either dry- or wet-processed (Images 7,8). Of the many brands that exist internationally, ‘Masonite’ is perhaps best known. The most common boards are smooth on one side, and rugged on the other. The majority of paintings are generally executed on the smooth side. There are un-tempered hardboards, and...
tempered ones (Images 9,10). Tempered hardboards are usually impregnated or covered with a thin oil layer, a resin, or a wax coating, which tends to reject painting materials, if not prepared properly by the artist. The fibres may consist of softwood or hardwood particles, ranging from pine wood to tropical wood. Tropical wood flakes may consist of red cedar, mahogany or eucalyptus, which tend to release acidic tannins, and tend to discolour easily. The huge variety of products that are composed by different wooden blends leads to a great variety of brownish colour-
tones. Any kind of hardboard has in common: high acidity of up to pH 3 (Image 11); sensitivity towards UV-radiation and humidity; capacity to retain up to 30% of water; swelling; vulnerability of exposed edges; flaking; and even infestation through termites (Image 12). With the vaporization of ligneous material, the remaining cellulose structure turns fragile and can finally collapse (Hudson Highland, 2006).

Due to its tendency to absorb and retain moisture, its organic contents and high acidity, hardboard provides an ideal substrate for the development of fungus, bacteria and even algae and moss. At the same time, oils, liquids, soils and organic substances are all readily absorbed onto the fibres, and can oxidize over time, developing into coloured stains.

3. ACRYLIC PAINT

As we know, acrylic colour systems are prone to infestation through micro-organisms, whether on its surface, or rooting within the material. The porosity of acrylic painting layers allows hardboard contents, liquids and gases to permeate to its surface. Cavities in the painting layers tend to retain moisture and substrates, and to create a micro-climate. Voids in the painting layer may provide access for fungal structures to the substrate and moisture content of the support. Artist’s acrylic painting materials are usually water-bound emulsions of Polybutyl-Methacrylates, and may provoke the extraction and bleeding of certain wood-contents such as tannin from the support.

Acrylic colour systems are usually set to a slightly alkaline level through additives, and they are known to possess good alkali resistance as well. Extractive bleeding, however, is capable to convert the surface and painting layer easily into an acidic pH, which may lead to intense microbial infestation and further acidification through metabolism. High acidity may hydrolyse parts of the acrylic painting system, and certain pigment contents may be transformed into metallic salts. The thinner an acrylic painting layer is, the more rapid can occur any kind of support-related staining process, which might be delayed through the previous application of a thorough priming with different and less porous binders.

Poly-Ethylene-Oxides (PEO’s) and other bleeding painting components and additives that may appear on the surface of aged acrylic colours, certainly can also have a significant influence on microbiological growth.

4. ‘SUPPORT INDUCED DISCOLOURATION’ (‘SID’)

Now, what exactly is Support Induced Discoloration? SID is a generalizing term that tries to describe any kind of extractive bleeding or off-gassing from the support material. SID can have its origin in the natural components of the wooden fibres that compose hardboard, such as tannin, lignin, resin, and oil, and/or in industrial additives such as waxes, oils and resins that were applied artificially for impregnation.
Humidity, heat, UV-radiation, air-pollution and microbial infestation are all factors that help to crack down the natural and artificial components which constitute hardboard. Ligneous material, tannins, resins, and oils may become hydrolysed and oxidized, and in consequence bleed-out or gas-off in the form of discoloured residues. The impact of high humidity helps to accelerate this process (Images 13, 14).

Image 15 shows us extractive bleeding through fibres that stick up, trespass the painting layer, and transport semi-transparent, resinous residues to the surface through osmosis. Extractives also can gas out through porosities, as we can see on Image 16: The decay of ligneous components occurs, since lignin is slowly volatile. It is easily broken down by oxygen and other components of the air, and transported through the porous painting to its surface, where it may accumulate as brownish transparent residues. Ligneous components may be identified and distinguished from other components by colour staining and counter-staining with chemical solutions, such as phloroglucinol, zinc-chlor-iodine, safranine and astral blue (Wülfert, 1999). (Images 17, 18, 19, 20).

Similar processes of Support Induced Discoloration may occur when oils, resins and waxes oxidize and gas-off or bleed-out. Occasionally, augmented 'Support Induced Discoloration' of resinous character can be detected, where wooden supports are glued or nailed onto the reverse of the hardboard - panel.
Occasionally, and despite its acidic characteristics, hardboard can even be found as 'conservation-material', for instance as backing support for paintings on canvas. There is, however, a high risk that such measures can lead to fatal discoloration of the original painting, due to the interaction between excessive humidity and bleeding ingredients of the hardboard.

5. FUNGAL INFESTATION

In general, macro- and microscopic examinations are sufficient to distinguish safely between SID and fungal infestation. We have to bear in mind, however, that the paintings under treatment usually have a long history of microbial infestation, and that we usually only detect recent or present growth. Biological infestation can be divided into opportunistic and substrate specific growth, and may include filamentous species, black mould, bacteria, and even algae.

In many cases, fungal growth is not substrate-specific, and the most important factors are the level of humidity, pH and temperature (Mary Lou E. Florian, 2002). In the case of test-dummies, Aspergillus and Penicillium spore chains and active conidiophores, and also Cladosporium sp. (sphaerospermum) could be detected after 3 weeks under humid conditions above 95% (Image 21). The encountered species are ubiquitous, and predominant in tropical and sub-tropical regions, and develop predominantly on acidic substrates. With the passing of time, and due to the shift towards an acidic pH-level, both acrylic paint and hardboard in combination may provide favourable conditions for fungal growth in a humid environment. Water is regarded as the determinant environmental factor for mould growing, and every single fungal species has its preferred individual range of available water content (Art, Biology & Conservation, 2003). The reduction of humidity below 50% over two weeks, stopped fungal growth, and left behind hyphal structures, inactive spores and metabolic residues, many of which consequently dried out. (Image 22).

On a porous and extremely dry (oil) painting on paper and hardboard, which was executed by the Puerto Rican artist Francisco Rodon during the 1960’s, both opportunistic growth such as Curvularia Lunata, Chaetomium sp. and Basidiomycetes could be determined. Also, on the reverse-side, substrate specific species, which are known to digest woody and cellulosic...
material, such as Alternaria sp., Cladosporium sp. and Basidiomycetes, were found. This painting was exposed for several decades in an open garden house to the environment. The presence of micro-organisms was respectively diverse and manifold.

A substrate-specific metabolization of black, carbonic pigment is also commonly observed (Images 23&23B). The degradation and metabolization of black pigments through fungus is a widely observed phenomenon in all kinds of paintings that contain elemental carbon. In addition, carbonic pigments seem to have the tendency to absorb an elevated level of humidity.

In some stages of their development, certain moulds, such as Memnoniella, may look like resinous extracts, and could be confused easily with SID. In such cases, the breeding of samples could help to identify fungal growth, and to distinguish them from SID.

Another important and ubiquitous group of fungi are the dark pigmented and black moulds, such as the melanin pigmented stains of Cladosporium, which are notorious for their irreversibility from delicate and porous paintings. The development of black mould occurs predominantly on water-damaged objects. The characteristic dark pigmented stains contain melanin.

In a few cases, melanin ghosts caused by some species of Memnoniella, Cladosporium, Aureobasidium and Alternaria, may remain disturbingly visible, and may require a touch-up locally. Enzyme treatments may be partially successful in specialized laboratory conditions, and may provide a promising tool with regard to the removal of specific fungal or oily stains (Wolbers, 2000). Several years ago, some promising trials were also carried out in an effort to establish enzymatic treatment methods for the removal of Chaetomium sp. and Cladosporium sp. and their by-products of metabolism (Baldwin; Art, Biology & Conservation, 2003).

6. BACTERIAL INFESTATION / YEAST

On some occasions, no fungal activity was detected, no fungal residues were found, no accumulation of resinous extractives was present, and no salt efflorescence was detected. The painted and unpainted reverses of several hardboards, however, were affected by heavy staining (Image 24). The examination of samples revealed a possible bacterial infestation, and assumes in another case yeast-cells as the stain-causing micro-organism (Image 24B). We also may find Zygomycetes (Bread moulds), Ascomycetes (Sac Fungi) and Saccharomycetes (Yeasts), linked to painting materials and the environment (Szczepanowska, Cavaliere, 2003). It is also quite likely that at times, acrylic colour and painting tools are already infested during the painting act, and cause an infestation right from the very beginning. Bacteria may affect the hardboard through erosion, tunnelling and cavitation.
Research carried out in the 1970s that investigated the ‘Progression of Micro-organisms on painted panels in Puerto Rico’, suggests that bacteria are more compatible with freshly painted surfaces than moulds or yeasts. It also implies that some of the moulds and yeasts have an adaptation period during which time the paint surface is conditioned by other micro-organisms or weathering before they can predominate (O’Neill & Drisko, 1978).

7. COMBINATION OF ‘SID’ AND MICROBIAL INFESTATION / SYMBIOTIC RELATION

Quite often, diverse stains exist side by side, and SID and bacterial infestation may provide an ideal acidic environment and appropriate substrates for subsequent fungal infestation. Ligneous residues, tannins, oils and resins that settle due to off-gassing or extractive bleeding on the surface of a porous acrylic painting medium, adhere dust and moisture, and as a consequence, allow fungal and bacterial structures to settle and develop.

Resulting metabolization products lead to further acidification of the painting layer, and to further hydrolization and destruction.

The test dummy on Image 25 shows a fungal stain (Penicillium?) next to a ‘Support Induced Discoloration’ on an un-tempered hardboard support (Image 23). The differences are, though, not always that clear. In the case of a deteriorated painting from the 1960’s (detail, Image 29), the deterioration is a much more complex matter: Extractive bleeding from the support and fungal stains of Basidiomycetes appear often at first sight to be similar in both form and colour. Only some tear-shaped residues in this specific case immediately indicate the presence of ligneous extractives. The Brazil-made support of this painting, for instance, is rich in tannins, and partially decomposed by Basidiomycetes. Whitish growth within the ochre colour field was determined as Chaetomium [Sp.], which is known to settle on wooden and synthetic material alike, and is commonly observed on paintings.

The coexistence of SID and fungal infestation seems at times to undergo a symbiotic-like relationship between extractives from the support that may provide nutrition, moisture, an acidic environment, and mould, which in the right conditions may settle easily on and around voids in porous acrylic painting layers (Image 26), and on extracts and woody residues (Compare Image 5).

8. TREATMENT / REMOVAL OF THE STAINS

The cleaning, disinfection and neutralization of stained acrylic paintings on hardboard requires the development of a safe and effective cleaning method. Bleaching agents, acidic cleaning solutions and fungicides can do a lot of harm to the original substance (Bishop Museum, 1994), and to our health, and should generally be substituted by more appropriate conservation materials. A widely practised approach seems in general, to bleach fox spots through the application of peroxides, chloride containing bleaches and reductive chemicals, which are known to have a destructive long-term-effect to acrylic polymers and wood fibre-containing supports. The often superfluous impregnation of treated paintings with toxic and reactive fungicides seems also widespread practice. Resulting damages and leached painting areas are then usually covered up through the application of solvent-based varnishes, which - in addition to changing the...
appearance of an originally unvarnished artwork – are almost impossible to remove afterwards without impacting the original acrylic painting layers. As these coatings usually remain semi-permeable, and tend to retain moisture within the hardboard, this effect may worsen the problem of fungal growth and Support Induced Discolouration.

The search for a safe and effective cleaning alternative for stains on unvarnished acrylic paintings on hardboard led to the evaluation of a range of absorbents and deacidifiers. Neutralizing agents that are commonly applied in paper conservation, such as Calcium Hydroxide, Natrium Hydroxide or Magnesium Hydroxide, hardly extracted any stains, whereas ‘Sodium Bicarbonate’ (Arm & Hammer) worked very efficiently on these paintings as chemisorbtion material. Ideally, it is applied in the form of dry powder on slightly wet paper, which resembles the structure and principle of a poultice (Images 27&28). The paper may consist of Japanese paper, e.g. Kozo Kashmir, Tengujo fine, or Green’s Mending Tissue, which is soaked with distilled water, to neutralize and extract the stains and any excess of humidity in combination with the dry absorbent medium. Sodium Bicarbonate also acts as scavenger material and pH buffer on the surface of the painting, and neutralizes acidic deposits, oxidized oils and resins, wooden extractives and biofilms (Image 29). Sodium Bicarbonate is also known to have fungistatic properties, and may be described as ‘contact fungicide’. With this method, most stains that originate in SID and fungal infestation could successfully be neutralized and extracted from the painting concerned (Compare Image 30 with Image 4 – ‘Before&After’). (Image 30).
The extraction method presented intends to stimulate cleaning trials and experiments with Sodium Bicarbonate, which may be combined with other neutralizing agents, to adjust the pH-level, if required. It is not the intention of the author to provide an ‘all-round’ recipe of general validity. The reactivity of the Sodium Bicarbonate is believed to root in the alkaline character, and its interaction with acidic materials such as metabolic residues from mould, or ligneous extractives from the hardboard support.

Wax stains may in addition need to be solved locally with mineral spirits. However, precaution always has to be the highest priority: “Although acrylic paint is mentioned in the literature as being insoluble in mineral spirits or water, many of the additives in emulsion products – [and Poly-Ethylene Oxides (PEO’s), which may aggregate as surfactants on the surface of an acrylic painting film] – might be dissolved in some cases by these liquids” (Leamer, 2004, p.5).

However, in general no negative effect should be expected from the poultices when applied temporarily as absorbant on acrylic paintings. In this context, it is noteworthy, that colour makers set acrylic emulsion paint alkaline, usually by adding Ammonia, to establish a pH of about 9.5 (!). Sodium Bicarbonate occasionally is found to have been used by artists as an additive to acrylic paint, to increase the impasto and texture, and in the field of Conservation it was successfully applied on many occasions as neutralizer of acetic acid deposits on tempera paint during the early 20th century. With the passing of time, though, this technique became forgotten.1

In some cases of stain-extraction, however, precaution is required: certain sensitive pigments and coloured areas might have suffered severely from fungal infestation and may easily be extracted through any kind of poultice or any other contact. Oil colour should under no circumstance be cleaned with Sodium Bicarbonate, as a leached painting surface could be the result.

Sodium Bicarbonate has comparatively weak temporal fungistatic properties, which in long-term effectiveness may be compared to low concentrations of Thymol. In combination with controlled drying and an appropriate storage of the painting after treatment, however, fungal re-infestation is very unlikely. Several paintings that were monitored one-and-a-half year after treatment with Sodium Bicarbonate, reversal fumigation with Thymol, and storage in controlled climatic conditions, showed no re-infestation. Drastic climatic changes, however, and an increased level of humidity, may cause repeated staining and microbiological infestation.

In the case of black mould removal from a polychrome surface, the literature also mentions poultices of (Kalium) perganmanate (KMnO4) and sepiolite (Meerschaum) as an efficient alternative treatment method (Graf, Burgstaller, 2004). Another source, which focuses on the removal of oxidized adhesives on cellulose supports, refers to clay, siliceous components and cellulose powders as possible absorption materials (Saéz, Gimeno, 2004).

9. COATINGS & VARNISHES

A quite common reaction towards the conservation of porous or sensitive paintings is the application of a ‘protective’ varnish. Although in many cases, the sealing or coating with acrylic varnishes can have beneficial aspects for the conservation of a painting layer (Image 31), some considerable drawbacks may be experienced: any coating on solvent base with higher polarity than Mineral Spirits, bears a high risk of severely harming an acrylic painting, and would also be irreversible from the original acrylic painting in the future. Reversible, water-based varnishes which contain aquazol or cellulosic derivates stay sensitive against high humidity, they are optically inappropriate, get sticky, and aquazol even may provide an additional substrate for certain fungal organisms. A mayor disadvantage in this context is, however, that multiple coating layers tend to retain moisture, and hence could increase microbial growth – especially when hardboards have already been infested by hyphae and dormant spores before the application of any coating, and which are continuously kept in extreme humid conditions.

Image 31. Varnish on aged acrylic Painting on hardboard (from 1966) - Preventive medium, or cause for accelerated decay? Noemi Ruiz, ‘Camino Sideral’ (1966), Approx. 85 cm x 61cm (Horizontal format), MAC Cons. File #024006, N. Ruiz
Research on moisture transport properties of paint coatings on wood, that were carried out and described by R. S. Williams (Williams, 1991) showed that most paints are fairly porous and that it is possible for moisture to diffuse readily into and out of painted wood. The author wishes to emphasize that paint coatings inhibit the loss of moisture more than they do to the absorption of moisture and that, under cyclic exposure to high and low relative humidity, paint traps moisture. This type of cyclic exposure is seldom a problem under most circumstances because sufficient drying time usually passes between periods of high humidity. If, however, wood is subjected to continuous high humidity from either the inside or the outside, loss of adhesion, Support Induced Discolouration and microbiological growth is likely.

The development of an appropriate and reversible varnish especially for acrylic paintings, which is not based on organic solvents, is a concern, that recently has brought on the way major research projects, such as the Tate AXA Art Modern Paints Project, which commenced in 2006, and investigates among other aspects the varnishing of acrylic emulsion paints and cleaning treatments. To make things even more complex, the ideal varnish for acrylic paintings in a humid, tropical environment would need to be water resistant, to avoid its dissolution.

10. CONCLUSIONS & OUTLOOK

The difference between stains caused through SID and microbiological growth is of prime importance, since it allows the conservator to adjust the method of treatment. A stain-infested painting with no fungal diagnosis obviously would not require the application of any fungicide, whereas a mouldy board would need to be kept separately, and require drying, cleaning, disinfection, and in some cases further treatment with stronger fungicides, anorexic environments, enzymes and oxygen scavengers.

Most of the some fifty (50) stain-infested acrylic paintings on hardboard, which entered during the past few years the conservation laboratory at the Museo de Arte Contemporáneo [Museum of Contemporary Art] in Puerto Rico, suffered from a combination of SID and microbial infestation. Both, symbiotic as well as isolated fungal growth, bacterial infestation and SID could be examined, while salt efflorescence through a maritime environment was only a minor factor. In general, SID and microbial growth could be differentiated from each other by means of microscopic examination and chemical staining. To determine the exact type of SID and extractive bleeding, however, GC and other analytical procedures would be helpful and necessary tools to undertake more specific investigations. DNA analysis might provide exact results, and GC might help to analyze and differentiate wax from oil and resin.

The majority of stains presented, that were caused whether through microbiological infestation or Support Induced Discolouration, were extracted and disinfected successfully through poultices of Sodium Bicarbonate, and could be kept stable through the reduction of environmental humidity and monitoring of the climatic conditions.

Further research in the staining processes involved is currently under way and may be presented alongside comparative cleaning trials and the assessment of the effectiveness of sealing techniques in a following publication.

CREDITS / ACKNOWLEDGEMENTS

A very special thanks to Daniel Friedman, American Home Service Company, for his most generous support and collaboration with the analysis of samples, and to Dr. Kozek and Ing. Cangani, for sharing the research facilities of the CEMU / R.C.M.I. Programme, Medical Sciences Campus, University of Puerto Rico. Gratitude also to the artist Noemi Ruiz who provided invaluable information and collaboration, and gave permission to use photographic material of her paintings for any educational and professional matter. Alexander Katlan, Fine Art Conservation, was very kind to provide a range of patents (Mason & Asplund), and other useful documents for background information.

The work on microscopic equipment at the University of Puerto Rico (Medical Sciences Campus) was made possible through the programme ‘Research Centres in Minority Institutions’, G12RR-03051, from the National Centre for Research Resources, National Institute of Health.
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FURTHER READING


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ENDNOTES

1. Current Issues in Restoration – the splitting of Easel Paintings and Murals; Scientific Conference; Academy of Fine Arts in Cracow, faculty of Art Conservation and Restoration; Cracow, June 2006: “Splitting methods abroad: The beginnings of splitting treatment on wooden panels abroad date back to the 1920s, when Russian restorers made their first attempts of split paint layers on icons. In the first experiments, they used acetic acid to soften tempera paint (neutralized with sodium bicarbonate) and cigarette paper glued with sturgeon adhesive as facing. The method devised was one of the great achievements of these times.”

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
ART, VISION, & AESTHETICS:
A CONSERVATOR'S QUEST TO UNDERSTAND THE NATURE OF VISION

Charlotte Seifen Ameringer, Associate Paintings Conservator

This talk was fundamentally visual in nature; as such it is not possible to properly convey the full content of the talk in this publication/format. A brief synopsis of the talk as well as links to several websites and a bibliography appear below.

"Ears hear and eyes see. What then does mind do?" (Zen meditation)

As conservators we spend a great deal of time looking at art. We interpret material evidence to arrive at aesthetic decisions. During this process many subtle and subjective distinctions are made. We refer to the way a painting "reads", discuss shifting color relationships, and describe a loss of depth. We debate “selective” versus “total cleaning" and the merits of "original intent”. We employ various techniques to reintegrate areas of loss: such as tratteggio and so-called invisible inpainting. Numerous symposia, seminars, and conferences have been dedicated to discussions of connoisseurship and the aesthetic evaluation of art. But what is it that we are actually seeing?

Vision itself is inherently subjective. Previous theories of vision said that the eye was like a camera; that it took an image and simply transmitted it to the brain. We now know that vision is infinitely more complex. Over 50% of the brain is thought to be involved in vision. Vision is a highly active, cognitive process. A large amount of interpretation and information processing takes place. The eyes receive information but it is only when that information reaches the brain and is interpreted that vision takes place. Vision is not merely passive perception: what we see is what our visual system constructs.

WEBSITES

http://www.visionscience.com/
http://www.lottolab.org/ (website of optical illusions)
http://www.purveslab.net/main/ (the “see for yourself” laboratory)
http://hubel.med.harvard.edu/bcontext.htm (Eye, Brain, and Vision)
http://www.gatsby.ucl.ac.uk/~qhuys/jcpapers/050215-ian_vision.pdf (early paper discussing the dorsal and ventral pathways)
http://www.hhmi.org/senses/b110.html (great series of articles on color perception by Jeremy Nathans, M.D. PhD.)

BIBLIOGRAPHY


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Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.

37 AIC PSG Postprints 20 (2008)
MYSTERY OF THE *MADONNA AND CHILD WITH ANGELS*


ABSTRACT – The charm and grace in the Madonna’s pose in *Madonna and Child with Angels* is characteristic of the thirteenth-century Sienese style of painting. Rigorous conservation treatment, a year-long art historical investigation, and scientific analysis by the Canadian Conservation Institute led to attribution of the *Madonna* to a Sienese copyist school active in the later-nineteenth century and continuing through the 1980s. The school’s founder, Icilio Federico Joni, taught aging methods for accurate copyist techniques to his students Bruno Marzi and Vasco Valachi, who are believed to be the artists of this convincing work.

1. INTRODUCTION

   *The Madonna’s gentle tilt and downward gaze,*  
   *Seems to reprimand her mischievous, frowning son.*  
   *She covets a secret,*  
   *All is not as it appears.*

![Figure 1. Madonna and Child with Angels, before treatment.](image1)

![Figure 2. Before treatment: raking light, showing central ridge and crack.](image2)

![Figure 3. Before treatment: verso overall view.](image3)

Three versions of this paper were presented previously in Toronto. Art historical researcher Mirella Cirfi Walton and icon conservator Roemen Kirinkov along with the author detailed all aspects of research and treatment. Analysis was carried out at the Canadian Conservation Institute by scientists Marie-Claude Corbeil and Elizabeth Moffatt. This paper will consist of a synopsis of those lectures plus new directions of study.

HISTORY

_Madonna and Child with Angels_ was owned by the descendants of a Cardinal, an avid art collector who lived in the Vatican before the mid-1950s. A victim of war, he was estranged from his family at a young age, and was reunited with his nephews only shortly before his death. When he passed away his family wanted to preserve his legacy by caring for his art collection.

DESCRIPTION

The painting _Madonna and Child with Angels_ (Figure 1) came to JANA Fine Art CPR Ltd. in 2002 laden with problems and shrouded in mystery. The panel painting, measuring approximately 2½ by 1½ feet was painted on wood in egg tempera with gold leaf background and halos. The painting is typical of those painted in Tuscany in the thirteenth and fourteenth centuries. The egg tempera was executed in multiple fine layers, directly on the gesso.¹ Severe water damage had occurred, evidenced by the efflorescence migration, and the tidemarks on the verso. When JANA CPR received the painting, it had been partially restored in Europe; it had undergone severe physical damage both before and after restoration.

The old poplar-wood panel was inferior in cut and quality, and was joined using only glue, applied vertically in the center. This contributed to the deep, central crack, which is clearly seen in raking light (Figure 2). The cradle was glued in the vertical direction to the panel verso over the central join and the horizontal members were free but wedged, restricting their movement (Figure 3). A closer look at the paint layer revealed the cracking pattern in the egg tempera that displayed the classic geometric, fractured lines, shrinkage and delamination, heavy cracking and extensive paint losses (Figure 4). The cupping and tenting, typical of severe water damage were visible in a variation of sizes, and conform to the tree ring patterns and knots. The gold leaf in the background and halos was laid down over red bole with a simple pattern of punch marks that formed a central encircled depression². A great deal of the background was dissolved, leaving areas of raised off-color retouching. The amber-toned varnish layer was resistant to strong polar solvents; window tests revealed a brilliant hard paint layer beneath the varnish (Figure 5).

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Figure 4. Before treatment: raking light detail.
Figure 5. During treatment: detail of cleaning test.
2. TREATMENT

Conservators Janice Passafiume (JANA Fine Art CPR Ltd.) and Roumen Kirinkov (Zograph Studios) collaborated to undertake the treatment, each bringing to the task his or her own specialties and preferences. Treatment was divided into three stages, stabilization, structural and aesthetic.

Stabilization Treatment
This stage started with pest removal using Ageless RP oxygen scavenger system¹ (Figures 6 and 7). Tenting paint was consolidated through a tissue facing using 6% rabbit skin glue in distilled water.¹

Structural treatment
The structural treatment stage addressed the problem with the contortion of the panel. Removal of the affixed cradle and the restricted horizontal members was carried out. The panel was relaxed overall through controlled humidification in a chamber¹, with all the necessary precautions associated with the delicate task. The panel was flattened to the degree safely possible, both during humidification and during the stabilization periods, using a variety of strategically placed clamps. The central crack was repaired by cutting a V-shaped wedge to remove the desiccated adhesive in order to allow the V-shaped balsa wood filler to retain flexibility (Figures 8 and 9). Before the balsa wood was inserted, the worm channels were filled. After the facing, grime, varnish and old fills were removed, losses were refilled using synthetic gesso and localized interlayer fabric to reinforce knots and cracks. Retouching was easily located using ultraviolet light and was removed using water to dissolve the gesso and solvents (Figures 10 and 11).

Figure 6. During treatment: detail of cradle and insect.
Figure 7. Treatment of insect infestation using a sealed envelope with Ageless oxygen scavenger.
Figure 8. Verso during incision of the V-shaped groove.
Figure 9. Verso during removal of the cradle.
Figure 10. During treatment. Showing filled areas.
Figure 11. Ultraviolet light shows old repairs.
Aesthetic Treatment

Inpainting was carried out using various methods. Roumen Kirinkov chose direct reconstruction in the face, hands, crown and foot. Janice Passafiume used the trattegio method, as taught at the Instituto Centrale per il Restauro in Rome, for the background and flat planes. The panel was varnished and a new slotted cradle was attached (Figure 12). A shadow frame was constructed and stained in walnut; the trim was hand gilded. Custom-made brackets support the panel on a linen background (Figure 13). Full written and photographic documentation of treatment was presented to the client in slide and print format.

3. AUTHENTICITY RESEARCH

It is our policy at JANA Fine Art to offer full curatorial, scientific analysis, and physical testing along with treatment. Investigative services including X-radiography, ultraviolet analysis, infrared analysis, dendrochronology and paint sample analysis were recommended to the client at the beginning of treatment, but analysis was declined. Our preliminary research dated the painting somewhere between 1280 and 1370. Further resources were required to narrow the search, but the owners were not concerned about dating, nor did they want to know who the artist was; we were directed to proceed with treatment. Analysis was carried out later in the treatment, at our recommendation. This was prompted by the fact that during the course of treatment the conservators became curious – which escalated to becoming concerned – regarding certain observations. Clues leading to ambiguous interpretations came to light only as the upper layers were systematically penetrated.

The first clue was the odd gibberish written on the scroll, of no apparent logic and in no recognizable language, but painted entirely over the paint layers without overlap (Figure 15). It was assumed to be a hasty old restoration. The next oddity was seen in the incised lines. The child’s bent pinky finger had been changed from an earlier delineation of an extended finger. There was also the strange deep frown on the Child’s forehead. Other deviations from the incised lines are also seen in areas such as the drapery under the child’s hand.
The slight ridge created by the movement of the panel created a visually disturbing central crack. The fill that was underneath the original paint layer was a modern synthetic and was accessible only from the central join. Upon initial inspection, the conservators presumed that the panel had been separated and rejoined. During the removal of the cradle, they saw that there was raw wood under the members and, curiously, the strapping was not stained at the intersections. One could not rule out that the cradle was a new addition and that the original panel verso had been planed down. An old restoration method of transferring paint layers was known to exist. While the support was suspicious, there still remained the physical nature of the paint layer. Cracking patterns are usually accepted as the definitive sign of an aged painting.

4. ART HISTORICAL RESEARCH

The conservators asked the advice of art historian and specialist in Sienese works, Mirella Cirfi Walton. She discovered in the Palazzo Barberini in Rome a panel that was strikingly similar in both size and design, by the Master of Venezia (Figure 15). There were a few differences such as the elongated shape of the Virgin’s mantle which was missing the inscription from the Roman painting. According to Cirfi Walton, Sienese paintings rarely showed these design features- a seated child holding a scroll, the Madonna, and crowning angels-together. The Madonna and Child with Angels was a pastiche that borrowed elements from different periods.

Mirella Cirfi Walton carried out extensive research. Through the work of her colleague Professor Gianni Mazzoni, we were introduced to the Sienese copyist school of Ilcilio Federico Joni, a restorer who trained apprentices in restoration. His best students created skillful copies in the style of the old Sienese masters, using his published recipes. The Sienese are fiercely proud of their copyist artists and this practice continues to thrive. True copies are the basic training in all highly academic art schools, but this school took it to higher levels, imitating also the antique appearance. The artists of this panel are thought to be two of Joni’s students during the 1940s. Bruno Marzi (1908-1981) may have painted the Virgin and Child, while Vasco Vallachi may have added the angels. Other examples of Marzi’s work such as, Madonna and Child & Crowning Angels, show the style of Nico di Segna.

Caciorgna and Pierini documented Bruno Marzi’s work in an exhibition in 1994. As a restorer Bruno Marzi had privileged access to original paintings in the museums. Evidence of direct copying comes from Marzi himself; upon his death he donated his collection of preparatory drawings to the Biblioteca Comunale di Siena (Figure 16). This collection comprises more than two hundred drawings, some of which are copies from well-known artists.

5. ANALYSIS

The inherent vice of the conservator is to be obsessed with detail in the pursuit of truth. Cross-section samples were sent to the Canadian Conservation Institute for scientific confirmation. Marie-Claude Corbeil and Elizabeth Moffatt of the Analytical Research Laboratory carried out pigment analysis including Fourier transform infrared spectroscopy. The client, requested minimal analysis for the lowest cost possible.

With many paintings it is feasible to select certain pigments that could provide possible target dates. A narrow timeline date is less promising with the common lead white and carbon blacks. Although yellows and reds can provide results if cadmium were present, the colors in the Madonna panel appeared to be made from earth pigments. Light blue can sometimes be a pigment useful for dating information. The CCI scientists confirmed that the light blue contained, among other components, Prussian blue and possibly viridian. The black in the dark upper layers of the Virgin’s mantle contained Prussian blue, a pigment introduced in 1704. Thus it was immediately evident that the painting was not from the fourteenth century. The gesso ground contained calcium carbonate, instead of the traditional gypsum, made from calcium sulfate. The ground layer also contained calcite and barium sulfate, modern additives from the nineteenth century. Titanium white was found in the pink and yellow skin tones, but titanium was not available until the first half of the twentieth century.
6. UNDERSTANDING THE METHODS AND MATERIALS OF THE JONI SCHOOL

Joni and his students began with old panels that were either stripped down completely or contained partial remnants of the original paint layer. The raw wood was exposed to a series of temperature and humidity variations, both outdoors in the cold and wet and indoors by the fire. It was essential that the existing cracks widen and also that new cracks formed naturally. After several months the gesso was applied in multiple lean, under-bound glue-and-chalk layers. Once the egg tempera paint layer had been applied, new cracks appeared quickly. Depending on the number of cycles and the patience of the copy artist, cracking, separation, and tenting would occur. Occasionally oil could be added to the glazes following the traditions of the Old Masters. The cracks were also abraded with knives and pumice and were filled and retouched to resemble old, slightly off-color restorations. Incomplete varnish removal was imitated as well. On the verso, weak gesso layers migrated and left tidemarks as seen in Joni’s panel (Figure 19).

The accelerated aging process gently abraded the paint layer peaks and created natural crack patterns following the tree rings. There is also a strong possibility that the Madonna painting was further damaged by drastic adverse conditions.

Despite having read the recipes, it was still difficult to comprehend how the copyists were able to achieve a convincing aged paint layer. Therefore an experiment was devised to reproduce the artificial aging techniques that may have been used on the Madonna and Child.

Hillary Ellis performed initial tests on aged wood samples with gesso and tempera, prepared according to recipes that were studied by I.F. Joni and Bruno Marzi. Different binders (rabbit skin glue, gelatin, and hide glue) and an inferior-grade calcium carbonate chalk were tested before deciding to use weak rabbit skin glue gesso for the ground layer. The egg tempera paint was applied in varying thicknesses in the same colors as those that were in the painting.

The wood samples, prepared from a fifty-year-old plank, were aged artificially using the primitive method of wetting the painting samples and placing them near a fireplace in order to reproduce the aged appearance of the copied paintings (Figures 17 and 18). The results were visible immediately: cracking and paint loss, solubility of the chalk gesso layer, and swelling of the wood. The samples displayed the characteristic tide line from the leaching ground layer similar to Joni’s examples (Figure 19). Following this initial success of induced aging according to Joni’s methods, the samples will continue to be studied.

7. CONCLUSIONS

The study of the Madonna and Child with Angels involved historic research, pigment analysis, and careful visual examination of the painting. The small details noticed at the beginning of treatment, including changes in incised lines, the nonsensical pastiche of commonly used religious imagery, and the illegible scroll, were the primary clues that led to further investigation. Scientific analysis and art historical research confirmed the hypothesis that the painting was not by an Old Master.
There is a very delicate balance between branding a painting a forgery and calling it a copy. In a court of law this investigation would not lead to the conclusion that this painting is a deliberate forgery, and thus no conviction would result. Unless it was sold as an original, and therefore a deliberate deception, we must reserve our judgment. The practice of copying art is still being carried out today as it has been throughout the history of academic training\(^1\).

No one knows if this painting was sold to the Cardinal as a copy or an original, or even sold at all. This just adds to the mystery.

8. ACKNOWLEDGEMENTS

Marie Claude Corbeil and Elizabeth Moffatt from CCI analyzed the paint samples from the painting. Conservator Roumen Kirinkov assisted with the treatment of the painting and provided invaluable insight into panel paintings and photodocumentation. Jerry Shiner assisted with recommendations on the Ageless oxygen scavenger system for the treatment of pests in this painting. Marianne Webb from the Royal Ontario Museum advised on poor-quality whiting. Mercedes Cirfi Walton carried out art historical research in both North America and Italy. Dr. Gianni Mazzoni, specialist in Sienese paintings, also provided his expertise. Hillary Ellis reproduced the tempera painting techniques used by Icilio Federico Joni and documented the artificial aging methods used on the samples at JANA Fine Art CPR Ltd. Hillary Ellis also helped prepare the Powerpoint presentation for the 2007 American Institute of Conservation 35th Annual Meeting, as well as the paper for the postprints of the AIC Paintings Specialty Group. Special thanks to the owner of the painting and to Gillian Watts, my long-time friend, former conservation supervisor, and now full-time editor.

9. REFERENCES


Corbeil, M.-C. and E. Moffatt to Janice Passafieme. 2004. Correspondence.


NOTES

1Egg tempera panel paintings consisted but not exclusively of a rabbit skin glue layer followed by several layers of gypsum and rabbit skin glue gesso with interlayers of one sheet of old cloth usually made from old remnants. This provided stability during panel fluctuations, and protection from the knots and cracks.

2Our preliminary research traced the circle and dot pattern to a co-op of artists including Giovanni di Milano who operated before the plague in 1665, and seemed to disappear after. Artists were known to use the punch mark as their signature, as pieces were not signed.

3Ageless© absorbs oxygen, moisture, and other gases and is a component of Integrated Pest Management programs.

4Exact treatment: Water and ethanol were brushed through a wet strength tissue and allowed to penetrate. Rabbit skin glue was brushed over the tissue, and as it began to dry a flat warm, tacking iron was gently pressed over several of blue industrial paper towels laid loosely over the tissue. As the moisture absorbed into the towel, and through the tissue, excess grime deposited as tide lines, into the blue squares. The squares were lifted continuously to avoid adhesion to the paint layer. The process was repeated many times, thus ensuring a slow, gradual relaxation without further cracking.

5The chamber was a simple construction designed to convert any table. It was made from lengths of wood or other narrow vertical material and attached by clamps, tape or wires upright to the table top. A loose sheet of polyester plastic is placed over so that the edge of the plastic falls below the table. The plastic can be changed or taped to the table. Inside is an ultrasonic mister, a small fan, used blotting paper and a small inexpensive relative humidity and temperature reader. The ultrasonic mister is turned on for a short period, raising the pH very slowly and allowing it to equilibrate. The mister is turned off at night but the fan is kept on. The blotting paper retains a small amount of moisture. A tub of water can also be used next to the fan.


8Corbeil, M.-C. and E. Moffatt. Analysis of paint samples from Madonna and Child with Angels. Unpublished report. Canadian Conservation Institute. In addition to FTIR, five cross-sections were examined by light and fluorescence microscopy and analyzed by scanning electron microscopy, x-ray spectrometry SEM/XES, x-ray diffraction (XRD) and polarized light microscopy (PLM).


11Many of the famous European art schools, such as the Academie Julien, where Picasso and many of the Group of Seven Artists studied and copied Old Masters’ paintings, are well-known among conservators. Today the Academy of Realist Art in Toronto and the Michael John Angel Academy in Florence hold true to this tradition.

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
A NEWLY DISCOVERED EARLY PAINTING BY FRANÇOIS GÉRARD

Dr. Anne Schroder, Curator of Academic Programs, Nasher Museum of Art at Duke University
Ruth Barach Cox, Independent Paintings Conservator

ABSTRACT – This paper investigates the collaboration between museum curator and paintings conservator in connoisseurship, art historical analysis and the scientific and technical research of late 18th-century French painting. In 2003 the Nasher Museum of Art acquired a French neoclassical painting whose attribution and subject had not been identified. The painting was said to have been in the possession of a French family since the 1830s. It had never been relined or even removed from its original stretcher. Curator Schroder and conservator Cox will discuss how they collaborated to identify the artist as the young François Gérard, who painted this early work while still in Jacques-Louis David’s studio. It may be his earliest surviving painting.

In early 2002 the Nasher Museum of Art at Duke University, formerly known as the Duke University Museum of Art, purchased the painting that you see here in its pre-conserved state (illus. 1). It was bought in Paris from Etienne Breton, of Blondeau and Associates. I first saw it on the very day that it came into Breton’s office, and it was identified only as “Classical Subject” by “School of David.” The painting had reportedly been in the possession since the 1830s of a single family from the southwest of France, whose name has remained anonymous. It being a neoclassical history painting, which would have tremendous teaching value at a university such as Duke, I was immediately struck by the composition and the connection to David’s studio. The painting measures 31 x 38¾ inches unframed, and is therefore somewhat smaller than most academic competition paintings for the prix de Rome, which can be 45 x 57 inches. The subject did not match any of the prix de Rome themes of the 1780s or 1790s.

I felt it was in reasonably good condition for its age, with some local abrasions, craquelure, and an old damage in the upper right quadrant, but its primary issue was a deeply yellowed varnish and clumsy overpainting. What also interested me, as a curator, was that in looking at the back of the canvas, it appeared that it had never been relined, a sign that the painting could be studied in its original canvas support.

The painting is inscribed “FG 1787.” However, a distinguished David scholar, whom I took with me to Breton’s to look at it the second day I went to Breton’s office, told me, “Surely it’s not François Gérard—that is probably a later inscription by someone wanting to sell it as a Gérard.” He said, however, that when I eventually determined the artist, it would seem that it should have been so obvious. In defense of my colleague who went with me to Breton’s shop, and to whom I am extremely grateful, the issue is that Gérard’s early style is so poorly understood. I liked this painting, convinced my director to buy it, feeling that it was a worthwhile investment for a university art museum. I was delighted to take it on as a research project and began to research the initials “FG” in association with David’s studio in the 1780s. Other than François Granet, who was born in 1775 and studied briefly with David in 1796, there were no other identifiable possibilities than Gérard, but I needed more evidence.

Dr. Anne Schroder, Curator of Academic Programs, Nasher Museum of Art at Duke University
Ruth Barach Cox, Independent Paintings Conservator

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What we know about Gérard’s early career comes primarily from his two 19th-century biographers who were both commissioned by Gérard’s family after the painter’s death in 1837 to write monographs about his career. Charles Lenormant’s book, *François Gérard, peintre d’histoire, essai de biographie et de critique*, was published in 1846 and reissued in 1847, and one by Henri Gérard, the artist’s own nephew, was issued in 1852-57, with engraved plates of Gérard’s works which were known at that time. The younger Gérard also published his uncle’s letters five years later, but these do not pertain to the artist’s youth. Neither writer knew this painting, which, as noted, had reportedly been in a private collection since the 1830s.

François Gérard was born in Rome in 1770, the son of an Italian mother and a French father in the service of the Baron de Breteuil, a minister of the King. Gérard came to Paris in 1782, at age twelve, where he was admitted to the school of the Pension du Roi established by the French arts minister Marigny. Around 1784 he entered the studio of the sculptor Pajou, then Brenet’s studio, before transferring to David’s studio in 1786, at age 16, where he became a favorite.

At the time I acquired this work, only two other early Gérard paintings were known to be extant. A sketch of 1784 was cited by the nephew Gérard as having received great acclaim but has not been documented since; its whereabouts are unknown. A painting of *Jesus and the Children* (illus. 2) now in the church of St. Jacques du Haut Pas in Paris, said to be from 1787, the same year as the Nasher painting, is in poor condition. It is also documented by an illustrative engraving that Gérard’s nephew Henri Gérard included in his catalogue. François Gérard’s first prix de Rome submission of *Joseph Revealing Himself to His Brethren*, now in Angers in France, was painted in 1789 (illus. 3). Neither of these is visibly signed.

However, in spring 2006, after I had purchased the Nasher painting, another Gérard painting resurfaced from a Gérard descendant and was sold at Christie’s. This painting of 1790/93 *Daniel and Susanna* (illus. 4), has the initials and date inscription very similar to the Nasher painting (illus. 5). Gérard began that work as a Prix de Rome submission in 1790, but at the sudden death of his father in Italy, he left Paris to return to his family and did not complete it until 1793, when he exhibited it at the Salon. Before it resurfaced, it was known only through one of the Henri Gérard catalogue engravings. Generally, however, Gérard’s style is better known through his later, more serene manner with fewer figures, such as the 1795 *Belisarius*, or the 1798 *Psyche’s First Kiss*, as well as for his portraiture.
Regarding the subject of the Nasher painting, I consulted with my colleagues in the Classics Department at Duke University who suggested that it might be an 18th-c. variant on the theme of Iphigenia's sacrifice. Other scholars suggested additional possibilities, such as the Rape of Cassandra by the lesser Ajax; or the Celtic Queen Boadicea poisoning herself and her two daughters in Britain rather than be taken prisoner by the Romans, or even, curiously, Nebuchadnezzar killing the sons of Sedecis, which was the subject of the 1787 concours for the prix de Rome, but these children are girls, not boys.

The story of Iphigenia in Aulis comes from Euripides, but there are later variations on its ending. Agamemnon, king of the Mycenaens, had offended the goddess Artemis by killing one of her sacred deer. In retribution, she stilled the winds over the Athenian harbor and prevented the Greeks from sailing for Troy. To change the situation, Agamemnon was ordered by Artemis to sacrifice his daughter Iphigenia. The girl was lured with her mother Clytemnestra to Aulis on a false pretext of a proposed wedding to an unwitting Achilles. In some versions she is sacrificed by the priest Calchas, and Clytemnestra's fury with Agamemnon sparked subsequent tragedy. Other later writers had her spared by Artemis, who appeared from the heavens and sent a stag to be sacrificed in her stead; Iphigenia was then whisked off to Tauris, for further adventures. Visual examples depicting the Goddess Artemis and the stag survive from Pompeii, from ancient vase painting, from the Renaissance and even in the eighteenth century by artists such as Jouvenet and Tiepolo.

In the Nasher painting I propose that we see Iphigenia clinging to her mother Clytemnestra, who bares her breast toward the attackers; another sister hides in her mother's lap. A group of armed men lunges towards Iphigenia. Achilles is involved in the fight. On the landing, we see Agamemnon entering, holding a document, probably the one decreeing Iphigenia's death. In the right foreground is a fallen statue of a heavily-draped goddess. Back on the far left is another group of men; the one in the foreground holds his hand in the smoke above the flames on an altar. On the ground is a spilled cup of wine, tied with a white ribbon, perhaps another reference to the wedding. In background niches are three deities—two can be identified as Demeter and Poseidon, the third on the left is ambiguous, an older man heavily draped, not readily identifiable by any recognizable attributes. Although I cannot go into all the detail here, I am examining an eighteenth century opera libretto which I believe to be the basis for Gérard's interpretation, with this scene as the dramatic climax of the opera. I am preparing another article for publication that discusses Gérard's early career and the sources for this painting.

This painting sheds new light on the development of Gérard as an artist and issues about David’s atelier. Although it is not a prix de Rome submission, it demonstrates the artist's ability at age 17 to complete a history painting, which he also did with the painting of Christ with the Children now in St. Jacques that same year. The Nasher work has its compositional, youthful awkwardnesses, as in the compressed group of male attackers in the center of the composition, seemingly “joined at the hip,” representing a forward rushing movement, also seen in the Joseph painting in Angers (illus. 6), a compression of figures that directly references Jacques-Louis David’s three brothers in the 1785 Oath of the Horatii. The centrally placed, red-cloaked figure, of Achilles, with striding legs forming a triangle, recalls the position of the Horatio father in David’s painting. But the painting also has its beautiful passages—such as the expressive anguish of Iphigenia and Clytemnestra (illus. 7), reminiscent of David’s Andromache and prefiguring the mother and two daughters in the Brutus. Although Gérard is absorbing elements of David’s corporal expressivity, here and in the Angers painting he retains the emotional drama of the neo-baroque trend still very much alive in the 1780s.
His style hereafter becomes more serene and fully neoclassi-
cal, but the Nasher painting is important to see how at this
point of his youth, he was still an artist in transition (illus. 8).

It is at this point that I turn the podium over to Ruth Cox,
who will talk about the conservation of the painting and her
contribution to the attribution to Gérard, with a discussion of
Gérard's painting technique.

Dr. Schroeder brought the painting to my studio for the
following visual reasons. The varnish was highly discolored
and inadequately saturated the paint film (illus. 9). The
cracked paint was cupped and in areas insecure (illus. 10).
Old retouches were discolored and there was a question of
whether the initials and date had been reinforced during a
previous restoration (illus. 11). The authorship of the picture
was also in question. Determination of the date and the
potential authorship of the work required examination of the
materials and techniques used in the artworks creation as
well as stylistic comparisons to known works by Gérard.

In order to properly conserve the painting historic and
modern literary sources were consulted regarding 18th
century painting technique. During the late 17th and 18th
century artists had debated the most advantageous color of
ground and the use, or not, of varnish and/or oil layers
between paint layers. At the heart of the debate was the
practical problem of how to keep the final painting from
developing sunken dark areas and uneven gloss. How could
an artist prevent the over absorption of the medium by the
ground and the denaturing of the upper paint layers? How
could the drying time of the layers be reduced without
sacrificing the painting’s long-term appearance? A brief
review of artists’ and theoreticians’ techniques will place
this painting in the context of its transitional position
between late Rococo and Neoclassical painting technique.

To begin, it has been assumed from comments made by
Oudry in his 1752 lectures for the Academy that artist’s
stretchers and canvas were made, prepared and stretched
under the direction and specifications of the master of the
atelier (illus. 12). In this case, the auxiliary support is a
four-membered blind, mortise and tenon softwood stretcher
with a horizontal and vertical cross member. (illus. 13
and 14). The canvas is a slightly open, plain weave, bast
fiber estimated to be hemp fabric. The canvas is punctuated
with sluffs and mild irregularities.

The priming layer, or ground, appeared in normal light to be
a medium light gray color that had pushed through the
canvas reverse in small droplets (illus. 15). Microscopic
analysis showed a double ground with a thin fluorescent
layer between the oil bound primarily lead carbonate layers.
(illus. 16). To grossly simplify, canvas grounds evolved
through the eighteenth century from single red-brown layers
to double or triple grounds of red-brown followed by gray to white. By the end of the century light colored grounds predominated.

The preparation layer was applied to the canvas on a separate strainer as exemplified by an outer number of tack holes along three of the four canvas edges and the lack of ground residues on the current stretcher. Mild cusping in the ground is seen in conjunction with the outer series of holes. Once the ground had dried the canvas was stretched onto its present stretcher. The paint film has aged in its present conformation as exemplified by a second set of canvas cusps and paint cracks that are related to the placement of the tacks. When the structural work was begun on the painting the hand-made nails were firmly corroded in the wooden stretcher – a further testament to the length of time the canvas, nails and wood had been in this assemblage. It was clear this painting had never left its current stretcher.

The painting’s execution appeared to follow aspects of Jean-Baptiste Oudry’s (1685-1755) recommended painting technique; however there were also departures. To quote Mr. Swicklick, the author of French Painting and their use of Varnish 1750 -1900, “Oudry advocated for the use of intermediate layers of varnish...that would not interfere with the union of the top and bottom layers of paint, and would provide the artist with a solid and durable technique.” If the artist applied these varnish layers he stated that colors would not sink and you would not have to “recall them with thick oil or walnut oil or with little colored glazes, applied in the areas that you wish to work on”.

Other theoreticians such as de Piles recommended thin oil layers separate paint layers. Abbé Louis Gouge-mot, however, commented that most 18th century manuals recommended that one layer be painted directly on top of the previous one without a varnish interleaf. This use of varnish between layers and as a paint additive became more pronounced as the Neoclassical aesthetic developed in the late 18th and early 19th century. The varnish, and or oil isolation layers, and inclusion of varnish in the paint permitted the artist to construct the coveted porcelain-like finishes of Neoclassical painting. This use of varnish is clearly discussed in Mérimée’s “Art of Painting in Oil” published in 1830. It should be noted that interleaf varnish layers are highly vulnerable to restorer’s cleaning solutions.

This is a rich and complex area of study that cannot be discussed further within the scope of this paper. For further discussion and analytical work related to the use of varnish and oil interleaf layers please refer to the endnotes.

Now let’s turn to what evidence of varnish and/or oil layers was found on this picture. I was permitted to take
three cross-sections in order to compare the written techniques of Oudry, De Piles and Mérimée to the reality of our picture (illus. 17). In the illustration you see a sampled area and the corresponding sections in normal and UV light illumination.

Please note the thin varnish layer separating the two ground layers and resinous interleaf layers linking Gérard’s technique to that described by Oudry.

To review, areas of the picture were damaged during one or more previous cleanings. After those cleanings some of the damages were retouched and a thick layer of natural resin varnish applied to the surface. Now the restorer’s varnish and old retouches had aged and needed to be reversed. After the bulk of the resin was removed the picture was examined under ultraviolet light illumination. A cohesive oil-rich layer fluoresced dark green uniformly over the surface. The picture had obviously been oiled-out after the majority of the design had been applied. (This is in accordance with De Piles recommended technique discussed above.) Directly above this layer was found the first layer of artist glazes that were reticulated due to the slick oiled out surface below (illus. 18). Covering bitten artist glazes was restorer’s overpaint. It is believed that the painting had been cleaned down to this more resilient oil-rich layer during a past treatment. During that treatment some of the artist’s changes, unifying scumbles, glazes and final touches were removed (illus. 19). This doubtlessly occurred because they were vulnerable to the cleaning solutions. The question of the intended level of finish and the “purpose” or reason for Gérard’s execution of this work is the logical next question to be asked, but regrettably cannot be addressed within the scope of this paper.

Areas of most severe damage (illus. 20) were thin transitions, shadows and flesh tones in general. The staring white eyes of Achilles were a result of the abrasion of the shadowed brow and the removal of his pupil.

Let’s now turn to the authenticity of the initials and date. Though the signature had been reinforced, the original paint was secure and remains legible. As much as possible of the discolored varnish and overpaint was removed from the inscription under the microscope (illus. 21). The remaining original paint had pooled slightly at the brush stroke edges and is thinner in the middle of the strokes. In canvas depressions the paint is thicker, having suffered less abrasion during past cleanings. The letters and numbers are completely contiguous with the paint film. Cracks in the underlying paint clearly run through the inscription.
When the cleaning phase of treatment was completed the structural work began. It is exceedingly rare to have an unlined 18th C. painting: however, the canvas and paint now visually and structurally required this type of stabilization. The paint film was cupped and insecure warranting a careful consolidation of the fragile paint film from the front with poly (vinyl acetate) AYAA and a minimal nap-bond lining. This intervention was not undertaken lightly but was felt necessary due to the potential travel of the artwork. When the painting was carefully removed from its stretcher an exciting new piece of evidence came to light. On the inside stretcher face was written the name M. Gérard (illus. 22), which gave veracity to the identification of the initials on the obverse as François Gérard.

Several nagging questions about his picture were “What exactly were the studio practices?” Who made this stretcher? Who prepared the canvas? Why was Gérard’s name on the reverse? If Gérard made the stretcher why was the honorific abbreviation used on the stretcher M. Gérard instead of F. Gérard. One can make a hypothesis about studio practices if the clues are systematically studied.

First I don’t think Gérard make the stretcher. It was probably commissioned by him and then made “out of house” as suggested by the formal use of Monsieur in the inscription. The arrow’s direction suggests it was originally intended for a portrait not a horizontal scene.

Second, because the inscription was covered by the stretched canvas, it would not be identifiable within the studio if it arrived there stretched. Oudry in his lectures stressed the importance of good technique. Could it be that in David’s studio young artists were responsible for preparing and stretching their own canvases, or did a studio assistant do this? If the latter was the case the “ownership” of the stretcher would not really matter. It would be the fully prepared support that would require identification as belonging to one artist or another. The logical conclusion of this thought process is that the stretcher was probably not made in the studio, that it was delivered to the workshop where young artists prepared the canvas on separate supports and then stretched their canvas onto the stretchers. In this illustration of David’s studio (illus. 23) if we look along the ledge one sees stacks of artist’s canvases with materials boxes. Is it possible that not unlike studios today each artist had a specific area to stack their canvas and put their materials?

Now let us return to the treatment. After the removal of the painting from the stretcher the planar deformations were reduced using a minimum of moisture and pressure. The old patch was removed from the tear and...
the torn fibers mended. The painting was lined on the vacuum hot table using sheet Beva 371 to the monofilament polyester Pecap. Because of the warped condition of the original stretcher, Simon Liu made a new stretcher and the original boxed for studied purposes at the Nasher art Museum. Losses were filled with gesso and the fills, and abrasion retouched (illus. 24).

Following the treatment’s completion Dr. Schroder and I went to Paris to compare our painting to early works by Gérard and other painters in David’s workshop. It is important to consider the original “purpose” of the painting and their conditions when making comparisons between pictures. Our painting is considerably less finished, and more damaged than the other work to which it will be compared. Despite these differences, this painting bears striking resemblance to known works by Gérard in form and technique. Due to the time restrictions only several of the numerous comparisons will be illustrated between the Angers Museum painting entitled Joseph and His Brothers and the Nasher picture.

To begin please refer to illustration 25 for an overview of Joseph and His Brothers and Clymenestra and Iphigenia. Note the disparity in the paintings’ sizes and the scale difference between the figures within their respective spaces.

I’d first like to compare the rendering of the head of the soldier at the far right of our painting and that of the kneeling brother in the Angers picture (illus. 26). Aside from the obvious similarity in model choice the rendering of the likenesses is similar. For example the furrowed brow and extension of the nose line between the brow muscles is indicative of a personal style as is the use of highlights, modeling and shadows.

Another example is of a highly arched foot (illus. 27). The outline of both feet is exceedingly similar. Look particularly at the way the sandal wraps around the large toe, the definition of the toe, and the slightly increased thickness of the brushstroke on the inside of the foot’s arch.

If one examines the Achilles’ leg and that of the kneeling brother further form and color use similarities can be found (illus. 28). Compare the line of the knee and calf muscle, the highlights and slightly abraded shadows on both calves.

The last detail I’d like to show today is in the painting of Achilles head and that of the youngest
brother in the Angers painting (illus. 29). Please note here the shape of the open mouths, the triangular wedge of teeth, the underpaint coloration as seen in Achilles face and how it relates to the finished surface of the youngest brother face and the slightly eroded shadows of both necks.

Regrettably discussion of other works by Gérard and fellow student’s work will have to wait for a future paper. Let it suffice to say that we believe that after the comparisons were made all the evidence supports the attribution of the painting to François Gérard. The collaboration between curator and conservator has hopefully yielded a result greater than the sum of their independent research: the identification of the authorship of a previously unattributed picture.

ENDNOTES

1. François Gérard, Clytemnestra Hearing the News of Iphigenia’s Impending Sacrifice, Collection of the Nasher Museum of Art at Duke University, 2002.31.1


4. Primary historic and modern sources are as follow:

   **Primary Sources:**


   Jean François Léonore Mérimée, The Art of Painting in Oil and in Fresco (1830), 3d.ed., trans. William Benjamin Sarsfield Taylor (London, 1839)


5. For a summary of ground color and application see Massing 1998, pp. 150-151. In O’Donoghue’s and Rasmussen’s article (1996, p. 42), they found thin auto-fluorescent layers between colored grounds and paint layers as seen in our samples. The use or not of varnish and oil isolating layers is discussed at length by Oudry 1861-62, pp. 110-115, de Piles 1776, p. 115, and Mérimée as reviewed by Swicklik 1993, pp. 159-160.

6. Oudry 1861-1862.


12. Mérimée 1839.

Illustrations 1 - 8 from Dr. Schroder’s contribution

Our heartfelt acknowledgments and thanks to the staff of the Nasher Museum of Art at Duke University, the Angers Museé des Beaux Arts, James Martin of Orion Analytical, LLC, and Amber Kerr-Allison Winterthur/University of Delaware graduate fellow.

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.

This paper has not undergone a formal process of peer review.
A NEWLY DISCOVERED PORTRAIT BY GIROLAMO FORABOSCO,
FOUND UNDERNEATH A FAKED “PORTRAIT OF VIOLANTE”,
SUPPOSEDLY BY PARIS BORDONE.

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SUMMARY

My research dealt mainly with a painting which demonstrates a case of superimposed forgery - a 17th-century Venetian portrait of a woman, over which another painting, ostensibly from the 16th century, was later forged. Several years ago I exposed the former 17th-century’s painting, by removing the later forgery. Both paintings were done in oil paints, on a 17th century’s canvas, measuring 117 x 85 cm.

In this study I have claimed that:
1. The original painting was painted by Girolamo Forabosco (1605-1679).
2. The original painting was painted in the 1630s, in Venice.
3. The model in the painting is Anzola Santuzzi-Contarini.
4. The painting on the surface, ostensibly painted by Paris Bordone (1500-1571), is a forgery, and was painted in Venice in the mid-19th century.
5. The forged painting was done by the Venetian artist and restorer Lattanzio Quarena (1768-1853).

Girolamo Forabosco
Born in Venice in 1605, Forabosco was probably a pupil of Alessandro Varotari, called Il Padovanino. Like other pupils of Padovanino, Forabosco found his pictorial models in the Venetian Renaissance, especially in the work of Titian. Forabosco’s paintings have in fact been mistaken for 16th-century works by Titian or by Lorenzo Lotto, another source of inspiration. Forabosco’s small oeuvre was divided between portraiture and paintings of Old-Testament or classical histories. Today, it is known that Forabosco painted 15 portraits of ladies, six of men, one family portrait and 24 “subject paintings” (religious, mythological, and other themes). In addition, 15 more paintings are also attributed to Forabosco, and at least 20 more are known to have been lost. Dated works are almost nonexistent. As regards his portraiture, his style is very distinctive, with highly decorative effects of flowers and costume, and a somewhat stark presentation of the sitter. After 1630, Bernardo Strozzi influenced Forabosco, technically, in his predilection for thickly applied pigment (“impasto”).

After several years of activity in Padua, the artist returned to Venice in 1654. His two paintings for the church of S. Niccolò da Tolentino probably date after this time. Around 1670 he painted his masterpiece, an enormous Family Miraculously Saved from the Shipwreck (parish church, Malamocco), which juxtaposes portraiture, incidents of genre, and celestial visions. Forabosco died in Padua in 1679.

The attribution of the painting Portrait of Anzola to Forabosco is based on several disciplines:

1. Opinions by experts in Venice (1982), including Prof. Rodolfo Pallucchini, Prof. Giuseppe Maria Pilo, Prof. Guido Perocco and Prof. Michelangelo Muraro.
2. The opinion of Mr. Homan Potterton (1979), Curator of the “Venetian 17th - Century Painting” exhibition held at

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3. Comparison of the painting to other portraits painted by Forabosco — mainly those painted in the 1630s, including format, composition, method of depiction of light and shadow, method of depicting clothes, lace, jewelry and flowers in the sitter’s hair, as well as gestures characteristic of the artist.

4. A survey of the relationships between Forabosco and the Contarini Families. Forabosco’s paintings were in these families’ collections, and the probability exists that Forabosco could indeed have painted Anzola Contarini.

During the 18th-19th centuries there was a “devaluation” of Forabosco’s paintings — a gradual process that explains, to a certain extent, how a Venetian forger in the mid-19th century could have obtained, at relatively inexpensive cost, Forabosco’s Portrait of Anzola Contarini, and then “sacrificed” it only in order to lend credibility to a forgery, for which it served as a support.

Identifying the Sitter

Two findings were instrumental in identifying the sitter — the letter she was found to have holding in her hand (this was discovered in the X-rays that were taken of the painting at the Courtauld Institute in London), and the family coat of arms, which I subsequently discovered and exposed in the upper left corner of the work. After a “cleaning test”, the following text was deciphered on the letter:

_All’ Ill’ et Magnifica S’ Anzolla...

(Alla Illustissima et Magnifica Signora Anzolla..., which roughly translated as: “To the illustrious and magnificent Signora Anzolla”).

No remnants of Anzola’s family name were found on the letter. Research in the archives of Venice revealed that the family coat of arms was applicable to three Venetian families in the 17th century: the Calergi, Zeno and Contarini Families. In the Zeno and Calergi Families of that century no Anzola was to be found, while two Anzolas were found in the Contarini families — one whose age would have matched the image of the lady depicted in the picture if it was indeed painted during the first half of the 17th century, and one who would have only reached this age during the second half of the century. Since the dating tests indicated that the painting was painted during the **first** half of the 17th century, an effort was made to find out just who the earlier Anzola of the Contarini Family was.

In the will of Giovanni Contarini, son of Nicolò, which was written on 16th September, 1646, the following passage appears on the third page: “... I leave to the Signora Anzola Zantuzzi called Contarini forty ducats per year in current money as long as she is alive...” (At first Giovanni willed her only thirty ducats, but later changed his mind and revised it to forty). Giovanni Contarini was born on 19th September, 1597. He got married three times: 1. To Francesca Renier (on 22.9.1620). 2. To Marina Contarini (on 21.4.1625, by whom he had two sons: Francesco and Allessandro). 3. To Beta (Elisabetta) Boldei (on 30.4.1646). Giovanni died several months after writing his will, on 20.3.1647. Anzola wrote her own will one day after Giovanni wrote his, on 17th September, 1646, and survived him by another 25 years (she died in 1671).

The phrasing “Zantuzzi called Contarini” is somewhat suspect. The two most reasonable possibilities are either that Anzola was Giovanni’s mistress (or was married to him “without the blessing of the church”), or that she was his illegitimate daughter (an official status that was completely acceptable in Venice at the time).

Anzola’s will could not be opened at the time of this part of my research. In the course of a search for Anzola’s documents in 1982, the copy found in the city archives of Venice was a security copy (a back-up), which she gave to the Public Notary, and it apparently was not necessary to open this copy after her death. (According to the laws of Venice, because her family, or her heirs, never opened this copy of the will, it could not be opened). However, in 1999 permission was eventually granted to open Anzola’s will, enabling three subjects to be cleared up: 1. Anzola was not an illegitimate daughter of Giovanni, since her father’s name was Piero Domenico. Therefore, she must have been Giovanni’s mistress. 2. She relates to Giovanni in her will only as its executor (mio comessario). 3. The only thing she bequeathed to him was her very valuable golden bed with the carved lions, including a purple bedcover, silk sheets and feather-pillows - estimated to be worth the very high sum of 200 Ducati (which was more than the annual salary of a professor at the University of Padua, for example).
An examination of the inventory of Anzola’s estate shows that she spent her last years (after the death of Giovanni) in relative poverty, surrounded by old and damaged objects (a complete inventory was included in my thesis). However, surprisingly enough, until her dying day, Anzola kept three expensive pieces of gold jewelry (a pair of bracelets, a necklace and a pair of earrings) worth 204 ducats (compared to the rest of her property, which was valued at a total of only 254 ducats). In the inventory, it was noted that she inherited these from Giovanni Contarini.

**Dating the Painting**

Dating was based on four criteria:

1. The chronological place of the painting (from a stylistic viewpoint) among Forabosco’s portraits.
2. The handwriting of the letter Anzola holds in her hand.
3. The style of Anzola’s clothing.
4. Chemical analysis of the pigments in the paint.

1. On the basis of Forabosco’s artistic and stylistic development in portraiture, it appears that Portrait of Anzola was painted during the same period as the Portrait of a Lady which is in the Querini Stampalia Gallery in Venice, i.e., somewhat later than the two portraits of ladies which today are in the Zattera and Frezzati Galleries in Venice, and slightly earlier than the three portraits of ladies in the Uffizi Gallery in Florence. This chronological order points to the year 1635 as approximately the year the painting was painted.

2. The Contessa Francesca-Maria Tiepolo (who was the Head of the Archivio di stato in Venice at the time when I did this part of the research) identified the handwriting in the letter Anzola is holding in her hand as characteristic of the 1630s. This is supported by a comparison of 15 different examples of handwriting in this research, which represent the variations in style throughout the 17th century.

3. Anzola’s dress is in the Spanish style, and is characteristic of the fashion that prevailed in Northern Italy in 1630-50. Her lace collar is characteristic of the second quarter of the 17th century.

4. Chemical analyses: Ten micro samples were taken from different places in the painting, and were examined in two ways: A: an examination of a cross-section of the paint layers of the double painting (in order to differentiate between the pigments belonging to the original painting, and those belonging to the fake one above it), and B: an optical pigment analysis with the aid of a high-powered microscope. The chemical analyses were carried out in two laboratories: Centraal Laboratorium voor Onderzoek van Voorwerpen van Kunst en Wetenschap, Amsterdam, Holland, and the McCrone Research Institute, Chicago, Illinois, USA.

The pigments found in the original painting (the one underneath) were mainly: Lead White, Lead-tin Yellow, Indian Yellow, Smalt, Umber, Vermillion, Madder Rose, Red Ochre. All these pigments were used by artists in the 17th century. No pigment was found in this layer which was not yet in use at the time, was not known about, or was not in use any more during the 17th century. No synthetic substitute for any pigment was found which may have pointed to an anachronism or possibility of a forgery. Because no pigment that was in use during any specific decade of the 17th century exists, it is only possible to say of the tests described here, that the findings do not contradict the dating of the painting to the first half of the 17th century.

**Flowers in the Painting**

As mentioned previously, Forabosco often incorporated flowers in his portraits of ladies. Three kinds of flowers were identified in Portrait of Anzola: Orange Flower, Rose of Provence, Anemone. These flowers could symbolize general concepts such as Eternity, Marriage, Purity, Chastity, Virginity and Innocence. At the same time, two of these flowers also symbolize more specific concepts:

1. The Orange Flower has a sweet scent, but its taste is bitter. Therefore, some see this flower as a symbol of the bitterness in love (especially since the orange as we know it today was not yet available in Europe in the first half of the 17th century. Only the inedible bitter orange was known and was used for the jam industry).

2. The Anemone (Wind Flower) is often a symbol of the transience of beauty, and the transience of life in general, since although its stamens are beautiful, they fall off very quickly and easily.
Bordone’s “Portrait of Violante”

At least four versions of the Portrait of Violante exist: the original painting by Paris Bordone (which is today in the Alte Pinakothek in Munich), and three forgeries of it — in Munich (the Doerner Institute), at the Schloss Fassanerie, and in a private collection in Tel Aviv, Israel. Bordone’s original painting was painted in the years 1530-1535, and the girl depicted in the painting recalls in her appearance several of the Venetian courtesans whom Bordone used to depict in his paintings. According to common legend - the girl depicted in this painting was called Violante, and she was the daughter of the painter Palma Vecchio and the mistress of Titian. In reality Palma Vecchio never had a daughter, but this did not prevent the legend from growing and spreading, reaching its peak in the Romantic period. Concurrently, among 19th-century art collectors there was a growing demand for Venetian art from the 16th century — especially for paintings by Giorgione and Titian and their pupils. Against the background of the depreciation of 17th-century Venetian art in this period, it is easy to understand why someone would find it worthwhile to “sacrifice” a quite anonymous 17th-century painting (in our case, by Forabosco) in order to use it to create a forged “Bordone”, one that even had an association with a legend of a romantic character.

Several scholars (Nagler, Kulzen and Elkemeier) have already noted that the two forgeries of the Portrait of Violante (which today are at the Doerner Institute and the Schloss Fassanerie in Fulda) were forged by the Venetian artist, restorer and forger Lattanzio Quarena. I suggest that Quarena (who knew Bordone’s original painting) forged the painting three times. He sold the first forgery in 1818 to King Maximilian I of Bavaria, and the second in 1832 to Frau Steinmann of Dresden (this version was later purchased by the painter Franz Xavier Winterhalter, who sold it to Empress Frederika von Hessen. It was inherited by Prince Wolfgang von Hessen, and is today in his collection at the Schloss Fassanerie). The third forgery was found in Quarena’s studio after his death (1853), and this is the version which is the subject of this research - the version under which Forabosco’s Portrait of Anzola Contarini was discovered. A technical and stylistic comparison of the first two forgeries and the third indicates that it is almost certain that all three were painted by the same hand. It turns out that already in 1831 Karl Friedrich von Rumohr (1785-1843) accused Quarena of forging the painting which had been purchased for Maximilian I. When Count Sagredo wrote an obituary for his good friend Quarena in 1855, he chose to describe “The Violante Affair” that von Rumohr had exposed as an “unfortunate misunderstanding”. The present study, as already stated, attempts to prove that Quarena was in fact responsible for the forgery of all three versions.
Left: The original “Portrait of Violante” by Paris Bordone.
Right: The first fake (out of three) of “Violante” done by Lattanzio Quarena

The double painting: X-rays

“Portrait of Anzola Contarini” (detail) – the letter
Cross section

Lattanzio Quarena: “Self Portrait”

Third page from Giovanni Contarini’s last will

Anzola’s last will

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
WHAT'S WRONG WITH THIS PICTURE? THE ANALYSIS OF A KNOWN FORGERY

James Hamm, Gregory Smith, Dan Kushel and Jennifer DiJoseph

ABSTRACT — In 1990, the United States’ District Court in Connecticut sentenced Robert Lawrence Trotter to 10 months in federal prison. His crime was the forgery, faking and selling of American primitive-style paintings. He pleaded guilty to the charges and served his full sentence. Court documents stated that at least 55 paintings were sold to collectors, either directly or through dealers and auction houses. Currently, only 16 of these paintings have been identified and recovered. One of these paintings, a 1985 landscape signed “Sarah Honn, 1886”, is the subject of this study.

Both visual and technical analyses were undertaken to identify anachronous features that would assist conservators in recognizing other creations by this same artist. The technical analyses were grouped into two phases: nondestructive and techniques requiring direct sampling. Nondestructive methods included reflected and transmitted infrared reflectography, ultraviolet fluorescence, x-radiography, microscopic examination and x-ray fluorescence of selected colors. Further analysis that required direct sampling employed Fourier transform infrared spectroscopy, cross-sectioning and other lab techniques.

This painting is already exhibiting some deterioration due to the artist’s choice of materials and their use. The possibility that the 39 undiscovered paintings may be experiencing similar degradation, suggests that conservators may soon encounter these Robert Trotter creations and should be better prepared to identify them as forgeries.

1. INTRODUCTION

In 1990, the United States’ District Court in Connecticut sentenced Robert Lawrence Trotter to 10 months in federal prison. His crime was the forgery, faking and selling of American primitive-style paintings. He pleaded guilty to the charges and served his full sentence. By the artist’s own admission at the time of his arrest, 55 sales transactions with dealers, collectors and auction houses took place before the FBI intervened. Of these 55 works of art, the FBI recovered only 16; consequently, at least 39 more Robert Trotter fake paintings remain in collections and could appear on the market at any time. Some collectors, even in the face of Trotter’s admission of guilt, were adamant that the painting they had purchased from him was in fact an authentic piece of antique folk art and worth the purchase price. According to the prosecuting attorney, Peter Jongbloed, “most of Trotter’s victims who bought his new paintings do not know they own a fake painting.” (Jongbloed 1990)

One client couple had purchased an apparent mid 19th century portrait of a sea captain following Trotter’s release from prison and proudly hung the painting in their house along with many authentic folk art objects. Knowing the dubious history of the painting made it a more desirable object according to the collectors. The owners stated that [we] “…think Trotter was a damn good artist...I don’t see why he needed to fake it.” (Hewett 1997)

Robert Trotter began creating and selling his fakes around eleven states in the Northeast in 1981. Prior to 1987, no single painting brought him over $12,500 ($16,000 sales price minus the 20% commission). The relatively low sales prices helped him keep a low profile. His usual working method relied on creating a pastiche of typical primitive features that he knew from experience in the trade had strong appeal to buyers. Evidently, Trotter became impatient with the relatively small sums these fakes were fetching, leading him to greater ambitions. He soon tried his hand at forging paintings in the style of known primitive artists.
One well-known dealer, despite her better judgment, paid $50,000 in December 1988 for an apparent Ammi Phillips portrait. According to his own admission, Trotter was getting bored with painting primitive folk art. In May of 1989 he sold a “John Haberle” trompe l’oeil painting for $25,000 to dealers in Woodbridge, Connecticut, who then offered it to a dealer in New York City for $750,000. The NYC dealer convinced them to contact the FBI after suspecting it was a fake. Shortly thereafter, the owner of the fake Ammi Phillips became involved and complained “my painting isn’t right either.” When confronted, Trotter confessed and the FBI arrested him. (Pennington 1990)

The possibility that a conservator will encounter a fake folk art painting by Robert Trotter should become increasingly likely over time, especially for those conservators working in the Northeast USA. The deterioration of the 39 known examples of his paintings in circulation will be accelerated due to the various manipulations he devised to mimic the effects of age. Most likely, Trotter’s methods evolved in response to the marketplace and his developing expertise resulted in more convincing fakes. In response to questioning regarding a fake Haberle, he stated that “[I]... used standard tube oil colors ..., synthetic over-the-counter brushes, and lots of driers. I also used a thin coat of copal varnish. It’s browner and thinner and with a blacklight it tends to throw that even overall glow that can fool people not used to using a blacklight.” (Pennington 1990)

The Art Conservation Department at Buffalo State College is in possession of an intriguing painting signed and dated “Sarah Honn, May 5, 1866 A.D.” According to Justice Department documents, it was actually painted by Robert Trotter in 1985. Without the benefit of the knowledge of its true provenance, we wondered if the physical and visual evidence together would be sufficient to implicate this painting as a fake and, if so, how far the investigation would have to proceed in order to confirm the fakery. We began with the simplest non-destructive analysis (close visual inspection) and progressed through various techniques including x-radiography, x-ray fluorescence and Fourier transform infrared spectroscopy, eventually mounting cross-sections of the paint and ground in order to look for characteristic or anomalous morphology.

2. EXAMINATION AND ANALYSIS

The examination and discussion that follows presumes that the provenance of the painting is unknown, and that some unspecified doubts about the authenticity of the painting have been expressed.

Viewed using the stereo binocular microscope, both the signature and date appear well integrated with the paint beneath, having aged and cracked together. Since no portion of the signature penetrates the cracks, the signature must have been applied early in the life of the painting before cracks formed. Raking light also suggests that the signature was applied to an essentially dried paint surface, since the pressure of the brushwork did not disturb the paint beneath. Infrared reflectography helped clarify the name and date in contrast to the background although similar results could be obtained using image manipulation software. The only remarkable feature of the signature is the precision of the block lettering. Few, if any, artists have signed their name with more forthright clarity than Sarah Honn. Fewer still are female folk artists, Grandma Moses notwithstanding. An online search, among other avenues of inquiry, uncovered no reference to the artist Sarah Honn. Given the nature of primitive painting, obscurity and anonymity are to be expected.

One detail – calculated to reward the careful viewer – is the sign above the front door of one of the buildings in the background advertising the “Honn Co.” It lends credence to the name of the artist and acts as a reference point. “Sarah Honn” becomes more believable as a person when her name exists associated with a family business. The painting becomes an historical document establishing the credibility of the family and their business and, in turn, reflects that credibility back to the artist.
The canvas, tacking margins and lining are of interest. First, the lining consists of a mattress-ticking stripe cotton fabric adhered with animal hide glue alone, instead of the starch and glue mixture typical of traditional “pasta” linings, as determined by the transparent amber color and ready solubility in water. FTIR later confirmed this assessment. A microchemical test with potassium iodide proved negative for the presence of starches. Some 19th century paintings executed directly on mattress ticking were the work of itinerant artists utilizing available materials, probably with an eye towards lowering costs. In this case, the mattress ticking was used for the lining fabric, not the painting, thus creating a confusing anomaly in painting materials history. Why would any restorer, even with the most minimal knowledge, use this material for lining? Regardless of the amateurish quality of the lining or the lack of need, the use of mattress ticking here is highly suspect, despite lending a flavor of period authenticity at first glance.

All four tacking margins of the original canvas remain intact, but are curiously ragged, as though someone pulled at intervals along the edges with pliers, taking short sections away. Restretching after lining should have been relatively easy with the extra mattress ticking providing ample material for stretching, obviating the need to pull on the actual tacking margins. The ragged edge makes the original canvas appear even more friable than it actually is. An off-white paint applied loosely over the tacking margins and tack heads, but not on the exposed lining fabric, further complicates interpretation.

The lining canvas reverse displays extensive dark stains and rampant light gray mold. The stains extend beneath the left stretcher bar all the way to the very edge of (and close observation indicates at one time even beyond) the tacking margin. The apparent mold is over much of the dark stain and extends beneath the stretcher bars in a manner that suggests it existed before the stretcher bars were in place. The stains and mold appear manufactured (there is no mildew odor) and were certainly created before restretching the lined canvas. The excessively damp environmental conditions necessary to support such rampant mold growth appear to have had no visible effect on the painting itself. The stretcher appears typical of mid 19th century design. A second set of tack holes exists beneath the tacking margins.

X-radiography revealed indeterminate, irregular transitions between areas of high and low density. Scant evidence of brushwork or hard-edged linear elements such as the white buildings in the landscape was visible. Localized, diffuse patterns were juxtaposed with highly dense, but scattered islands that did not relate to the image. In an effort to better understand the unique appearance of the x-radiograph, we created a mock-up using a 19th century canvas painting fragment covered with a typical lead white ground layer. We applied a commercial paint stripper and scraped down the paint and much of the ground layers. The x-radiograph of this canvas fragment was compared with that of the painting. The thin, diffuse areas in both exhibited a canvas weave pattern, because some white lead remained in the interstices of the weave. Both exhibited dark areas of very little density to x-rays. The highly dense, scattered islands were just remnants of the thicker ground layer that remained largely intact after the scraping. The mock-up appears to support the appearance of the x-radiographic image of the painting.

Figures 3. and 4. Detail of x-radiograph of the left side, center, of the Sarah Horn painting compared with the x-radiograph of a mock-up scraped down with paint stripper.
Ultraviolet induced visible fluorescence provided some insight. From the front, we see a very subdued overall greenish fluorescence from the thin varnish. Primitive paintings were usually varnished by owners, or later on, dealers with a variety of resins and oils. This varnish is typical in a world of atypical possibilities. From the reverse, an unstained corner of the mattress ticking fluoresces a bright cool white suggesting it may contain optical brighteners or that it had been washed in modern detergents containing optical brighteners. Since the use of optical brighteners in textiles and detergents first appeared approximately 50 years ago, the mattress ticking lining could not have been adhered earlier than the 1950's.

Transmitted infrared imaging indicates that the two buildings in the background were painted over the horizon line. In other words, the position of the buildings was determined after painting the rolling landscape and sky. Generally, a copyist works with the advantage of seeing the finished work, having no need to develop the composition or make adjustments during the painting process. Although the evidence is slight, infrared imaging supports the originality of the Honn work. Transmitted infrared brought the overall paint craquelure into high contrast, clarifying the remarkably fine and even pattern throughout the surface. The typical aging or mechanical crack patterns found on most 19th century canvas paintings kept in poor environmental circumstances are not present. The dense craquelure pattern may be the result of the glue lining responding to environmental cycling or may have been intentionally induced or both; nevertheless, the paint has begun to cleave from the ground and canvas, necessitating conservation intervention in the near future.

After analyzing the pigments using x-ray fluorescence, we found several anachronistic areas. The XRF spectra taken from the white building at the horizon line confirms the presence of titanium, zinc, lead and cobalt. Titanium was first used in house paint in Norway in 1916 and in artists' paint in 1921 with the introduction of Weber's Permalba (a mix of zinc oxide and titanium dioxide in safflower oil). Lead could be found in parts of the ground and weak cobalt signatures were found in every XRF spectrum from samples taken across the painting. The broad, but weak, presence of cobalt is likely due to its use as a drier in the form of cobalt linoleate or cobalt naphthenate.

In the yellow-orange sky just above the horizon line, the XRF spectrum suggests the presence of titanium, lead, zinc, iron, cobalt and calcium elements. The iron likely represents ocher or umber pigments. Calcium peaks are stronger in this spectrum and may pinpoint a thicker portion of the original ground containing chalk and lead or chalk fillers from commercial ochre paints.

An XRF spectrum was obtained from the exposed ground in the doorway of the central red building. Barium, zinc, lead and calcium peaks dominate in addition to minor peaks for cobalt and iron. Barium and zinc together suggest the presence of lithopone (30% zinc sulfide and 70% barium sulfate). Lithopone is an opaque white paint introduced in 1874 and often used as an extender in house paint. Many other locations on the painting show this same barium - zinc pairing. It seems likely that the ground consists of two layers and at least one layer contains lithopone.

The green hills showed XRF peaks for barium, zinc, iron, lead, and cobalt as discovered already, but no other inorganic element to suggest the origin of the green color. A Fourier transform infrared spectrum obtained from a green paint sample indicates the presence of an organic yellow identified as Hansa yellow. An additional green or blue organic colorant could not be identified positively. Synthetic Hansa yellow was first made available in artists' paints around 1910, notably later.

Figures 5. and 6. Mounted cross-section of paint sample from bottom center under quartz illumination compared with the same cross-section viewed under ultraviolet radiation, both at 64x photographic magnification. The three interspersed glue layers are noted with arrows.
than the 1866 date on the painting. Since a significant portion of the painting contains this green color and there is no indication that it may have been applied at a later date, the veracity of the artwork is further brought into question.

The dark blue window sash on the white house showed an FTIR spectrum suggestive of Prussian blue bound with linseed oil and probably dammar or a similar resin. FTIR also confirmed the presence of animal hide glue, especially in the samples taken from the green hills.

By examining a sample of the paint taken from a loss in the bottom center as a mounted cross section, we determined that the paint film consists of three layers interspersed with a translucent material. When viewed under ultraviolet radiation, the translucent material exhibits a bright fluorescence suggestive of a protein layer, probably animal glue. Such an atypical layering scheme, when exposed to modest heating, will inevitably result in a widespread, finely-divided cracking pattern much like that exhibited by the Sarah Honn painting.

3. CONCLUSION

After reviewing U. S. Department of Justice documents describing the Trotter case, contemporary issues of the Maine Antique Digest reporting on Trotter’s activities, and examining a known Trotter forgery in detail, we feel that some specific observations can be made regarding his working methods. Whether other Trotter works follow this same scheme can only be determined by analyzing more of his paintings.

In the case of the Sarah Honn painting, Trotter began by purchasing an authentically aged painting from the mid-to-late 19th century. He scraped off most of the original paint layers and part of the ground using commercial paint stripper. He removed the old canvas from the stretcher, applied a lining of mattress ticking adhered with hide glue and applied dark stains to the lining reverse. Light gray colored mold effects were created in a manner still to be determined. Selected bits of the original tacking margin were pulled off with a tool (perhaps pliers) to give a more ragged edge to the older canvas. He then restretched the newly prepared canvas on the original stretcher using old tacks. He applied a thin ground layer, possible containing lithopone and cobalt drier, followed by the first glue layer and more ground, and finally the first layer of oil paint. After a second layer of glue followed by more oil paint, he induced cracks in the structure, either mechanically or by gently heating in an oven. The final glue layer penetrated these new cracks and coated the second layer of paint. He then applied the final layer of oil paint and varnished thinly overall with a dark copal resin and dammar varnish. Of course, each layer would have to dry before the next could be applied, thus the necessity for the cobalt drier to speed the process along.

Returning to our original query, the multiple visual oddities, either singly or even together, would probably not implicate the painting as an obvious fake. The technical evidence obtained without direct sampling informs some of the visual evidence and adds substance to those initial observations. Although the x-radiograph certainly exposes anomalous ground preparations, interpreting evidence from primitive paintings requires a greater degree of latitude regarding expectations for working methods. The XRF spectra are more difficult to explain away and clearly provide near irrefutable evidence challenging the authenticity of the painting. Although often not permitted, direct sampling opens further possibilities for resolving questions raised through previous analysis. The FTIR analysis discovered a second significant anachronistic error of pigment choice. The interspersed glue layers discovered in cross-section serve no normal artistic purpose. They simply enhance the tendency for the drier laden paint to crack, thus accelerating the appearance of aging. Eventually, comparing other known Trotter fakes with the Sarah Honn painting will help clarify whether the materials and methods discovered here are typical of his work or unique.

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AUTHENTICITY AND PAINTINGS ATTRIBUTED TO ALBERT PINKHAM RYDER

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ABSTRACT — A systematic, interdisciplinary approach, intimately combining procedures from both art history and scientific analysis, can help discriminate between authentic and inauthentic paintings attributed to Albert Pinkham Ryder (1847–1917), an American artist whose works have been extensively forged. Technical examination, including pigment and media analysis, X-radiography, cross-sectional analysis, fluorescent staining, and elemental analysis using an electron microprobe, is combined with traditional methods of art historical investigation to define distinguishing characteristics in a group of authentic Ryders. A comparison of the same characteristics from a group of unquestionably fake Ryders highlights ways in which they differ. The same examinations and analyses, performed on questionable paintings attributed to Ryder, show how they compare with results from the authentic works and the fakes. Discriminate analysis is used to form inferences and evaluate the reliability of the results.

In 1915 the American painter Albert Pinkham Ryder wrote, “I am sorry to say, a great many spurious Ryders have lately come into the market.” The artist wrote these words to the collector Alexander Morton, who had asked him to authenticate fourteen Ryders that Morton owned. Ryder was nearing the end of his life. The small number of paintings he had produced during his long career—possibly as few as 125—were increasingly in demand, and their scarcity had inspired the creation of forgeries of his work. Forgers continued to turn out fake Ryders in abundance long after the artist’s death. According to two leading Ryder experts, the number of paintings that at one time or another have been erroneously attributed to Ryder is close to one thousand. This fascinating problem, coupled with the then-recent acquisition of the Ryder Archive by the University of Delaware, launched my six-year dissertation research project in 1993 to see if a carefully designed interdisciplinary study could help distinguish between authentic Ryders and the fakes. This paper is an overview of that research.

Albert Pinkham Ryder (Fig. 1) was born in 1847 in the whaling town of New Bedford, Massachusetts. About 1870 he moved to New York City, where, after a brief enrollment at the National Academy of Design, he lived and painted until his death in 1917. Contemporaries hailed Ryder as the last great Romantic visionary (Fig. 2); to the avant-garde artists of the twentieth century, he was seminally important because of the modernist qualities of his bold, simplified designs (Fig. 3). Although his artistic contribution was not widely recognized until late in his career, historians now view him as one of America’s most important artists.
Even exclusive of the forgeries, understanding Ryder's life and oeuvre remains extremely difficult. He was notoriously eccentric and disorganized, and stories abound concerning the disorder in which he lived and worked. The many idiosyncrasies of his life and work became embellished to the point that separating the man from the myth proves no easy matter.

We remain in doubt as to precisely how many paintings Ryder actually created. He did little to document his career, and others recorded few thoroughly reliable accounts. Ryder never dated his paintings and seldom signed them. He unintentionally confused matters by repeatedly reworking many of his pictures, sometimes for twenty years or more. Additionally, his desire for expressiveness and special effects led to his use of unorthodox materials and techniques, so most of his paintings have suffered unfortunate changes that include darkening, sagging of the paint, severe cracking, and accelerated deterioration, an extreme example of which can be seen in The Curfew Hour from the Metropolitan Museum of Art (Fig. 4). This, in turn, has led to numerous restorations, including extensive repainting, which has done much to alter the pictures. Written descriptions or images of Ryder's paintings from his lifetime often vary significantly from the paintings we see today, making a tidy definition of Ryder's oeuvre virtually impossible.

In addition to the confusing paintings that likely are by Ryder are a multitude of paintings that have been at one time or another attributed to him. Some are presumably unfinished pictures that were “completed” by later hands, whereas others are intentional forgeries. There are also numerous unsigned works, most likely painted innocently “in the style of Ryder,” that subsequently were misattributed to him either mistakenly or intentionally. Although some of the fakes are in institutional collections, most are privately owned and surface regularly at museums, dealers’ galleries, and on eBay.

Over the years, both the art historical and scientific communities alike have attempted to distinguish between authentic and fake Ryders. Rarely have these two camps combined efforts. As seen from various impressive methodological studies conducted in the recent past, it is obvious that one cannot approach the problem of authenticity in artworks from the standpoint of either art historical research or scientific analysis alone. I set out to combine scientific analysis and traditional methods of art historical investigation, systematically performed, to define some distinguishing characteristics in a group of unquestionably authentic Ryders and a group of definite fakes. I could then compare some questionable Ryders with the results.

After a lengthy review of earlier Ryder studies, discussions with Ryder experts, and a look at the paintings potentially available for technical examination, I chose ten unquestionably authentic Ryders from the artist’s mature work, seven definite forgeries, and three pictures of questionable authenticity. I narrowed the scope of investigation to eleven points of technical connoisseurship. These are Provenance and History, Subject Matter, Design, Technique, Color, Physical Structure, Paint Surface, X-Radiographic Image, Layer Structure, Media Diversity, and Pigment Identification. I decided that a systematic investigation of these points across a number of authentic Ryders and Ryder fakes would set the stage for a computerized discriminant analysis procedure that could answer questions about the probable origins of the “unknowns” included in the study. Rather than dwell here on the research methodology, however, I would like to look at the criteria that exhibited the highest degree of statistical validity at the end of the study, to provide a more useful overview of how authentic Ryders contrast with the fakes.

I will conclude with Storm Rock, a painting owned by the Memorial Art Museum, University of Rochester, whose attribution to Ryder has long been questioned, and show how it compares with characteristics of authentic Ryders versus the fakes. Let us now examine a few of the above-mentioned criteria that yield the greatest distinction between authentic Ryders and those that pretend to be.

Provenance research is one of the most important tools of the art historian. Sometimes authenticity can be firmly established by this method alone, with evidence such as an unbroken, well-documented history of ownership going back to the artist, or with early photographs, sales records, exhibition catalogs, newspaper reviews, and so forth. With many of Ryder’s paintings this is possible, but in other instances, records are missing and the connection between
Ryder and particular paintings is only circumstantial. In the case of forgeries, however, the history of such paintings is often complicated by fake pedigrees, such as forged signatures, impressive “provenances,” inscriptions on the backs of paintings, articles presenting previously unknown works by Ryder, and official authentications from “experts” on Ryder’s work. For example, one book on Ryder, published in 1932 by Frederic Newlin Price of Ferargil Galleries in New York, lists 202 paintings—one with photographs—of which possibly three-quarters are fakes. The frontispiece (Fig. 5) features a fake self-portrait of the artist validating another forgery on the easel, supposedly the lost Nourmahal that Ryder was known to have painted but has never been found.

A look at Ryder’s subject matter is also helpful. About 1880 his interest shifted from his early pastoral landscapes to subjects drawn from mythology, the Bible, opera, and popular Romantic literature of the day. During this period, Ryder also painted haunting transformations of life and nature that were manifestations of intensely personal inner visions, such as nocturnal landscapes or dreamlike marines with menacing clouds. Most important, however, his topics were subjective representations that transcended physical reality in search of a much broader meaning. For example, many historians see his lonely ships on a moonlit sea (Fig. 6) as an allegory of man’s perilous journey through life. Forgers usually portrayed subject matter literally, making little or no effort to explore deeper content. Ryder’s moonlight marines were their favorite topic—they were not only iconic but also easier to imitate—and by far the greatest number of forgeries are of these. The forgers also created pastiches using elements copied from various authentic works or fabricated new versions of popular Ryders. Because Ryder worked out visual refinements over and over again on the same canvas rather than through a series of similar paintings, nearly identical variations of unquestionably authentic Ryders are open to question (Fig. 7).

Ryder’s best compositions display a brilliant innate capacity for abstract design that was never matched by the forgers. He simplified his forms to their essence and enhanced the interplay of two and three dimensions by habitually interlocking positive and negative space in such a way as to give each equal importance; the background is rarely neutral but is instead a powerful compositional force (Fig. 8). Ryder also used design to deliver motion and dramatic content. He captured and locked a vital energy into the sinuous forms of his compositions, as if his emotional state were transformed into the physical substance of his endlessly reworked designs. The fakes and forgeries almost always lack a rhythmic integration of parts, nor do they display Ryder’s exceptional capacity to convey mood.

Fig. 5. Frontispiece to Ryder: A Study of Appreciation by Frederic Newlin Price, 1932.

Fig. 6. Ryder, Homeward Bound. The Phillips Collection, Washington, D.C.

Fig. 7. Left: Ryder, Toilers of the Sea. The Metropolitan Museum of Art, New York. Right: Ryder forgery, Sailing by Moonlight, Ryder Archive, University of Delaware Library, Newark, Delaware.

Fig. 8. Ryder, Moonlit Cove. The Phillips Collection, Washington, D.C.
Ryder’s prodigious abilities as a colorist were praised by critics of his time. Superimposed on works that often displayed dramatic, high-contrast lighting, Ryder’s color was carefully contrived to convey the emotional significance of the scene. Today one can only imagine how his paintings must have looked through the eyes of contemporary critics who praised their glowing, gemlike tones. A vestige of this color remains in a few of the better-preserved pictures, like Gay Head from the Phillips Collection, but in most, the inner fire has all but disappeared. Nonetheless, authentic Ryders still retain a certain depth and translucency that are not equaled by the fakes. Imitations of Ryder’s paintings tend to have less subtle coloration. The tone, frequently limited to brown or gold, was most often achieved with a heavy application of yellowed, natural resin varnish or coatings tinted with pigments, metal flakes, or dyes, a feature easily confirmed under the microscope. As a result of the above-mentioned procedures, the fakes lack depth and translucency, displaying only an unmodulated, often dull, brown or gold appearance overall.

Ryder’s painting technique was unique. No specific information left by the artist on his technical practices has come to light; there are only obscure references to his “experiments” and tantalizing but questionable accounts by others. The artist Kenneth Hayes Miller reported that Ryder began his paintings mainly with broad applications of white and black, which he used to build up and refine his design. A cross section from Ryder’s The Forest of Arden (Fig. 9) clearly shows black and white layers immediately above the priming. As the design came together, he added thin layers of paint and/or pigmented glazes over the reflective white surfaces, a procedure he used to “put the light underneath.” In addition to mixing layer after layer of wet paint and glaze into a surface that had not yet dried, he poured on thick layers of varnish between glaze and paint applications. There is a strong indication that Ryder used ordinary coach varnish for this purpose. In creating the final finish, he used small brushes to lay on delicate, fine strokes.

Currently, technical analyses yield the most reliable new information to illuminate Ryder’s technique or refute earlier technical misinformation—for example, the commonly held belief that he used bitumen in his paints has been disproved by research in 1989 at the Conservation Analytical Laboratory. Significant among the technical analyses of Ryder’s paint in my study was a consistently strong positive (i.e., yellow) reaction under ultraviolet light to the fluorescent stain 2,7-dichlorofluorescein, or DCF, a test for saturated lipids that I performed on micro cross-sections of the paint layer. This might indicate Ryder’s use of non-drying oils that do not harden and are therefore inappropriate as paint binders. As yet there has been no specific identification of such ingredients, but conjecture about Ryder’s unusual additives range from cooking oil to candle wax. Even trace positive responses for saturated lipids were uncommon in the fakes. Although Ryder’s technical practices had an unfortunate effect on the durability of his pictures, his unorthodox materials and methods greatly aid in the identification of the authentic paintings, as no other artist is known to have applied similar materials in the same unusual manner. The fakes simulate Ryder’s complex technique only superficially.
The paint surfaces of authentic Ryders contain very little impasto. Because the artist’s painting material must have been very fluid to begin with and continued to level and flow over time, there remains almost no texture from the brush. Nearly all Ryder’s paintings have cracked profusely as a result of his technique. In some of his paintings, these prominent fissures are wide and deep (Fig. 10), often exhibiting the pattern known as alligatoring, which imparts a leatherlike appearance to the paint surface (Fig. 11). Frequently, one can observe tiny globules of hardened, translucent material that have erupted through the cracks (Fig. 12). Fake Ryders usually have a much less complex surface than the authentic paintings. The craquelure in the fakes I have examined tends to be fairly uniform, often consisting of simple mechanical cracks that have occurred naturally or were induced by baking or other treatments to mimic the appearance of age.

In the 1930s the paintings conservator Sheldon Keck discovered that X-radiography was his most powerful analytical tool when he helped the art historian Lloyd Goodrich begin investigating the difference between fake and authentic Ryders. X-radiographic images of authentic Ryders are generally high in contrast, showing large masses with soft, blurred edges that otherwise contain very little detail (Fig. 13). Sometimes there are traces of forms that Ryder moved or painted out altogether, consistent with his method of often working for years on the same painting, constructing his designs by trial and error, and using large quantities of high-density pigments such as lead white next to areas of low-density varnishes and glazes. Many fake Ryders yield an X-radiograph that displays little or no design image. The forgers did not imitate Ryder’s laborious creative process; instead, they created the illusion of a heavy paint buildup with a thick application of priming and varnish sandwiching a thinly painted design layer. The majority of the fakes I have examined yield an X-radiographic image that shows little more than the wood panel, canvas, or texture of the thick priming layer (Fig. 14).

The distinctive layer structure of micro cross-sections from authentic Ryders, examined under the microscope in both normal and ultraviolet light, is one of the most useful criteria in separating authentic Ryders from the fakes. Ryder’s pictures became unusually thick through seemingly endless reworkings in which he applied repeated applications of paint, medium, and varnish over layers that were not yet dry. Using this wet-into-wet technique, Ryder pushed and mixed his soft materials into one another as he painted (Fig. 15). As a result, cross sections from authentic Ryders—especially from his mature work—display practically no discrete layer.
structure, showing instead applications of paint, medium, and varnish that are folded and swirled together, instead of the tidy, horizontal bands normally observed in cross sections from traditional nineteenth-century paintings and from Ryder forgeries. All the fake Ryders I have examined have a very simple structure, usually consisting of a thick priming, one or more paint layers, and a thick buildup of varnish. There are no admixtures of medium and natural resin (Fig. 16).

Pigment identification has two important applications in the detection of forgeries. First, pigments that were discovered or manufactured only after a certain date would never be found in works supposedly painted before that date. Second, the systematic analysis of elements and/or pigments contained in a number of paintings by a given artist can sometimes establish a pattern of preference that is distinctly different from that of other artists. Significantly, authentic Ryders frequently contain an abundance of lead antimoniate, also known as Naples or antimony yellow (Fig. 17), an ancient pigment not widely used after the mid-nineteenth century. Forgers of Ryder’s work made no attempt to duplicate his pigments. Their choice of materials appears to have been dictated primarily by their desire to imitate the artist’s colors, with either paint, toned varnishes, or both. The forgeries I have examined do not contain Naples yellow. Moreover, they sometimes contain pigments that seldom or never show up in Ryder’s work—for example, zinc white is often the primary white pigment found in the fakes, whereas Ryder preferred lead white.

Having presented an overview of the differences between authentic Ryders and the fakes, I will now show how I have used that information to examine “Ryders” of questionable authenticity. The case study I include here compares the systematically examined characteristics of Storm Rock, owned by the Memorial Art Gallery of the University of Rochester, with group characteristics of both the authentic Ryders and the fakes. Storm Rock was included with permission as one of the unknowns in my research.

Storm Rock (Fig. 18), like many of Ryder’s authentic works, is a small painting on a thin wooden panel. There is no evidence of restoration. There is an indistinct signature, “A.P.Ryder,” in the lower right corner. In addition to two stamps and one label from Ferargil Gallery, New York, the back of the panel bears an inscription, scratched into wet paint, “To Mrs McCom—[the last part is illegible], from A P Ryder” (Fig. 19). The authenticity of the painting has been questioned on the basis of style since the 1930s.
Ryder painted several pictures featuring a boat or ship on a beach near a rocky cliff. However, the ship and figures of the man and horse are nearly identical to those in Ryder’s *The Smugglers’ Cove* (Fig. 20), an unquestionably authentic painting that has been on view at the Metropolitan Museum of Art since 1909. No published reference to *Storm Rock* or other mention of its existence has been found before it was purchased in 1930 from Ferargil Gallery for donation to the Metropolitan Art Gallery.

The history of the painting is sparse and incomplete, the inscription on the back is questionable by virtue of its intentional illegibility, the design is nearly identical to that of an authentic Ryder, and the attribution is suspect because of its association with Ferargil Gallery, which was deeply involved in the sale of fake Ryders.

From the standpoint of design, *Storm Rock* is somewhat stiff and static, especially in the clouds; there are no interlocking shapes, and the two-dimensional, abstract quality of the composition is also not particularly strong. The pattern of cracking in the paint consists of uniform fissures resulting from contraction of the thick, translucent surface layer of oil medium. Additionally, between these fissures is a pronounced, regular pattern of extremely fine wrinkles. Overall, the surface of *Storm Rock* is relatively dry and matte. The surface is not representative of those found in authentic Ryders.

Almost none of the design can be distinguished in the X-radiograph of *Storm Rock* (Fig. 21); the only feature clearly visible is the moon, along with the image of a slightly larger orb near the upper right corner, suggesting a change of mind regarding its size and placement. Most of the image in the X-radiograph comes from the lead white priming, which was applied heavily as a creamy paste. The appearance of the X-radiograph is not consistent with those taken of authentic Ryders, but it is similar to those from Ryder forgeries.

Micro cross-sections (Fig. 22), examined under the microscope, display very few features. There is a layer of white priming, a thin application of colored wash, and an extraordinarily thick top layer of lightly pigmented oil medium, all typical of the forgeries. The cross sections also stain negative for saturated lipids. Elemental analysis of the cross sections detected an abundance of zinc white but relatively little lead white. Naples yellow, often found in Ryder’s work, was not detected.
The discriminant analysis program placed this painting solidly in the group of fakes examined in my study (Fig. 23). Storm Rock (#20, upper left) is not only uncharacteristic of Ryder’s work, but it also displays many of the characteristics common to the forgeries. Storm Rock is an easy, straightforward example, leaving little doubt that the painting is a deliberate forgery. Although many fake Ryders are just as easily detected, there are, of course, more complex cases in which authenticity or inauthenticity is only implied as a 90 percent probability, 80 percent, or even less.

In conclusion, all eleven characteristics I elected to examine systematically throughout my study proved to be statistically significant in separating authentic paintings from the fakes. However, confirming results from earlier investigations, statistical analysis identified the X-radiographic image and the appearance of micro cross-sections from the paint layers as the most significant. My study also highlights three new discriminating features that exhibit a high degree of statistical validity: (1) the presence of Naples yellow (lead antimoniate) in the authentic works, (2) a relative abundance of zinc white in the fakes, and (3) a tendency of the authentic Ryders to test positive for the presence of saturated lipids in the media.

Much work remains to be done in understanding Ryder’s artistic contribution and separating it from the fakes and forgeries. It is a difficult and fascinating challenge, but one that I feel is best addressed by a systematic, interdisciplinary approach combining the skills of both scientists and art historians. As with any extremely complex problem, all observations must be weighed carefully and thoughtfully. I believe, however, that this approach creates a more firmly grounded study by having roots in more than one field, especially when tied together in such a way that the results of each illuminates and enriches the other.

ENDNOTES
1 Ryder to Alexander Morton, original bound into the American Art Association’s exhibition sale catalog of Thomas A. Kirby, January 29, 1919, American Antiquarian Society, Worcester, Massachusetts; photocopy in the Ryder Archive, Special Collections, University of Delaware Library, Newark, Delaware.
2 There are about 100 pictures that are accepted as authentic, to which must be added approximately 25 documented Ryders that are lost (see Frederic Fairchild Sherman, Albert Pinkham Ryder [New York: privately printed, 1920], 45; and William Innes Homer and Lloyd Goodrich, Albert Pinkham Ryder: Painter of Dreams [New York: Harry N. Abrams, 1989], 234 and 40 n. 16).
3 The art historian William Innes Homer, University of Delaware, and former director of the Whitney Museum of American Art, the late Lloyd Goodrich. Homer and Goodrich, Ryder, 117 and 245 n. 2.
5 The following writings are representative: “His romanticism has the fervor and heat of the earlier votaries of the movement” (Roger Fry, “The Art of Albert Pinkham Ryder,” Burlington Magazine 13 [April 1908]: 63); “He was the purest example of the romantic spirit that American art has produced” (Frank Jewett Mather Jr., “The Romantic Spirit in American Art,” Nation 104 [April 12, 1917]: 427); and “Ryder was the last of the romantics” (Marsden Hartley, “Albert P. Ryder,” Seven Arts 2 [May 1917]: 96).
In a review of Ryder’s paintings on display at the Armory Show of 1913, the critic Charles Caffin wrote, “In the quality of his work he is much nearer to the modern expression of intellectualized emotion than all but a few of the young men. In his unobtrusive sincerity he, in fact, anticipated that abstract expression toward which painting is returning and may almost be said to take his place as an old master in the modern movement” (Caffin, “International Still Stirs the Public,” New York American, March 10, 1913). In 1947 a reviewer of the Ryder retrospective at the Whitney Museum of American Art commented, “[Ryder] came to use forms almost as symbols, working away from details to fundamentals, supplanting the literal transcription with shapes and colors to convey the artist's emotional reaction and the inner picture rather than the outer semblance which appeals to the factually recording eye. And in this he prefigured what we now call expressionism” (Howard Devree, “Ryder—Modernist,” New York Times, October 26, 1947).

The art critic Sadakichi Hartmann, who first visited Ryder’s studio in 1897 and made subsequent visits over the next twenty-three years, wrote, “Ryder’s place was like a neglected storage room, filled with boxes of every kind and size, gunny sacks and rags, a scuttle and a cider keg amidst bundles of clothing, stacks of old canvases, crowded to such an extent that the merest trail led from the entrance door to his easel near a window and from there into the adjoining room. . . . [E]very crevice [was] filled with . . . stretchers, sketch pads, old shoes, laundry, packages unopened, chunks of coal, kindling wood, a gas range, piles of magazines and newspapers . . . rows of cereal boxes, stacks of milk bottle tops, heaps of twine and cord nicely tied up, loose change, wire spools of thread, plaster casts, lamps out of commission, candlesticks, all sorts of bottles, an assembly of oil color tubes, twisted, half-squeezed, dried up, not to mention hardened brushes. All this debris was buried under the dust-patina of years” (Hartmann, “Albert Pinkham Ryder,” Magazine of Art 31 [September 1938]: 502).

Ryder wrote, “The canvas I began ten years ago I shall perhaps complete to-day or to-morrow. It has been ripening under the sunlight of the years that come and go” (Ryder, “Paragraphs from the Studio of a Recluse,” Broadway Magazine 14 [September 1905]: 11). For example, Ryder worked on The Tempest, which was still in his studio at the time of his death, for about twenty-six years (see “Albert P. Ryder: A Poe of the Brush,” New York Press [December 16, 1906]: 5).

Ryder’s artist friend Kenneth Hayes Miller quoted Ryder as having exclaimed, when reproached for melting candles into his paint, “But I only used one candle!” (Lloyd Goodrich, “Conversation with Kenneth Hayes Miller,” manuscript, February 1, 1940, Ryder Archive, University of Delaware, 1). The artist Philip Evergood said Ryder used to “chew tobacco, spit into a spittoon next to his easel and dip his brushes into the tobacco juice” (Evergood, “Speech Given at Iowa State Teachers College in Cedar Falls,” quoted in Kendall Taylor, “Ryder Remembered,” Archives of American Art Journal 24, no. 3 [1984]: 15). Some of the numerous accounts of Ryder’s unorthodox materials and techniques are likely apocryphal.

“[Arthur B.] Davies related that Ryder came to him one day in great distress to ask what he (Davies) did to keep the paint on his canvas.” Ryder stated that his paint at times would drip down and dry on his easel in blobs” (George B. Hollister, “Albert P. Ryder as Remembered by Arthur B. Davies,” manuscript, 1947, Ryder Archive, University of Delaware, 4). Sadakichi Hartmann wrote, “There occur not only extensive crackings but regular varnish slides, moving lava-like through the surface, and here and there pieces of the size of small coins deliberately fall out. A humorous incident is reported to have happened to his ‘Flight into Egypt’. . . . The head of the infant suddenly began to move and wriggled downwards to abdominal regions where it remained as far as I know until days of restoration” (Hartmann, “The Story of an American Painter,” typescript, 1926, Archives of the Metropolitan Museum of Art, New York, 8).

In 1917 Frank Jewett Mather Jr. wrote that Ryder’s lack of proper training “led him to build up his jewel-like fantasies out of bad pigments and destructive vehicles. Many of his pictures are wrecks. Much of his old age was spent in conscientiously restoring the paintings of his youth” (Mather, “The Romantic Spirit in American Art,” 427).

Evidence points to at least three artists and possibly two dealers who may have been engaged in producing forgeries or finishing works Ryder left incomplete at the time of his death.

15 Over the years, I have looked at almost all the paintings customarily attributed to Ryder; for the purposes of this study, I have performed the detailed examination and analysis of more than thirty authentic, questionable, and fake Ryders from various museum and private collections.

16 Lloyd Goodrich combed every possible source of information on Ryder, methodically compiling records and using the results of his research to establish a group of unquestionably authentic works. “Every such bit of information was entered under each picture. This established that over a hundred works were recorded during Ryder’s life in such ways as to prove their authenticity” (Goodrich, *Ryder*, 117). Unfortunately, a number of these paintings have been altered significantly by later hands, and some of the historically documented Ryders, presumably lost, have been replaced by clever forgeries.


19 The fake *Nourmahal* featured in the frontispiece is in the study collection of the Metropolitan Museum of Art.


22 “The simplest of his small marines are big in a way more important than that of mere size. The boat that appears in them is a sensible symbol of Life presented in such a manner as to illustrate forcibly the uncertainty that encompasses it” (Sherman, *Ryder*, 60).

23 Moonlight marines were relatively easy to forge by comparison with Ryder’s other work. His *The Toilers of the Sea* (on view at the Metropolitan Museum of Art by 1915) and *Moonlight Marine* (often exhibited, including in the Armory Show in 1913; purchased by the Metropolitan Museum of Art in 1934) served as ready models to inform the forgers’ work. The Ryder Archive contains records on a large number of questionable moonlight marines.

24 “He is really painting the same picture on the same canvas a hundred times” (see Hartmann, “The Story of an American Painter,” 10).


26 As Leo Stein observed, “He keys his compositions up to a pitch of such intensity as to make them rhythmically quite singularly self-sufficing, and independently alive” (Stein, “Albert Ryder,” *New Republic* 14 (April 1918): 386). In the intensity of his dramatic forms, Ryder owes much to British artists like J. M. W. Turner, whose *Slave Ship* he must have seen exhibited in New York in the 1870s (see Dorinda Evans, “Albert Pinkham Ryder’s Use of Visual Sources,” *Winterthur Portfolio* 21 [Spring 1986]: 35), and John Martin, whose *Seventh Plague of Egypt* (1823) he may have seen in England.

27 “It is to color charm that Mr. Ryder’s work will owe its fixed stellar position. Its marvelous quality, its full yet always restrained harmonies, have never been equaled in my judgment” (“The Critic” [Alfred Trumble?], “Albert P. Ryder,” *Art Collector* 9 [December 1, 1898]: 37). See also Henry Eckford [Charles de Kay], “A Modern Colorist: Albert Pinkham Ryder,” *Century Magazine* 40 (June 1890): 250–59.

28 Roger Fry wrote, “I wish I could translate the ominous coloring into words.... [It is] inscrutable, and yet full of the hidden life of jewels and transparent things” (Fry, “The Art of Albert P. Ryder,” 64). Col. C. E. S. Wood, an avid collector of Ryder’s work, commented, “I look at Ryders and it is as I say like satiating my eyes on a glorious ruby” (Wood to Olin L. Warner, March 17, 1889, Olin L. Warner Papers, Archives of American Art, Smithsonian Institution, Washington, D.C.).

29 Hartmann likened some of Ryder’s paint to “gray agate, somber, dull and mottled, and yet translucent” (Hartmann, “Story of an American Painter,” 6). I have observed some degree of this almost indescribably translucent, pearly gray in every authentic Ryder I have examined.

30 It was Ryder’s quest for special visual effects that fostered his experimental technique. Forbes Watson, critic for the *New York Evening Post*, quoted Ryder as saying, “Have you ever seen an inchworm crawl up a leaf or a twig, and, then, clinging to the very end, revolve in the air, feeling for something to reach something? That’s like me. I am trying to find something out there, beyond the place on which I have a footing” (Watson, “A Poet’s Painter,” *Literary Digest* 54 [April 21, 1917]: 1164).
Among the technical remarks that I feel are conjectural are the assertion by the artist Marsden Hartley that Ryder used ordinary varnish. Ordinary varnish (as opposed to artists’ varnish) probably meant the protective finish over the carriage painters’ decorative work, was made by boiling hard fossil resins such as copal and thin with 5 1/2 gallons of turpentine. The two lots are mixed together, strained, and allowed to mature. This varnish dries hard with a fine polish in about five hours in summer and in about seven hours in winter. It is used for varnishing common carriages and also for cabinet work (George H. Hurst, A Manual of Painters’ Colours. Oils, and Varnishes, 5th ed. [London: Charles Griffin and Co., 1913], 455–56). Liberal intermediate layers of coach varnish would have given the translucent effect Ryder was seeking but also would have resulted in poor aging qualities and could account for much of the darkening and cracking in his paintings (see Ralph Mayer, The Artist’s Handbook of Materials and Techniques, rev. ed. [New York: Viking Press, 1970], 209).

Although considerable work remains to be done, much has been accomplished in the identification of Ryder’s media. For example, his reputed use of bitumen can now be disproved: “It may be bitumen that has caused the deterioration of such favorites as The Toilers of the Sea and Moonlight Marine, in which some areas have gradually become tarry” (Broun, Ryder, 129); and “The pigment asphaltum of bitumen which frequently occurs...
in Ryder’s pictures, prevents the oil with which it is mixed from drying, thus encouraging plastic flow” (Sheldon Keck, “Albert P. Ryder: His Technical Procedures,” in Homer and Goodrich, Ryder, 182). A recent scientific study found that there was no bitumen in samples from the authentic Ryders included in the investigation (see David Erhardt, David von Endt, and Jia-sun Tsang, “Condition, Change and Complexity: The Media of Albert Pinkham Ryder,” in The Paintings Specialty Group Annual [Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 1990], 28–35).

38 According to the artists Kenneth Hayes Miller and Louise Fitzpatrick, Ryder melted wax into his paints (Miller specified candle wax [Goodrich, “Talk with Kenneth Hayes Miller,” 2]; for Fitzpatrick’s account, see Louise Fitzpatrick to Col. C. E.S. Wood, April 17, 1918. C. E.S. Wood Papers, Huntington Library, San Marino, California). Because both Miller and Fitzpatrick knew Ryder’s technical practices, the report probably is true but remains to be confirmed by technical studies focusing on media identification. Some theories that remain to be supported or disproved by further technical studies are his inclusion of foodstuffs such as butter (Joyce Hill Stoner, “Art Historical and Technical Evaluation of Works by Three Nineteenth-Century Artists: Allston, Whistler and Ryder,” in Appearance, Opinion, Change: Evaluating the Look of Paintings [London: United Kingdom Institute for Conservation, 1990], 40) or perfume oils and cooking oils (Shelley A. Svoboda and Camilla J. Van Vooren, “An Investigation of Albert Pinkham Ryder’s Painting Materials and Techniques with Additional Research on Forgeries,” in Paintings Specialty Group, Postprints of Papers Presented at the Seventeenth Annual Meeting [Washington, D.C.: American Institute for Conservation of Historic and Artistic Works, 1989], 41). The technical problems associated with identifying such materials, however, are considerable, because many such substances by now would have oxidized and decomposed into a variety of simpler components.

39 This leathery appearance is greatly diminished if the varnish on the painting has been thinned or if the painting has been generously revarnished.

40 In 1994 René de la Rie, Head of Scientific Research, National Gallery of Art, Washington, D.C., used pyrolysis-gas chromatography/mass spectrometry to analyze the material in globules I had collected from six authentic Ryders. The media in spherules from all six paintings were a combination of linseed oil and diterpenoid resin (René de la Rie, analysis report, July 15, 1994. Scientific Research Department, National Gallery of Art, Washington, D.C.). Diterpenoid resins are a class of natural resins that have been used as varnishes; they include materials such as colophony, sandarac, and copal (one of the common components of carriage varnish). For a discussion of traditional artists’ varnishes and references to further reading, see Lance Mayer, “Traditional Artists’ Varnishes,” Painting Conservation Catalog, vol. 1, Varnishes and Surface Coatings (Washington, D.C.: Paintings Specialty Group of the American Institute for Conservation, 1998), 21–26.

41 “[Max J.] Friedländer noted that forged craquelure was arbitrary, monotonous and pedantic whereas ‘natural craquelure throbs with rich variety’” (Spike Bucklow, “The Description of Craquelure Patterns,” Studies in Conservation 42, no. 3 [1997]: 129).


43 Sadakichi Hartmann, who visited Ryder’s studio off and on for more than twenty years, wrote of Ryder’s changes in The Lorelei: “There is his ‘Lorelei’ sitting for more than fifteen years at one side of a rock with a glimpse of the Rhine below. How often she has changed since I first became acquainted with her! She is going through a whole cycle of evolution. Now large, now small, now emerging from the rock, now sinking back into it, almost vanishing at times, coming forth again, changing her position, drapery, expression, color of her hair, a hundred times. And the rock itself shifts its outline in every direction” (Hartmann, “Story of an American Painter,” 9).

44 By far the most abundant pigment in authentic Ryders, lead white (lead oxide) is primarily responsible for forming the image in the X-radiographs. However, Ryder customarily used several other high-density pigments as well: Naples yellow (lead antimoniate), chrome yellow (lead chromate), and vermilion (mercuric sulfide).

45 Electron microscopy and elemental analysis/pigment identification of the samples using energy-dispersive X-ray spectrometry (SEM-EDX) were performed at the Getty Conservation Institute at the J. Paul Getty Center in Los Angeles.

46 This technique can prove inauthenticity but not authenticity, as pigments generally remain available as artists’ materials for years after their introduction. It is also important to note that pigments located on or near the paint surface are possibly the result of repainting or retouching by restorers or other artists at a later date. These additions
can be identified by careful examination of cross sections taken from the painting as well as by other techniques. Information from areas of samples possibly containing repainting or restoration was not included in this study.

47 In a report on technical studies of Ryder paintings done at the Conservation Analytical Laboratory, Smithsonian Institution, Shelley Svoboda mentions that the artist's pigments were limited to a small group including antimony yellow (Shelley Svoboda, “Continued Studies of Albert Pinkham Ryder,” research project, Art Conservation Program, University of Delaware, 1990). In an earlier study carried out at Brookhaven National Laboratory, neutron-activation autoradiography performed on Ryder's The Curfew Hour also detected large amounts of antimony, indicative of Naples yellow. (Maurice Cotter, Pieter Meyers, Lambertus van Zelst, Charles Olin, and Edward Sayre, “A Study of the Materials and Techniques Used by Some Nineteenth-Century American Oil Painters by Means of Neutron Activation Autoradiography,” Applicazione dei metodi nucleari del campo delle opere d'arte [Rome: Academia Nationale dei Lincei, 1976], 190).

48 Rutherford Gettens and George Stout, Painting Materials, rev. ed. (New York: Dover Publications, 1966), 133. Because of problems with the durability of true Naples yellow, its color began to be imitated by other pigment combinations in the mid-nineteenth century (see Leslie Carlyle, “A Critical Analysis of Artists’ Handbooks, Manuals and Treatises on Oil Painting Published in Britain between 1800–1900: With Reference to Selected Eighteenth-Century Sources,” Ph.D. diss., Courtauld Institute of Art, University of London, 1991, vol. 2, 265). In the 1866 The Artist and Tradesman's Companion, Naples yellow was not included in a list of artists' common yellow pigments, although two other yellows that Ryder used—chrome yellow and yellow ocher—were featured; see M. Lafayette Byrn, The Artist and Tradesman's Companion (Philadelphia: J. B. Lippincott and Co., 1866), 109. By the early twentieth century—when the majority of Ryder forgeries were being created—A. P. Laurie wrote that Naples yellow was “a favorite yellow with the early oil painters . . . [but], like massicot, has been removed from the artist’s palette owing to the fear of darkening by the action of sulphuretted hydrogen, and is now replaced by mixtures of yellow of the same tint” (A. P. Laurie, The Painter’s Methods and Materials [London: Seeley, Service and Co., 1926], 91).

49 This idea is further supported by the fact that none of the imitators attempted to duplicate Ryder's complex technique, being content with a superficial imitation of the surface appearance.

50 The old Ferargil Gallery label records the painting as “No. 5075, ‘The [crossed out] Storm Rock’”; there are also two Ferargil Gallery stamps directly on the wood.

51 When Lloyd Goodrich examined Storm Rock on February 7, 1938, the director of Memorial Art Gallery, Gertrude Herdie Moore, told him that she thought the painting came from Montross Gallery (Goodrich, folder on Storm Rock, Ryder Archive, University of Delaware Library). In a subsequent letter to Goodrich, she amended the comment by saying, “We have no history of the painting. It was presented to the Gallery by Mrs. James Sibley Watson, September 1938, who bought it from a New York dealer” (Moore to Goodrich, April 16, 1938, Goodrich, folder on Storm Rock, Ryder Archive, University of Delaware Library).

52 Curatorial records, Storm Rock, Memorial Art Gallery, University of Rochester.


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Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.

This paper has not undergone a formal process of peer review.
I COULD PAINT THAT!... FORGERY OF AN HOMAGE TO THE SQUARE

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ABSTRACT – This paper focuses on a forgery of an Homage to the Square that had arrived at the Josef Albers Foundation several years ago, from a dealer who had concerns about its authenticity. Beginning with a brief review of Albers’ methodical technique in preparing and painting this, his most recognizable of compositions, examination of the forgery reveals a complex and clearly intentional presentation of a painting as if by the artist himself. Subtle distinctions, however, make it clear that this was not the case and that the forger overlooked details that, to the untrained eye, might go unnoticed.

At first glance, it might seem obvious and relatively easy, to copy an Homage to the Square painting by Josef Albers. The compositions are simple intentionally, as the subject is “color” and “color relationships”. The materials are straightforward and generally, readily available. As a rule, Albers spoon feeds us his methods, spelling out the basics on the verso of most of the panels. His choice of materials, the preparation and even his working environment were well defined and openly discussed by him. And there has been much written about him, including many personal interviews. But the ideas are complex. Albers was a great teacher... at the Bauhaus, where he was educated, until 1933... at Black Mountain College from then until 1949... and as head of the Yale Art School from 1950 until his retirement in 1960. And the technique is precise, methodical and highly skilled. While, to the untrained eye it appears simple, Albers’ proficiency with the palette knife was legendary. It goes without saying that “intent” is the operative word with a forgery, but creating a replica of an Homage to the Square, while not impossible, does take more effort than meets the eye.

During the years of my work with the Josef and Anni Albers Foundation, I encountered very few forgeries. But every now and then, the Foundation would be notified of cluster operations, historically, particularly in Europe, and more specifically, in Italy it seems, where dealers have passed problematic pictures. Typically, a reputable dealer will forward a painting in question (one that had somehow been passed to him) to the Foundation for confirmation, either positive or negative. It is on these occasions that I would consult with both the Director and the Curator to reach a consensus on the particular work.

Spotting a forgery naturally necessitates a complete understanding of the fabrication of an original. So a brief review is worthwhile:

Albers began painting the Homage to the Squares in 1950, painting them until his death in 1976. He painted over 1,000 of these. And while his oeuvre encompasses many other explorations, it was in these paintings that he was best able to refine and project his color theories.

There were four formats for the Homages:
1. three square, large center, large middle (Fig. 1)
2. three square, small center, large middle (Fig. 2)
3. three square, small center, small middle (Fig. 3)
4. four square (Fig. 4)

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Albers also painted a fifth format in this series: *Mitred Squares.*¹ (Fig. 5)

The squares are drawn on a specific grid system of ten units by ten units. The units to the left and right are two times as large as the bottom. The top is three times as wide as the bottom. (Fig. 6)

Albers painted the *Homage to the Square* largely on a substrate that was eighth inch, un-tempered (un-oiled, not chemically treated) wood-fibre-board panel. Generally sold under the proprietary name of *Masonite,* he didn’t always use the brand. He also occasionally painted *Homages* on aluminum panels and on blotting paper. *Homage to the Square* and Studies for *Homage to the Square* (which is what he generally called the paintings up to and including the 32” ones) were painted in the following sizes (approximate): 16” x 16”, 18” x 18”, 20” x 20” (these on aluminum only), 24” x 24”, 30” x 30”, 32” x 32”, 40” x 40” and, in 1964 he began painting on boards that measured 48” x 48”.

Early Homages were executed on the smooth side of the panels. These works tend to look more “painterly” in that the paint sits up on the untextured board. (Fig. 7) Albers would manipulate the palette knife in such a way as to remove most of the excess paint, but he couldn’t create a completely flat surface. He ultimately had concerns about paint adhesion and so, in the late fifties, switched to the textured side of the board.³ Here he was able to reduce the “physical” texture of the paint. (Fig. 8) He accepted the underlying texture of the board in favor of a flatter delivery of the color. In some cases, the priming shows through. This he accepted as the behavior of the particular paint.

Ground—-*Liquitex Gesso,* the ground that Albers used from 1959 onward,⁴ is still made and widely used. It is a consistent, high quality product, which is the reason that Albers liked it so much. It is bright white, stable and the most luminous surface he had encountered up until then. Prior to ’64, Albers had used a variety of casein and alkyd primers. He abandoned these earlier grounds because they ultimately discolored, sometimes yellowing visibly. On occasion, he actually overpainted the discolored visible edges of the grounds in order to brighten them. The *Liquitex Gesso* was applied by an assistant, in up to 8 thin coats that were sanded in-between.⁵

Drawing--- The grid system was laid in using a 7H pencil. Albers also used a pencil for notations around the perimeter of the face of some, not all, of the panels. (Fig. 9)

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² See: Josef Albers, *Homage to the Square:* *Unconditioned,* 1952-54, oil on masonite panel, 43 x 43 in., Yale University Art Gallery, Maitland Griggs, BA 1896, Fund, 1952.27.5
⁵ See: Josef Albers, *Homage to the Square:* *Unconditioned,* 1952-54, oil on masonite panel, 43 x 43 in., Yale University Art Gallery, Maitland Griggs, BA 1896, Fund, 1952.27.5
Paint--- Albers painted the *Homages*, almost exclusively in oil. There are a very few where casein was used. He used a wide variety of good quality paint, up to 15 brands, using them directly from the tube, after extruding as much binder as possible from the paint onto blotting paper. He preferred the handling of the underbound paint as he manipulated it with his palette knife, his instrument of choice. He did not use a brush. He once purchased an airbrush, but never used it. The stiffer paint could be directed with more control to make a smoother less "painterly" surface, one where it would be less about the paint and more about the color. Albers colors, for the most part were unmixed, pure colors, pure colors being the most luminous. The only exceptions of which I’m aware are light blue and pink. Albers painted all his colors directly over the white ground, except where he changed his mind about a composition and overpainted a square. His intention was, often, to express the in-betweens, so even though there’s an appearance of overlapping, this is not the case. (Figs. 10, 11)

Occasionally, when Albers changed his mind, painting over the colors, he did this right away, and noted it on the verso. But sometimes he would go back and make a change later. In this case, the layers might be separated by a varnish layer. This scenario is also frequently noted on the verso, as an addition. Sometimes, however, there is no indication, but it is clear that Albers is the culprit.

Virtually all of the *Homages* were signed in the lower right with an uppercase A and the last two digits of the date. (Fig. 12) Usually Albers would sign his name on the verso as well, “Albers” and the complete date. (Fig. 13) I’ve seen a few undated or unsigned (Figs. 14, 15) paintings and some are dated twice, or with a bridged date: A 53-56, for example.

The whole process was completed by hand. (Figs. 16, 17) Evidence of the artist is visible in all of the paintings. While it is subtle, it is definitely visible. Craftsmanship was very important to Albers. He never used tape and he used no rulers after the grid lines were placed. Varnish--- Albers wanted his colors saturated. He varnished, or had virtually all of his paintings varnished. They were varnished overall, not locally over one
square or the other. Some paintings, over the years, exhibit gloss/matte surface. This is not intentional and can be attributed to sinking into the paint film and/or a degrading of the varnish.  

Earlier works were varnished with Dammar or PVA mixed with wax, which he called “M” varnish. Later, Albers had studio assistants or conservators apply a variety of available synthetics, often, but not exclusively Lucite 44 by itself, or in combination with wax, to reduce the gloss. The varnishes applied by his assistant, Charles Tauss, or later, the restorer, Daniel Goldreyer, are noted in black pen on the backs of the panels, in the hand of the “varnisher”… distinct from Albers hand.  

Framing--- There is a beginning and an end to the Homages, indicated by the ubiquitous white border. Furthermore, Albers considered the framing of his paintings very important, occasionally choosing to frame out the white border. (Figs. 18, 19) He either made the frames himself, (he did this exclusively early on) or, in the case of his later work, he specified a particular metal frame molding from Kulicke framers in New York. (Fig. 20) After the artist’s death, the Foundation modified the look of the frame to a sleeker, narrower profile, when Kulicke closed their business. They are currently made by Bark Framers, New York City.  

Paintings are set in their frames by means specifically designed by the artist. On some of the early frames, there are four triangular blocks that are set into the corners of the rabbet with screws (Fig. 21). On others, there is a system of small slats of wood that are nailed into the side of...
the rabbet of the frame (Fig. 22). Later, metal strip frames have strainers, some with a horizontal crossbar, some not... some painted black, some not (Figs. 23, 24). These are screwed into the sides of the frame.

A few years ago, a suspicious Homage to the Square arrived at the Josef and Anni Albers Foundation from an Italian dealer. The initial assumption was that it was meant for a routine examination; a routine authentication; as no information to the contrary was provided (Fig. 25). The dealer was looking for the imprimatur of the Foundation, in order to complete his sale of the work. We were aware that our time was limited with this particular painting and that our examination could only be a visual one. There would have been no opportunity, nor permission given, had we desired it, for any invasive or prolonged analysis. This seemed a red flag in and of itself. But it was the systematic evaluation that really clinched it.

While the nature of the problem was not immediately clear, all present felt, without a doubt that it looked wrong. As a result, we proceeded with our examination, seeking specific ways to prove this, but hoping to find otherwise. Some of this is so basic, really. To us this was such an obvious case, but we needed the due diligence, as it was, of course, a delicate matter. And one must remember that, even though this “screamed” out at us as an obvious forgery, it was being passed as an original.

The board seemed plausible, but it felt a bit too lightweight. While we never actually went to a scale, or calculated the weight of original panels vs. this one, it was our collective intuition that it was light.

The signature on the front of the panel, the cross bar of the letter “A” didn’t continue across the letter (Fig. 26). This is characteristic of all of the signatures I’ve seen, even early on. Here it was broken, stopping in the middle of the letter. The location was also odd. It was placed too far from the lower right edge of the square. And the relative size of the initial A, to the date numbers was also problematic. The numbers were too small. This was convincing.

The verso of the painting was wrong. The handwriting was off (Fig. 27). The signature, when superimposed over verifiable signatures, not only didn’t match,
but had a strained, “studied”, almost stiff aspect to it, as though it was being
copied, maybe traced from another.

The list of paints in no way conformed to Albers’ methods (Fig. 28). It read:
“Study for ‘Homage to the Square’ Painting: paints used from center; Emerald
green (light)” If this were correct, it would read, Emerald green light… and in
parentheses, the manufacturer. (Note the materials list of an original) And then:
“light brown and emerald green”. This was a misunderstanding of what Albers
was doing. It implied that the center color was a mixture of the outer and center
color. While Albers looked for the “in-between” color on some of the Homages
as said earlier, he never mixed in order to arrive at it. All colors were painted directly onto the white ground. His
skill was in finding that color, through methodical experimentation with colors and paints. And finally, “light brown
Red ochre----”, no manufacturer listed (a generic, supposed color). The list was an amateurish attempt at imitation.
We surmised that it was a bad translation. It would have been better for the forger to leave it off entirely because, as
mentioned previously, there are many verified Homages with no materials list.

The ground didn’t seem problematic. It had the same qualities as Liquitex Gesso,
this, of course, being something that is readily available.

The format of the picture seemed correct, the first format outline: 3 squares,
large center. We measured to confirm: three squares, bottom 1/2 half the
dimension of the sides; sides, one-half, the dimension of the top (Fig. 29). While
this part of the execution was correct, it was the application of the paint that
looked entirely wrong. The colors were plausible, but they were painted in a
manner that didn’t ring true. It was almost too perfect, too machine-like. Albers
was incredibly facile with the palette knife. Nevertheless, his hand was always
“present”. In the later pictures, the paint is often thin, but always smoothly applied. While there is
little evidence of the artist, the trained eye can see the fluidity with which Albers applied his
paints. The forgery is simply too perfunctory, too horizontal and vertical; too studied; too labored
(Figs. 30, 31). The forger was trying too hard and simply did not have the skill. The white spaces,
the places where the paint was thin, exposing the ground, were too obvious. The directional motion
of the palette knife strokes was too mechanical.

After examination, the Foundation notified the dealer. The whereabouts of the painting is not
known. It was returned to the dealer with a report. Had it been possible to purchase it and thereby remove it from the
marketplace, this might have been desireable.

It is worth mentioning another method of forgery, though it cannot be illustrated here. It is a supposition, as a result of
confusion about another suspect picture. We were clear that something was amiss— the back was right, but the front
looked wrong. We had also seen paintings that looked perfect, but the written material on the back had been a weak
imitation of Albers’ hand. We postulated that the forger slices, transversally through the panel. He then uses a “correct”
front and a “correct” back to create two new paintings. This method not only renders the forger 2 for the price of 1, but
it, therefore, theoretically minimizes by half the chances of anyone questioning the work. While this method sounds
near impossible to execute, it is food for thought. It is also possible, of course, that someone may have simply added
writing to the back of a good Homage, believing that the information was necessary in order to prove its authenticity.

Albers methods are well known. Yet, I have received many queries through the years, from concerned collectors,
wondering why their picture lacks a materials list on the verso. While this was his habit, it doesn’t appear every time.
Even the standard “A” and the year, the signature, doesn’t always appear either.
I recently treated a picture for a dealer in New York. There was no question that the painting is right. Both front and back are above suspicion. However, there is an obviously a careless error of the artist, one that could, conceivably, confuse. The ground, listed by Albers is: 6 coats of Xylene (Permanent Pigments) (Fig. 32).

While Josef Albers was a painter that left a precise trail, he was human and he diverged from his proscribed path. His hand is definitely present and we can tell the difference. We can also expect deviations from the norm. While his methods are indeed straightforward and, largely, placed before us, there are times when this is not the case. As with any painter, and any painting, it is the incalculable subtleties that make a picture right or wrong. It is the sheer simplicity of an Homage to the Square that might lead a forger to believe that he could get away with passing one of these. It is the “Hey, I could do that!” kind of mentality with some contemporary art, that could convince a forger that he actually could.

ACKNOWLEDGEMENTS:
The author is grateful to the following individuals, whose help with the preparation of the presentation and/or paper were invaluable:

John ffrench, Associate Director of Visual Resources, Yale University Art Gallery
Elizabeth Godcher, Senior Administrative Assistant, Yale University Art Gallery
Burrus Harlow, Associate Director of Installations, Yale University Art Gallery
Stephen Kornhauser, Chief Conservator, Wadsworth Atheneum Museum of Art
Christopher Mir, Museum Technician, Yale University Art Gallery
Irma Passeri, Assistant Conservator, Yale University Art Gallery
Natalie Russo, Senior Photographer, Yale University Art Gallery

ENDNOTES
5 Ibid., p. 63.
6 Ibid.
7 Ibid., p. 64.
8 Ibid.
9 Ibid.
12 Ibid., p. 65.
13 Ibid.
14 Ibid., p. 66.
THANGKA PAINTING TECHNIQUES:
TRADITIONAL, CONTEMPORARY, AND “INSTANTLY OLD”
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ABSTRACT – Fakes, Forgeries and Fabrications are terms that are difficult to apply to artifacts of a living spiritual tradition. Himalayan Buddhist thangkas are complicated, composite objects that are changing in form with both the changes in the socio/economic/geographic situations in which they are used, and the media that contemporary artists utilize in their manufacture.

Traditional but new thangkas, can be purchased in the full composite object form, at a fair price. However, some thangkas are made as intentional fakes, with the deliberate purpose of deception and profit for the maker and seller.

It is important to document the changes in technique and style of “fake” thangkas as they have emerged onto the high-end art market in Western cities and the tourist market in Asia. I was shown a “fake” thangka in India in 1970 and since then have been tracking the evolution of thangka “fakes”. Jennifer Mass, Conservation Scientist at University of Delaware/Winterthur has assisted with scientific analyses.

This paper was presented in conjunction with a paper prepared for the Textile Specialty Group of the American Institute for Conservation. Entitled “Spiritual..But Fake”.

INTRODUCTION
Thangkas are complicated, composite, three-dimensional objects consisting of a picture panel which is painted or embroidered, a textile mounting, and one or more of the following: a silk cover, leather or metal corners, wooden dowels at the top and bottom of the mounting, metal or wooden decorative knobs on the bottom dowel, and ribbons and cords to hang the thangka and drape the cover.

This paper is presented in conjunction with a paper prepared for the Textile Specialty Group of the American Institute for Conservation. Entitled “Spiritual..But Fake”, the TSG paper discusses textile mountings of a traditional thangka, whereas this paper, written for the Paintings Study Group, emphasizes technical details of paintings. Fakes, Forgeries and Fabrications, was the subject of the AIC Annual Conference where these two papers were presented. These terms, however, are difficult to apply to a living spiritual tradition. Himalayan Buddhist thangkas are complicated, composite objects that are changing in form with both the changes in the socio/economic/geographic situations in which they are used and the media that contemporary artists utilize in their manufacture.

Paintings, removed from the complete and complex thangka form, are found on museum walls and in art dealers’ showrooms. These paintings, which were once part of a thangka, are labeled as Thangkas, when in fact they are fragments. Museum visitors may be misled that a thangka is a Himalayan painting in a western style mat and frame. The aesthetics of framed paintings in museum displays vary from Western style matting to an assemblage of only part of the textile mounting that is incorporated into the framing package, to creative matting concepts which hint at the thangka form.

1. Traditional thangka form.

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INSTANTLY OLD

Thangka picture panel owners often contact me about recently purchased paintings. People email jpg images of their newly acquired thangka treasures, and include a description of the circumstance of its purchase. Some of these thangka paintings, whether purchased on-line, or on-site in Asia, have been purposefully created to appear older than their actual physical age.

Techniques for producing thangka paintings that are deliberately created to deceive can be contrasted with those of new thangkas, traditionally painted by graduates of traditional apprenticeships and government-sponsored thangka painting schools.

It is often possible to determine where the fake thangka painting was made, by certain characteristics of the materials and techniques, combined with basic information about iconography and style.

NEW THANGKAS

Traditional but new thangkas, can be purchased in the full composite object form, at a fair price. Traditional crafts schools, teaching both thangka painting and textile arts, continue in Northern India, Bhutan and Nepal. I visit these schools, and whether state sponsored or sponsored by private foundations, the quality of instruction is usually excellent. The students are dedicated to learning their craft and are often taught by the national masters of their particular art form.

I routinely interview teachers and students in these schools to document what kind of pigments and binders are in use. In Bhutan, traditional earth colors are ground into pellets in preparation for use by painters.

In many painting schools, indicative of changing times, painters use what is available. For example from one painting school in Nepal that advertises traditional techniques, this was the reply to my email inquiry on painting materials:

“They use mineral pigments and acrylics. Mineral pigments for blue and yellow. All remaining colors are acrylic (tube colours). All natural colors are available in Bhutan, but the price is extraordinary (sic).” Thangka Center Director, private communication.

His painters, similar to others interviewed, use some dry pigments mixed in traditional glue medium, and some commercial acrylic paints. Many traditional pigments are still sold as dry colors, but either not available locally for the painters, or far too expensive. The acrylic paints they are using seem to vary in quality from fine arts quality to commercial mass-market acrylics, to children’s acrylic tube paint, said to be quite fugitive. According my sources, some painters use Camel brand paints.

2, 3. Zorig Chusum, the traditional arts and crafts school in Thimphu, Bhutan, creates easy-to-use pellets of finely ground traditional pigment. These pigment pellets are used in the school and available for sale to local artists.

4. Many contemporary thangka painters must use whatever is available paint in a traditional style.
INTENTIONAL FAKE

Some thangkas are made as intentional fakes, with the deliberate purpose of deception and profit for the maker and seller. For 36 years, I have documented the changes in technique and style of “fake” thangkas as they have emerged onto the high-end art market in Western cities and the tourist market in Asia.

When I was in Old Delhi with my father in 1970, he purchased a thangka of Tara for me, which was sold to him as 14th century. Skeptical, we brought it to Tibet House in Delhi, and were told that it was painted “yesterday, dirtied and smoked”.

Today, complete thangkas are created by workshops, “distressed” and smoked, then sold as valuable antiques, at high prices. The proportions of their figures and specific iconographic details may be non-traditional, as well as the painting technique. In the intentional fakes, colours are often mixed with grey and brown in order to immediately appear “old”. This contrasts with the earth pigments traditionally used that are strong and vibrant primary colours, often delicately shaded. With use over time, exposure to incense grit and butter lamp smoke may have darkened these colours. However, there is a different “look” to a traditional painting darkened through traditional usage, than the “look” of an intentional fake painted in gray/brown tones perhaps with layers of “dirt” applied.

I purchased this painting (Figure 7) in a Hong Kong market stall. The vendor assured me that is “15th century, very old”. The painting smelled strongly of fresh smoke, similar to the smell of BBQ’d meat. For a Conservator, sophisticated scientific analysis is not always necessary for a determination of the age of a thangka painting, especially if it was produced within the last 10 years but marketed as centuries old.

For research purposes, to document techniques of thangka faking, I sent the painting for analysis to Jennifer Mass, Conservation Scientist at University of Delaware/Winterthur. This is a summary of her preliminary findings that indicate a more recent date of manufacture than the 15th century.

• Mn shows up everywhere - I think this is a component of the ‘smoking’

• Blue - main elements = Ca, Ba, Mn, Cu, Zn = copper-based blue, phthalocyanine blue confirmed with Raman spectroscopy

• White = Ca, Ba, Mn, Zn = barium sulfate confirmed with Raman

• Red = Ca, Ba, Cr, Mn, Fe, Zn = red lake

• Green = Ca, Ba, Cr, Mn, Zn, Pb, Cu = chromium-based green and phthalocyanine green (confirmed with Raman)

Jennifer Mass
I asked a knowledgeable friend who was traveling to Nepal to purchase a “fake” for me, pretending that she thought it was old. She purchased this painting, which is a commonly found type of painting sold to tourists as “antique”:

Jennifer Mass analyzed this painting as well: “There are lots of things wrong with the palette, with the two most problematic being the use of titanium white and phthalocyanine blue.”

Intentionally inflicted damage is often located in areas of a fake thangka painting that are otherwise new and strong. Many of the support textiles used for thangka fakes are mill-woven, not hand-woven. Sometimes the bright white edges of the threads are visible where the support was trimmed sharply with a knife or scissors.

The intentionally inflicted damage usually does not follow actual patterns of damage that result from the rolling and unrolling, and other traditional methods of handling, that include storage in a trunk with other rolled up thangkas. Traditional handling damages thangka supports in vertical, horizontal or diagonal creases, folds and tears, and ground and paint layers with abrasions and scratches.

Traditional usage can cause uneven darkening from butter lamp smoke and incense grit; as well as accretions from when other offering substances are flicked towards the image during ceremonies. “Flyspecks” are a common featu
as well. The reverse of a thangka painting often reveals uneven areas of water damage, from a time when the thangka was hung against the damp wall of a stone/clay structure in its home culture.

One of the most disrespectful practices used these days in “faking” thangkas, is to “fake” the Empowerment seed syllables which are located on the back of the iconographic figures depicted on front. The purpose of an Empowerment ceremony is to awaken the specific qualities of the iconographic figures in the painting. Empowerment can take place in several ways, sometimes visible and sometimes not visible. Empowerment syllables, often “Om, Ah, Hum”, can be seen on the reverse, painted in locations relating to the head, throat and chest on the body of the main figure, or main and subsidiary figures both. Sometimes, Empowerment is known as “The Opening of the Eyes” ceremony, where a teacher or the artist paints in the pupils of the main figure. Empowerment is sometimes enacted by a teacher saying verses and perhaps offering rice, which would not be visible on the thangka.

Other visible Empowerments are extensive. For example, an Empowerment of one series of thangkas in the collection of the University of Pennsylvania Museum of Anthropology consists of elaborate stupa forms with accompanying verses to indicate steps of spiritual accomplishment along the Bodhisattva Path. Each thangka is this series has a different stupa form and corresponding verses of the text.
COPYING OF PAINTINGS

When a thangka painting is no longer considered serviceable, a copy may be commissioned to replace it, and the original painting may be retired to a respectful storage area in the shrine hall, or in an adjacent room. One informant mentioned that retired thangkas might be burned. Another informant described how he had placed sections of deteriorated thangkas inside statues to serve as a blessing.

SAVVY MARKETING

I am frequently contacted by collectors who purchased costly thangkas over the internet. One such thangka was labeled “a 14th century Avalokitesvara painted by monks deep in Tibet who are selling it out of the necessity to buy food for their monastery”. However, when I examined it, I found that the circumstance of manufacture, the date and iconography were all misrepresented. One tourist, when informed that her thangka, purchased at a monastery gift shop in Asia for thousands of dollars, was painted recently with incorrect iconography, replied that her thangka is sacred and she would pray to it anyway.

SUMMARY

In the thangka marketplace these days, it is often “Buyer Beware.” High financial value is given to thangka paintings, and therefore the production of thangka painting “fakes” is increasing. It is important to document the changes in technique and style of “fake” thangkas as they have emerged onto the high-end art market in Western cities and the tourist market in Asia.
MODERN INDUSTRIAL PIGMENTS IN AUTHENTICITY INVESTIGATIONS

James Martin, Principal, Orion Analytical, LLC

ABSTRACT — Authenticity investigations seek to establish whether cultural property is the work of a particular person, place, or period. Authenticity studies also might seek to establish whether cultural property is connected to a particular historical event or other claimed attributes, such as a fire or a burial site. Scholarly investigations of authenticity involve connoisseurship, provenance research, and materials analysis. Rigorous investigations of authenticity also demand objective, dispassionate consideration of all known, and possibly conflicting, information about the cultural property. Materials analysis is unique in its potential to verify that materials comprising cultural property are, in fact, consistent or inconsistent with a claimed attribute. The literature regarding the identification and history of modern industrial pigments is expansive. Modern industrial pigments are important in authenticity investigations, because they are insoluble in paint media and easy to differentiate from restoration, enjoy widespread use in a variety of media, are readily identified, and have well-documented histories that are useful in indirect dating.

1. AUTHENTICITY INVESTIGATIONS

Authenticity studies seek to establish whether cultural property is the work of a particular person, place, or period. Authenticity studies also might seek to establish whether cultural property is connected to a particular historical event or other claimed attributes, such as having been in a fire or part of a burial site.

1.1 SCHOLARLY INVESTIGATIONS

Scholarly investigations of authenticity involve connoisseurship, provenance research, and materials analysis. Connoisseurs look at the appearance, style, and iconography of the cultural property, and may offer an opinion on age, attribution, or authenticity based on visual similarities with works of a particular period, culture, or artist. Art historians research the completeness and validity of provenance (the documented history of the property), such as purchase and sales records, illustrations or descriptions in exhibition catalogues, the meaning of marks and inscriptions, and so on. Scientists examine the physical substance and chemical composition of the property to assess whether the materials used to create, alter, restore, and conserve the property are consistent with claimed attributes.

1.2 RIGOROUS INVESTIGATIONS

Rigorous investigations of authenticity also demand objective, dispassionate consideration of all known, and possibly conflicting, information about the cultural property. Things may not always be what they seem, and that certainly is true with cultural property. Insatiable demand and record prices at auction for fine art and artifacts have fueled new interest in optimistic attribution of cultural property, willful misattribution of property, and creation of deceptive forgeries, provenance, and laboratory reports. Law enforcement has exposed elaborate schemes to pass off copies of known works as originals, so even established works of art recorded in catalogues raisonné may need to be examined and carefully researched when they come to market or the insurance underwriter.

1.3 THREE-LEGGED STOOL MODEL

A three-legged stool bears weight only when each of its three legs is present and without defect. Similarly, attributions of age and authenticity bear scholarly weight only when connoisseurship, provenance, and materials analysis are consistent with those claimed attributes.

2. MATERIALS ANALYSIS

2.1 ROLE OF MATERIALS ANALYSIS

Materials analysis is unique in its potential to verify that materials comprising cultural property are, in fact, consistent or inconsistent with a claimed attribute. A strong similarity between known and unknown (or questioned)
property may support a claimed attribute, while identification of an anachronistic material or technique of manufacture may expose misattributed or fraudulent cultural property.

2.2 PROFESSIONAL STANDARDS

The American Institute for Conservation (AIC) Code of Ethics and Guidelines for Practice provides standards for practice concerning use of accepted scientific standards and research protocols, and use of sound evidence as a basis for declarations of age, origin or authenticity (AIC 2007). These guidelines are a good starting point for scientific investigations of authenticity. Additional standards of practice may be required if the investigation is part of a criminal or civil proceeding, where Federal and state rules of evidence determine what expert testimony is admissible in court. The methods scientists use to study cultural property are numerous and technically sophisticated, with strong parallels to methods used for trace analysis of forensic evidence: polarized light microscopy, scanning electron microscopy with x-ray spectrometry, x-ray diffraction, Fourier transform infrared spectroscopy, and instrumental chromatography with mass spectrometry.

2.3 ORIGINAL VS. ADDED MATERIAL

When analyzing cultural property, scientists must take great care to differentiate original materials from later additions or alteration – hence, the importance of visual inspection and careful sampling. In addition, scientists must always be mindful that artists and artisans – and forgers – sometimes recycle old materials or combine parts from different property to create new works. Such practices have occurred for many hundreds or thousands of years, and can be very difficult to sort out if one is not aware of historical materials and methods used to create, restore and conserve cultural property. For these reasons, investigations of age, attribution or authenticity should never stand or fall on a single test result, but, rather, on a broad-based systematic approach that includes connoisseurship, provenance, and materials analysis.

3. MODERN INDUSTRIAL PIGMENTS

Hundreds of industrial pigments have been discovered and produced since the late nineteenth century for use in plastics, paints, and other coatings. Many of these pigments are found in cultural property, through use of industrial paints and plastics, or use of artists’ paints that contain industrial pigments. De Keijzer (2002) observes, “At the dawn of the 21st century many artists, restorers and conservation scientists, though familiar with dyestuffs and pigments from the 19th century and earlier, are rather unaware of the detailed chronology of the development of modern pigments.”

Buxbaum and Pfaff (2004) define the word “pigment” as “a substance consisting of small particles that is practically insoluble in the applied medium and is used on account of its coloring, protective, or magnetic properties.” They state the most important areas of use of pigments are “paints, varnishes, plastics, artists’ colors, printing inks for paper and textiles, leather decoration, building materials (cement, renderings, concrete brick and tiles, mostly based on iron oxide and chromium oxide pigments), imitation leather, floor coverings, rubber, paper, cosmetics, ceramic glazes, and enamels.” Buxbaum and Pfaff (2004) also state that the “industrial synthesis of inorganic pigments is strictly controlled by qualitative and quantitative chemical analyses in modern, well-equipped physicochemical test laboratories.”

3.1 METAL OXIDE-COATED MICA INTERFERENCE PIGMENTS

3.1.1. Technology and Types

Metal oxide-coated mica interference pigments are a class of synthetic pearl luster pigments. Pearl luster pigments, like metal effect pigments, are composed of thin platelets that show “strong lustrous effects when oriented in parallel alignment” (Buxbaum and Pfaff 2004). Like natural pearls, the lustrous appearance of synthetic pearl luster pigments occurs from alternating transparent layers with differing refractive indices. Interference effects “develop when the distances of the various layers or the thicknesses of the platelets have the right values” (Ibid.). Metal oxide-coated mica interference pigments are made by coating mica platelets with ultra-thin layers of metal oxides, such as titanium dioxide and iron oxide. The thickness of the mica and metal oxide coatings determine the interference color displayed.
According to Buxbaum and Pfaff, pearl luster pigments can be divided into two sub-groups: pearl luster pigments formed without a substrate, and pigments formed by coating a substrate. Substrate-free pearl luster pigments include natural pearl essence, basic lead carbonate, bismuth oxychloride, micaceous iron oxide, and titanium dioxide flakes. Pearl luster pigments formed by coating a substrate include metal oxide-coated mica, silica flake pigments, alumina flake pigments, borosilicate-based pigments, and coated metal flakes. According to Buxbaum and Pfaff, metal oxide-coated mica interference pigments are the dominant industrial pearl luster pigment.

3.1.2 Principal Applications

Manufacturers use metal oxide coated-mica interference pigments in a wide array of commercial products, ranging from automotive finishes, to pearl luster plastics, to artists’ paints (e.g., Golden Artist Colors, New Berlin, NY). Further, metal oxide-coated mica interference pigments are available as raw materials for use by artists, conservators, and hobbyists (e.g., Sepp Leaf Products, New York, NY).

3.2 DIKETOPYRROLOPYRROLE (DPP) PIGMENTS

3.2.1 Technology and Types

DPP pigments are a family of heterocyclic pigments, based on a symmetric chromophore, the 1,4-diketopyrrolo(3,4c)pyrrole system. According to Herbst and Hunger (2004), DPP pigments display hues ranging from reddish yellow to bluish violet, depending on the selected chemical substituent (CH$_{v}$, CF$_{v}$, Cl, Br, N(CH$_{3}$)$_{2}$). DPP pigments show excellent lightfastness and weatherfastness, and good to very good solvent fastness. Further, the particle size of a DPP pigment determines whether the pigment is transparent or opaque.

According to Peters and Freeman (1995), the discovery and introduction of DPP pigments to the marketplace “is believed by many to be the most significant development in the area of organic pigments since the introduction of quinacridones over 30 years ago.” Zollinger (2003) explains,

“the discovery of DPP pigments at Ciba-Geigy was the result of an “open-minded” literature study. While scrutinizing a compilation of interesting new chemical transformations presented in a book titled *Further Challenging Problems in Organic Reaction Mechanisms*, the attention was brought to a 1974-publication of *Farnum et al.* in which the attempted synthesis of 4-phenylazet-2(1H)-one from benzonitrile and 2-bromoacetates had been described (Scheme 8.50). The reaction had actually “failed”, but the authors had isolated, together with other products, small amounts of a brilliant red, high-melting point powder corresponding to 137b. Iqbal and Cassar then decided to repeat the synthesis and found that this compound, indeed, possesses all the properties of an excellent new pigment.”

De Kiejzer (1999) lists four available DPP pigments: Pigment Reds 254, 255, and 264, and Pigment Orange 73. Herbst and Hunger (2004) list eight commercially available DPP pigments, plus solid solutions of DPP and quinacridone pigments, which produce opaque shades of bluish red. These eight pigments include Pigment Oranges 71, 73, and 81, and Pigment Reds 254, 255, 264, 270, and 272. Of these, Pigment 254 is the dominant industrial DPP pigment. For example, according to Ciba-Geigy, Pigment Red 254 was used on “all solid-red Ferraris from 2000 to 2002, and on all solid-red Alfa Romeos, BMWs, Corvettes, Volkswagen GTI models and the Lexus Soarer from 2000 to 2006” (Litt 2007).

3.2.2 Principal Applications

Manufacturers use DPP pigments primarily in high performance applications, such as automotive and other industrial paints, plastics processed at high temperatures, and printing inks, where excellent light- and weatherfastness and good to very good solvent fastness is desired (Herbst and Hunger 2004).

4. THE IMPORTANCE OF MODERN INDUSTRIAL PIGMENTS IN AUTHENTICITY INVESTIGATIONS

Modern industrial pigments may be encountered in a broad spectrum of cultural property, from paintings, to polychrome sculpture and furniture, to building materials and ceramic glazes, to paper, rubber, plastics, and so on.
Because pigments are insoluble colored particles, scientists are able to discriminate between original material and infiltration or contamination by pigments arising from alterations, restoration, or conservation treatments. Strict control over the production of specific products may provide for identification of specific pigment products within a family of modern industrial pigments. Industrial pigments are well documented as to their chemical and physical properties, which are necessary for identification. Their documented history pertaining to research and development, patents, production, and marketing is important for indirect dating of materials found to contain the pigments, and assessing the accuracy or truthfulness of claimed attributes. Consequently, modern industrial pigments are potentially important materials in investigations of age, attribution, and authenticity.

4.1 IDENTIFICATION

The literature regarding identification of pigments and dyes is expansive. Vesce (1942) published methods for identification of organic dyes and pigments, recrystallized from solution in sulfuric acid or organic solvents. Chamot and Mason (1940) published an analytical scheme for organic compounds and inorganic ions based on microchemical tests. Feigl describes spot tests in organic analysis (1966) and inorganic analysis (1972).


4.2 DOCUMENTED HISTORIES

The documented history of pigments, and, in particular, modern industrial pigments, also is expansive. According to Pratt (1947), Prussian blue is the first pigment “about which there is a fairly definite knowledge and written contemporary record” of the circumstances surrounding its discovery in 1704. “From then on,” Pratt writes, “equally definite knowledge of the date of discovery of new pigments is available from published records in scientific journals.” While information for some pigments is lacking or incomplete, or scattered across different publications and databases, many pigments found in cultural property are described in conservation literature. Examples of such literature include Technical Studies in the Field of the Fine Arts, Studies in Conservation, Journal of the AIC, the Artists' Pigments series, and in on-line databases such as the Conservation and Materials Encyclopedia Online (http://cameo.mfa.org/).

Publications ranging from Mattiello (1941-1945) and Pratt (1947), to Gettens and Stout (1966), to Buxbaum and Pfaff (2004) and Herbst and Hunger (2004) discuss pigments of commercial, artistic, and industrial importance. De Keijzer (1999) authored a series of papers on a “systematic and comprehensive analysis” of the “availability and use of modern synthetic pigments in the field of artists’ materials.” De Keijzer (1999) consulted “manufacturers and suppliers of artists’ materials concerning the types of paint in which a certain pigment was first used, and the date it was introduced.”

4.2.1 Patent Dates

Patents follow discoveries, and are key documents used to trace the history of modern industrial pigments. Biesterfeld (1941), Vaughn (1956), and Elias (1996) discuss patents, and patent law in force during much of the 20th century. (The authors appear to agree on the aspects of patents and patent law discussed in this section.) According to Elias (1996), “patents allow the creator of certain kinds of inventions that contain new ideas to keep others from making commercial use of those ideas without the creator’s permission.”

Inventors may assign patents, and their corresponding rights, to other persons or entities—often their employer or an outside development or manufacturing company. Elias explains, “Most inventors do not themselves develop the invention covered by a patent. Rather, they make arrangements with an existing company to do this for them.
Typically, the arrangement takes the form of a license (contract) under which the developer is authorized to commercially exploit the invention in exchange for paying the patent owner royalties for each invention sold.

Patents record a wealth of information concerning the invention or idea: a unique patent number, the patent date, a brief description of the patent, the name and location of the inventor, the name and location of any assignee, drawings (if relevant), the date the patent application was filed, and claims that describe the structure of the invention or idea. Patent applications are treated as confidential while they are pending, which may take as long as three or four years. The filing date corresponds to the day the patent application is sent, and "closes the one-year period during which an inventor can publicly use, work, describe, or place an invention on sale in the U.S. without the anticipation rule being applied to bar a patent on it" (Elias).

Patent applications must refer to and attach copies of known “prior art,” which Elias describes as "any printed publication, prior patent or other document that contains a discussion or description relevant to an invention for which a patent is currently sought or enforced.” Prior art references are a means to trace earlier, related inventions and ideas.

Patents issued in the United States may be searched online at the United States Patent and Trademark Office (www.uspto.gov). Google Patent Search (www.google.com/patents) covers the entire collection of patents made available by the USPTO — from patents issued in the 1790s through those filed in the middle of 2007. Europe’s network of patent databases, Esp@cenet (www.espacenet.com/index.en.htm), is a free patent search service developed by the European Patent Office (EPO) that provides access to over 20 European patent offices, the EPO and the World Intellectual Property Office.

4.2.2 Commercial Introduction Dates

Personal communications with manufacturers and printed materials announcing, promoting, or otherwise describing commercial modern industrial pigments are another source of information about the history of specific pigments. The Colour Index (www.colour-index.org), which was first published in 1925, is an authoritative international reference work on the nomenclature, constitution, main applications and suppliers of colorants.

Patents precede commercial introduction of modern industrial pigments. However, the first date of commercial introduction by a manufacturer is not necessarily the earliest date of commercial availability to users, such as paint manufacturers. For example, Suzuki (1999) reports that the first use of Pigment Red 254 in an original U.S. automobile finish apparently occurred for the model year 1989. Consequently, Suzuki reports that identification of Pigment Red 254 in an "unknown original finish" thus provides strong evidence that a relatively recent vehicle, most likely from the 1990s, was the source of the paint.” However, Suzuki is careful to add that the introduction dates cited for pigments in his article represent the "commercial launch dates, but the products were provided to select customers prior to the introduction dates for evaluation,” a practice Herbst and Hunger (2004) describe:

“The introduction of newly developed, especially high-performance pigments, may take a considerable period of time. Owing to the outdoors weathering tests required, the extensive and comprehensive testing procedures of very lightfast and weatherfast pigments for automotive finishes or certain plastics applications may last two years or longer. Because of the dependence of lightfastness and weatherfastness on the entire application media, corresponding comprehensive testing procedures have to be performed by the pigment manufacturer, i.e., the paint company or plastics processor. For this reason, high-performance pigments may often take several years to reach the market.”

5. THE IMPORTANCE OF METAL OXIDE-COATED MICA INTERFERENCE PIGMENTS AND DIKETOPYRROLOPYRROLE PIGMENTS IN AUTHENTICITY INVESTIGATIONS

5.1 METAL OXIDE-COATED MICA INTERFERENCE PIGMENTS

Howard R. Linton (1963) described his invention of the first metal oxide-coated mica interference pigment (titanium dioxide-coated mica) in a patent filed in 1961 and assigned in 1963 to E.I. du Pont de Nemours and Company. Two
companies licensed the right to develop and commercially exploit Linton’s invention: Merck (Germany) and The Mearl Corp. (U.S.A). Independent research by both companies led to processes that coat mica with the rutile crystal form of titanium dioxide, which formed a superior pigment, for which patents were assigned to The Mearl Corp. in 1977 and Merck in 1978 (DeLuca, Miller and Waitkins 1977; Esselborn and Bernhard 1978). Further developments resulted in iron oxide coated-mica interference pigments patented by The Mearl Corp. in 1977 and 1979 (Armanini and Johnson 1977; Armanini and Bagala 1979). Additional innovations followed. Of the more than one hundred patents awarded between 1977 and 2007 that refer to Linton’s 1963 patent as prior art, thirty-four were assigned to Merck and twenty-two were assigned to The Mearl Corp. and Engelhard, which acquired The Mearl Corp. in 1996 (BASF acquired Engelhard in 2006).

The earliest literature reference found by the author for titanium dioxide coated-mica interference pigments in cultural property pertains to research by the Canadian Conservation Institute, whose scientists identified titanium dioxide-coated mica pigment in an acrylic terpolymer binder in works painted in the 1980s by Jean Paul Riopelle (Canadian painter, 1923-2002) (Corbeil, Helwig, and Poulin 2005).

5.2 DIKETOPYRROLOPYRROLE PIGMENTS

The author’s review of literature pertaining to DPP pigments found universal credit given to Professor Donald Farnum and colleagues at Michigan State University for the inadvertent discovery of the DPP chromophore in 1974. According to Professor Farnum (2007), the small amount of DPP produced in the failed experiment was kept in the lab, and would not have been sufficient to incorporate into paints.


6. DISCUSSION

Authenticity investigations seek to establish whether cultural property is consistent with some claimed attribute. Scholarly investigations of authenticity involve connoisseurship, provenance research, and materials analysis. Rigorous investigations of authenticity also demand objective, dispassionate consideration of all known, and possibly conflicting, information about the cultural property. Attributions of age and authenticity bear scholarly weight only when connoisseurship, provenance, and materials analysis are consistent with claimed attributes, such as age, attribution, or authenticity.

The literature regarding the identification and history of modern industrial pigments is expansive. Modern industrial pigments are important in authenticity investigations, because they are insoluble in paint media and easy to differentiate from restoration, enjoy widespread use in a variety of media, are readily identified, and have well-documented histories that are useful in indirect dating.

Awareness of the use of modern industrial pigments in cultural property – and their importance in authenticity investigations – will increase as more cultural property produced in the 20th and 21st centuries becomes the focus of rigorous scientific investigation.
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A NEW DIGITAL X-RAY SYSTEM DESIGNED FOR ART OBJECT ANALYSIS

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ABSTRACT—X-rays have already been applied to the examination of art objects soon after their discovery in 1895 by Wilhelm Conrad Röntgen. Ever since, the method has only slightly advanced technologically as it always required the use of some kind of film to detect, record and display an image. At the same time, the use of film inherently poses several limitations and is quite time consuming as well as labor intensive. Film based x-radiography requires testing for appropriate parameters, film positioning, use of multiple film sheets for larger objects as well as film processing with toxic chemicals. Furthermore, most films in the modern museum world are subsequently scanned and saved in digital format for documentation purposes. In the case of multiple images, the digitization process also requires the “stitching together” of the individual film scans leading to further difficulties and possible loss of information and/or image alterations. An alternative to the troublesome film based process can be found in digital x-radiography.

While the medical and materials science fields are already migrating towards digital technology this does not yet seem to be the case in the art conservation and museum world although digital x-radiography could very well substitute or at least complement conventional film technology as it offers numerous major advantages. For that reason, when faced with the task to identify the most appropriate and versatile x-ray technology for the Conservation Department at the New University of Lisbon, the decision, especially in the context of a research and teaching environment, was clearly that going digital would be the best choice. That on the other hand meant identifying the most appropriate digital technology and off-the-shelf system to meet all or most of the following requirements:

• A complete system comprising: x-ray source, digital detector as well as computer hardware and software, preferentially without the need for post-purchase modifications and adaptations.
• Versatile for a great variety of objects and materials to be encountered in the conservation department with individual sections for paintings, polychrome sculpture, textiles and metal conservation, with other specialties still to be added.
• Ease of use and rugged design as x-radiography is to be considered a standard examination method within the research, teaching and student environment.
• Safety
• High resolution, high dynamic range, i.e. excellent image quality.
• Large detector area so that image stitching is not necessary for small to mid size objects.
• Minimum object handling and manipulation requirements during use.
• Reasonably economic in terms of cost benefit.
• Possibly portable or at least transportable.

While searching for a ready-to-use digital system to meet the above requirements it became clear that there was no such system on the market. Possible medical, materials science or non-destructive testing systems would at the most fulfill three or four of the criteria, always lacking others that were still considered fundamental. As a consequence, a cost effective, high performance digital detector technology was identified and a system has been developed tailored to the needs of art object examination as a collaborative effort between the University and a German company that offered the desired detector technology. The development has passed the design and prototype stage and lead to a final product which has been successfully installed in the conservation department in the University of Lisbon. The equipment has literally been in daily use since its first installation (end of 2005) and to date, hundreds of objects have been radiographed. The system has proven to produce equal or superior image quality while offering several major advantages when compared to traditional film based technology.

Among the many art objects that entered the University’s painting conservation studio some have been detected as fakes. Among these, an Italian Renaissance frame (previously considered original and accepted for auction at one of the world's leading auction houses), and a supposed 15th/16th century triptych. These case studies will be presented along with all the technical features of this novel piece of equipment.

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Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
AUTHENTICITY AND THE SCIENTIFIC METHOD.
PAST APPROACHES, PRESENT PROBLEMS AND FUTURE PROMISE

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The use of scientific techniques to unmask forgeries and fakes of paintings is much vaunted and has a high public profile. Since the earliest applications of X-radiography and pigment analysis in such renowned cases as the Wacker Van Gogh forgeries of the 1930s and the Van Meegeren Vermeers, science has seemingly held a key role in the popular imagination, the expert in analysis unmasking the master faker. There is though by now a degree of maturity to the field, with significant demands for such analysis ranging from due diligence questions during acquisition in the public and private sectors, through resolution of legal disputes, to ‘aspirational’ owners seeking to validate their discoveries. Never the less there is no generally accepted methodological approach or universally agreed set of benchmarks for carrying out such studies, with the lack of such agreed parameters potentially threatening to undermine what we do. This paper explores some of the key background history, the currently prevalent methodology, some associated problems and possible solutions presented by the use of science in authenticity studies of paintings.

1. INTRODUCTION

In June 1927 the Burlington Magazine published a letter from A.P. Laurie. The critical focus of this letter was a review by Roger Fry of an exhibition that had appeared in a previous edition. Laurie was exercised by Fry’s apparently straying into what he clearly felt was his own territory:

“Mr Fry having abandoned his claims as an art critic and based the question of authenticity on the examination of the surface of the picture, is it evident that the right person to consult is the chemist?”

(Laurie 1927)

Fry’s response goes unrecorded, but the Editor of the Burlington Magazine none-the-less added his own comment:

“Does not one’s past experience of the scientist’s decisions force us to accept [this] with some degree of hesitation…the question which many of our readers will be inclined to ask is, ‘How reliable are the tests on which Professor Laurie is prepared to rely?’” (Tatlock 1927)

While we might initially read this as yet another, minor, example of the interminable ‘Two Cultures’ debate of CP Snow, in fact closer examination reveals a much richer context. This exchange, and the events surrounding it, is symptomatic of the emergence of a ‘scientific’ approach to questions of authenticity. If we were to look for origins of such scientific rationalisation, then the 1920s were the point at which methods and approaches coalesced into a coherent discipline.

Arthur Pilans Laurie (1861-1949) remains well known within this community for his book The Painter’s Methods and Materials, still in print some 80-odd years since it first appeared just before Laurie was writing so acerbically to the Burlington. Laurie was a chemist and principal of Heriot-Watt College in Edinburgh who had reputedly been encouraged into the analysis of paintings by the artist William Holman Hunt (1827-1910). Laurie attended the University of Edinburgh, then King’s College, Cambridge, from where he graduated with first class honours in the science tripos of 1884. Laurie’s subsequent career saw him split his time between academic work in chemistry, roles in government committees and book writing. His academic work included a lecturer’s position in chemistry and physics at the St Mary’s Hospital Medical School in London, the chair in chemistry at the Royal Academy of Arts and, latterly, an advisory post at the Courtauld Institute of Art. The crowning achievement of his career was probably his appointment as principal of Heriot-Watt College, Edinburgh, in 1900 though, of course, his most enduring legacy must be his studies of the materials and techniques of art (Who’s Who 1938 1937; Forbes 1949-1950; NAHTSE).

Roger Fry (1866-1934) is perhaps best known today for his invention of the term ‘Post-Impressionism’, a somewhat salacious private life and (maybe) his own painting, but he was also a noted art historian and critic of his time, firstly of

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the Italian Renaissance, later of contemporary movements in French art. What makes Fry an especially interesting figure
in our present context however is that his first grounding was as a scientist – he read Natural Sciences, like Laurie at
King’s College, University of Cambridge. He was drawn though to art during his undergraduate years, turning to this as
his principle field of study immediately after (Woolf 1940; Spalding 1980; Bruneau). Such early training must none-the-
less have remained with Fry throughout his life because we find him commenting not long before his death that:

“If ever there was a study... needing as it does the co-operation of so many sciences... it is surely that
of Art-history, and I would make the claim that the benefits it would confer would be at least equal
to those it would receive. [...] We have such a crying need for systematic study in which scientific
methods will be followed wherever possible.” (Fry 1939, 3)

In fact a notable feature of Fry’s way of looking at art was his focus on the object and things internal to it, as
opposed, say, to those strands in art history in the late nineteenth century where documentary sources were
paramount. It is not surprising to find for example Fry taking Giovanni Morelli’s archly analytical study of Italian
painters with him on an early trip to Italy (Spalding 1980, 49; Morelli 1893; Sorensen). Fry had also studied ‘Old
Master’ techniques, using them in his paintings and advising others on their application. He was even known to
dabble as a restorer, notably while he was on the staff of the Metropolitan Museum in New York and later, on the
much-damaged Mantegna *Triumphs of Caesar* at Hampton Court Palace in England.

That Laurie was taking Fry to task for straying from art to science might consequently start to look a little peculiar,
with an almost dogmatic insistence on separation of the art historian from the scientist. In fact Laurie and Fry had
had contact beforehand, both sitting as panel members of a ‘committee of experts’ in one of the most celebrated
cases of authenticity of the time, that of the so-called Hahn *Belle Ferronière*.

The Hahn *Belle Ferronière* is a version of the work by Leonardo da Vinci in the Louvre and we can summarise the
case as follows: Harry Hahn, an American, apparently acquired the painting in France. However, in 1920, just as
Hahn was about to sell the painting to the Kansas City Art Institute, the renowned London dealer Sir Joseph Duveen
denounced the Hahn *Belle Ferronière* as a fake. Hahn promptly sued Duveen for 0.5M$. Duveen, in a counter-
move, used all his influence to set up a confrontation between the two paintings, establishing a panel of 10 experts
to pronounce judgement. The panel, selected by Duveen, included the renowned art historian Bernard Berenson,
various leading museum directors, Roger Fry and, as a late and self-offered addition, A.P. Laurie. On viewing the
Hahn and Louvre versions together these experts largely dismissed the Hahn version. None-the-less, during the
following six years Hahn’s lawyers systematically undermined the expert testimony in the trial, such that by 1929
Duveen felt it necessary to settle out of court with Hahn.

As John Brewer has recently written of this case:

“Harry Hahn contrasted ‘the air-spun conjectures, subjective guessings, sixth-sense flairs, and, in
certain instances, downright dishonesty produced by members of the Duveen clan’ with ‘reliable
historical documentation’ founded on the ‘objective and scientific nature of accurate historical
research.’ [...] The case of Hahn versus Duveen not only raised questions about the authenticity of
a particular (and potentially extraordinarily valuable) picture, it raised, in stark terms, the question
of whether the 20th-century art world was to be governed by the aesthetic opinions of a self-
anointed elite of connoisseurs, or by the rigorous strictures of modern science. Duveen set out to
vindicate not only his condemnation of the Hahn picture, but the entire system of attribution and
connoisseurship on which his hugely profitable business depended.” (Brewer 2005)

This background makes Laurie’s attack on Fry’s methodology all the more remarkable. Clearly they had both been
present during discussions on the *Belle Ferronière* case four years earlier and, moreover, the trial was ongoing,
dragging through the American courts. That Laurie would choose this particular moment (1927) to launch a public
attack on Fry, in a journal the latter had founded, is consequently at first sight surprising. In fact Laurie’s muscle
flexing should instead be seen as more of a reflection of the strength of analysis of paintings at that time – Laurie
would probably have felt that at no point previously was there such a promising set of scientific tools and methods
with which to tackle questions of attribution and authenticity. If we look at the range of techniques developed by and
through the 1920s, it forms a template for much practice since.
2. THE DISCIPLINARY MATRIX

It is always an instructive exercise in any field to reflect upon the features that define it. Who is in the community? What are our common practices? How do we describe our field to others? A helpful framework in these circumstances is what is known as a ‘disciplinary matrix’, largely popularised through the philosopher of science Thomas S. Kuhn (Kuhn 1970). This is the set of features – the theories, assumptions, methods and case studies – that we would all largely agree upon as constituting the basic knowledge of the field. To understand what Laurie must have perceived as occurring we must examine what features we (actually or instinctively) recognize as being present in the field.

Although we are focusing on the 1920s we should not lose sight of the fact that the use of scientific techniques to analyse paintings was, even then, by no means new. Nadolny, for example, has traced the use of simple methods of investigation on historical paintings as far back as the late eighteenth century, with relatively sophisticated studies certainly being employed by the early nineteenth century (Nadolny 2003). Important figures such as Mrs. Merrifield and Charles Lock Eastlake researching historical materials and techniques in the mid-nineteenth century, and A.H. Church, the chemist, writer on artists’ materials and first professor of chemistry at the Royal Academy in London (thus standing as a direct precursor to Laurie) laid foundations in critical areas for the subsequent development of this field during the later nineteenth and early twentieth centuries. Use of X-rays for the examination of paintings occurred not long after the discovery of the X-rays themselves – in fact in 1896, less than a year after Roentgen announced his findings (Bridgeman 1964) – while all the basic elements of the approaches practiced today were certainly in place by the 1930s. A group of names stands out from this latter period (including but certainly not limited to) such luminaries of the field as A.M. de Wild in Holland, Kurt Wehlin in Germany and, of course, A.P. Laurie in Britain. Edward Forbes, renowned himself in the annals of this field as well as for his pigment collection, writing Laurie’s obituary in 1949, explicitly credited him with being a pioneer of “... research into the methods and material (sic) of the old masters by chemical study as well as the use of the X-ray, ultra violet and infra red rays, microscopic examination, micro photographs, and the perusal of the early documents which bore on these studies” (Forbes 1949-1950). While Laurie did not establish this field single-handedly, Forbes’ summary nonetheless serves as a useful reference point for the essential methodological toolkit for the scientist investigating art. It can be summarized as follows:

- General examination by imaging techniques such as X-radiography, infrared imaging and UV fluorescence.
- Detailed surface observations of the painting using low-power microscopy.
- Analysis of the constituent materials by chemical testing.
- Examination of ‘technique’ – the way in which these materials were used as well as aspects such as what may be loosely termed ‘brushwork’.
- Comparative study of historical documents for information on materials stated to have been used by artists in the past.

It could plausibly be argued at this point that all modern scientific analysis of paintings derives from this basic pattern and, while more advanced analytical instruments such as the electron microscope and the gas chromatograph have been developed, in essence the same common threads of method are still being followed.

At the same time we should also be aware that this toolkit encompasses more than just the physical processes required – the sampling and direct analysis of samples – it also encapsulates a philosophical approach (which we will discuss shortly) as well as a rôle, for example, for historical studies and comparative analysis. It also contains a specific conception of what science ‘is’ in this context: that of the analytical chemist, this being quite distinct from, say, the process of the art historian.

To complete our disciplinary matrix of scientific methods for authenticity we need to add two other components, the so-called ‘paradigm’ cases the field cites, and a philosophy of science argument that allows us to ‘test’ for authenticity.

Kuhn’s narrower meaning of paradigm – case studies presented as exemplars – allows us to highlight that, repeatedly, certain cases come up when people discuss science and authenticity, features that we want to emphasise as discipline markers. Apart from the Belle Ferronière, we might therefore cite the Otto Wacker Van Gogh case and, of course, Van Meegeren and his forged Vermeers and de Hoochs.
The elements of the Wacker case can be briefly outlined. Otto Wacker, a dancer, took up dealing in art in 1925 and quickly developed a ‘sound’ reputation with Van Gogh experts. Such was his renown the 1928 De la Faille Catalogue Raisonné of Van Gogh listed some 33 paintings from Wacker. However four of these were subsequently included in an exhibition where they were recognised as fakes, thereby casting doubt on the entire group. Legal proceedings were instituted against Wacker in December 1928 and, when it came to trial in 1932, there was expert testimony from two technical specialists. These were A.M. de Wild and Kurt Wehlte, both names still remembered. de Wild reported the presence of ‘resin’ in the paint which was ‘not used by Van Gogh’, while Wehlte presented comparison X-rays to show differences between real and fake Van Goghs.

Second, the notorious Van Meegeren case has of course been discussed extensively before, but we may again summarise (Coremans 1949; Dutton). During the 1930s the art historian Bredius authenticated the painting known as the Supper at Emmaus. However, in the late 1940s, to avoid the more serious charge of wartime collaboration, Van Meegeren confessed to having created this and other paintings. Analysis by Paul Coremans at this time showed anomalous features were present, such as that the natural ultramarine Van Meegeren had used was actually contaminated with cobalt blue, a pigment unavailable to Vermeer and his contemporaries, while cracks sometimes did not pass through upper paint layers.

As stated earlier, such paradigm cases are important as exemplars used by a field to define its scope, practices and theoretical framework. Each of these cases therefore illustrates the role of science in the authentication process and they are commonly cited for just such purposes. However, importantly, the contemporary field view of them is not necessarily exactly what happened and there is commonly simplification, selectivity and inaccuracy in the retelling. For example, in the Van Meegeren case it was not until the period 1967-1973 that researchers such as Keisch used lead 210 decay and isotope analysis to show that the lead white was modern (Keisch 1968) and Breek and Froentjes identified the paint medium as a phenol formaldehyde resin (Breek and Froentjes 1975). For the purposes of promoting the field, its contribution is also ‘played up’ – while scientists participated in these particular cases, it is not so clear that their testimony necessarily brought about the specific legal conclusion. (With Van Meegeren it was instead probably his confession and recreation of a painting for the court.)

Our other component of the disciplinary matrix was a specific ‘authenticity’ test, a criterion for deciding when something is or is not genuine. When a philosophical basis for the methodology of ‘analytical authenticity’ is explicitly mentioned, it is invariably that of falsification, a concept adapted from the philosopher Sir Karl Popper that has become embedded in day-to-day consciousness, especially amongst the ‘hard’ scientific community to whom it was addressed (Popper 1934). Briefly expressed we may state Popper’s position as being that no number of positive outcomes at the level of experimental testing can confirm a scientific theory, but that a single genuine counter-instance is logically decisive in rejecting it. Re-phrasing, if we have a theory about something – the existence of the atom, planetary motion – then however many times we check it against some observation and get a ‘positive’ result, we are only not disproving it; on the other hand any contradictory result should cause us to abandon our theory. Crucial to Popper’s method, any truly scientific theory is required to make testable claims, otherwise (according to Popper) the theory is ‘non-scientific.’

Translating this into our present context, then according to the Popperian conception of analytical authenticity scientists take a hypothesis, in this case the claim that a painting P is by a specific artist X. This claim is then tested by taking samples and analysing them, declaring if there is any counter-evidence, such as anachronisms or features alien to artist X, that the hypothesis that the painting is by X, is false. Thus we have a very clear statement of methodology.

In this way we have a set of protocols that allow us to use scientific methods to determine authenticity. Analytical tools such as X-rays and pigment analysis are combined with knowledge of what is and is not appropriate to find historically through an unambiguous test with sound philosophical foundations.

3. PROBLEMS...

The disciplinary matrix just outlined provides a clearly established methodological approach to questions of scientific authenticity. Since the time of A.P. Laurie and others in the 1920s and 30s, successive generations have seemingly built on this, giving us an ever deepening knowledge of artists and their materials as well as new analytical solutions...
to problems of identification (such as non-invasive methods, advanced organic analysis and new imaging techniques) that mean that we can go further and deeper than ever before. There are well-demarcated spheres of expertise – art historian, conservator and scientist – working together symbiotically to solve problems. There is also an increasing awareness and use, in both institutional and commercial arenas, of the contributions of scientific analysis.

Or is this really a true picture of the discipline? A counter-view might run:

In fact there has been little critical examination of the procedures for decades. The apparent stability of methods applied actually hides a lack of rigorous assessment of the protocols used or whether they truly tell us what we want to know. Accurate and reproducible results are held back by a lack of knowledge, access to equipment and reliable sources of reference data. Interdisciplinarity is often a fiction, with ultimate judgement deferred to non-scientific dogmas, a process that technical specialists connive with. Nor has there been any serious research into either how the overall and detailed process functions or how we can really do it better.

The truth probably lies somewhere in between, but if we want to properly disentangle the state of the discipline, then we need to examine such questions as:

- How well defined and reliable actually is our methodology?
- What are the questions really being asked?
- Who is defining these questions and what impact does this have on the processes we use and the conclusions we reach?
- What are the unstated assumptions we use and what impact do these have?
- Are we working within a system that fails to let us answer legitimate questions?
- Are there unstated methodologies that we use without justification?
- What is the effect of pragmatic constraints, such as time, money and confidentiality?
- What is the nature of any interdisciplinary process?

In partial answer we should perhaps first make some clarification of what is done when practising ‘scientific authenticity’. For example, we generally grasp that there is a distinction between the process of determining authenticity and that of making an attribution. The application of science to the determination of authenticity is widely practised and generally accepted as a legitimate and useful process. It involves the application of analytical methods to uncover contradictory evidence for what something is believed to be. Attribution on the other hand is both pro-active and controversial. It involves taking a painting without prior assumptions and, through analytical means, determining authorship. Few scientists currently make such claims, and those who do tend to be those using mathematical analyses of images rather than chemical analyses of materials, these being identifiable and separate sub-disciplines.

To authenticity and attribution studies a third process should in practice be added: the determination of date. While clearly connected to issues of authenticity and attribution it can nonetheless be a process carried out quite independently of any specific authorial question. Through use of direct dating techniques like radiocarbon or dendrochronology, or by applying a detailed knowledge of changing patterns of use of materials, it is possible to give estimates of when something was created. Such evidence can therefore be used to underpin a more specific belief, such as that of authorship. Moreover the creation of a date specific test that can be used for our falsification process – explicitly that of anachronism – has been much easier than, say, finding a material or technique always or never used by an artist. An assessment of date is thus the most oft-stated approach to scientific authenticity.

At the expense of discussing some of the broad issues mentioned above (and some that were not) we will instead take Popperian falsification as an exemplar of the problems that exist. Falsification theory has a number of well-recognized problems, such as the so-called underdetermination problem and the Quine-Duhem problem. There is also a failing specific to the application of analysis to falsification of art works, which will be called here the ‘hypothesis test’ problem. From this we shall see that it is possible to critically examine what we do, identify specific difficulties that we may or may not be aware of, and find solutions where necessary.

The underdetermination problem concerns the making of unwitting assumptions by choosing one hypothesis to test rather than another. Simply put, for every theory imaginable, another, contradictory, one may also be conceived that
to bring down the art establishment'? Who decides which 'reasonable' hypotheses (whatever 'reasonable' means) should be considered? Significant argument often seems to rest on conflicting ideas of what people think the (sole) hypothesis should be rather than, say, determining an appropriate set of hypotheses and then testing these side by side.

Another difficulty with Popper, known as the Quine-Duhem Problem, illustrates the extent of care needed in applying scientific methods to questions of authenticity. The Quine-Duhem problem essentially states that there are inevitably multiple components to any hypothesis. For example, when testing the hypothesis that 'This painting is by X,' a range of other aspects are also being tested, including the fundamentals of analytical methods (‘elements are identifiable on the basis of their characteristic X-ray emissions’), the reliability of comparative information (from ‘this is how X painted’ to ‘these were the pigments available to X’), investigative skills (‘this paint sample comes from an original area of paint and not later restoration’) and so forth. If the test ‘fails,’ it could be due to any one of these parts. Philosophy of science has several strong responses to this problem, mainly aimed at determining the analyst’s confidence in each element of these component hypotheses, but these have not commonly been appealed to in our field. Usually (in this author’s experience at least) the communities involved in these decisions accept the reliability of analytical science and tend to blame either the analyst or the presence of restoration. These are of course actually informal, tacit, specifications of component hypothesis likelihoods. The true challenge however is to ascertain what these component hypotheses really are and then establish objective measures of reliability for each, something that requires a profound knowledge of the domain(s). Moreover, the use of ad hominem arguments for example – those that seek to dismiss an argument on the basis of who is making the argument rather than the merits of the argument itself, such as referring to what institution they do or don’t belong to – is simply unacceptable.

Lastly, as we saw earlier, a fundamental aspect of Popperian falsification is the provision of a ‘test,’ the experiment that is applied to a hypothesis in an attempt to falsify a prediction of it. Our specific exemplar is anachronism, since it is the most easily defined and widely used of these tests. Commonly the ‘anachronism test’ is expressed through the concept of terminal dates, the dates before and after which a pigment or other material was not available. Such data have been collated in a number of forms, such as the important pioneering paper by Kühn (Kühn 1973), though this author has also not infrequently seen use of supposed lists of ‘terminal dates’ that are actually nothing of a sort. In practice these might better be called ‘pseudo-termini,’ as they use what initially appears to be a clear statement of cut-off points, but which, in practice, are not. A good example is patent dates, which might at first seem to present strong termini – dates before which they had not yet been invented but after which they were a product on the open market. Whereas one could expect the flaw to be that pigments were available to be used at an unknown date earlier than the patent date, in fact the converse will be argued here (Eastaugh 2006). A good illustration is the case of the phthalocyanine pigments. Phthalocyanines form a highly important class of organic pigments of twentieth century introduction that provide stable and strongly chromatic blues and greens used for everything from paint to the coating on CD-ROMs. An accidental discovery apparently took place in 1928 at the Grangemouth works of Scottish Dyes Ltd., which directly led to the recognition and development of phthalocyanines; the first patent, British Patent 322,169, was to Dandridge, Drescher and Thomas of Scottish Dyes in 1929. Detailed studies of the chemistry and commercialization of the manufacturing processes took place in the earlier 1930s, with formal public announcement in the press in 1935. However, according to most histories of the discovery of these compounds there were plausibly two prior reported syntheses of phthalocyanines, first Braun and Tchemiac in 1907 at the South Metropolitan Gas Co. in London, and then Diesbach and von der Weid during 1927 at the University of Fribourg. But neither group recognized their discoveries as the potential commercial success phthalocyanines they would become. (Eastaugh et al. 2004)

So, what is the terminal date? A hard line approach would surely argue for the earliest demonstrable identification as the terminus, which would place the date for phthalocyanines at 1907. Others might argue that it has to be the first explicit discovery and characterisation, in 1928. Then again, why not argue for the full-scale commercialization, sometime in the mid-1930s?

In fact if one examines the history of painting materials one finds a strikingly similar situation in every case. Even if it is believed that there must be a ‘magic moment’ of discovery (such as supposedly happened with Prussian blue) there is
often not only uncertainty as to precisely when this ‘magic moment’ took place, but also questions about how long it took for the discovery to have any practical impact. This phenomenon is well understood, though not apparently so in painting analysis circles, even if the better review articles implicitly demonstrate it (Laver 1997; Keijzer 2002). So-called ‘diffusion of innovation’ studies, a field with a surprisingly long history of which the chief modern exponent has been Everett Rogers in his classic *Diffusion of Innovation* (Rogers 1962), provide a fuller understanding of this idea. Inventions and their impact on society follow a distinct and almost invariable pattern. A small group known as ‘innovators’ are the primary discoverers of things, followed by a larger group of ‘early adopters,’ followed by the main ‘early majority,’ the similarly large ‘late majority’ and then the ‘laggards.’ The theory provides a useful model of how things actually come to be used, few at the beginning, with a cumulative uptake over time, and all those who are going to use it by the end.

Unfortunately this view fundamentally undermines our use of Popper and his falsification method since we no longer have a clear test; there is no obvious cut-off point with which to define any ‘before’ and ‘after’, leading us into a falsificationist nightmare.

4. AND SOLUTIONS

It would be unfortunate if we were forced to abandon the use of scientific methods in studies of authenticity, especially as (apart from putting us out of a job!) it seems intuitively clear that there is a role for such processes. How, therefore, can we resolve this situation? In practice there seem to be a number of strategies, of which we will look at two. The first to be described here is based on a revision of how we apply use chronologies; the second is a brief exploration of how we might approach formalising comparative analysis.

As a concept diffusion of innovation helps us towards our first solution. We find that we can deconstruct the terminal date problem such that instead of giving a dichotomous solution it provides us with a measure of ‘reasonableness’ across the period of introduction. In the case of phthalocyanines discussed earlier, the ‘discoveries’ that took place prior to the grant of patent in 1929 were made by the group we call ‘innovators’; then, once the managers at Scottish Dyes Ltd. were persuaded of the significance of the discovery and they moved towards commercialisation we see the ‘early adopters’ arrive, and so forth. More importantly we can see that there is a) no sharp cut-off representing a terminal date and b) a pattern of increasing use over time that represents the gross uptake of the innovation. This can be usefully re-expressed here as the likelihood of finding a product in use at any particular chronological period. Imagine that something is invented and someone wants to monitor how widely it is being used. As time passes, surveys should indicate that increasingly more people are using the invention. Similarly, the analysis of paintings will confirm that as time elapses from the date of introduction of a new pigment, more and more paintings will be found to include that pigment. Typically the same diffusion of innovation pattern will be manifest in all new introductions, including not just different materials such as supports and paint media, but also techniques – comparable patterns can be found in such features as red/grey double grounds popular in the seventeenth century for example.

When applied to paintings, the core implication of this is that it is far more likely that we will encounter a material in a painting when that material is available in abundance. Conversely, it is extremely unlikely that the pigment will be encountered when it had just been discovered, or even for some period of time after it is initially introduced commercially. The probability is that one has to wait until well after, say, a patent, to see the invention widely employed. Such probabilistic judgements are used widely and reliably in life in general and can also be used in matters of authenticity. I would be far more sceptical of a painting for example if it required me to believe in the earliest known use of a material or technique than if it was just a run-of-the-mill occurrence. Exclusive, yes-or-no judgements respond poorly to real-life situations whereas formalised ‘is-this-reasonable?’ type statements based on sound knowledge and methods of analysis are both informative and useful. A ‘likelihoodist’ solution therefore provides us with a means of specifying, quite precisely, whether a proposition such as ‘Liubov Popova used titanium dioxide white in the 1910s’ is reasonable or not (it is not, the likelihood being close to zero).

In fact the approach is richly productive, as it opens up a range of other practical steps. In particular it encourages a far more complex view of the history of materials. If we can escape from the notion that we have to find clearly unambiguous situations, like Rembrandt and synthetic ultramarine say, and use marginal probabilities, then we can make use of information on many aspects of pigment history. A simple (and simplified) case might be Prussian blue: in its early life it was made from crude starting materials such as blood, but was later synthesised from purer chemicals. If we can differentiate these types analytically, then we have not one dating pigment but two. And so forth.
We are currently exploring ways of taking these kinds of data and combining multiple results to give overall date estimates, with interesting and promising results. Such approaches are also opening up the possibility of incorporating different types of data, notably those that might be considered as coming from the ‘art historical’ domain, such as the availability of a source image or the structure of a workshop. An important future development is likely to be sophisticated model building, such as already takes place in archaeological applications.

However, refining dating methods is not the only solution. In practice there is commonly informal use of comparative methods based on what may broadly be called ‘similarity’ where statements about ‘alikeness’ are used. As with the falsification issue, little systematic research has been made into the formal methods both required and available.

We can unpack the area to some extent none-the-less. For a start there is a basic justification of process in that when an artist is expressing his ideas through the medium of paint he is making a series of choices that are significantly constrained by the time and place in which he works, as well as his own situation and predilections within that. Thus the set of materials chosen, how these are combined and then used, represents the physical manifestation of both the artist’s creativity and the broader socio-economic context. Typically we thus get questions such as: What pigments, paint media and artists’ techniques does one expect to find at a given time and place, or used by a specific artist? Are the pigments, paint media, artists’ techniques found in the painting examined sufficiently similar to what we would be expected for that time, place or artist to justify a claim to authorship? However, what is of actual consequence here is the specific ‘uniqueness’ of an artist and his situation. Can we discover physical attributes of paintings that are characteristic and, therefore, potentially diagnostic at different levels of resolution, from broad time and place down to (ideally) an individual practitioner? Broadly speaking the answer should be yes, though for such approaches to work two elements are essentially required: first, sufficient data of high quality that is relevant to the problem and, second, a well-characterised method of comparison between cases.

A common practice for any field is the presentation of case studies and surveys of differing extents. For us this ranges from conservation-related examinations of a single painting to entire oeuvre-busting exercises such as the Rembrandt Research Project. Apart from their intrinsic interest regarding the works concerned, they also act as important benchmarking exercises providing raw data for comparative evaluation. Unfortunately such studies also tend to be arbitrary and difficult to use as reference points for our purposes since there is a tendency to use what is available rather than what is ideal, have poor coverage, inconsistent methodology, restricted analysis, provide interpretation rather than data, and so forth. Up until the present time there has been no satisfactory system of data consolidation for such studies, with relevant information often published piecemeal or not at all. Moreover, such intra- and inter-institutional databases of painting technical data that currently exist are also largely inadequate as a result of poor access, standardization and interoperability issues. This is a problem not only for scientific authenticity studies but also its sister discipline of technical art history, one that needs to be seriously addressed if we are to progress in these areas.

The nature of the comparative process is perhaps even more open at the present time. Objectively, we are looking for a means capable of taking diverse information such as number and types of pigments, features of technique, perhaps even aspects of pictorial composition, and converting it into a robust measure of similarity or difference. Many of these in fact exist, so much so that the choice can be confusing. For example, so-called ‘discriminant analysis’ sounds appealing, since it is designed to predict membership assignment into dichotomous groups (such as ‘Democrat voter/Republican voter’, or ‘real/fake’) on the basis of potentially diagnostic features of the individuals to be assigned. Unfortunately in practice there are significant difficulties for our application, including the major issue that you need to have a set of data where the outcomes (group memberships) are clearly and unambiguously known, something not necessarily easy to define with authenticity questions. Instead, on the basis of studies we have made, neutral data exploration approaches where there is no such knowledge prerequisite seem to perform better. Clustering techniques for example allow differentiation and grouping of cases from which a critical evaluation of the meaning of the groups formed, as well as the extent of their distinctness, can take over.

We have also been exploring a technique known as Case Based Reasoning (‘CBR’). In CBR reasoning is based on remembering: ‘reminders’ facilitate human reasoning in many contexts and for many tasks, ranging from children’s simple reasoning to expert decision-making (Leake 1996). As a technique, however, CBR compares the decisions taken in past cases to guide choice in a current, undecided, case. Such cases may be closely related to the original cases, or else a novel one. A key benefit for us is that as an approach it is tolerant of smaller case groups than, say, clustering, while at the same time offering the possibility of ‘learning’ – the simple addition of newly decided cases add to the overall discriminatory power of the system. We expect to be able to report on these results in the near future.
5. CONCLUSION

Day-to-day experience often raises questions about one’s basic ideas and approaches. How do you deal with issues that seem intuitively important but are irresolvable with the techniques available? Or quantify the residual uncertainty that one may feel after a judgment has been made? Many of the areas explored in this paper have been framed in direct response to questions such as these that the author has faced in his own practice. Systematic reflection for this paper led to some interesting lines of thought. For example, it was quite surprising to realise that A.P. Laurie would probably recognise so much of the way science is applied to questions of authenticity today, some 80 years after he was writing to the Burlington Magazine about the respective roles of the chemist and the art historian. That the methodology has been so constant would most likely have pleased Laurie. He was operating in an environment where Bernard Berenson could in all seriousness during the Belle Ferronière trial repeatedly pour scorn on technical knowledge of pigments, X-rays, and chemical analysis as ‘matters beneath a gentleman connoisseur’ (Brewer 2005, 38). To Laurie, we might imagine, the widespread acceptance of his analytical approach and its apparent integration today into decision-making about paintings would count as a vindication. At the same time we must also recognise from our own perspective that, while study of the physical does not, as Berenson believed, put us into the lower classes, we should none-the-less continue to critically and systematically examine the methods that we use. Stasis does not necessarily equal reliability.

The central part of our discussion here additionally concerned some subtle but important points about how we take the data we derive from paintings analysis and then use it to arrive at decisions. This focus was deliberate in that maybe we can at times become over-enthused about the technology we employ, at the expense of due consideration of interpretation and its methods. There are evident flaws in oft-cited rationales for determining authenticity and so we must seek solutions. One of the most important points however was that viable approaches that can resolve such problems do already exist. These approaches (notably statistical data analysis, diffusion of innovation and case-based reasoning) have been developed and tested widely in numerous disciplines, their behaviour and robustness well understood through study and use. While we need to find the most appropriate of these techniques for our situation, the formalism that they bring can actually help us identify strengths and weaknesses in our own approaches. To be able to assess the reliability of the judgments we make in these ways is of fundamental importance. In the process we also find that such methods can also radically open out the way in which we view systematic approaches to authenticity questions.

At the present time it is unclear where these studies will lead us. The growth of technical art history, the study of physical aspects of paintings, for example is bound to feed new and important information into the field as a whole. The need for reliable data for broader scientific studies makes revisiting questions of how to determine ‘authorship’ and date essential. The way these things are achieved in practice though will surely depend on us as a discipline continuing to ask pragmatic, self-reflective questions about our common assumptions. We must not take things for granted.

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ENDNOTES

1 There are various introductions to Popper and the philosophy of science; two good recent overviews placing him in context are Curd and Cover (1998) and Ladyman (2001).

2 For instance when we look at the various steps in a piece of analysis we might be much more confident about, say, that the basic technique works (since many people have developed and used it) than the interpretation of the results. The two main solutions are the use of so-called 'Bayesian' approaches and 'error statistics,' both of which assign probabilities to each component. See, for example Mayo (1997).

3 It is not the place here to describe the methodologies in detail, though they are based on established approaches to defining likelihood and manipulating such values mathematically. In essence we can apply techniques such as the Bayesian approaches mentioned earlier.

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.

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MENDING TEARS VERTICALLY ON LARGE PAINTINGS USING MAGNETS

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ABSTRACT — In 2005 and 2006 the faculty and students of the Winterthur/University of Delaware Program treated two large oil-on-canvas mural paintings on stretchers. Using small neodymium magnets and a series of flat plaques of metal and wood, the tears were mended while both murals were upright on easels or on blocks against the wall using the magnets to provide the needed weight and pressure. The magnet system was a simplification of the electromagnetic plates used by Gustav Berger to carry out structural work on the Atlanta cyclorama. Mended tears were reinforced with Stabiltex impregnated with BEVA 371, nicknamed “BEVA band-aids.”

In 2005 and 2006 the Winterthur/University of Delaware Program treated two large oil-on-canvas mural paintings on stretchers: Ralph Pallen Coleman’s 1944 *Go Forth to Serve* (8’ x 10’) and *Baptism, 1947*, by John Biggers (ca. 4’ x 12’). Both paintings had several tears, but we did not intend to line the paintings overall. Using several small (1½” x 1½” x ¼”) but very strong neodymium magnets and a series of flat plaques of metal and wood, we were able to mend the tears “under weight” while both murals were still upright on easels or on blocks against the wall.

We were originally planning to mend the tears on the Coleman mural while the painting was face down on blotters on the floor. The Coleman mural was attached to a large work strainer with a gridding of string to act as a “loose-lining” support behind the mural while still allowing access to both the front and the back of the painting in order to be able to align the tears properly. However, we were concerned about the fairly heavy canvas bulging forward while it was being lowered face down to the floor.

I thought about Gustav Berger’s work with the Atlanta cyclorama, carrying out a BEVA lining while the mural was in a vertical, hanging position using large electromagnetic plates, creating a sort of vertical hot table. I ordered several small strong magnets to test the logistics of creating a simpler modified version of Berger’s system to apply pressure while in a vertical configuration. Debra Evans and Jim Bernstein graciously provided information about a source for the magnets.

We dampened the buckled areas surrounding the tears, put blotters on each side, and then sandwiched the blotters between two flat plaques larger than the tears, one wooden or non-magnetic (with the magnet behind it) and one steel (that attracted the magnet through the blotters, canvas, and wooden plaque). We then mended
the tears using the Japanese tissue and poly(vinyl acetate) emulsion method, changing the blotters and Hollytex papers occasionally by sliding aside the magnet and separating the plates. (This required two people working in tandem, one at the front and one at the back.)

We then reinforced the mended tears with “BEVA band-aids”—Stabiltex or Pe-Cap fabric impregnated with BEVA. The needed shape is traced onto the BEVA-infused Stabiltex or Pe-Cap, cut out with small curved scissors, and then heat sealed to the tear. We apply at least three coats of BEVA onto the area surrounding the mended tear, feathered—so that the first coat is only slightly larger than the tear; the next coat is larger than the first coat, and the third coat covers a wider area. Then the BEVA “band-aid” should be somewhere in the middle of the area of adhesive in its size, so that the shape of neither the band-aid nor the application of the BEVA telegraphs through to the front. The heat sealing is done vertically by one person working at the back with the tacking iron while the other person holds a blotter and silicone-coated Mylar-covered plaque at the front of the painting. The BEVA band-aid can then cool while sandwiched again between plaques held in place with the magnets as discussed above.

The mended tears in the Coleman mural had additional support from a panel-back stretcher that was original to the piece. To return the mural to its home location, we removed it from the work stretcher, draped it over a padded rolling “horse,” and drove it in a truck back to the church where it had been displayed. The mural was re-stretched onto the panel-back stretcher inside the church lobby by a group of faculty members and students.

The magnet tear-mending system was so effective for small (2-6") tears in the Coleman mural that it was used for larger tears (10") during the treatment of the John Biggers mural the following summer. Two or three magnets were used to keep the larger area under even pressure. The mended tears in the Biggers mural were later additionally supported by padded inserts attached to the backing boards that fit between the stretcher cross bars.

UPDATES ON STRIP LINING AND INSERT LINING

Rustin Levenson, Rustin Levenson Art Conservation Associates, New York and Miami

Strip Lining

Conservators have expressed concern that the adhesive and fabric of a strip lining on the reverse of the painting could cause deformation or weakening of the canvas near the inner edge of the strip lining. In some cases, we have been able to use a method that minimizes the adhesive and fabric behind the painting.

First, all tears and weak areas along the tacking margin are strengthened, with local patches, thread bridges, or in cases of severe degradation a strip lining of PeCap adhered with BEVA Film. Then a strip lining is attached to the outside of the tacking margin, usually using linen fabric adhered with BEVA film. The painting can then be safely mounted on the stretcher.

PeCap is available from Sefar America (716-683-4050, ext. 3177). The product number is 7-44/25 for the 61" width and 7-105/52 for the 40" width. We also find PeCap ideal for loose lining.

Insert Lining

Our studios continue to do insert linings. The materials we use for making the inserts to fill the areas between the stretcher bars has evolved in the last twenty seven years. In 1980, my first insert lining was inspired by an emergency on a large work being shipped from storage. I used the materials on hand, and produced inserts from urethane foam attached to cardboard with Elmer’s glue. We are now using polyester batting adhered to gatorboard with Goudy adhesive sheets. To keep polyester dimensionally stable, we cover it with PeCap adhered to the board around the perimeter with BEVA film. The inserts are set in place and screwed into the stretcher. Because of the excellent support and easy reversibility, many museums have been using inserts for works in transit.

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Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
DOLPHIN NOSED Pliers FOR HARD TO REACH PLACES

Nancy Pollak, Art Care Associates

Finding a properly shaped tool that can remove keys from stretchers without damaging the canvas can be difficult. These dolphin nosed pliers work beautifully, because their tip is bent, but the jaws still open up and down, appearing very much like a dolphin’s head (Figure 1). This allows you to get the jaws of the pliers on the key without your hand being in the way (Figure 2). These pliers are the Knipex® 8” Mechanic’s Dolphin Pliers, available from Crawford Tool, www.crawfordtool.com or 800-272-9373.

Figure 1.

Figure 2.

SPACE CONSERVATION AND
THE MURPHY FOLDING BED OF HOT TABLES

In studios where floor space is at a premium, a large hot table can take up valuable space without being able to be broken down or moved out of the way. In my studio, I chose to mount my 4’ x 6’ hot table on hinges, so that it can be folded up and secured against the wall when not in use, similar to the “Murphy Folding Beds” used in small apartments (Figures 3 and 4).

Figure 3. Hot table (indicated by arrow) in folded storage position

Figure 4. Hot table in working position

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The hot table is constructed in the manner described by Gustav Berger in Conservation of Paintings: Research and Innovations (Archetype, 2000). It consists of a plywood base, heat blankets and an aluminum surface, all held within a simple aluminum frame. One short end of the table is attached by hinges to a support board on the wall, approximately 6" off the floor (Figure 5). The table then swings on these hinges to fold up against the wall, where it is held at the top by two hinged clamps which fold over and secure the table (Figure 6). Two pivoting legs are attached to the other short end of the table. They swing flat against the table when it is raised, and swing down perpendicular to the table when it is lowered for use (Figure 7).

Figure 5. Hinges holding hot table to wall

Figure 6. Clamps holding hot table in storage position: a) open; b) holding hot table

Figure 7. Support legs: a) pivoted down when table is in storage position; b) pivoted to perpendicular to support table in working position

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.

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CONSOLIDATING ON AND OFF THE VACUUM HOT TABLE

George Schwartz, Senior Conservator - ConservArt, Inc., Boca Raton, Florida

1. Painters’ plastic drop sheet as membrane – table film for the vacuum hot table.
I found an excellent product for use as a cover sheet on the hot table. I buy my stash at the local Home Depot, but I imagine it would be available at most home renovation, or paint and hardware stores under the same or other brand names. It’s called “Film-Gard” Professional Painter’s Plastic drop-sheeting, .35 Mil or 9μm thick It is relatively tough, but flexible enough to stretch out and mold itself to all, but the most fragile impasto. These same qualities make it easy to draw vacuum, since the plastic becomes malleable and conforms even more when it’s warm. And it’s very cheap: about $25.00 for a 12 ft x 400 ft roll (4800 ft²) Can’t beat it!

2. Makeshift suction table with window screens and vacuum pump, or vacuum cleaner
You can make a makeshift suction table to consolidate flaking or cracked areas of paintings, by using screening material like Pecap, wire mesh, or ordinary plastic mosquito screening from the hardware store, that will tolerate the solvents used. Lay down one or more layers on a non-porous surface or the hot table, lay the painting on it face up and cover with non-reactive membrane sealed around the perimeter to the table. Make a vacuum port on the edge as usual and cut away the membrane where you need to apply the consolidant. Draw vacuum, switch on the heat as needed and go to it.

A trick I use: Seal the membrane also to the painting at the tacking edge so the painting is not covered and use a larger, loose piece of thin mylar membrane material with a hole through it, which can be moved to each area undergoing treatment, while covering the rest of the painting. Beware of texture transfer if using heat or high vacuum!

3. You can also do the same as above but using the painting itself as the membrane.
This requires much higher volume of air suction, so you will need to use an industrial vacuum cleaner instead of the vacuum pump, but you can consolidate even large or porous paintings on unprimed fabric by this method. It works equally well on or off the hot table. For extra large paintings, you can use more than one vacuum cleaner. Beware of exhaust fumes, flammable solvents and use vacuum cleaners that use fresh air for cooling the motor, rather than those, which rely on the air they draw in by their suction. Bonus of using this method is super fast drying of water or solvent-born consolidants.

Another bonus, that you can perform your consolidation cold, like with Lascaux P-550 for example, and after the evaporation of the benzine, turn on the hot table to fuse the butyl methacrylate resin.

4. Cyclododecane as temporary consolidant.
While we are on the topic of consolidation, Cyclododecane can be a real lifesaver to temporarily attach flaking paint, fragments, etc., on all sorts for artifacts waiting to be treated, which will be handled or transported. Cyclododecane \((C_{12}H_{24})\), behaves much like paraffin wax, low temperature melting point \(-60°\ C\) but with the special characteristic, that it completely sublimes into thin air without going through a liquid phase. Just like moth balls. I mix in 2-5% Naphtha, which makes it somewhat less brittle and a bit more sticky, so it works better as a consolidant and flexes a bit rather than cracking. If you use it on a painting, and the painting is destined to be treated on the hot table, it can be blotted up with paper towel or a tacking iron without residue. It’s really great stuff, have used it for years in thousands of ways and constantly discover more applications.

5. Wax lining with Mylar and G-10 to reduce stresses.
Microcrystalline Waxes continue to be used as very useful consolidants but also work well as lining adhesives when used in conjunction with Mylar or G-10 inter-layers. The use with a non porous interlayer produces an easily reversible bond on a dimensionally stable substrate, it reduces stresses on the painting caused by the tension of the lining fabric, which can be attached to the reverse of the inter layer with Beva film to avoid staining.

6. Space blankets.
I buy mine at the Dollar store. Use it to drop over the hot table while working. The table heats up in half the time, temperature stabilizes and stays even all over, hardly cycles on. There is much less load on my A/C and I use a fraction of electricity than before. It’s the Green thing to do.
A SMALL, POWERFUL, HAND-HELD UV LIGHT

Gay Myers

TIP: A pocket-sized flashlight made by Inova provides very bright UV light, light bright enough to do UV examinations without darkening the room. It has 5 LED lamps and runs on two lithium batteries. According to the manufacturer, the wavelength is 395 nm (longwave).

Product information:
Inova X5 Ultraviolet light Titanium flashlight, X5MT-UV
Purchased in 2007 from BatteryJunction.com for $38.95. Replacement batteries CR 123A are available from the same source (and probably elsewhere).

BatteryJunction.com
11 Bokum Rd Unit B
Essex, CT 06426 USA
Phone: 860-767-8888 M-F 9-5 EST
FAX: 240-524-2571

HOUSEHOLD ITEMS ADAPTED FOR STUDIO USE

Nina A. Roth-Wells, manager
Nina A. Roth-Wells LLC, Painting Conservation
backriver1@gwi.net

Nylon Tea Strainer useful for making varnishes, manufactured by The Republic of Tea
Portable battery-operated UV light, manufactured by Urine Clean
Emery board-tipped sticks used for manicures, available at Sally’s Beauty Supply
Lumina Tweeze tweezers with built-in LED light, available at drugstores and at LuminaTweeze.com

Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
APPLYING AZEOTROPE SOLVENT MIXTURES TO CLEANING ISSUES IN THE TREATMENT OF PAINTINGS

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Los Angeles County Museum of Art

During the course of several treatments undertaken at the Los Angeles County Museum of Art and in private work, I have been comparing the characteristics of different aliphatic-aromatic hydrocarbon solvents as well as exploring the use of azeotropes for specific cleaning concerns. In part this has been motivated by the fact that the availability of solvents differs from the United States, Great Britain and Europe and I wanted to become more specifically aware of what the different components of the proprietary solvents blends imparted to different cleaning considerations. In addition, the availability of these solvent blends is constantly changing relative to industry demands and health and safety regulations. Solvent mixtures such as azeotropes may prove useful alternatives. I was also interested in comparing the relative solvent safety of different solvents and mixtures from the point of view of the practitioner’s health. While these overriding concerns informed my interest in azeotropes, they may not be specifically addressed in the examples outlined below.

From the examples below, it will become clear that in some situations, exploring the use of an azeotrope with similar solubility parameters to the solvents more commonly used in conservation may be of great benefit. An azeotrope is a mixture of solvents that behave as one, evaporating singly rather than at independent rates. Azeotropes therefore avoid the problem of changes in relative solvent ratios on the surface of a painting. Azeotropes also have the added advantage of evaporating more quickly than the component solvents which can be advantageous in cleaning situations where the original materials of the artwork are sensitive to a broad range of solvent classes.

Example 1: Controlled removal of a poly-isobutylmethacrylate varnish.

The treatment of the landscape painting, Thomas Doughty, White Mountains New Hampshire, 1836, proved an example of when an azeotrope provided a different working property than more traditional solvents used for synthetic varnish removal. The painting had been wax-lined, selectively cleaned and inpainted probably in the mid-1970s prior to sale at auction. The wax lining of the original twill weave canvas has resulted in flattening of impasto and weave emphasis. Portions of the original paint layer have been abraded in many cases reflecting the twill weave texture, and in some cases revealing the ground and canvas fibers. This is prominent in the middle ground, water, and trees on the far shore.

A sample of the overall varnish coating was identified as a poly-isobutylmethacrylate using ATR/FTIR. The varnish had discolored and become slowly soluble in both xylenes, acetone and mixtures of xylene:acetone, but only after long exposures. Furthermore, some paint colors were sensitive to acetone even in mixtures. Ethyl acetate alone and in mixtures with xylene behaved similarly to acetone:xylene mixtures and again some paint colors proved sensitive. Therefore, because of solvent sensitivity, xylene was the only solvent alternative for cleaning. However, solubilizing the varnish coating with xylene imparted working properties where the resultant varnish behaved as a viscous gel. This meant that the varnish could not be reduced independent of the retouchings and therefore would result in total cleaning of the painting. The varnish could also be removed mechanically using strappo technique--by applying ordinary scotch tape to the varnish, with light finger burnishing, and lifting to remove from the paint surface. However, the retouchings were also removed with this technique; therefore, this approach would result in a total cleaning of the painting.

Because of the extensive abrasion and retouching particularly in the middle ground, it was decided that rather than fully clean the painting, selective cleaning would be more appropriate at this time. I had been reviewing the literature on azeotropes and was intrigued by Chris Augerson’s article “The Use of Less Toxic Solvents in the Treatment of a Royal French Sleigh, ca. 1720”, 2000 WAG Postprints, Philadelphia Pennsylvania. In that article Augerson outlined the testing of seven azeotropes for toluene chosen because they had similar solubility parameters to toluene and for the relative solvent safety. Because toluene and xylene have similar solubility parameters, I felt these azeotropes would be good possible alternatives to xylene as a solvent for the poly-isobutylmethacrylate coating on the Doughty.
The seven xylene azeotropes outlined in Augerson’s article were initially tested working at the edge of the cleaning line, and the three most promising were tested systematically (rolling each area three times) and compared to xylene in an area of the sky. Azeotropes A2 and A5 proved the most effective, with A6 showing slight effect. However, both A2 and A6 contain hexane and were excluded for health concerns. Azeotrope A5, the mixture of 38% methylethylketone (MEK) to 62% cyclohexane (volume %), proved most effective, imparting working properties that were advantageous over xylene, described below. Given my interest in solvent safety and concerns about using MEK in the past, I wondered whether xylene or MEK were a “safer” solvent for the practitioner. In discussing this issue with Chris Stavroudis about the relative solvent safety of MEK to xylene, he noted that it is difficult to compare different classes of solvents, but that as long as appropriate safety measures (gloves, respirator, and solvent extractor) are being used, MEK could be used safely.

Azeotrope A5 (mixture of 38% methylethylketone and 62% cyclohexane) was used for cleaning and had some distinct advantages over xylene in terms of the ability to control the working properties of the gelled coating. It was quickly applied to areas where the varnish and retouchings were to be retained, succeeding in reforming the varnish resulting in better saturation. Initial application of solvent in an area where the varnish was to be removed allowed for “thinning” of the coating. Presumably, in the initial application, this rather fast evaporating solvent mixture (b.p. 71.8°C) was only affecting the upper portion of the varnish coating. This quality was later exploited in thinning the transitions between cleaned and uncleaned areas. In the sky, cliff faces, and left tree of the middle ground, the discolored poly-isobutylmethacrylate varnish coating was efficiently removed with three passes of solvent mixture, and the residues of discolored natural resin varnish were retained. The painting was then varnished using mastic resin in turpentine and inpainted using Gamblin Conservation Colors diluted with isopropanol.

Example 2: removal of a “rubber cement”

In a second example, the same azeotrope mixture was useful in removing an adhesive that had the appearance of an aged rubber cement applied directly to the surface of a Seventeenth Century Peruvian devotional painting. The small canvas painting has been adhered to a wooden board and a gilded frame was glued to the face of the perimeter of the painting. The framing elements had suffered extensive insect damage and the owner had removed most of the framing elements prior to bringing the painting for conservation treatment. However, the thick, orange-brown adhesive layer with fragments of wood remained. This adhesive was slightly glossy, could be dented with a scalpel, but not removed from paint surface, and gave the general appearance of an aged rubber cement.

Solvent testing was begun using xylene and acetone, alone and in mixtures. However, while these solvent tests swollen the adhesive, the material still needed to be pried from the paint surface, and could not be removed efficiently nor thoroughly. Since the xylene was somewhat effective, the azeotrope mixture of 38% methyl ethyl ketone in 62% cyclohexane (volume %) was tested and it resulted in the adhesive swelling, contracting and releasing from the paint surface. As an area was treated it could be then cut from the remaining adhered section. The cleaning was thorough and efficient.

Example 3: Removal of dense layer of fatty acid efflorescence

The treatment of a fatty acid efflorescence on a painting by Raymond Parker, Untitled, 1960, demonstrated that specificity in the choice of an aliphatic/aromatic hydrocarbon can greatly affect the efficacy of a treatment and the overall surface imparted after treatment. The painting is executed in oil on cotton duck canvas prepared with a thin titanium white ground and exhibited a thick layer of material that had developed on the surface over a period of 40 years. The efflorescence had occurred only in the area of the painting where cadmium sulpho selinide had been used. This layer had become a dense layer, almost like a wax coating with feathery crystals on top. At the edges of this color form there were some areas that were not affected by the efflorescence. The aim of the treatment was to remove the efflorescence to achieve the slightly matte surface that was visible at the edges of the form as well as in keeping with the slightly weathered surfaces of the adjacent color forms.

A variety of aliphatic/aromatic hydrocarbons were tested of varying evaporation rates; however those solvents
containing aromatics were excluded as the aromatic content resulted in an increase in gloss of the paint surface. Cleaning was initiated using Shelsol 340HT (2411 seconds to evaporation) which succeeded in removing some of the material. By introducing a polar component with the addition of 8% isopropanol, the cleaning became more efficient, but not complete. When higher concentrations of isopropanol were tested, the surface gloss was affected, possibly due to longer retention time of the polar solvent on the paint surface.

Noting that a faster evaporating solvent would improve the efficacy as well as reduced solvent exposure time, n-heptane was tested, and found to be somewhat but not completely effective in removing the efflorescence. In this instance, acetone was chosen as a fast evaporating solvent with a strong dipole moment that could have a similar effect to the isopropanol in the isopropanol/Shellsol 340 HT mixture. Mixtures of n-heptane and acetone were tested from 2%, 4%, 6%, 8% and 10% volume acetone. Ultimately a mixture of 10% acetone and 90% n-heptane proved the most efficient in removing the material thoroughly. It was only after the treatment was completed that I learned that n-heptane and acetone formed an azeotrope at 10.5% acetone and 89.5% n-heptane (b.p. 55.8°C). It is likely that this would have been the most efficient mixture for removing the efflorescence thoroughly. The faster evaporation rate of the azeotrope would mitigate the retention time of the acetone on the surface and possibly any potential increased gloss and paint sensitivity.

While aliphatic/aromatic solvents have been used in the past for the removal of fatty acid efflorescence, in this instance with all solvents tested, aliphatic/aromatics alone were not successful. It is speculated that the densification of this layer increased the bonding interaction of the acid portion of the molecular structure and therefore a polar component was necessary to help dissociate the materials. A fatty acid structure combines both aliphatic long chain portion and a carboxylic acid portion (COOH). The introduction of the solvent with a dipolar moment (in the form of acetone) was intended to interact with the COOH component of the fatty acid, while the aliphatic solvent (n-heptane) was affecting the longchain hydrocarbon aspect of the fatty acids.

**Example 4: Reduction of black “magic marker” from solvent sensitive surface:**

Since presenting this information at AIC Paintings Specialty Group lunch, I have used the same azeotrope (10.5% acetone, 89.5% n-heptane; b.p. 55.8°C) in a situation where I was reducing a black marker from a sensitive screen printed paint layer on “plastic” support (described in auction records as polyvinyl chloride panels). The exact polymer components of the panels and original paint were not investigated. While acetone and xylene did reduce the marker, the original screen printed paint was sensitive to both solvents. The acetone:n-heptane azeotrope allowed for reduction of the marker with no observable sensitivity of the paint or support.

**SUMMARY**

In the first two examples — removal of aged p-isobutylmethacrylate varnish and removal of aged “rubber cement” — the same azeotrope worked for the situations I encountered, but other azeotropes from the group may work in different situations. I recommend exploring the range of azeotropes that are of similar solubility parameter to what you are using, as the different functional groups and evaporation rates may impart different working properties, depending on the nature and the age of the materials you are working with.

If you know you want to add a solvent or solvent type to your mixture, but are concerned about reaching a concentration that is detrimental to the paint layer/support, check to see if there is an azeotrope that includes that solvent or another that would impart the same characteristic, as the faster evaporation rate of an azeotrope may act in your favor. In the example of the removal of the fatty acid efflorescence from the Raymond Parker painting, I was searching for a solvent system that included a moderately fast evaporating non-aromatic hydrocarbon with a small amount of polar solvent added. If I had known that the solvent mixture I was testing (n-heptane with increasing amounts of acetone) was an azeotrope just above the concentration that I ultimately worked with, perhaps I would have been less hesitant with increasing the concentration of acetone. In the example of the reduction of marker from a sensitive paint and support structure, the faster evaporation rate of the azeotrope allowed for cleaning on an otherwise sensitive paint and support material.

This author noted a general trend in the efficacy of azeotropes. Where a solvent alone or in non-azeotrope mixtures may be effective in solubilizing the desired material, it may also affect the original paint and or support layers. When
a solvent is used in an azeotrope mixture, the efficacy of the solvent appears increased while at the same time the faster evaporation rate limits the sensitivity of the original materials.

ACKNOWLEDGEMENTS

During the course of these treatments I consulted with a number of colleagues regarding solvent safety, azeotropes, and cleaning issues. Special thanks to Dr. Terry Schaeffer, Conservation Safety Officer, LACMA; Chris Stavroudis, Conservator in Private Practice, Los Angeles; and Alan Phenix, Scientist, Getty Research Institute.

Additional thanks to Joe Fronke, Jini Rassmussen and Elma O’Donoghue of the Paintings Conservation Department and Dr. Frank Preuser and Dr. Charlotte Eng of the Scientific Research Department, both at the Conservation Center, LACMA, as well as Rosamund Westmoreland, Conservator in Private Practice, Los Angeles.

REFERENCES


NOTES

1 For a more detailed introduction to azeotropes please see the article by Chris Stavroudis, “Azeotropes from A to Z”, WAAC Newsletter, Vol. 28, No 3, September 2006. Additional references to articles on azeotropes are included at the close of this article.

2 Thomas Doughty, White Mountains, New Hampshire, 1836, 25 7/8 in (H) x 35 7/8 in (W), Los Angeles County Museum of Art, Gift of Camilla Chandler Frost, AC.1992.96.1

3 See Scientific Research report in file dated November 9, 2006 by Dr. Charlotte Eng, Associate Scientist at LACMA.

4 The azeotrope mixtures were the following:
   A1 4.8% isopropanol (vol %) in pentane, b.p.: 35.5 C
   A2 24.8% 2-butanone (vol %) in hexane, b.p.: 64.2 C
   A3 30.2 % pentanone (vol%) in heptane, b.p.: 93.2 C
   A4 20.0% 2-propanol (vol%) in hexane, b.p.:62.7 C
   A5 38.0% 2-butanone (vol%) in cyclohexane, b.p.:71.8 C
   A6 32.7% ethyl acetate (vol%) in cyclohexane, b.p.:65.15 C
   A7 31.8% isopropanol (vol%) in cyclohexane, b.p. 69.4 C

5 Hexane had been shown to metabolize in the liver to a compound causing irreversible nerve damage. Personal communication, Chris Stavroudis.

6 Devotional image of St. Clare, Anonymous, Cuzco, Peru, oil on canvas adhered to board, c.1820s, Private Collection, Los Angeles.

7 Raymond Parker, Untitled, 1960, oil on canvas, 88 in (W) x 84 in (H), Los Angeles County Museum of Art, M.63.19.2.


10 Jean Dubuffet, Le Tetrascopique, 1974, Private Collection, Los Angeles.
USING PRE-CONDITIONED SILICA GEL FOR PAINTINGS

Tiarna Doherty, Associate Conservator of Paintings
J. Paul Getty Museum

In November 2006 the exhibition “Holy Image, Hallowed Ground: Icons from Sinai” opened at the J. Paul Getty Museum in Los Angeles. The exhibition included the display of forty-nine icons, five manuscripts, three large metal objects and a liturgical vestment. These objects are all from the active Greek Orthodox monastery of St. Catherine, Sinai, Egypt. The monastery is located in the desert of the Sinai peninsula where there are large variations in climate. The conditions of loan for the exhibition were proposed by the monks at St. Catherine in consultation with icon conservators from the Benaki Museum in Athens. The conditions required that the icons would be displayed at a relative humidity of 30 +/- 2% relative humidity. All of the exhibition cases were conditioned with pre-conditioned silica gel in ½ pound bags.

Pre-conditioned Silica gel
Pre-conditioned silica gel can be bought in ½ pound bags, commercially sold as “Rapid Pack” from Art Preservation Services, that are shipped and stored in moisture-impermeable Marvelseal bags. The Marvelseal bags hold a total of 6 bags or 3 lbs of pre-conditioned silica gel. The Marvelseal bags can be easily re-sealed with heated spatulas.

How much silica gel?
In order to determine how much silica gel would be needed for exhibition cases we began with the published equation

\[ Q = \frac{(C_{eq}D) V (N_t)}{M_{h f}} \]

Since there are many variables that influence the behavior of silica gel we decided to carry out tests based on different calculations. In testing, we found that silica gel pre-conditioned to 25% would start effectively conditioning a sealed case at 28% Rh. We chose to use this silica gel since it would effectively start conditioning the environment at 28 which fell within our 30 +/- 2% requirement and could then buffer a small increase in humidity over the four month period.

Running tests was useful in order to assess how re-conditioning the silica gel would work. Heating the silica gel bags to a temperature of 107 degrees Fahrenheit over a few days proved to be very effective at drying the silica gel to a relative humidity of about 10%. We did see that the adhesive on the pre-conditioned silica gel bags sometimes failed so we recommend sewing or stapling these bags to reinforce the edges before re-conditioning them.

Cartridges for holding silica gel
Cartridges were designed to hold the ½ pound bags of silica gel so that the maximum amount of their surface area would be exposed to air inside the exhibition case. The cartridges were made up of aluminum frames with window screen material. The frames were made from formed, rectangular aluminum tubing fitted together with corner assembly blocks. The fiberglass screen was fitted into the tubing using Tygon tubing channel (Figure 1). Binder clips were used to close the cartridge (Figure 2). These cartridges were designed in two
dimensions so that they could fit into both wall and free-standing exhibition cases (Figure 3). The smaller cartridge held one bag of silica gel and the larger cartridge held up to four bags of silica gel.

The objects on loan for this exhibition were packed in the Sinai in September when the relative humidity was measured at 18%. In most of our exhibition cases the objects maintained relative humidity in the low to mid-20’s over a four-month period. Our lenders were told that this may happen since the objects were packed in an environment with a very low Rh and an agreement was made that objects would be allowed to self-condition the space with the silica gel in any range from 18 – 32%; however if the humidity went above 32% we would have to open the cases. Our exhibition cases were designed to minimize the interior volume where the object was displayed. The seal on the case was made of a Poly/Aluminum barrier material, laminated with 3M 465 Adhesive transfer tape. The method of sealing the cases proved to be very effective as all cases, monitored on a weekly basis, maintained their humidity levels.

Conclusion

Using pre-conditioned silica gel is useful because it helps facilitate the quick installation of objects sensitive to fluctuations in relative humidity. The silica gel is easily re-conditioned since the bags can be placed directly in ovens. The bags are also adapted to different types of case design since they can be ordered in different sizes.

Special thanks to Getty Museum staff for their assistance with this project:
Bruce Metro, Rita Gomez, Martin Greene, Kevin Marshall, Sue Ann Chui, and Laura Rivers.

Supply Sources

Pre-conditioned Silica gel: Art Preservation Services, 315 East 89th St., New York, NY, 10128.  www.apsny.com
Aluminum frame stock: Active Window Products, 5431 San Fernando Road West, Los Angeles, CA 90039-1088, tel: 323 245 5185
Poly/Aluminum barrier material: http://www.acorn-paper.com/
Tygon tubing material: McMaster-Carr.  www.mcmastercarr.com, tel: (562) 463-4277
3M 465 Transfer Acrylic Adhesive Tape: http://rshughes.com/

Notes


Presented at the AIC annual meeting in Richmond, Virginia, April 16 - 20, 2007.
This paper has not undergone a formal process of peer review.
DIGITAL INFRARED PHOTOGRAPHY: FUJIFILM S3PRO FINEPIX UVIR

Jeronimo Perez-Roca, Conservator of Paintings

In 2006, Fujifilm USA announced a new camera: the S3Pro UVIR, a modified Digital Single Lens Reflex capable of capturing images in the ultraviolet, visible and near infrared spectra. It was the first time that a camera with these characteristics was produced, only as a limited edition manufactured exclusively for the American market and basically targeting law enforcement agencies, crime scene investigation, and also on a minor scale, artistic photography.

Based on a Nikon body (N80) it uses all Nikon F mount compatible lenses and writes images in RAW format, which is likely to become a new standard in photographic documentation. The CCD sensor has 6.1 primary megapixels that the camera by default interpolates to 12.3 megapixels; which means that the pictures taken by the Fuji S3Pro (4256 x 2848) are almost twice as big as, for example those obtained with a well known camera in the conservation world, the Sony Cybershot DSC F707 (2560 x 1920).

Obviously, the extra sensitivity of this camera can also be used by conservators to document and examine more extensively the characteristics of the artwork. It’s very well known that CCD’s are sensitive to a wider spectrum than the visible light; however the manufacturers of digital cameras block these wavelengths by means of an infrared absorbing filter placed in front of the sensor. By replacing that filter with a clear glass block, the Fujifilm S3Pro UVIR can record acceptable images between 350nm (UV-A) and 1000nm (N-IR), but it will not be able to cut through certain materials that require a higher wavelength.

While the images captured in the UV spectrum, (reflected UV) are not especially useful to painting conservators, the visible fluorescence induced by UV radiation is a common practice to show clearly varnish layers and old overpaints. This technique is available with almost any kind of digital camera, but due to its wide dynamic range, the S3Pro is not likely to suffer extreme purplish highlights that are quite frequent when using most consumer cameras.

The capability of generating reflected infrared digital photographs is the most interesting feature of the S3Pro UVIR, since it allows us to record clearly and easily the underdrawings that hide beneath the visible pictorial layers; something much more tedious, difficult and arduous to obtain using conventional infrared film. The example studied in this case is an 8½" by 13¾" painted wood panel by Italian artist Giovanni Battista Quadronne (1844-1898). The normal picture (Photo 1) was taken placing a B+H UV-IR cut filter that blocks most non visible radiation, and allows the S3Pro UVIR to be used as a conventional camera. On the other hand, without any filtration the sensor is so sensitive to the infrared that a shot under tungsten light will create a semi-transparent reddish image (Photo 2). The use of an infrared transmitting filter will help in separating the visible image from the IR spectrum, providing more accuracy and contrast (Photo 3).

Jeronimo Perez-Roca, Senior Paintings Conservator
The Fine Arts Conservancy Inc.
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The ability to use different lenses constitutes an invaluable advantage since it permits one to reach as much magnification and detail as required. In this case an old 55mm. micro-nikkor was used to obtain the close up of an area around 4" by 2 ½", both under visible and infrared conditions (Photos 4&5 and 6&7). The differences between the first sketched composition and the final painted scene are unmistakably visible in both examples.

However, even though obtaining digital images in the IR is quite easy with this camera, there are some aspects that should be considered before purchasing this equipment. Since Fujifilm does not recommend a specific lens to mount on this camera and because of the different possible applications and the diverse response of a particular model under the whole spectrum, it should be noted that:

• Autofocus and light metering will not work properly in the IR, these adjustments should be done manually, no matter what the capabilities of your lens. So any “vintage” lens compatible with the Nikon F mount will work just as well, and sometimes even better, than the newest ones.
• In the IR spectrum the focusing should be compensated in order to acquire a well-defined image, the red dot on the measuring scale of the lens will help in this matter, although the camera provides a preview mode to do final adjustments.
• Very complex lenses with a large amount of elements, such as zooms, are more prone to show defects while working in the IR spectrum. Accordingly, the coatings on conventional lenses tend to block the IR and the UV radiation; so again a simple lens with fixed focal length will pass a sharper and cleaner image to the CCD.

Through our tests we have found that the smallest and simplest lens manufactured by Nikon, the nikkor 45mm f/2.8P, an extremely uncomplicated Tessar design of four lenses in three groups, will perform well with the Fujifilm S3Pro UVIR under any lighting conditions without showing any distortions or problems. It's only partially electronic and even if the aperture can be adjusted through the camera, the focus is completely manual; not a big deal considering that most of the documentation work is done in a studio setup. Another point to consider is that due to the camera conversion factor of 1.5 it behaves more as a short telephoto rather than like a wide angle.

Fujifilm USA is very interested in this “pro-sumer” area of the market, and moves toward new products like the IS-1 or the, not even developed yet, Fujifilm S5Pro UVIR (IS-Pro). At the Fine Arts Conservancy we are cooperating in the testing of these cameras and their specific applications in conservation, through collaboration with manufacturers and their suppliers we expect to be able to implement this technology in our working process. If you are interested in additional information you might want to check our website: www.art-conservation.org and look under Fujifilm Collaboration on the home page.

Special thanks to Mr. Darin Pepple, Consumer and Professional Marketing Manager for Fujifilm USA Electronic Imaging Division. This project would not have been possible without his help and support.