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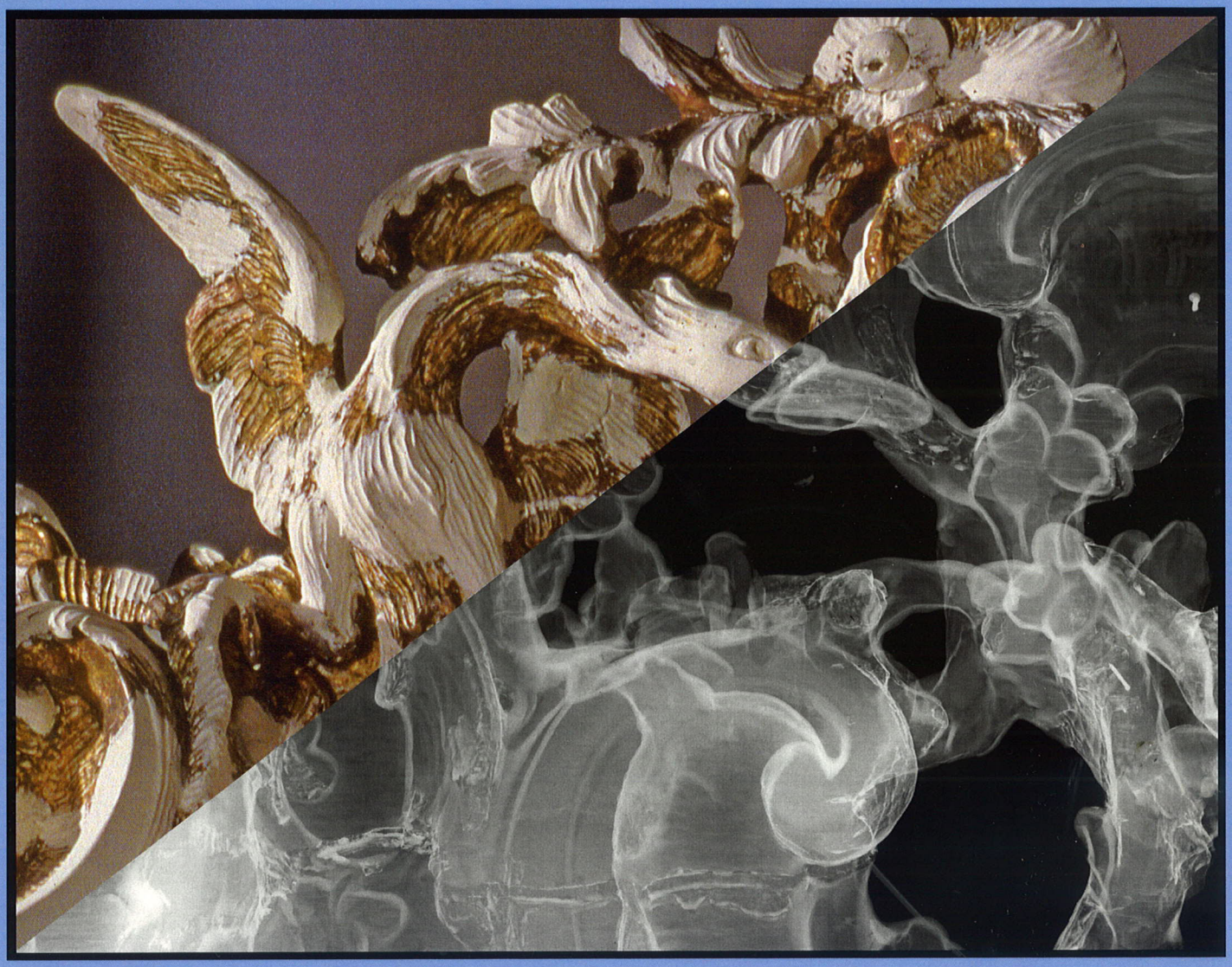

AIC
AMERICAN INSTITUTE FOR CONSERVATION OF HISTORIC AND ARTISTIC WORKS

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Front cover photos courtesy Philadelphia Museum of Art. See p. 71.
Back cover photos courtesy The Metropolitan Museum of Art. See p. 2.

Figure 1. Parisian ebony cabinet-on-stand, mid-seventeenth century, The Metropolitan Museum of Art, Gift of Mrs. Harold Fowler, 1931, (31.66,a,b).

A seventeenth-century Parisian ebony cabinet restored by Herter Brothers

Part one by Mechthild Baumeister

ABSTRACT

An ebony cabinet brought from Spain to Philadelphia in the early nineteenth century by United States naval agent Richard W. Meade, and since 1931 in the collection of The Metropolitan Museum of Art, is a fine example of a type of furniture fashionable in Paris during the mid-seventeenth century. A restoration in 1884–85 by the established New York cabinetmaking and interior design firm Herter Brothers was documented by two inscriptions stamped into the back of the cabinet, while information that Charles Guenold, a cabinetmaker in Philadelphia and previous owner of the cabinet, had supposedly already restored it two years earlier, was only discovered during the recent investigation into the cabinet's complicated history.

In seventeenth-century Europe, ebony was an exotic and expensive material, which generally was glued to substrates made of locally available woods. Its economical use on the cabinet is also seen in the layering technique that allowed ebony veneers, carved ebony reliefs and ebony ripple moldings to be applied using a minimum amount of this valuable material. Hidden inside the furniture is a colorful, architectural perspective made of various materials such as different species of wood, mirror plates, and marbleized or stained ivory and bone forming a central compartment that contrasts boldly with the cabinets somber black exterior and the interior façade.

The extensive nineteenth-century restorations were skillfully executed and well-integrated into the fabric of the original. The talk will present distinctive features of the techniques and materials used in the manufacture of the cabinet and its restoration, describe the extent of the alterations, and consider how the nineteenth century cabinetmakers approached the task of restoring this piece of historic furniture. The presentation will also discuss certain elements of the cabinet that were not reconstructed during the 1880s restoration, such as the secret compartments behind the architectural perspective, which can be understood on the basis of technical evidence and comparative study of similar ebony cabinets.

INTRODUCTION

A Parisian ebony cabinet-on-stand in the Metropolitan Museum of Art is one of approximately sixty surviving examples of a type of furniture that was fashionable in France during the reign of Louis XIII in the first half of the seventeenth century (fig. 1). The possession of such a cabinet, elaborately decorated with carved ebony, engraved ebony veneer, and ebony ripple moldings, reflected the high status of its owner, who would have used it to store and display valuables and curiosities. In seventeenth-century Europe, ebony was an exotic, expensive material imported from Madagascar and nearby islands. Ebony workers came from Germany and the Low Countries and settled in the French capital early in the seventeenth century, where they were known as *menuisiers en ébène* and later as *ébénistes*, which became the French term for makers of veneered furniture of all kinds.

Figure 2. Ebony cabinet, with interior façade visible.

The carved scenes on a number of these cabinets derive from illustrations in various early seventeenth-century editions of the Bible. Woodcut illustrations by Jean Cousin in *Figures Historiques du Vieux Testament*, first published in Paris in 1596 by Jean le Clerc, served as inspiration for some of the carved panels on the Metropolitan Museum's cabinet. Depicted on the exterior of the left door is *The Judgment of Solomon*, and on the right, *Solomon and the Queen of Sheba*.

Behind the two large doors of the cabinet is an elaborate interior with two smaller doors flanked by drawers (fig. 2). A colorful architectural perspective, known in French as a *caisson*, forms the central compartment in each of the known ebony cabinets, contrasting boldly with their somber black exteriors and interior facades (fig. 3). The *caissons* are composed of a variety of materials; in this case, they include various species of wood, marbleized or stained ivory and bone and, most importantly, mirrors that give an illusion of infinite space and show objects displayed in the *caisson* from all sides.

History

A remarkable event in the cabinet's history is documented by an inscription stamped twice into the back: "restored 1884-5 Herter Brothers" (fig. 4). This renowned New York cabinetmaking and interior design firm was established in 1864 by two German immigrant cabinetmakers, Gustave (1830-1892) and Christian Herter (1839-1883). By 1883 the firm had passed out of their hands and was under the direction of William Baumgartner and William Gilman Nichols. The role of Herter Brothers as restorers is less well known, but its services included repairs and restorations of furniture of its own design and furniture made by other firms, as well as antique furniture and woodwork. As early as 1866, the company was assessed on that part of its business related to repairs, which constituted a small but regular monthly share of the firm's income.

The ebony cabinet was brought from Spain to Philadelphia in 1820 by Richard Worsam Meade (1778-1828). Meade, an American merchant who established his business in Cadiz in 1803, was also the United States naval agent for the Cadiz

Figure 3. Architectural perspective (*caisson*) of the ebony cabinet.

port from 1805-1816. His son, General George Gordon Meade (1815-1872), who led Union forces to victory at the Battle of Gettysburg, inherited the cabinet from his father. Of special relevance to its restoration history is a lawsuit regarding the ownership of the cabinet, initiated in Philadelphia in 1882 by Margaretta S. Meade, General Meade's widow.

An article published in the *Philadelphia Inquirer* on Christmas Day of that year under the headline "A Curious Suit. Litigation Over an Antique Cabinet Found in Memorial Hall" provides some background information about the dispute. In 1860 the Meade family had sent the cabinet, "having become considerably scratched and defaced in the course of time," for repair to a cabinetmaker by the name of William H. Quass. The Civil War broke out and the cabinet apparently was forgotten in Quass's workshop on Monroe Street. When Quass died in the spring of 1882, the executors of his estate held a public sale, and Charles Gunold, a cabinetmaker on Dock Street, bought the cabinet. The article states:

> The cabinet caught the experienced eye of Mr. Gunold, who purchased it and then spent much time and labor in restoring it to its former beauty. Having to a great extent succeeded in this endeavor he then deposited it in Memorial Hall in charge of the [Pennsylvania] Museum, where it has since remained on public view.

A son of General Meade, George Meade, recognized the cabinet, and the lawsuit for its recovery was initiated. A letter written by George Meade in October 1882 to Dalton Dorr, Director of the Pennsylvania Museum and School of Industrial Art,

Figure 4. Inscriptions stamped into the back of the cabinet and the stand..

Figure 5. Details of the proper left door of the ebony cabinet showing the layering technique of the ebony. The veneer was inlaid in recesses cut into the oak substrates, and then the carved relief and ripple moldings were applied.

Figure 6. Center panel of the proper left door of the ebony cabinet. When the ebony decoration was removed, cutting marks were found on recessed areas in the oak substrate along both sides of the remaining relief, indicating the extent of the original cavity prepared for the background veneer. The white lines represent the cutting marks while the dashed lines show the altered outline of the cavity that was recut because the veneer would not have provided sufficient background for the applied relief.

which was named as a co-defendant with Charles Gunold, mentions $ 800 as the price Gunold apparently had paid for the cabinet. Conditions of the settlement that was reached in October 1883 are not known, but according to surviving court records the cabinet had been valued by the plaintiff at $1000, who requested an additional $2000 for sustained damages.

The ebony cabinet made the news again in June 1885, when it was featured on the front page of *The Art Amateur Journal* and in an article under the headline "A Remarkable Cabinet":

> The cabinet was bought for a trifle at a sale of personal effects not long ago in Philadelphia by a furniture dealer of that city. He found it shockingly dilapidated, it having for many years been put to the most ignoble uses, and finally banished to the lumber room as valueless. Recognized despite the bad treatment it had suffered, as a marvelous work of Italian art of the latter part of the sixteenth century, it was sent to the Pennsylvania Museum for exhibition in Memorial Hall, where it attracted much attention."

The article also discusses the lawsuit and mentions that the settlement left the cabinet in the hands of the dealer, presumably Gunold. Furthermore, the article reveals the connection to Herter Brothers: "In the meanwhile a member of the Herter Brothers had seen it, and recognizing the possibility of its complete restoration, bought it, and converted it into the admirable piece of cabinetwork we see."

After the cabinet was restored by Herter Brothers it was acquired by Mrs. Robert Hoe as a gift for her husband, who was a Trustee of the Metropolitan Museum from 1870-1892. In 1931 their granddaughter, Mrs. Harold Fowler, gave the ebony cabinet to the Museum, where several restoration treatments were subsequently carried out.

The cabinet has not been on display for decades, in part, allegedly, because it was considered a nineteenth-century pastiche. Recently, having recognized the historical importance of the cabinet, and in view of Herter Brothers's increasing fame, curators in the Museum's Department of European Sculpture and Decorative Arts decided to display the cabinet again in the permanent galleries and sent it—once again in poor condition—to the Sherman Fairchild Center for Objects Conservation for examination and treatment.

It is not possible to judge the extent of Gunold's and Herter Brothers's restorations based on documentary evidence discovered to date. More to the point, it is difficult to believe that the cabinet was completely restored twice in the short period between 1882 and 1885. Still, the cabinet speaks for itself, and the technical examination revealed much of the 1880s alterations.

Original construction versus nineteenth-century restoration

The economical use of ebony typical of the seventeenth-century workmanship can be seen in the layering technique that allowed ebony veneers, carved ebony reliefs, and ebony ripple moldings to be applied using a minimum amount of this valuable material. As the first step, relatively thin sheets of veneer, measuring 0.8–1mm in thickness, were inlaid in recesses cut into the oak substrate, so that the veneers and the exposed oak surfaces were on the same level (fig. 5). The carved reliefs, raised architectural elements, and ripple moldings were then glued to the oak substrate, overlapping the edges of the inlaid veneer.

Cutting marks found on recessed areas in the oak substrate along both sides of the carved center panel clearly are due to an error in planning. They indicate the original extent of the cavity prepared for the background veneer, which was then enlarged during the actual execution. One logical interpretation is that these cuts reflect an attempt to use as little ebony as possible, and that the alteration was necessary because the veneer would not have provided sufficient background for the

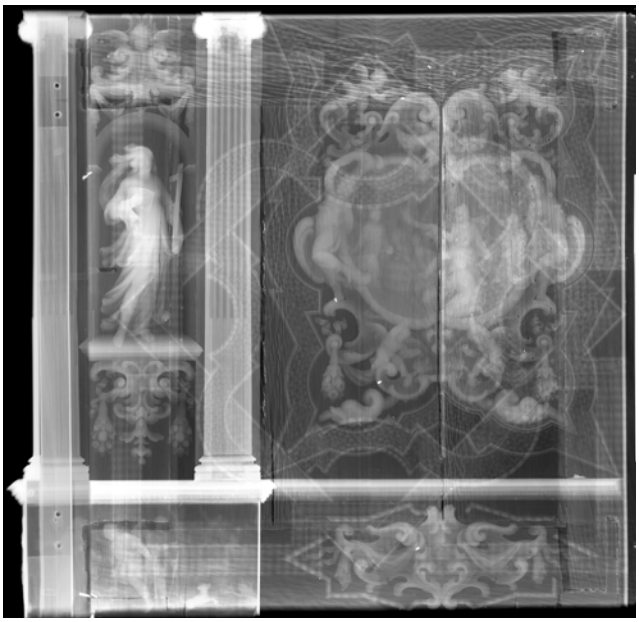

Figure 7. Radiograph of the proper right door of the ebony cabinet.

applied relief (fig. 6). Also, to further reduce costs, ebony was applied mainly at eye level; the columns on the stand for example, are made of ebonized pear wood.

A major restoration on the exterior of the proper right door can be dated to the 1880's, when the proper left half of *The Judgment of Solomon* was entirely replaced. The technique used here is completely different from the original layering technique: both the relief and surrounding background were carved from solid ebony. The radiograph of the door reveals that during the restoration the oak substrate, which had already been recessed for the ebony veneer, was further cut back to a depth of 7mm in order to insert the solid panel of ebony (fig. 7). This was done with a ¾ " drill bit with a center point in a drill press. The use of this technique proves that the restorers did not try to economize on ebony, which was readily available and less expensive during the nineteenth century than in the seventeenth century. When a ripple molding is removed, the edge of the solid ebony panel and a section remaining from the original veneer are visible.

Delamination and loss of ebony elements were surely always a problem, as they are today. On the larger door on the proper left, which consists of a frame with two panels, damages are much a result of the fact that the grain of the oak panels runs perpendicular to the grain of the applied ebony decoration. On the proper right door the grain directions of the single oak panel and the ebony decoration are the same, and it is therefore difficult to imagine why the proper left side of the "Judgement" relief needed to be replaced, especially given that the surviving half of the relief panel is in good condition and most of the original ripple moldings are present.

While the framing cartouche could have been easily reconstructed because of the symmetry of the design, the figural scene may be based on an available illustration of *The Judgment of Solomon* or copied from original fragments, if they survived. On first sight, the replaced panel seems to be a good match, but on closer inspection one notes the use of an ebony with an open grain texture and that the carving is more three-dimensional and not as refined as the original (fig. 8). Also the background, while nominally flat, has gouge marks and is not as smooth as the original ebony veneer.

The difference in the use of ebony in the seventeenth and nineteenth centuries is also visible on some of the moldings. In the original technique the cabinetmaker utilized a maximum of oak and just enough ebony to scrape the molding. On the

Figure 8. Detail of proper right door showing an original section on the left-hand side and a replaced section on the right-hand side.

Figure 9. Comparison of drawer construction. Rebuilt drawer (left); an original dovetailed drawer from an ebony cabinet in a private collection (center); an original dovetailed drawer with applied front panel from the ebony cabinet in the Victoria and Albert Museum (right).

contrary, a block of solid ebony was used for the replacements. The original ripple moldings differ from their nineteenth-century replacements in scale and in their selection of an ebony with a more open grain texture and the engraving is much stiffer than the original.

Another major alteration of the nineteenth century is the replacement of the backs, bottoms, and sides of all of the drawers. Except in two cases, the original oak fronts decorated with carved ebony panels framed by ripple moldings and engraved ebony veneer were preserved. The use of an exotic hardwood, as yet unidentified, but otherwise never seen on seventeenth-century European furniture, and the construction of the drawers indicate their 1880s date. As seen on examples of original drawers from other seventeenth-century Parisian ebony cabinets the original dovetailed drawers may have been made either of oak or of another wood, onto which an oak panel with the ebony decoration was applied (fig. 9). The preservation of almost all of the original drawer fronts suggests that the drawers were largely extant, although the bottoms were probably cracked, warped, and detached from the sides so that the drawers did not work properly. The seventeenth-century drawer bottoms would have been glued and nailed to the bottom edges of the sides and not inserted into grooves as seen on the nineteenth-century replacements. The goal of the nineteenth-century restoration in this respect was to insure that the cabinet was functional, but also can be seen as modernization, reflecting improvements in the construction of drawers introduced in intervening centuries.

The boards of the poplar case were originally joined with dovetails while the vertical interior dividers were connected to the top and bottom with tenons. The dust boards between the drawers, which in the seventeenth century did not extend to the full depth into the case, were inserted in grooves. The dust boards were later extended to the back of the case, and circular saw marks visible on the back edges indicate that this alteration dates to the nineteenth century. At this time, in fact, the entire carcass was taken apart and wooden strips were set into grooves cut into the inner faces of the side boards, which must have warped due to the one-sided application of the ebony decoration, in an attempt to straighten them. The same treatment was also carried out on the backsides of the veneered floor and ceiling of the caisson. While the cabinet was dismantled, all interior surfaces were smoothed with a jointer. Strips of wood were inserted into the grooves to make up for the reduced

Figure 10. Back of *caisson*.

thickness of the boards.

white. The ivory was dipped into a blue stain that colored the remaining exposed surfaces. The stains do not penetrate very deeply into the ivory, and for the ceiling of the *caisson*, bone, with its more porous structure, was chosen for elements to be stained green. This assured that the color would still be visible after the marquetry decoration of the ceiling, which includes also ivory, ebony, kingwood, and Brazil wood, was smoothed after it was glued to the wooden substrate.

The architectural perspective—the jewel of the cabinet—has been much altered (fig. 3). Whereas the veneered floor and ceilings, most of the cornices with marbleized ivory friezes, and the two front ivory columns, stained red to simulate coral, are original, other elements, such as the engraved bone and ebony decoration, the mirrored arcades and central belvedere, and the two rear wooden columns, showing traces of a fugitive red stain, are nineteenth-century replacements.

A closer look at the techniques used for the staining of the original ivory friezes and the later replacements, demonstrates on one hand, the unusual nature of the original technique, and on the other, the degree to which the restorers were able to imitate these effects using simpler methods and to integrate the restorations with the original. Marbleized ivory, which embellishes the inside of the caisson doors and the frieze of the interior, can be found inside many of the surviving Parisian ebony cabinets. Contemporary instructions for marbleizing ivory reveal that a mottled or veined effect was achieved using a wax resist method. The examination of the reverse of lifting ivory and cross sections revealed that both the obverse and reverse were marbleized in the following way. The red stain was applied first. Wax was then used to mask the red-stained areas and to coat surfaces intended to remain

Non-destructive analysis with Raman spectroscopy revealed that indigo or woad was the colorant for the blue. Energy-dispersive X-ray spectrometry was used to identify copper in the green stain, which is most likely verdigris. The red stain was identified with high performance liquid chromatography as a mixture of two different red dyes, madder (probably *Rubia tinctorum*, L.) and Kermes (*Kermes vermilo* Planchon) as well as a yellow dye, weld (*Reseda luteola* L). In the nineteenth century, painted bone was used for the well-integrated replacements of the marbleized frieze. Prussian blue was identified as the blue pigment and the pinkish red is a mixture of vermilion and lead white.

Major alterations can be seen more easily from the back of the *caisson*. The original dovetailed cornices made of oak, onto which the marbleized ivory frieze and a thin strip of ebony were applied, are adjacent to lumber core, screwed and glued together, where it was used as the substrate for the nineteenth-century bone and ebony veneer on the wall panels, the mirrored arcades, and the belvedere (fig. 10). The appearance of the original wall decoration of the *caisson* is unknown, but most likely the restorers approached their reconstruction based on the evidence of surviving material that they found. The use of engraved bone to represent oculi surrounded by balustrades in the cen-

ter of the original ceiling supports the assumption that originally the wall decoration also contained some engraved bone or ivory panels, as is seen on other *caissons*, where the engraving is filled with a dark paste. The position of the reconstructed wall paneling follows the original layout, as delineated by the contours of the original floor and ceiling, with associated cornices.

Recessed areas in the back of the *caisson*, cut to accommodate the four replacement mirrors, so that their bottom edges would not be visible, are nineteenth-century alterations to the original floor. The dovetailed grooves on the sides of the *caisson* no longer have a function. When first made, the *caisson* was fitted with secret compartments, a feature always found in this type of cabinet. Placed in the grooves on each side of the *caisson* were three shelves supporting hidden drawers. Access to each of these elaborately decorated secret compartments would have been through a side panel that pivoted on hinges. The holes for the hinge pins are preserved on the undersides of the original cornice sections. Evidence of a system for locking the side panels can be seen on the side walls of the *caisson*. Two dovetailed groves in the floor of the *caisson* indicate the original placement of its sides and, therefore, the size of the secret compartments, which were wider than the openings created by swiveling the side panels. This suggests that originally each shelf housed two secret drawers, placed such that when the first was removed, the second could be found. Such a playful organization of secret compartments can be found in *caissons* of other surviving Parisian ebony cabinets, such as the pieces in Windsor Castle and the Rijksmuseum. Most of the cabinets examined and studied thus far appear similar in layout, in the decoration of the architectural facades, and in the mode of access to the secret compartments. The Metropolitan Museum's cabinet differs from these examples both in layout and access, and for now we can base our provisional reconstruction of the secret compartments only on the basis of surviving physical evidence.

Discussion

The nineteenth-century restorers appear to have been respectful in their work, following the original design and reusing many of the seventeenth-century elements. The replacements were carefully integrated with the original, demonstrating the sensitivity of the craftsmen to the character of the cabinet. When they replaced lost elements, however, they sometimes invented or simplified them. For example, the use of mother-of-pearl, selected to represent the sky in the belvedere, is not seen on any of the other *caissons*.

A simplification of form in the replacements can be seen in the straight front edges of the lower shelf and top of the stand, the originals of which must have had projecting center and side sections echoing the layout of the cabinet's façade, as is seen on other examples of Parisian ebony cabinets.

Significant parts of the structure, such as the top and back of the cabinet, as well as all sixteen drawers, with the exception of the decorated drawer fronts, have been replaced showing that design elements but not necessarily the original fabric were respected.

From the restorations it is also possible to judge what the restorers, as well as the local art establishment, did not understand about the cabinet. The 1882 article in the *Philadelphia Inquirer* erroneously describes the furniture as:

> An antique sacerdotal cabinet, wrought in ebony and oak by the cunning hand of a medieval wood worker. It was of the kind placed beside the altar in the early days of the church to hold the sacred vessels used in the communion service.

A similar attribution was held as doubtless by the writer of the 1885 article in *The Art Amateur Journal*. Furthermore the author, in praising Herter Brothers' restoration, reveals an important discovery made by the restorers: "in taking it to pieces the date 1561 was found behind one of the

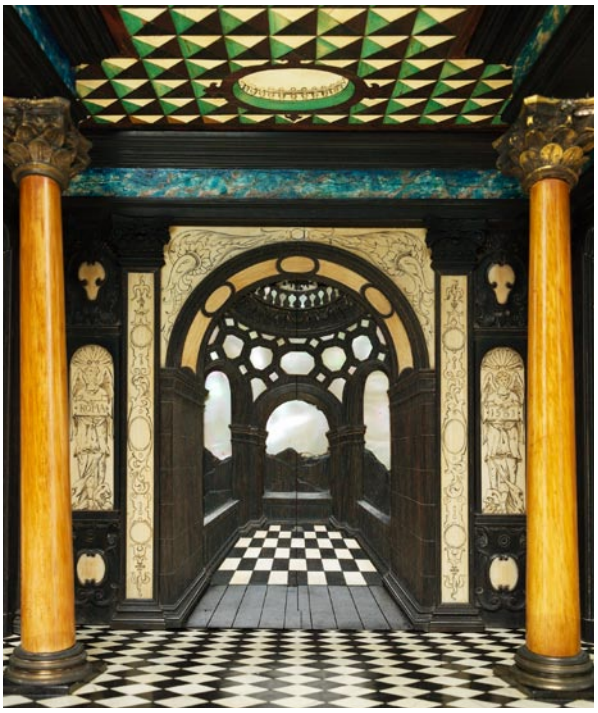

Figure 11. Detail of caisson showing nineteenth-century bone replacements engraved with angels holding plaques

columns." The nineteenth-century angels engraved in bone flanking the belvedere, holding plaques inscribed "Roma" and "1561" presumably reflect this discovery and also the belief at the time that the cabinet was of Italian origin (fig. 11). If the report is true, the date probably read 1651 and was incorrectly transcribed by Herter Brothers. In fact, on the basis of this article, it is certain that Herter Brothers is responsible for the restoration of the *caisson* and most likely also for the restoration of the proper right door and the replacements of the carved drawer fronts, as the article states: "The original carving is very fine, and the missing parts have been well restored."

Herter Brothers proudly identified its work by stamping the back of the cabinet twice. It remains to be investigated whether or not this was the company's usual practice or if it reflects the unusual scale of this restoration. Certainly furniture restorers in the nineteenth century generally did not sign their work.

Part two: A study of toothing plane marks found on the ebony cabinet

by Stéphanie Rabourdin-Auffret

Introduction

In order to differentiate original elements from later replacements, and in an attempt to attribute reworked elements and replacements to specific restoration campaigns, a systematic study of toothing plane marks was conducted in different locations on the ebony cabinet, chosen on the basis of accessibility. These sites include back surfaces of ebony veneers, carved elements, ripple and other types of moldings, as well as the side walls and the back panel of the *caisson*, which is known to have been replaced by Herter Brothers. Approximately sixty areas were studied and photographed through a stereomicroscope.

A toothing plane is a plane with its cutting iron grooved on the top surface so that the cutting edge is serrated. Traditionally, this tool was used by cabinetmakers to plane hand-sawn boards or sheets of veneer. In addition, the roughened surfaces resulting from its use is generally considered to improve the adhesion of surfaces when they are glued.

The study of toothing plane marks is important because it can provide valuable information as to the date when a piece of wood was worked. Both André Félibien (1619–1695) and Jacques André Roubo (1739–1791) discuss toothing planes and their use in their technical treatises. Generally, the number of teeth increases over time—the teeth are wider in the seventeenth century than in the eighteenth and nineteenth centuries—although the number of teeth can vary even within the same period; depending on the needs and the characteristics of the wood, a cabinetmaker might use blades with wider or narrower teeth. Also the shape of the teeth is helpful for dating plane marks. Roubo precisely describes the trapezoidal shape of the teeth in the eighteenth century, which became progressively more triangular over time. One explanation of this evolution may be found in the mechanization of the wood sawing process: as long as the

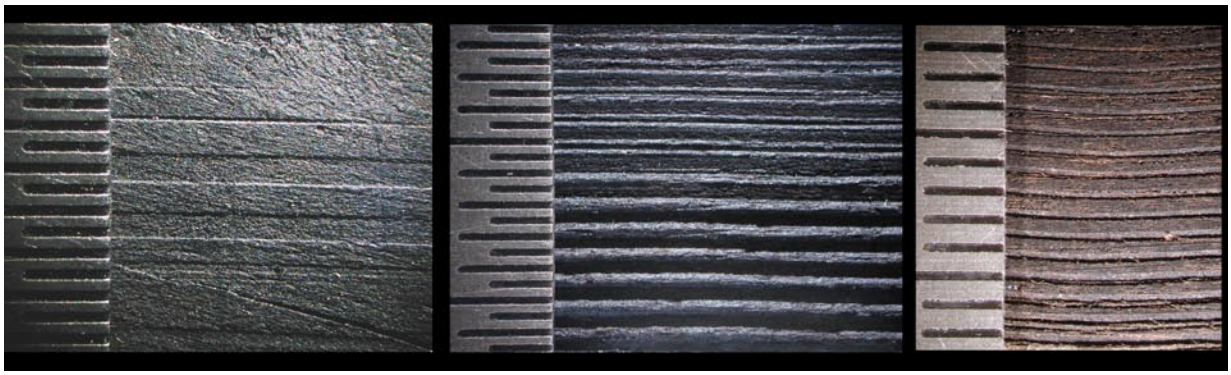

Figure 12. Toothing plane marks found on the ebony cabinet. Original seventeenth-century toothing plane marks (left); first type of nineteenth-century toothing plane marks (center); second type of nineteenth-century toothing plane marks, attributed to Herter Brothers (right).

wood was manually sawn, it was necessary to plane the surfaces afterwards, which became less the case when wood was mechanically sawn. The trapezoidal teeth allowed a rough surface to be easily planed, whereas triangular teeth primarily would scratch the wood. The different toothing plane profiles result in distinctive marks on the wood.

There are essentially two ways to measure toothing plane marks. The first one is to count the number of teeth per unit of measurement. This is the more reliable method but it is only possible when there are sufficient contiguous tooth marks on a specific surface. The second way is to measure the distance between two teeth, or between two adjacent ridges that separate the teeth. Because accuracy depends on the clarity of the marks, the results are not always reliable. The two systems can also be used in combination.

It is important to observe characteristics of the marks other than size: do they go from one end of the piece of wood to the other? Are they straight? Are they deep? These features can indicate if the toothing plane marks were made in the wood at the time the furniture was constructed or during a restoration. In the first case, the marks tend to be deep, straight, and to continue along the entire length of the board. Often when an original element has been reworked, the marks are random, more shallow, or obscured. Indeed, during a restoration, the cutting iron frequently is removed from the plane and used to remove old glue, or to score the wood before gluing.

Examination

It was expected, as a matter of course, that large, trapezoidal toothing-plane marks such as those usually left by a seventeenth-century tool would be found on the ebony cabinet. But after examination of many of the original elements, it appeared that their back surfaces had been most likely scraped or planed smooth. Specific marks, probably made by a dented scraper or plane blade were found in some areas and, in many cases, there were no marks at all. A very few residual hand saw marks were observed.

Just in one location, on the edge of the back surface of a piece of veneer, the large and trapezoidal toothing plane marks expected to be seen everywhere were observed (fig. 12, left). In that case, the bottoms of the grooves are large and flat, indicating that the teeth were trapezoidal, such as described by Roubo. Also the space between adjacent teeth is large. Because no more than three teeth were ever found together, it was not possible to get a count per centimeter, although by measuring their width and the spaces between adjacent teeth, it was possible to calculate that the plane could not have had more than seven teeth per centimeter.

Two other types of toothing plane marks were found as well, most likely made by two different

nineteenth-century planes. Both have triangular shaped teeth but are easily distinguished by their size and other features.

Marks of the first type (fig. 12, center) were observed on the back surfaces of a few areas studied, including three different kinds of straight moldings, an element of the base, and two ripple moldings, the latter being obvious replacements. They were also found on the back of some ripple moldings of the drawers surrounding the caisson. Between twelve and thirteen teeth per cm were counted. The marks are deep and straight and run from one end of the piece of wood to the other, which indicates that the pieces were planed before the pieces were cut or, in the case of a large element, while the piece was held in a vice. In many instances, the ebony itself has different features than ebony used on the rest of the cabinet, in particular a longer and more open grain, and the frequent occurrence of brown streaks in the wood. The combination of these observations and characteristics of the toothing plane marks support the conclusion that these elements are replacements, whereas a few others are most likely reworked originals.

Identical toothing plane marks were also found on both side walls of the *caisson* (fig. 13). In this case, they were not cut into the wood itself but impressed into the glue where an adjacent element, no longer extant, was attached. This clearly indicates that something else was glued here before Herter Brothers restored the cabinet, because the wall paneling of the *caisson*, which was replaced in its entirety by Herter Brothers, now covers this area and is screwed, not glued.

The marks left by the second nineteenth-century toothing plane measure about fifteen teeth per centimeter (fig. 12, right) and are not as deep as the marks left by the tool described previously. They were first observed on the back part of the *caisson* made by Herter Brothers. In this case, it is clear that the wood was planed prior to being cut because the marks run the entire length of the board. The backsides of some veneers and ripple moldings that were judged as original, exhibit similar marks, but here, the toothing plane was certainly used in connection of a restoration. This conclusion is supported by the curvature of some of these marks, which clearly indicate that the blade used had been removed from the plane.

Figure 13. First type of nineteenth-century toothing plane marks, impressed into the glue, found on both side walls of the *caisson*.

Deep, random scratches were also observed on other ebony elements and in some areas on the oak substrate. In one instance, these scratches were found in association with a filler exposed during the treatment currently in progress. This filler, present under a piece of ebony on the proper left door, consists mainly of fine saw dust in a cellulose nitrate medium, which indicates that this restoration took place during the twentieth century, when the cabinet already had entered the Museum's collection.

Discussion

This study provides further information regarding

the different campaigns of restoration carried out on the cabinet. Based on the observations described above, it can be stated that at the time of manufacture, the back surfaces of the ebony elements were planed first with a toothing plane in order to remove the hand-saw marks, and then scraped or planed to reach the desired thickness. Although the absence of original toothing plane marks at first seemed surprising, it can be explained: if the toothing plane marks were still on the reverse side of the veneer, there would have been considerable risk of cutting through the veneer in the deeper parts of the engraving. In the case of the carved elements or ripple moldings, the grooves left by the teeth would have been visible at the edges.

The presence of two different toothing plane marks datable to the nineteenth century might support the documentary evidence for two different campaigns of restoration during the 1880s. Because the first type of marks is present on the side walls of the *caisson*, it can be assumed that a cabinetmaker worked on that area before Herter Brothers replaced the wall paneling. Can this be attributed to Gunold? If so, what was the extent of his work? Does the occurrence of the first type of toothing plane marks on the back surfaces of several ripple moldings on the drawers surrounding the *caisson* indicate that Gunold may be responsible for their construction?

The toothing plane marks observed on the back of the *caisson*, known to have been replaced by Herter Brothers, provides a reference point for identifying other work that the company undertook, such as the regluing of original elements.

Finally, the scratches observed on other elements, including the oak substrates, most likely result from a later restoration carried out in the Museum, when detached elements were reglued.

Future research

In order to understand more fully the history of the Museum's ebony cabinet and the restoration campaigns of the nineteenth century, it is necessary to continue the physical investigation of the cabinet itself and to consult further documentary sources. In addition to close study of surviving tool marks, microscopic identification of the various ebony species and other woods present on the cabinet as well as the characterization of surface finishes, should allow more conclusive attributions of the nineteenth-century restorations to Charles Gunold or Herter Brothers. In fact, details of Charles Gunold's activities as a cabinetmaker and furniture restorer are unknown, and contemporary documents describing the condition of the cabinet when it was on display at Memorial Hall might shed some light on the extent of his restoration. Although many publications have been devoted to the work of Herter Brothers in its early years, while under the direction of Gustave and Christian Herter, little attention has been given to the firm's later activities. Entirely neglected by scholars is the role of Herter Brothers in the restoration of contemporary and historic furniture.

Furthermore, while the present publication has focused primarily on the history of the restoration of the Metropolitan Museum's cabinet, the parallel study of its original manufacture should prove highly useful in future research related to the surviving corpus of more than sixty Parisian ebony cabinets dated to the seventeenth century, specifically with the goal of workshop attributions.

Acknowledgments

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About the authors

Mechthild Baumeister, Conservator, has worked in The Sherman Fairchild Center for Objects Conservation at The Metropolitan Museum of Art since 1988. After an apprenticeship in cabinetmaking, she received training in furniture conservation in the Westfälisches Landesmuseum für Kunst- und Kulturgeschichte in Münster, at the Klosterkammer Hannover, and in the Victoria and Albert Museum in London. At the Metropolitan Museum her primary responsibility is the examination and treatment of furniture and woodwork in the collection of the European Sculpture and Decorative Arts Department, while she also works on the Museum's twentieth-century furniture collection. In connection with the de- and reinstallation of the Museum's Islamic Art Galleries, Mechthild has been supervising the study and treatment of an eighteenth-century Syrian room and a sixteenth-century Spanish ceiling.

Stéphanie Rabourdin-Auffret is working as an Assistant Conservator in the Furniture and Frame Conservation lab at the Museum of Fine Arts, Boston since October 2006. In 2004-5 Stéphanie was an Andrew W. Mellon Conservation Fellow in the Sherman Fairchild Center for Objects Conservation at The Metropolitan Museum of Art in New York. Since taking an interest in art history and furniture conservation in 1993, she has worked in several private furniture conservation studios in France while pursuing art history studies at the Sorbonne University in Paris. She has also held an internship at the J. Paul Getty Museum in 2001 and a fellowship at Historic New England (formerly known as SPNEA) in Haverhill, Massachusetts in 2003-04.
Stéphanie is currently writing her PhD dissertation in Art History on the concept of authenticity in regard to furniture and has recently completed a Master in Art Conservation degree in Paris.

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Endnotes

a The dimensions of the cabinet are: 190 cm (74¾ in.) high, 167.6 cm (66 in.) wide and 57.2 cm (22½ in.) deep. Remington, P. An ebony cabinet of the seventeenth century. *Bulletin of The Metropolitan Museum of Art* 26(10): 232-236. Kisluk-Grosheide, D., Koeppe, W. and Rieder, B. 2006. *European furniture in the Metropolitan Museum of Art: highlights of the collection,* New York:

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b Lunsingh Scheurleer, Th. H. 2005. *Pierre Gole ébéniste de Louis XIV*. Dijon: Edition Faton. 52.

c The inventory taken after Pierre Gole's death in 1685 lists the quantity and price of the ebony (# 63 in the inventory) present in his workshop: "premièrement dans la cour s'est trouvé la quantité de six mil cent soixante quatre livres d'esbyne prisée à raison de quinze livres le cent revenant aud. prix à la somme de neuf cent vingt quatre livres douze sols". The amount of 6164 livres equals 3014.20 kg or 6631.2 lbs. In reference to the given value of 924 livres for the ebony, it is interesting that a large ebony cabinet made in Gole's workshop between 1645 and 1650 is listed in the inventory for 150 livres. At that time the ebony cabinets had fallen out of fashion, while the material itself was still in high demand for furniture with marquetry decorations. An earlier inventory taken in 1635 after the death of the *menuisier en ébène* Pierre Boulle, nine ebony cabinets ranging in value between 70 and 240 livres are listed. Lunsingh Scheurleer, Th. H. 2005. 223, 267, 52. Viaux-Locquin, J. 1997. *Les bois d'ébénisterie dans le mobilier français.* Paris: Léonce Laget. 88-98.

d *Herter Brothers, furniture and interiors for a gilded age*. New York / Houston: Exh. cat., Museum of Fine Arts Houston, High Museum of Art, Atlanta, The Metropolitan Museum of Art, New York, 1994.

e *Herter Brothers, furniture and interiors for a gilded age*. 1994. 84-86. Documentation regarding restoration and repair projects carried out by the firm, which had evolved more into a decorating and furnishings business after 1883, is preserved in the Herter Brothers archive at The Winterthur Library, which covers the activities of the company from 1891 – 1906, when the company closed. We would like to thank Jeanne Solensky, Librarian at The Winterthur Library, for providing us with information from the Herter Brothers archive.

f http://www.virtualology.com/georgemeade/ The entry on George Meade (1741-1808) includes also biographical information on his son Richard Worsam Meade**.**

g *The national cyclopedia of American biography*. 1984. Clifton, New Jersey: James T. White & Co. 4:66.

See also the American National Biography online http://www.anb.org/articles/home.html.

h The lawsuit took place from December 16, 1882 to October 12, 1883 in Philadelphia's Court of Common Pleas, No. 4.

i A curious suit. Litigation over an antique cabinet found in Memorial Hall. *Philadelphia Inquirer*, December 25, 1882. One day later the *New York Times* published the same but slightly shortened article under the headline "Gen. Meade's Antique cabinet." *New York Times*, December 26, 1882.

j We would like to thank Behrooz Salimnejad**,** Conservator, Philadelphia Museum of Art, for providing us with a copy of the letter preserved in that Museum's archives.

k A remarkable cabinet. 1885. *The Art Amateur Journal* 13(1): 1, 17-18.

l Variations of the spelling of Gunold have been found in different documents as Günold and Guenold, suggesting a Germanic origin of the name. If Gunold, who is referred to also as cabinetmaker in George Meade's letter to Dalton Dorr, Director of the Pennsylvania Museum and School of Industrial Art, might have been a furniture dealer as well is speculative at this point, although the 1882 *Gopsill's Philadelphia City Directory* mentions a Gunold Charles, furniture, at 247 S 2nd and 233 Dock Street, implying that he had two workshops or possibly a workshop and salesroom. We would like to thank Jack Hinton,

Mellon Fellow, Philadelphia Museum of Art, for providing us with the information from the City Directory.

m Mr. Robert Hoe was a member of the appointed committee to establish the Metropolitan Museum in 1869 and served on the first executive committee after the Museum was founded in 1870. Howe, W. 1913. *A history of the Metropolitan Museum of Art*. New York. 92, 117, 123. We would like to thank Deborah Schorsch, Conservator in The Sherman Fairchild Center for Objects Conservation, for bringing this information to our attention.

n Based on the recollections of Mrs. Hoe documented in a letter from February 1932 and preserved in the Metropolitan Museum Archive, Mr. Hoe apparently had come across the cabinet in Philadelphia "in some family attic", but felt at the time it was too expensive for him. He kept an eye on it until purchased by Herter Brothers, who evidently put it in order before selling it to his wife.

o Sometime after the cabinet had arrived at the Museum in 1931 the following statement attributed to Preston Remington, Curator for Western Art, was entered into the departmental card catalogue: "The entire carcass of the cabinet has been rebuilt, using in part the old wood, planed down to new surfaces, and in part new wood. The bottoms and backs of the drawers, and in some cases, the sides, are new. Occasional moldings have been replaced and the lower shelf and feet seem to be restorations. None of these repairs, however, are important considering the rarity of the piece." It is not known when exactly the cabinet was removed from display, but a photograph taken of the Louis XIV bedroom shows the cabinet in this gallery in 1962. According to Claire Vincent, Associate Curator, European Sculpture and Decorative Arts Department, the cabinet was taken off display in the early 1970s when the gallery was turned into a storeroom.

p The cabinet is featured in the recent publication: Kisluk-Grosheide, D., Koeppe, W. and Rieder, B. 2006. *European furniture in the Metropolitan Museum of Art: highlights of the collection,* New York: The Metropolitan Museum of Art; New Haven: Yale University Press. 34-37.

q The microscopic identification of the pear wood (*Pyrus communis L.)* was undertaken by Dorothea von Rotenhan, former conservation intern, and Marijn Manuels, Associate Conservator, The Sherman Fairchild Center for Objects Conservation, The Metropolitan Museum of Art. Meiler, J. and Klein, P. 2002. Holzarten zur Imitation von Ebenholz. *Restauro* (2): 110-115. Michaelsen, H. and Buchholz, R. 2006. *Vom Färben des Holzes, Holzbeizen von der Antike bis in die Gegenwart*. Petersberg: Michael Imhof Verlag. 502-504.

r Jutzi, V. and Ringer, P. 1986. Die Wellenleiste und ihre maschinelle Herstellung. *Maltechnik Restauro* 92(2): 34-62. Thornton, J. 2002. The history and technology of waveform moldings: reproducing and using Moxon's "waving engine". In *Postprints of the Wooden Artifacts Group presented at the 30th Annual Meeting of the American Institute for Conservation, Miami, Florida. June* 2002. 43-52. http://www.wag-aic.org/2002/WAG_02_thornton.pdf. Van Soestbergen, C. 1999.The reproduction of a ripple moulding machine by Roubo. In *Fourth international symposium on wood and furniture conservation. Amsterdam, The Netherlands, 10 December 1998*. 65-81.

s An exception is the two upper proper right drawers where the ebony, sculpture and engraving are slightly different than on the other drawers, indicating their nineteenth century date.

t Interesting is the reversed placement of the dovetails seen in the center drawer in fig. 9.

u The microscopic identification of the poplar (*Populus tremula L.*) was undertaken by Dorothea von Rotenhan, former conservation intern, and Marijn Manuels, Associate Conservator, The Sherman Fairchild Center for Objects Conservation, The Metropolitan Museum of Art.

v The technique of inserting wooden strips

into grooves cut along the grain on the reverse of warped panel paintings was also a common technique used in paintings restoration in an effort to keep the panel straight after flattening the panel by applying water to its backside. Schiessl, U. 1999. History of structural panel paintings conservation in Austria, Germany, and Switzerland. In *The structural conservation of panel paintings*. Los Angeles: The Getty Conservation Institute. 200-236.

w Michaelsen, H., Barthold, J. and Weissmann, R. 2003. "Marmelirtes Helffenbein", Rekonstruktionsversuche zu einer Imitationstechnik in der Mitte des 17. Jahrhunderts. *Restauro* (3): 194-202. Similar recipes exist also for imitations in ivory of tortoiseshell, which are seen on the front edge of the ceiling. Kunckel, J. 1992/1689. *Ars Vitraria Experimentalis: oder vollkommene Glasmacher-Kunst*. Hildesheim, New York: G. Olm. Facsimile reproduction of the 1689 Frankfurt/Leipzig edition. 416.

x We would like to thank Patrick Georges, dealer and expert of fine woods in Paris, for the wood identification of the brazil wood (*Caesalpinia spp.*).

y It is not possible to distinguish between these quite similar dyes using Raman spectroscopy. The analysis was carried out by Silvia A. Centeno, Associate Research Scientist, Department of Scientific Research, The Metropolitan Museum of Art.

z Energy-dispersive X-ray spectrometry was carried out by Mark T. Wypyski, Research Scientist, Department of Scientific Research, The Metropolitan Museum of Art. Michaelsen, H. and Bucholz, R. 2006. 735-741.

aa The analysis was conducted by Nobuko Shibayama, Associate Research Scientist, Department of Scientific Research, The Metropolitan Museum of Art.

ab The pigments were analyzed using Raman spectroscopy by Silvia A. Centeno.

ac For example, engraved ivory or bone embellish the caissons of the ebony cabinets in the collections of the National Museum in Stockholm and the Musée Rolin in Autun.

ad For published illustrations showing secret compartments in the ebony cabinet in the Rijksmuseum see Baarsen R. 2000. The triumph of Paris: Pierre Gole. In *seventeenth-century cabinets*, Baarsen. R. Amsterdam: Rijksmuseum. 50-51, or Lunsingh Scheurleer, Th. H. 2005. 67. The secret compartments of the ebony cabinet in the Musée des Beaux-Arts in Troyes, and of the ebony cabinet in the château de Serrant are featured in Castelluccio, St. 2002, *Le Style Louis XIII*. Paris: Les Editions de L'Amateur. 89, 92, 104-105.

ae Baarsen R. 2000. 48-55. Lunsingh Scheurleer, Th. H. 2005. 62-79. Roberts, H. 2002. Collecting French furniture before George IV. *Apollo* (486): 3-9.

af A curious suit. Litigation over an antique cabinet found in Memorial Hall. 1882.

ag "It was doubtless designed originally to stand in a church beside the altar, as a receptacle for the sacred vessels and utensils when not in use." A remarkable cabinet. 1885. 17.

ah The article in *The Art Amateur Journal* describes the cabinet as: "…a marvelous work of Italian art of the latter part of the sixteenth century...", while the 1882 Annual Report of the Pennsylvania Museum and School of Industrial Art refers to the cabinet as Spanish, sixteenth century in the listing of loans of objects to the Museum: "Charles Günold: carved ebony cabinet, Spanish sixteenth century." A remarkable cabinet. 1885. 1, 17. The Pennsylvania Museum and School of Industrial Art, Philadelphia. 1883. *Seventh annual report of the trustees and a list of members for the fiscal year ending December 30, 1882*, 14.

ai A remarkable cabinet. 1885. 18.

aj It is interesting to note that individual dies with upper case block letters were used for the stamping of Herter Brothers, while on furniture designed and manufactured by the company a continuous stamp reading "Herther Bro's" is

found. It remains to be investigated if after 1883, when the company was under the direction of William Baumgartner and William Gilman Nichols the stamp was changed or if the individual letters were used by the repair workshop. *Herter Brothers, furniture and interior for a gilded age*. 1994. 123, 224.

ak Félibien, A. 1676. *Des principes de l'architecture, de la sculpture, de la peinture, et des autres arts qui en dépendent / Avec un dictionnaire des termes propres à chacun de ces arts*. Paris: J. B. Coignard. Chapter 19: De la menuiserie de placage, p. 186 : "… et lorsque la dureté du bois est excessive, qu'ils craignent de l'éclater, ils se servent de ceux qui ont de petites dents comme des limes, ou truelles bretées, afin de ne faire que comme limer le bois; ce qui sert aussi à le redresser." Roubo, J. A. 1769-1775. *L'art du menuisier*. Paris: Académie Royale des Sciences.

al Roubo, J. A. 1977. *L'art du menuisier*. Paris: L. Laget. P. 809 and plate 281: "Les rayures ou cannelures des fers à dents, sont creusées, du côté de l'acier, d'une forme triangulaire, et entre chacune d'elles il y a un petit filet plat, qui seul est tranchant, vu que le fer étant affûté, chacun de ces filets forme une espèce de dent d'une forme carrée, qui va en s'épaississant sur le fond. Il y a des fers brettés dont la denture est plus ou moins grosse, selon les différents besoins. *Voyez la fig. 3*, où j'en ai représenté un de grandeur d'exécution, dont les dents sont d'une moyenne grandeur, y en ayant de près de moitié plus petites, et du double plus grosses, dont on fait usage selon les diverses sortes d'ouvrages…"

am The medium was analyzed with Fourier Transform Infrared Spectroscopy by Silvia A. Centeno.

Figure 1.

Conservation of a Diminutive Ivory-Clad Drop-Front Secretary from Vizigapatam, India

Kathy Z. Gillis, Head of Objects Conservation, Virginia Museum of Fine Arts

ABSTRACT

The Virginia Museum of Fine Arts recently acquired a diminutive, ivory-clad drop front secretary that exemplifies the 18th century international luxury trade between India and America in the 18th century. Made in Vizagapatam, a coastal station in southeastern India, the diminutive secretary is part of a group of furniture made by craftsmen there in the 18th century specifically for the western market. The use of ivory as a veneer, black lac within incised patterns drawn from chintz textiles, and the derivation from an 18th century English furniture form make this one object a perfect example on which to study exotic materials, innovative decoration, and the history of cultural exchanges.

This secretary has an impeccable provenance that can be traced to its initial arrival in the United States in the 1780s on a ship belonging to a prominent Philadelphian merchant.

The ivory-clad secretary was purchased prior to the usual restoration many such items go through before coming on the American market. The current condition, including some water damage to the carcass, lifting and cracking veneer, detached moldings, and old, crude attempts at faux ivory, might look to the causal observer to be an eyesore, but to a conservator, it is a jewel: an enviable opportunity to study untouched surfaces and explore construction methods and exotic materials centuries old.

The technical research and conservation treatment for this object will be discussed along with much of the information about its construction discovered during this process.

This is a follow up to a presentation given in Amsterdam in 2002 at the Sixth International Symposium on Wood and Furniture Conservation, The Meeting of East and West in the Furniture Trade. That article, published in the Proceedings of that symposium and given jointly with VMFA's Curator of American Art, David Park Curry, discussed the provenance and context of the object as well as information gathered in the technical examination of the cabinet (Figure 1) and problems to be addressed in the treatment.[a] This paper will focus on the treatment decisions made in the course of the actual treatment.

Some decisions were easy: the 16 detached ivory pieces that arrived with the cabinet (in drawers or plastic bags) were returned to their original locations and secured with either Acryloid B-72[b], or Acryloid B-48N[c]. The decision as to which adhesive to use was determined by the weight of the detached piece and the ability of the adhesive to hold it in place. For example, the upper case molding on the proper left side was a piece that required the additional holding power of Acryloid B-48N.

Cleaning materials were also chosen easily, based on accepted practices in cleaning ivory and ivory veneers. Various methods to remove surface grime or remnants of adhesive were used depending on effec-

tiveness: primarily dry erasers; then in heavily soiled areas swabbing with unstimulated saliva, followed by acetone to ensure removal of any remaining moisture on the ivory.

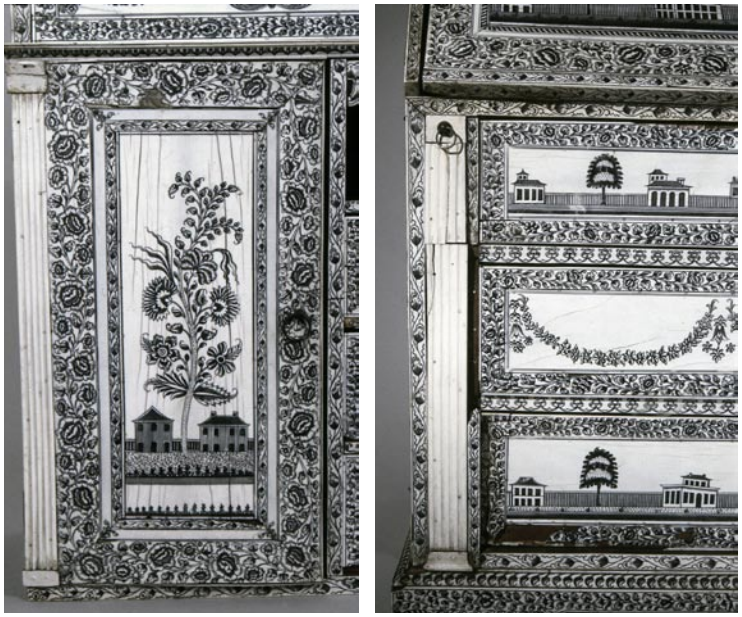

Figure 2.

Severely lifting veneer was removed in areas where this could be safely done. Old glue on the back this veneer was softened with moisture and removed mechanically. The pieces were flattened with humidification and reapplied as well as possible to the original positions. These panels required the holding power of animal hide glue for reattachment. For smaller areas of lifting, these elements were eased back into place where possible. They were left proud if the efforts necessary for re-laying had the potential of breaking the ivory, i.e., the underlying wood structure had shrunk enough that there was insufficient surface area to contain the veneer.

Much of the black material (possibly ebony) laid into the black and white dentil frieze surrounding the pediment was missing and had been inpainted or inked in with a black paint, ink or marker. This was not done consistently or completely, and the stepped loss was distracting at close range. The decision made here was to add black-pigmented wax into the areas where the black material was missing.

Next came the decisions regarding previous repairs. Questions as to which should remain in place and which should be reversed and redone with more stable materials were more complex. The visual impact of the repair and the possible historical importance of each repair were taken into consideration. Previous repairs included one documented repair by Anne Eckert Brown, wife of the last descendent in the Brown Family in which the cabinet had descended.[d] Mrs. Brown's repair involved the upper case proper right drawer beneath the pediment and was carried out in the year 2000. The most useful information in her report states that this repair was done over the existing 19th-century replacement by painting with a toned, alkyd paint in an effort to "soften the negative visual impact" of this non-original section which had been "primitively recreated" on a "painted wooden surface which had badly yellowed over 150 years." Since Mrs. Brown's repair already obscured a 19th-century repair, was done by a member of the Brown family and was fully documented by Mrs. Brown, we decided to keep this repair intact.

Other areas on the cabinet, particularly a long, horizontal section of replaced ivory at the center, just below the drop-front board, displayed this appearance of "badly yellowed" material that Mrs. Brown describes, and probably dated to between 1826 and 1846.[e] These compensations were poorly executed and deemed visually obscuring, and therefore the decision was made to remove them. In all cases these areas were documented in photographic and written form before removal, and the removed sections were retained where possible. The two massive, unsightly iron screws holding the pediment in place, obviously later additions that were causing iron staining on the ivory, were also removed. Evidence on the cabinet suggests that the pediment was originally only glued on.

Figure 3.

Replacement moldings were fabricated for areas where they were missing. These were made by taking silicone rubber molds of similar moldings and casting the replacements in plaster. Losses were filled with conservation-stable materials and inpainted to continue the surrounding incised decoration.[f] Filling was required in approximately 70 areas where the original ivory had sustained losses or where the 19th-century repairs had been removed. Along the sides old ivory piano keys were used to create a continuous line where the warped backboards protruded from the edges.

The most difficult decision involved the question of the appropriate appearance of the capitals and bases on the exterior pilasters of the secretary. We have yet to locate another secretary of this comparatively "large" size for clues as to the original appearance of these elements. (I encourage anyone who might be aware of one to please notify VMFA.) All of these elements had been replaced on our secretary at some point with flat or crudely carved pieces of wood (Figure 2). The interior of the desk has similar pilasters with three of the four original capitals and bases intact (Figure 3). The proportions of the bases to pilasters could be extrapolated to the exterior, but not the capitals. On the interior, the capitals occupied a rectangular area. On the exterior, the space left for capitals was square.

An examination of clues from other similar cabinets from Vizigapatam only complicated the issue. As mentioned above, VMFA's secretary is the only one we are aware of on its scale. Most other examples are much smaller, about half the size of ours, not divided in upper and lower cases, and with only one drawer below the drop-front desk. The closest examples to our secretary had no exterior pilasters, and the interior document drawers were usually round half columns (Fig 4). The capitals on this cabinet, auctioned at Sotheby's in New York in 2002,[g] are somewhat of a fantasy variety – triple tori, not really in keeping with classical prototypes.

No other examples examined had ring pulls on the lopers that supported the drop front. In fact, the small pulls we found on other examples appeared to be designed almost to blend into the front surface of the cabinet. The brass pulls on our loper/document drawers appear to have been replacements, as other original ring pulls on the drawers and drop front are silver. Ring pulls are probably not reflective of the original means of extending the lopers.

Two cabinets appeared at Christies in London in 1989 and 1996 that did have exterior pilasters, although, they did not have the same configuration of cabinet doors and drawers as did our piece.[h] One of these (1989) was missing its capitals, but had multiple element bases, similar to the capitals on Figure 4. On both, the bases were stepped almost as three bases stacked on top of each other.

Figure 4.

Figures 6 – 8.

The 1996 cabinet had capitals that defy the classical expectations of pilaster capitals, but fit the requirement of filling the strange square space (Figure 5). On this cabinet the bases are also trimmed flush with the side of the cabinet. The capitals are mirror images of the bases.[i]

As long as we were making replacement capitals and bases, we decided to make a series and try them all out on the cabinet. James Heitchue, Mountmaker and Conservation Technician at VMFA, prepared six sets of capitals and three sets of bases.[j] The vacancy of the bases had the correct proportions to reflect the interior bases. Therefore, only one base was prepared for the lower case, following the example of the interior bases. On the upper case, however, the appearance of trimmed capitals and bases on the upper case of the Christie's 1996 mini secretary allowed for this possibility.

Upper Case

Three options for the capital and two options for the base allowed for the following combinations:
a) Full capital with one cove; full base with one cove
b) Trimmed capital with one cove; trimmed base with one cove
c) Full capital with two coves; full base with one cove
d) Trimmed capital with two coves; trimmed base with one cove

Lower case

Three options for the capital and one option for the base:
a) Flat capital with pull; full base with one cove (modeled on interior)
b) Full capital with one cove; full base with one cove
c) Full capital with two coves; full base with one cove

The various combinations listed above allowed for a possible five interchanges (Figures 6 -10).
The decision for upper case was option "d"; the decision made for the lower case was option "c." These options seemed to be in keeping with the proportions of the exterior pilasters and with the scant evidence from other secretaries. The full capital on the lower case provides a means of pulling the lopers/document drawers open, yet it blends into the exterior surface like so many of its smaller cousins. It is also likely that this type of capital would have been susceptible to falling off and thus would explain its being lost. The trimmed capitals and bases on the upper case, since they move with


Figures 9 – 10.

the doors when they are opened, allow for easier opening of these doors and do not interfere with the side moldings that are at the same height. All samples were retained, and these capitals and bases can be easily removed and replaced with one of the other samples or a new sample if additional information comes to light.

It appears that no convention was followed consistently in the group of Vizigapatam cabinets observed thus far.[k] Based on the current information we have about our cabinet and other examples, these seemed to be the most logical selections. Additionally, a poll taken of my colleagues at the AIC meeting in Minneapolis seemed to agree on the visual satisfaction of the option chosen for now.

We look forward to someone unearthing another such cabinet with exterior pilasters and capitals and bases intact for comparison and possible modification of the selections we made.

Endnotes

a Gillis, Kathy Z. and David Park Curry, Conservation of an ivory-clad drop-front secretary from Vizigapatam, India, *The Meeting of East and West in the Furniture Trade*, Proceedings of the Sixth International Symposium on Wood and Furniture Conservation, 2002, p. 10-17. Since this publication, wood analysis confirmed that the backboards and interior woods are from the Family *rubiaceae* and the pediment substrate is teak. A sample of the Rear Proper Right foot analysis was carried out at both the Jodrell Laboratory at the Royal Botanic Gardens in the United Kingdom and at the Forest Products Laboratory in Madison, Wisconsin (with consistent results).

b Acryloid B-72 - Ethyl Methacrylate copolymer; Thermoplastic Acrylic Resin. Conservation Materials, Sparks, NV

c Acryloid B-48N, Methyl Methacrylate copolymer, Thermoplastic Acrylic Resin, Rohm and Haas, Philadelphia.

d Report from Anne Brown, April, 2000. The penwork was done with Pigma Micron Pens. No clear coating was applied.

e A "testamentary letter" from Dorothy Willing Francis to her children, Elizabeth Francis and Anne Bayard, written in June of 1846 refers to this cabinet and notes "… I found it in my garret and much broken & had it repaired at no small expense …" Since the cabinet came into the possession of Dorothy in 1826, we can ascertain that the old repairs on the cabinet date between 1826 and 1846.

f Materials for loss replacement included Modostuc (Distributed by Peregrine, Wellsville, UT), Sculpy (Distributed by Polyform Products, Elk Grove Village, IL 60007).

g Sotheby's Sale #N07779, 19 Apr 02 NY (See Note #11 below for listing of all the Vizigapatam cabinets which were consulted in our research; space does not allow for a comprehensive illustration of them here.)

h Christie's London Sale "FORSAKE" 4163, November 16, 1989, Lot 28 and Christie's

London Sale FANTASIA 5626, July 4, 1996, Lot 211.

i Information is not currently available to ascertain whether these bases and capitals are original.

j Replacement capitals and bases were first carved in basswood, and then silicone rubber molds were created. The final products were cast in Aluminlite White (an aromatic isocyanate and blend of polyols, Alumilite Corporation, Kalamazoo, MI 49007).

k At press time, this was the list of cabinets investigated. Not all were available for personal inspection.

Peabody Essex Museum, Salem, Massachusetts
Rijksmuseum, Amsterdam
Philadelphia Museum of Art
Christie's Sale LILA 1559, New York, October 18, 2005, Lot 303
Christie's Sale 7074, London, September 23, 2005, Lot 121
Sotheby's Sale N07779, New York, April 19, 2002, Lot 775
Sotheby's Sale LN7414 "COLZA" London July 4, 1997, Lot 1
Christie's Sale "FANTASIA" 5626 London, July 4, 1996, Lot 211
Christie's Sale "FORSAKE" 4163, London, November 16, 1989, Lot 28
Angus Wilkie, "Anglo-Indian Furniture", *Elle Décor* Feb/Mar 2001 p. 88
Christie's London (Pitchford Hall Sale) 1992 (illustrated in Anne-Noëlle Tamplin, "Twin Traditions," *The*
Antique Collector, December/January 1994/1995, Volume 66, No. 1, p. 62

Rethinking Conservation Paradigms for the Preservation of Waterlogged Wood

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Abstract

One important outcome of the 1978 ICOM Committee for Conservation Conference in Zagreb, Croatia, was the creation of a list of 8 areas of research topics deemed to be problematic in the field of artifact conservation. The author will discuss shortfalls of this list with respect to past history, current issues and complications in using traditional treatment strategies for the preservation of waterlogged wood. Additionally, a case study on the preservation and evaluation of waterlogged wood treated using organic polymers will be presented. A critical assessment of traditional and newly developed treatment methods will be presented with suggestions for new research opportunities.

One important outcome of the 1978 ICOM Committee for Conservation Conference in Zagreb, Croatia was the creation of a list of eight research topics deemed to be problematic for the preservation of waterlogged wood. In his address to the Proceedings of the ICOM Waterlogged Wood Working Group Conference, Ottawa, 1981, Colin Pearson, a Materials Conservation Specialist with the Canberra College of Advanced Education, Australia, noted the research topics outlined at the Zagreb 1978 conference [1]:

1. Use of detergents in the conservation of waterlogged wood
2. Use of tetraethyl ortho silicate
3. Problems with the salvage of waterlogged wood
4. Freeze-drying
5. Methods of analysis of PEG in waterlogged wood
6. Use of sucrose
7. Use of organic polymers
8. Irradiation techniques

The following additional topics of research were added by newsletter from the ICOM Waterlogged Wood Working Group after the conference:

9. Analysis and research
10. Treatment of large ship's timbers
11. Acetone/rosin processes
12. Controlled drying
13. PEG impregnation
14. General interest

In spite of the numerous research areas outlined, however, most research since that conference has focused on preservation of waterlogged wood using sucrose and PEG/freeze-drying strategies. Cliff McCawley, David Grattan and Clifford Cook advanced research into the effects of PEG/freeze-drying waterlogged wood [2][3]. Per Hoffmann conducted some invaluable studies indicating that wood structures do not

degrade at uniform rates, leading to his development of a highly effective, two-phase PEG treatment strategy [4]. ARC-Nucleart has advanced studies in the preservation of waterlogged wood by impregnating wood with resins, which are then hardened using radiation [5]. Alternatively, they have worked successfully in treating larger artifacts using PEG impregnation followed by freeze-drying.

Although contributions to the discipline of waterlogged wood conservation continue, some of the long-term problems of waterlogged wood treatments using PEG and other bulking agents are coming to light. In his address at the Ottawa ICOM Conference, Dr. Allen Brownstein, a senior chemist at Union Carbide Company, addressed the complexities of conserving waterlogged wood and numerous factors related to the degradation of PEG [6]. During the discussion, Cliff McCawley touched on the topic of the effects of metal salts on the degradation of PEG. In retrospect, this has become a topic of great concern. In recent years, the problem of PEG decomposition with the formation of chemical complexes including aldehydes, ferrous, ferric and cupric salts has become a pressing issue. Indeed, some of our finest examples of conserved waterlogged wood are developing potential problems due to our inability to control oxidation and the miscibility/chemical reactivity of PEG with oxides and compounds found naturally in waterlogged timbers. Sadly, it appears that Brownstein may have been correct in stating that 'PEG treatments may not be the perfect solution to difficult problems.'

Using some of Allen Brownstein's suggestions, we started researching organic polymers (topic number seven in the Zagreb list) with a series of experiments entitled "Treatment of Waterlogged Wood Using Hydrolyzable, Multi-Functional Alkoxysilane Polymers." This was conducted to study the use of tri-functional polyols both to stabilize and to maintain the physical attributes of waterlogged wood samples. Instead of just creating a 'very hard and durable finish,' as Brownstein suggested, experimentation was also directed at impregnating a variety of waterlogged wood samples with a self-condensing polymer to form a stable resin throughout the pore structure of the wood. As we perceived it, there were some benefits to this type of resin-forming chemical reaction. Contrary to rapid water/PEG, which often causes cellular collapse or cell wall distortion, water/methyltrimethoxysilane (MTMS) displacement does not appear to distress waterlogged wood, resulting in thorough impregnation with a reduced chance of cellular distortion. Using trace amounts of water, the alkoxysilane MTMS condenses, forming a triol of resins that preserve physical and structural attributes of an organic artifact without causing distortion of cell walls or appreciable shrinkage. Post-treatment microscopic and NMR (Nuclear Magnetic Resonance) evaluation of the treated wood indicates complex resins are formed throughout the wood. These resins are bound to the cell wall structures of the wood. Visually, the wood is aesthetically pleasing without the somewhat waxy, dark coloration associated with PEG-treated wood. Most importantly, resins formed appear to prevent chemical reactivity due to the presence of oxides in the wood. The end result of this research was a unique method of preserving waterlogged wood that used intracellular water in wood samples to create a durable resin, which preserved both the microstructure and the general physical attributes of an artifact.

Once these initial experiments were completed, it was immediately evident that peer review within the conservation community was going to be difficult. First, conservators did not like the idea of forming resins inside of an artifact. Correctly, they observed that these processes were not reversible. Second, the language and direction of our experiments were better suited for the discipline of organic chemistry. Ultimately, we determined that the best way to obtain an accurate assessment of the chemical mechanisms and the viability of prescribed treatment methodologies outlined from experimentation was to apply for patents within United States and Europe. Our research was then

assessed by people knowledgeable in the use of such chemistries, thus alleviating any doubt about the viability of the materials and chemical mechanisms we were using for conservation research. The following five patents outline our research:

Klosowski, J., C. Wayne Smith and Donny Leon Hamilton
Conservation of Organic and Inorganic Materials. United States patent 6,881,435

Smith, C. Wayne and D.L. Hamilton
Method of Preserving a Sample with Methyltrimethoxysilane. U.S. patent 6,835,411

Klosowski, J. M., C. W. Smith and D. L. Hamilton
Methods of Conserving Waterlogged Materials. United States patent 6,020,027

Klosowski, J. M., C. W. Smith and D. L. Hamilton
Conservation of Organic and Inorganic Materials. United States patent 6,022,589

Klosowski, J. M., C. W. Smith and D. L. Hamilton
A Method of Conserving Waterlogged Materials. United States patent 5,789,087

What remained, then, was to demonstrate the combination of these tested chemical mechanisms with organic materials collected from submerged archaeological site excavations. This research, including accelerated weathering tests, was conducted at Dow Corning Corp., Midland, Michigan, over a period of months in 1997.

Evaluating the aesthetic nature of artifacts preserved using MTMS and other organic polymer chemistries is, in fact, a very difficult task. Initially, we observed that, while dimensionally stable, some artifacts preserved using functional polymers with cross-linking additives managed to retain their physical structure but were not aesthetically pleasing. We later found that after we impregnated waterlogged wood with functional polymers, washing the surfaces of the wood with rinses of MTMS to remove excess polymers produced natural appearing wood surfaces that were pleasing to the touch. So while there are no standards that apply to the aesthetic nature of artifacts, the conservator must consider the provenance and long-term curatorial considerations of artifacts when determining the aesthetic appeal of an artifact.

At present, the alkoxysilane polymer MTMS is expensive; therefore, its use as a principle treatment agent is only practical in the preservation of small artifacts. To alleviate this problem, the addition of hydroxyl-ended, functional polymers such as Dow Corning's SFD-1 extends both the working volume and the cost-effectiveness of using MTMS. Stoichiometrically, a traditional addition of 3-5% MTMS by weight of the hydroxyl-ended polymer should be an ideal bulking agent for most organic, waterlogged materials. To date, more than 3000 waterlogged artifacts have been conserved with this combination of functional polymer and cross-linker and are on display in the Bob Bullock Texas State History Museum in Austin, Texas. Numerous other artifacts are also on display in a variety of locations: the Canadian Museum of Civilization, Gatineau, Québec; the Oklahoma History Center, Oklahoma City, Oklahoma; the Del Norte County Historical Society Museum, Crescent City, California; the Corpus Christi Museum of Science and History, Corpus Christi, Texas; and the Texas Maritime Museum, Rockport, Texas.

Our initial research was designed to evaluate the effectiveness of the resin-forming mechanism to preserve waterlogged wood. The use of functional polymers for the preservation of waterlogged wood may hold many advantages not shared by less functional polymers, such as PEG. Because PEG remains partially miscible once integrated into the cell structure of wood, long-term chemical reactivity is an issue. Recent findings indicate that the slow degradation of PEG combined with a host of oxides and other deleterious materials may cause rapid degradation of treated wood. In contrast,

polymerization of functional polymers has been shown to produce a more stable and less chemically reactive bulking agent. Mankind has learned to manipulate bonding/polymerization processes, but in truth, polymerization is a natural process. Most of the components of a tree, themselves polymers, work together to impart rigidity, strength, flexibility and intracellular transport of vital fluids necessary to promote growth. Use of functional polymers for the preservation of wood appears to be a natural fit. Our concerns about using polymerizing agents to preserve the physical integrity and microstructure attributes of artifacts may be misplaced since material science research indicates that organic polymers may interact more predictably than PEG with natural polymers within the structure of organic artifacts. This, in turn, should promote long-term, predictable artifact preservation. Before implementing any conservation strategy, it is natural to be concerned about the chemical reactivity of materials we are introducing into the matrix of waterlogged artifacts. Hindsight has shown that the adoption of PEG for the treatment of some waterlogged artifacts may have been hasty and possibly lacking sufficient research regarding chemical decomposition over time, as well as chemical reactivity within the artifact itself.

Ironically, the non-reversible nature of the functional polymer process may hold the key to reducing the chemical reactivity that remains problematic with PEG. When any bulking agent is introduced into the cell structure of wood, some degree of chemical bonding and potential polymerization takes place. Accordingly, the stable nature of materials being introduced into waterlogged wood and other organic materials should be of concern. As prescribed by the ICOM Waterlogged Wood Working Group activities committee in 1978, experimentation using alkoxysilane polymers and other organic polymers is an essential phase of development in the discipline of organic artifact conservation.

References

1 Pearson, Colin, ICOM Committee For Conservation Working Group on the Conservation of Waterlogged Wood, Proceedings of the ICOM Waterlogged Wood Working Group Conference, Ottawa, Canada, 1981, p.7-9.

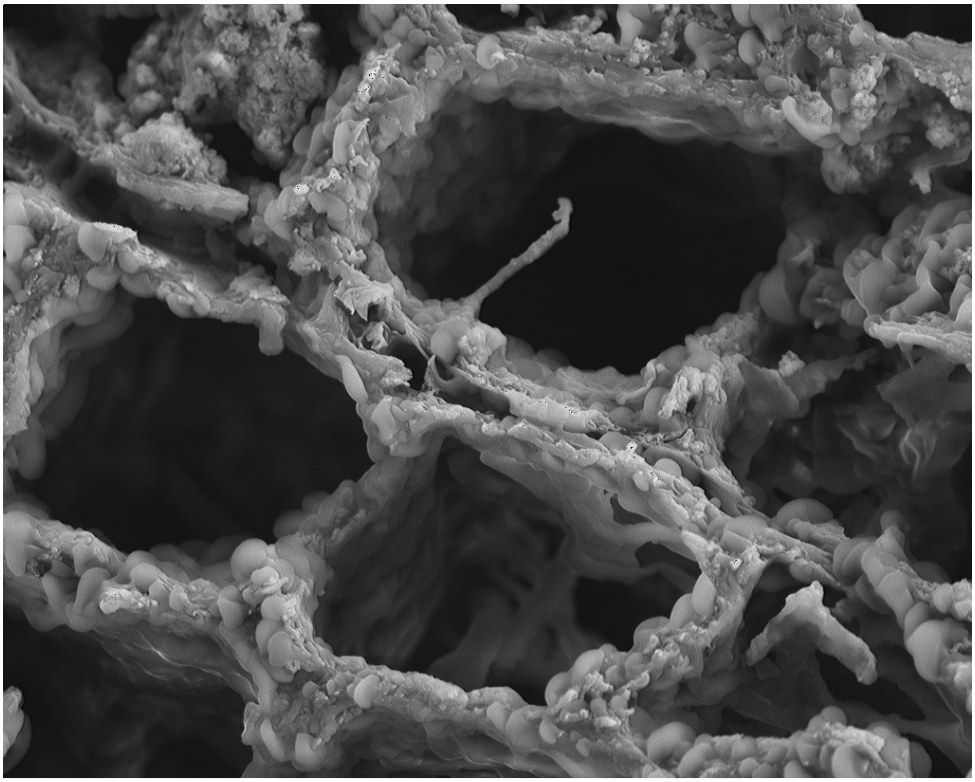
2 McCawley, J. Cliff, David W. Grattan and Clifford Cook, Some Experiments on Freeze-drying: Design and Testing of a Non-Vacuum Freeze Dryer, Proceedings of the ICOM Waterlogged Wood Working Group Conference, Ottawa, Canada, 1981, p. 253 - 262.

3. Grattan, David W. And Clifford Cook, A Practical Comparative Study of Treatments for Waterlogged Wood, Part III: Pretreatment Solutions For Freeze-Drying Waterlogged Wood, Studies in Conservation, Proceedings of the 2nd ICOM Waterlogged Wood Working Group Conference, Grenoble, France, 1984, p. 219 - 239.

4. Hoffmann, Per, On the Stabilization of Waterlogged Oakwood with PEG Molecular Size Versus Degree of Degradation, Proceedings of the 2nd ICOM Waterlogged Wood Working Group Conference, Grenoble, France, 1984, p. 95 - 115.

5. Ginier-Gillet, Andre, Marie-Dominique Parchas, Regis Ramiere and Quoc Khoi Tran, Proceedings of the 2nd ICOM Waterlogged Wood Working Group Conference, Grenoble, France, 1984, p. 125-137.

6. Brownstein, Allen, The Chemistry of Polyethylene Glycol, Proceedings of the ICOM Waterlogged Wood Working Group Conference, Ottawa, Canada, 1981, p. 279 – 285.



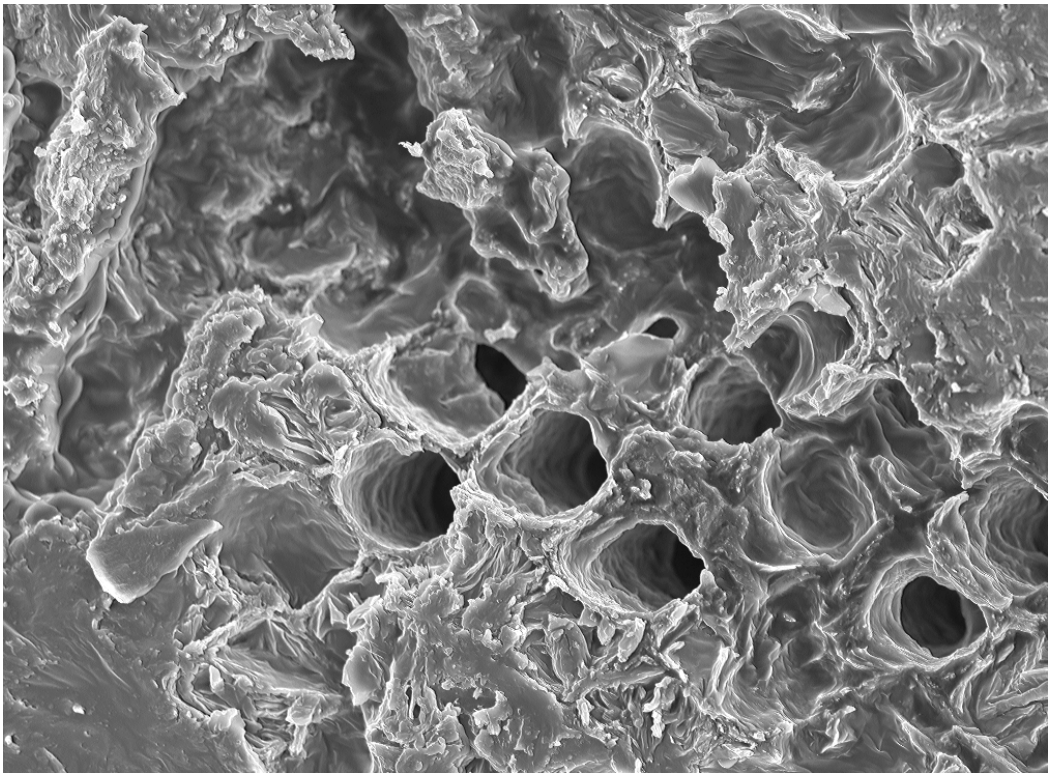


Figure 1. 1929 Rolls-Royce Silver Ghost with Brewster body in front of the Winterthur Museum.

Treatment Protocol for a 1929 Phantom I Wood Body Rolls-Royce Automobile

Mark Anderson & Gregory Landrey

Abstract

The subject of this study is a 1929 Rolls-Royce Phantom I automobile owned by a private collector. This vehicle was "re-bodied" in 1935 when its original limousine passenger coachwork made by the Brewster Company was replaced with a larger nine passenger wooden "Suburban" style coachwork also fabricated by Brewster. Replacing coachwork for the purposes of fashion or function was a common practice in the early days of high-end automobiles. The chassis, mechanical units, and the 1935 Brewster Suburban coachwork are in un-restored condition except for minor repairs and surface work. The wooden section of the body has a second coat of varnish which the current owner would like to remove due to deterioration. The interior of the body is made up of a structural wood frame, decorative wood paneling, textile floor carpets and black leather seats. The exterior of the body also consists of a structural wood frame, but the panels are woodgrain painted sheet metal on top of a wood substrate. The roof covering is a sealed canvas textile on top of a wooden deck. Documentation of the history, materials, and mechanisms of deterioration of the automobile will be discussed. The primary focus of the study is the nature and condition of the wood, surface coatings and upholstery in the 1935 Suburban coachwork and fenders of the Rolls-Royce. The treatment proposal will take into account ethical considerations, analytical data, recommendations for cleaning and minor repairs as well as preventive conservation steps for the automobile's long term preservation.

Introduction

Rolls –Royce: Best car in the world! Especially when fitted with a handsome all wood coach-body. The opportunity to study this motorcar was our first chance to engage the Last Chance Garage located at 13 Cemetery Lane in Unionville, Pennsylvania, where the Rolls-Royce is awaiting restoration. As conservators, we're interested in understanding significant objects better and forestalling ultimate demise. The remarkable state of preservation of this automobile made it an excellent case study for the assessment of the coatings and materials used in its fabrication.

This study resulted in part because Henry Francis du Pont, founder of the Winterthur Museum, had his Cadillacs custom built in a manner very similar to the Rolls-Royce of this study. This was an era when business executives and well-to-do clients engaged custom coach firms to create unique automobiles, carrying on a centuries old tradition of having a coach built to ones personal taste. A research project has been conducted concerning the historic automobiles that were once a part of the Winterthur estate (Landrey and Thompson, 2005). This interest in the automobiles that graced Winterthur generations ago led us to this Rolls-Royce and the opportunity to document its coatings and upholstery.

Background

The high state of preservation of this Rolls-Royce is explained by its history. The chassis was constructed in 1929 at the Rolls-Royce plant in Springfield, Massachusetts and was fitted with a metal limousine

sedan body. In 1934, the limousine body was removed and a nine passenger wooden Suburban coach-body was installed by the Brewster Body Company. Oral history holds that executives of the Pennsylvania Turnpike Commission used the car during the construction of the toll road. It was then sold to the Split Rock Lodge in the Pocono Mountains of Pennsylvania where again tradition has it in use as a jitney between the Lodge and the local train station. In 1950 the car was acquired by Robert E. Ferguson Sr. of Kennett Square, Pennsylvania who stored it in a small rented garage for more than forty years. After decades of inactivity, the car was made roadworthy with little more than soaking the cylinders with oil and a fresh tank of gas. While the motorcar has been exhibited occasionally at antique car shows since that time, it has been driven very little as a restoration plan is developed by the current owner Robert Ferguson, Jr. and the Last Chance Garage of Unionville, Pennsylvania. Any vehicle with a claim and a reputation to be the best in the world is reason for pause and the beauty of this vehicle caught our attention immediately.

Vehicle Type

The Rolls-Royce Phantom I series was introduced in 1925, being produced in the new Springfield, Massachusetts plant as well as in Derby, England. All Phantom Is came equipped with a 6 cylinder 7 liter gasoline engine capable of producing 120 horsepower. By comparison a Ford Model A of that era sported a 4 cyl, 3.3 liter power plant generating 40 horsepower (Georgano, 1969) . The economy was strong in the 1920s and the luxury car market was growing. Wanting to take advantage of this situation, Rolls-Royce, Ltd of the United Kingdom built the Springfield works and started producing Phantom I automobiles. This production venture in North America lasted until the 1930s when the plant closed, a victim of the Great Depression. The tradition of Rolls-Royce continues in the United Kingdom, although now the legendary firm is owned by BMW.

Seeing a body made of wood intrigued us as furniture conservators, particularly on a Rolls-Royce. The Brewster Company, the creator of this hand crafted coachwork, was founded in 1810 and became a premier maker of horse drawn carriages in Manhattan. In the early 20th century, the company made a successful transition to the fabrication of custom coaches for the new automotive trade, moving to Long Island City, New York, which is where the body for the subject of this paper was made. Rolls-Royce of America purchased Brewster in 1926, ended its North American manufacturing activity in 1933 and Brewster closed its doors in the mid 1930s (www.coachbuilt.com). By mid-century, the great age of custom coach builders had all but passed from the automotive scene.

The authors were struck by the exceptional state of preservation of the 1929 Rolls-Royce as it is unfortunately uncommon and saw an opportunity to engage in a documentation project. With Winterthur's permission, we proposed to the owner of the Rolls-Royce and the staff of the Last Chance Garage that we pursue a pro bono documentation project on this grand vehicle and they accepted.

Objectives of the Study

The objectives of the project were:

- To gain experience in the assessment of objects outside of Winterthur's collection.
- To secure a unique opportunity for a student documentation project in our Art Conservation program's curriculum.
- To engage conservation in general with our local community.
- And to make connections between the conservation profession and those involved in the restoration of historic automobiles.

Status of Automobile Restoration

Historic vehicles are routinely stripped to bare metal, refinished, replated and reupholstered to create a showroom or better type appearance. In fact, it is commonplace to not only completely restore an historic vehicle but to change colors and materials to suit present tastes. A 2005 American

Institute of Conservation general session presentation on the preservation of a Saturn V rocket brought forth some of the same issues of needing to balance preserving a large, very mobile historic object while dealing with a public expectation of a "shiny and new" presentation. Those who attend antique car shows often put a premium on seeing vehicles presented in a better-than-new condition.

Figure 2. Ash coachwork.

In contrast to this, recently, some historic automobile clubs such as the Antique Automobile Club of America have been developing awards for a "preservation class" which acknowledges an increased interest in a less intrusive approach to preserving automotive heritage. Perhaps the time is right to share the potential that techniques of assessment, documentation and treatment protocols common to the AIC membership may have in the realm of antique automobiles. And why not! This Rolls-Royce may well rival a grand carriage of an 18th-century aristocrat like General John Cadwalader of Philadelphia.

This assessment covers some of the mulit-media components of the automobile by documenting the nature of the wood body, faux painting, exterior black finish and upholstery. We will leave the assessment and documentation of other aspects of the vehicle such as the corrosion of metals, deteriorating safety glass and mechanical concerns to other specialists.

Coachwork Assessment

The coachwork is constructed entirely of ash (fraxinus spp.) utilizing the wood for the thick structural floor elements, the interior trim and roof boards and the joined frame and panel construction. In several instances the wood is covered by protective overlays including faux wood grain painted aluminum panels exhibited on the exterior of the coach-body and the wooden roof structure which is covered by a sealed textile roof canvas marketed under the name Neverleek. The construction of the coachwork utilizes mostly open bridle style joinery which is augmented by mechanical fasteners. The "open finger" system of joinery is slipping and separating in many areas of the doors and coachwork structure.

While setting a rustic tone and creating a warm feeling, the wooden body parts have yielded to rot and decay in some areas of the coachwork and require restoration. Ash has only moderate resistance to rot and decay but coach builders often chose it for its high strength to weight ratio, for its easy machining and for its ability to take and hold stain and varnish. The joined wooden coachwork from the Brewster shops, while of high quality is certainly the product of a "modern" commercial technology, employing power shaping and sawing and mechanical fastening systems. (Figure 2.)

The interior aspects of construction reveal degradation that is the result of trapped moisture combined with the relatively decay prone timber. (Figure 3.). This deterioration is the result of design and material failure built into the original construction. Unlike today's rubber window seals this Rolls-Royce makes use of a woolen felt weatherstrip at the interface of the window sill area and the crank down window. While making for a quiet

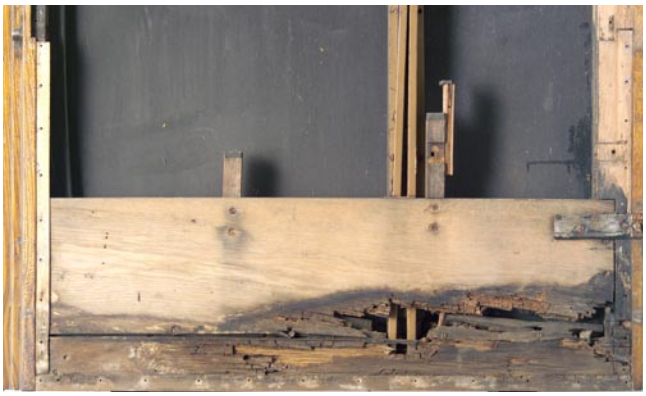


Figure 3. Degraded wood, interior of door.

and easy descent of the window glass, the felt seal has allowed water to collect in the interior areas of the lower door. The vertical metal track lined with felt helps guide the lowering of both the small triangular vent window and the larger side window. With the deterioration of the felt the track has also acted as a rain spout, channeling water down and into the lower areas of wooden door framing.

Many of the deteriorated elements are not important structural components but they retain important period documentation and therefore should be preserved rather than replaced. The signature of "Rudy" in red chalk, that could date from the 1930s on a door panel covered by upholstery, and other factory markings like the script on the lower areas of the door panel are also valuable in the overall context of the vehicle's history.
In some areas the rot has extended into the hinge stiles causing weakness in the door-to-frame attachments as in a heavily deteriorated area above the hinge. These losses will require inserting new structural wood elements.

Coachwork Treatment Options:

It is our recommendation to consolidate as much of the existing rotted material as possible and add new spliced or patched wood elements only as necessary. Because the car is intended to be used, the repairs must be strong and field serviceable and will require mechanical fasteners as needed. This more active approach differs from the very passive way most furniture conservators would treat a fine joined wooden object. As in furniture conservation though, we recommend that any added wood elements be sympathetic to the original grain, color and porosity of the original timber and any finish variances between old and new should not be immediately obvious. Previous repairs meet some but not all of these criteria.

Surface Coating Assessment

Varnish on Wood: Wood and varnishes used in the fabrication of early 20th-century vehicles were not dissimilar to the manner and passion with which we might write about 18th-century furniture. The transparent coating applied to the interior wood is close in visual character to the look of traditional coach varnishes which were usually full bodied long oil varnishes (Augerson, 2004). The varnisher's trade is known to most of us as a skilled endeavor but the current top varnish coat has developed defects, including traction crackle and curtaining. A contemporary advertisement indicates that Rolls-Royce used Valentine Varnishes along with other well known trademarked products of the period including Neverleek roofing materials. We located publications produced by the Valentine Company from the same era as our Brewster coach-body. The advertisement informs the public that the traditional materials of "the old coach and carriage days" are changing, a truth that will be corroborated in the analytical section of the talk (Valentine's 1923).

The Valspar vanish product line is mentioned in the Valentine publication, and specifies its use for both clear and tinted varnishes. It is interesting to note that Valentine's suggests several colors for staining wooden coachwork including light oak, dark oak and even green. Many Brewster bodies included their special moss green curly maple trim, though our Suburban body is all ash tinted to one of the oak colors. The long oil varnishes required two days of drying before recoating and in other sections of the Valentine guide, finishing schedules span a full three week period from start to completion to accommodate the many layers and rubbing out processes.

Figure 4. Degraded varnish on the exterior coachwork

We have noted the quality of the existing top varnish coat on the Suburban body examined for this study is less than superior and Valentine's provides information on this topic as well in their publications of the period (Varnish Difficulties). In fact most of the pitfalls warned against in the Valentine's literature are evident on the current topcoat of varnish on this Phantom I. (Figure 4.)

Paint on metal: The exterior door panels are grained painted on aluminum which is particularly fragile. Flakes seem to pop from the surface with energy all their own. (Figure 5.) The other non-wood components of the body, fenders, hood and cowl are painted black. There is some separation but little corrosion.

Coating Analysis:

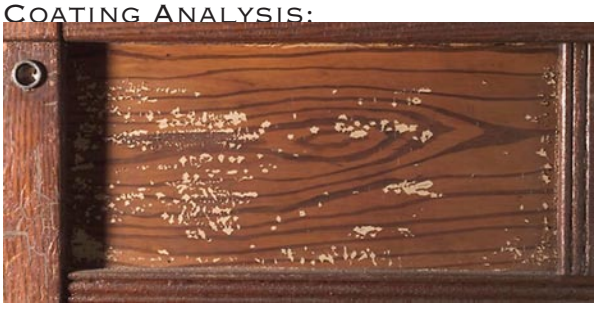


Figure 5. Grained paint on aluminum substrate.

Analysis of the coatings was performed to understand the vehicle better and to help develop surface treatment recommendations to the owner and the staff of the Last Chance Garage. Samples were taken from the varnish from exterior wood of the driver's side front door, the grained paint on the driver's side rear door and the black paint under the lower hinge of the driver's door.

The coatings on the wood and metal parts of the body were analyzed by the staff of Winterthur's Scientific and Research Analysis Laboratory: Dr. Jennifer Mass, Catherine Matsen and volunteer scientists Janice Carlson and Dr. Chris Petersen. The varnish on the ash wood body was analyzed using optical microscopy and Fourier transform infrared spectroscopy (FTIR) and gas chromatography-mass spectrometry (GC-MS).

Varnish on Wood: A cross-section was taken from the front passenger's exterior wood door frame member and viewed in ultra-violet light using the Leitz D filter cube. The image indicates the presence of two zones of a transparent coating. (Figure 6.) Note the weathered characteristic of the first, lower layer in Figure6, which could well be the varnish applied by Brewster in 1935. A second, upper layer covers the earlier weathered surface. This second coating most likely dates no later than 1950, the year Mr. Ferguson purchased the vehicle, since the oral history indicates that nothing has been done to the wood body since that time. The fluorescence emission of the two layers suggests that the properties of the two coatings may be sufficiently different that they could be separated, but this is just speculation at this point. Additional layer-by-layer analysis may help identify specific characteristics that could be taken advantage of should selective cleaning be desired.

FTIR

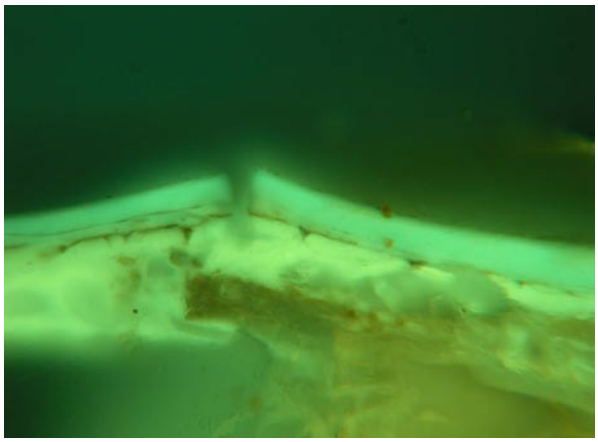


Figure 6. Cross section, exterior varnish, UV light, Leitz D filter cube

Analysis with FTIR indicated that the top coating seen in this section was primarily an alkyd resin and oil, possibly tung oil and GC-MS confirmed these findings. Additional analysis is needed to determine the composition of the lower layer. A spot test of the outer surface indicated that the varnish softened readily with ethanol. This may be in contrast to the experience of some, that alkyds are resistant to such polar solvents. However, alkyds are vulnerable to a degree to alcohols and this may be good news if the owner wishes to selectively remove just the later layer.

Grained Paint on Metal: A sample of the grained paint was analyzed using scanning electron microscopy – energy dispersive spectroscopy (SEM-EDS). A variety of elements were found in the base layer of the grained paint including silicon, aluminum, sulfur, barium, calcium, zinc. (Carlson, Mass, Matsen, Petersen, 2005). A cross-section of a cupped grained paint sample shows the layering of the semi-transparent varnishes used to create the grained effect as well as the complexity of this coating which is less apparent when viewed with visible light. (Figure 7.).

FTIR and SEM-EDS analysis indicates that the

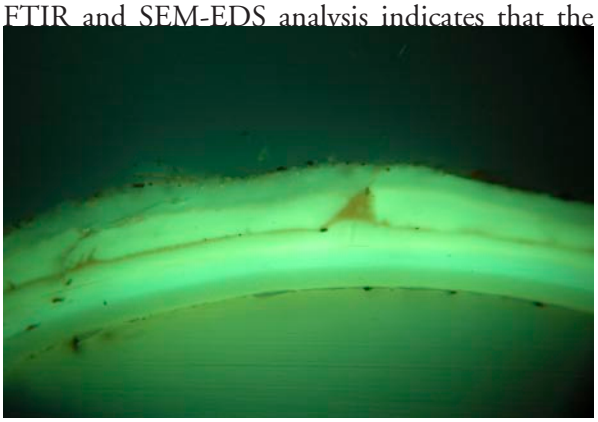


Figure 7. Cross section, ultra-violet light, grained paint.

grain painting is a combination of cellulose nitrate, fillers, phenolic resins and oils. (Carlson, Mass, Matsen, Petersen, 2005). To summarize the grained painting analysis, the fuax surface was achieved by using a white base of kaolinite and barium sulfate in a cellulose nitrate binder with the grained affect produced by using sparsely dispersed pigments in a phenolic resin and tung oil binder.

Black Paint on Metal: Optical microscopy indicates three zones, a thin reddish primer, a gray base and a black show surface. XRF, FTIR and SEM-EDS were used to analyze these components. (Carlson, Mass, Matsen, Petersen, 2005)

The thin reddish layer is primarily iron oxide which could be primer for aluminum. The sample studied was taken from an aluminum door panel reducing the possibility that this is residue from a ferrous substrate. However, the authors would like to re-analyze this paint to be sure that we are not confusing this with iron contamination from elsewhere on the door.

The gray base layer is heavily bulked out with the pigment lithophone (barium sulphate, zinc sulphide) as well as a host of other materials containing lead, calcium, magnesium and silicon as seen in this elemental mapping of the gray base layer.

The closest match for the binder of the gray base layer is an alkyd resin, which is the second time that an alkyd has come up in the analysis. As furniture specialists, this struck us as an early date for this material as we are not used to seeing it in regular use on furniture until later in the century. However, the DuPont Company developed an alkyd resin for automotive finishes in the mid 1920s marketed under the trade name "Dulux" which was a successor to the successful "Duco" line of paint.

FTIR analysis indicates that the black paint on top of the gray base is a cellulose nitrate coating. Cellulose nitrates were introduced as automotive finishes shortly after the First World War being marketed by DuPont as "Duco" in 1922 (www.heritage.duPont.com). The use of DuPont cellulose nitrate paint products on Rolls-Royce bodies built by Brewster is documented in a sales contract for Henry Francis du Pont's 1928 Cadillac that specifies the body to be painted "all black, striped white,

same as John D. Rockefeller, Jr.'s new Rolls-Royce, but in Duco finish and polished."(Winterthur Archives) Thus the analytical findings are consistent with the documents from the time period.

Analytical summary:

The varnish on wood is in two layers and appears to be comprised primarily of an alkyd resin. The grained paint contains kaolinite, barium sulfate, cellulose nitrate, phenolic resins and pigments. The nature of the black body paint is consistent with cellulose nitrate on top of an alkyd base.

Surface Coating Treatment Options:

What should be done with these surfaces? Perhaps the most important step may be helping the owner to not only accept but to desire a presentation of the vehicle in a preserved state rather than better-than-new. We need to know more about the base layer to develop specific treatment options. However, it seems likely that a controlled solvent system such as an ethanol gel may be successful in removing the later layer and thereby retaining the original coating applied by the Brewster Company.

It seems likely that the vehicle will be driven and exposed to the elements, even if infrequently, increasing the need for a protective top coat over the existing varnish. This is where our colleagues who deal with large scale exterior projects may be helpful in selecting a coating that would be as reversible as possible and aesthetically pleasing while protecting the original varnish and wood from the elements.

The treatment options for the grained paint are varied. It does seem reasonable, even if not easily reversible, to consolidate this grain painting using a weather resistant material. Possibilities for consolidents need to be researched and explored to select a material with proper glass transition point, UV stability and colorfastness. Acrylic resins are materials that may meet these criteria and are common to the conservation profession.

Areas of loss could then be inpainted to blend visually. While such a treatment might not win this vehicle 100 points in a competitive concourse exhibit, the skills common to a decorated surface conservator could bring the aesthetic to a point that the grandeur of the vehicle could be brought back while retaining the originality of the unknown Brewster artist who rendered this faux surface in 1935. Another approach would be to create a precise reproduction of each of the panels and retain the originals either in place behind the reproductions or in secure storage.

The options for the black paint were discussed with the staff at the Last Chance Garage. The specific original visual quality of this particular black paint could be reproduced using the analytical information generated by the Winterthur scientists. The areas of loss could be consolidated and skillfully inpainted rendering a sense of overall completeness to the paint while preserving the original integrity of the surface. The owner will need to decide on the ultimate balance of presentation and preservation.

A conservation principle that we will strongly encourage for all surfaces, no matter what treatment choices are made, is to leave at least some small portion of the varnish, grained paint and black paint intact and undisturbed as a physical document of the surface history of the vehicle.

Upholstery Assessment:

Interior: The interior upholstery of the Phantom I appears to be well preserved. (Figure 8). The primary upholstery material for the seats is leather but durable faux rattan slipcovers have been made for each of the self contained seat units. At first we thought the cases covering the leather upholstery were comtemporary to the 1934 body but upon further study they now seem to be associated with the Split Rock Lodge Period and were nailed over the leather to protect it while the car was used as a jitney.

Figure 8. Seat Cushion.

Only one seat cushion unit was removed from the car and brought to the labs at Winterthur for study. This seat was offered as a documentation project during the Organic Materials unit taught for the first-year students in the Winterthur/University of Delaware Program in Art Conservation. Mayumi Yoshizawa selected the cushion as her object and created a very thorough work on its materials and construction.

The upholstery under the faux rattan case is a standard panel and buttoned leather cover common to the 19th and early 20th centuries. There are dissimilar aging qualities on the outer edge of the seat. A student working on the project was the first to observe this wear and minor deterioration which is localized to the three outer panels (Yoshizawa, 2005). This is illustrated quite clearly by the sharp area of degradation transferred to the paper rattan on the underside of the top case which is acting as a useful, yet unfortunate, litmus test.

Obviously, a different batch of leather was cut to make the outer panels and it is not known how much more of this grade material exists on the other seats. For the time being the degradation is not at all severe even though the car is kept in totally uncontrolled storage.
The interior of the seat is difficult to access due to the relatively tight and intact cover. The seat bottom is tightly covered with a cotton oil cloth bottom. One small air vent hole allowed access to the interior to assess the spring work. An x-radiograph that we made gave a clear image of the complicated coil spring and metal accordion tie construction of the inner seat. Curled hair stuffing is visible in the digitally processed x-radiograph and a single hair was sampled and correlated to known photomicrograph library samples. A complete catalogue of loft measurements and fibers was generated for this study (Yoshizawa, 2005). A printed reference from an early Rolls-Royce brochure from the '30s touts the upholstery provided in their Brewster coachbodies:

"UPHOLSTERY - Between each fold of Brewster upholstery, a shell of fine curled hair is filled and rounded with soft swan's down.
The springs are firm at the front of the seat and the lower part of the back cushion; soft and resilient at the back of the seat and upper part of the back cushion". (www.coachbuilt.com)

Other textile components surviving in the Phantom I included woolen carpet with almost no evidence of insect grazing though the leather piping on the edges is beginning to embrittle.

Exterior: The "Boot" mounted on the outside back of the car is lined with a light-weight cotton oil cloth that is in serious need of stabilization. The roof is covered with Neverleek which is an oil cloth.

Upholstery Analysis:
The assessment of the original seat indicated that it is a vegetable tanned leather. Microscopy indicated that the seat covers are paper and cotton fibers which comprise the "faux rattan" covers.

Upholstery Treatment Options:
It is recommended that the rattan covers be kept in place as they do serve to protect the original leather seats. The covers could also be removed and preserved separately following routine conservation guidelines (Landrey et al, 2000). Binding and consolidation of piping areas on the interior upholstery is recommended along with standard cleaning procedures. The boot (trunk) compartment should not be used for the current collection of tools and jumper cables that it holds.

Conclusion:

The assessment and analytical tools described here were useful in understanding more completely the nature of this historic motor car, how its body was crafted, what its original appearance might have been, and how it has aged. This information can be drawn on directly by staff at the Last Chance Garage and their contractors so that they may restore a grand vehicle in an informed manner while preserving its history in the process. We do not know what direction they will take with this object. However, it seems that a carefully planned and crafted treatment of this Rolls-Royce could result in an immensely satisfying balance of preservation, function and aesthetics without losing the integrity of its history.

The results of this study along with additional analyses will be shared with the historic automobile collecting and restoring community. In the process, it is our desire that the influence of the conservation profession may continue to grow in new areas of our heritage including historic automobiles. Exceptional examples of historic automobiles are just as deserving of the input from conservators and scientists as are the more established aspects of cultural property.

Even conservators want to take a ride in the Rolls. We were treated to a ride around the Winterthur estate getting a sense of the vehicle and all of its materials in motion.

A vehicle such as this appears right at home at the front door of the Winterthur Museum and Country Estate

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GJL MJA

"There is a House that is no more a House": Conservation of the Painted Wall Paneling in Shelburne Museum's Stencil House

Nancie Ravenel, Objects Conservator, Shelburne Museum

Abstract

Often an artifact's past history can provides clues to its current condition and influence proposed conservation treatment. That history can be discerned through physical examination and through archival research. When the painted wood wall paneling from the Stencil House came to Shelburne Museum founder Electra Havemeyer Webb's attention in 1952, it was covered by about 5 layers of wall paper. Although she was collecting examples of New England vernacular architecture at the time, it was really these painted walls that grabbed her interest rather than the farm house. This paper will consider the available documentation concerning the move of the house from Columbus, NY to Shelburne, VT , the ensuing restoration of the wall paneling undertaken in 1952-57, and the issues that they raise. The manner in which the documentation and past treatment influenced the 1999-2000 conservation/restoration treatment of the painted wall paneling will be discussed.

Often an artifact's past can provides clues to its current condition and influence proposed conservation treatment. That history sometimes can be discerned through physical examination and through archival research. When the painted wood wall paneling from the Stencil House came to Shelburne Museum founder Electra Havemeyer Webb's attention in 1952, it was covered by about five layers of wall paper. Although she was collecting examples of New England vernacular architecture at the time, it was really these painted walls that grabbed her interest rather than the farm house itself. This paper will consider the available documentation concerning the move of the house from Columbus, NY to Shelburne, VT, the ensuing restoration of the wall paneling undertaken in 1952-57, and the issues that they raise. The manner in which the documentation and past treatment influenced the 1999-2000 conservation/restoration treatment of the painted wall paneling will be discussed.

Electra Havemeyer Webb grew up in a household surrounded by fine and decorative arts. Her parents, H.O. and Louisine Havemeyer, collected old master and Impressionist paintings and Asian ceramics and bronzes. The Havemeyer New York apartment was decorated with furnishings designed by Louis Comfort Tiffany. In contrast to her parents, Electra sought out American antiques and folk art. The Webb's homes in Shelburne, Vermont and Westbury, New York overflowed with her treasures.

In 1947, after raising five children and following her husband's retirement, Mrs. Webb concentrated her efforts on creating a museum to share her collection with the public. She purchased a farmhouse to display her collections of ceramics, glass, dolls and pewter. On the surrounding land she decided to build a structure to exhibit the Webb family's collection of horse-drawn vehicles. The structure was based on a horseshoe-shaped barn from Georgia, VT built in place using wood salvaged from a total of 11 barns.

Figure 1. Exterior of the Stencil House in Columbus, NY, 1952.
Figure 2. Stencil House "dining room" before disassembly in Columbus, NY, 1952.

Between 1947 and 1952, eleven more buildings were moved onto the property. Most were disassembled and then reassembled on site. Museum staff typically drew floor plans and took detailed photographs of the structures before and during disassembly to guide them in reassembling the buildings once they were in Shelburne.

Sometimes she could be quite inventive as to how a structure would be reassembled. The Vermont House was a clapboard structure that she clad in stone and then furnished as the home of a fictional retired sea captain whose house contained wonderful things that he had acquired during his travels. Her intention was to delight the eye more than it was to educate.

Through Mrs. Webb's numerous letters to her assistants, notes to the workmen, and planning lists in the Shelburne Museum Archives, we know she was an active participant in every decision that was made when these structures were re-erected and the artifacts installed.

When the painted wall paneling from the Stencil House came to Mrs. Webb's attention in 1952 it was covered by about five layers of wall paper (Fig. 1, Fig. 2). And rather than the house itself, it was really these painted walls that grabbed her interest. In a letter dated October 1952 to American Decorative Arts scholar Nina Fletcher Little, Mrs. Webb writes:

> I asked Mr. Bayard to get your opinion regarding a stenciled room in New York State . . . the room seems to me like a very good and rare one. Although I have no special place to put it just now, I would hate to lose it if it is as good as I think."1

> No longer useful as a dwelling due to structural problems, it was, to quote Robert Frost, "a house that was no more a house, on a farm that was no more a farm."

In November 1952, Mrs. Webb writes to Mrs. Little that the Museum had purchased the Stencil House. The following month, a group of workmen from the Museum went to Columbus, NY to photograph the house, label the interior paneling, and remove it to Shelburne. In the spring of 1953, the workmen returned to label the beams and undecorated boards from the rest of the house and bring them to Shelburne.

In photos of the Columbus, NY work site taken at the time, there is a lot of what appears to be waste wood on the ground around the truck. One can assume that that wood was too rotten to be reused, so there was no point in bringing it back to Shelburne. In Mrs. Webb's correspondence with her workmen between 1953 and 1954, there is quite a bit of discussion about finding appropriate wood boards to reconstruct the Stencil House. In con-

Figure 3. Alan Munro working on Stencil House paneling, circa 1954.

trast to the other historic houses at Shelburne, it appears that no floor plan was made of the house in Columbus before it was moved, though a floor plan has been established based on the photographs. Additionally, the dining room and front hall were only partially photo documented, leaving gaps in our records as to what the house looked like before it was reassembled at the museum.

One has to wonder if Mrs. Webb was still thinking of the decoratively painted walls as the object that she was acquiring, and the house simply as a container for their display. Letters to Nina Fletcher Little indicate that Mrs. Webb was looking for more painted wall paneling to add to the house and that she was already concocting stories to make it into a "historic house." Architectural alteration was not unusual within her circle of collector colleagues, which included Henry Francis Dupont and Katherine Prentis Murphy, particularly if the alterations made the building or interior room more symmetrical, more comfortable in dimension or more harmonious with an exterior landscape.

That sense of the architecture as a backdrop for the paneling and the collections is further reinforced by an undated memo from Mrs. Webb entitled "Suggestions for Stencil House." She says, "Must use Holmes boards in this house. We also have some other very fine wide planks which could be cut and used on the walls or on the floor . . . Maybe in this case the stairs could be worked in on the West side. Let us try and find an open stairs which would be nicer than closed in. Like the little stone house or even with simple spindles. See page 196 Old American Houses by Williams."2

In the case of the Stencil House, it seems Mrs. Webb was creating an exhibition building from salvaged lumber, as she did with the Horseshoe Barn, rather than saving an example of domestic architecture. The house is no more a house; it's an exhibit hall.

This paper addresses the documentation and treatments of three of the rooms in the house – the parlor, the dining room, and the front hallway. Documentation from the 1950s of what was actually done to the painted paneling in the parlor consists of a series of un-annotated photographs from the museum's archives. No similar documentation exists for the other two rooms. In 1990, University of Vermont historic preservation student Letitia Richardson interviewed former Shelburne Museum employee Alan Munro to fill in some of the blanks. 3

After the house arrived in the 1950s, Alan undertook most of the work on the painted wall paneling in the parlor (Fig. 3). It appears he also worked in the front hallway, but probably did not work in the dining room. Generously, he described his methods of removing the wall paper and incorporating new wood boards with the old.

At some point while the house was in New York, the windows throughout the house were enlarged and the paneling was chopped out to accommodate the larger windows. The windows currently

Figure 4. Wall, during treatment, with panel fills under the windows, circa 1954.

in the house are smaller than they were when the house was acquired, so he had to add new boards under the windows in his reconstruction (Fig. 4). He also had to add new boards to the parlor and front hallway to accommodate the changes in the floor plan that Mrs. Webb desired. For example, with the exception of the boards under the windows, the three walls other than the fireplace wall were in original paint. The fireplace wall is unusual because so many panels were completely added.

He described the Stencil House work to Letitia as a "dirty, dusty, lousy job." His system for incorporating new boards into the old was to first coat them with a protein glue based gesso to give them the right textural feel, then to apply an oil-based paint. The appearance of age, the old hand-worn appearance Mrs. Webb so desired, was provided by a layer of varnish followed by paste wax on to which rottenstone, raw umber dry pigment, and pumice were worked into the surface.4

By 1990 Alan's varnish had unevenly discolored in the parlor and the front hallway, and the painted surfaces in the dining room were cracking and shearing off the wood paneling (Fig. 5, Fig. 6). For more specificity of what was done to the walls, I mapped the paneled surfaces either on photographs or on measured drawings with the help of volunteers. We noted the condition of all the paint, the 1950s additions and alterations, and the alterations that were likely to have been made after installation.

We learned that additions made in the 1950s were easily distinguished because of a difference in texture due to that gesso layer under the paint. The original is much thinner in appearance and almost free of brush strokes while the paint applied in the 1950s has a pronounced brush stroke.

To support our observations, cross sectional samples were taken throughout the house and stained with fluorescent dyes to indicate the media in the layers. There was a good deal of original paint visible under the varnish and wax layers that had been applied by Alan Munro in the parlor and front hallway. Samples from the parlor and front hallway show a priming layer of glue, topped with a distemper paint, followed by the varnish that Alan described applying. In the front hallway and parlor, the discolored varnish was removed and overpaints were reduced creating a more unified appearance to the walls.

In terms of condition and structure, the painted surface in the dining room was much more com-

Figure 5. View of two "parlor" walls, 1990.
Figure 6. Detail of painted surface on "dining room" walls in raking light, 1999.

Figure 7. Fireplace wall in "dining room" after repainting, 2000.

plex. The texturally uneven paint surface suggested that these walls had been completely repainted in the 1950s, and this top layer covered areas of original paint as well as large areas where original paint had been lost. It is in this room that we see the hand of Mrs. Webb. I don't mean to suggest that she got out her paint brush and had at it herself, but the paint cross sections from the dining room are very different from those in the other rooms.

While a few dining room panels seemed to have been overpainted with just oil paint, on most panels whatever salmon-colored original background paint remained was covered by a thick layer of gesso followed by a number of different colors. Lack of grime between those paint layers above the gesso suggests that they were applied in quick succession. I think what we see is Mrs. Webb searching for what she might have considered a better background color for her furnishings in this room.

The gesso appeared to be pulling whatever original paint that might have been left off of the wood. Since the overall goal of the treatment was to create surfaces that were harmonious within the house, consolidating and overpainting flaking surfaces in the dining room was not a reasonable option. Moreover, since so much original paint survived in the front hallway and parlor and there wasn't sufficient early photo documentation to indicate how much original paint was in the dining room before the room was repainted in the 1950s, the curators and conservator made the difficult decision to recreate this room with museum painters and a decorative painter hired for the project.

After the dining room walls were documented as they existed, the flaking paint resulting from the 1950s restoration was mechanically stripped. Where gesso was not present, the surfaces were coated with an isolating layer of Acryloid B72 prior to repainting. Finally the stencil painted decoration on those walls was recreated using the salmon color discovered in the analysis as the background color and repeating the stencil pattern applied in the 1950s (Fig. 7).

In closing, fairly complete photo documentation of the parlor and its treatment in the 1950s combined with an oral history from the workman involved with the project in the 1950s provided the current caretakers, the curators and conservators with a very good picture of the history of these wall panels.

In contrast, the lack of early photo documentation of the dining room, a lack of oral histories from the

workmen involved in this project, the poor quality of the stencil painting executed in the 1950s and the very poor condition of the paint left conservators and curators to make educated guesses about what the painted surfaces might have looked like and how to recreate them.

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I am indebted to the work of the individuals mentioned above. Volunteers and former interns who worked on the documentation and cleaning include conservators Melissa McGrew and Kerith Koss among others. As with any research project I've undertaken at Shelburne Museum, I am indebted to Polly Darnell, Shelburne Museum Librarian, Archivist and expert guide to Mrs. Webb's correspondence. I'd also like to thank Rick Kerschner for his support and bravely offering to present this paper at the Wooden Artifacts Group meeting in my absence.

Endnotes

1. Letter from Electra Havemeyer Webb to Nina Fletcher Little, October 21, 1952. Shelburne Museum Archives, Electra Havemeyer Webb papers, Box 3, Folder 10:30.
2. Electra Havemeyer Webb, "Suggestions for Stencil House", n.d. Shelburne Museum Archives, SMA-254 Box 8, Stencil House (4.19) Contents 1953-1958 folder.
3. Alan Munro Stencil House interview, 1990. Part of Sound Recording Collection, Shelburne Museum Archives. Audio cassette.
4. Alan Munro Stencil House interview, 1990.

Traditions and Trends in Furniture Conservation

Antoine M. Wilmering

> What our great-grandfathers bought and valued (1750 to 1790);
> what our grandfathers despised and neglected (1790 to 1820);
> what our fathers utterly forgot (1820 to 1850);
> we value, restore and copy! John A. Heaton, 1888 [1, p. 5]

Abstract

This review examines the development of the furniture conservation profession from its origin to the early years of the emerging discipline by examining selected relevant literature. Furniture repair and restoration traditionally has been the domain of trained joiners and cabinetmakers. Its strong ties to traditional woodworking have been elemental in shaping the profession as it emerged in the late 1970s and early 1980s in Europe and the United States. From the end of the nineteenth century onwards, in a parallel development, furniture repair also became a popular pastime with amateur woodworkers. Influenced by progress in research, developments in philosophy and ethics, and by treatment strategies of allied conservation disciplines, furniture conservation became an established professional field.

Introduction

On a rainy day in the late spring of 1845, Edward Jenner Carpenter, a 19-year-old apprentice cabinetmaker in Greenfield, Massachusetts, recorded in his diary that on the morning of Thursday, 29 May he had repaired a desk [2]. This desk presumably was the first piece of furniture that the young woodworker had repaired because all of his earlier diary entries refer exclusively to making new furniture. Carpenter had been an apprentice with the firm Miles & Lyons since April 1842 and the work of this young craftsman was exemplary of a tradition that was centuries old: joiners and cabinetmakers repaired worn or damaged furniture as part of their job [2, 3].

Early records on furniture repair such as the diary of Carpenter are, however, relatively scarce. Although historic documents that list objects or craftsmen are plentiful, these often do not reveal any substantial information on the nature of the repair work and notes often are incomplete and cryptic. Traditionally, craftsmen of every art and trade were involved in repair and restoration work in the area of their expertise. But social changes, beginning in the eighteenth century, caused a shift in labour practices that resulted in (among other things) greater freedom for craftsmen [4–6]. Craftsmen in the New World, for example, often crossed trade boundaries and were 'jacks of all trades', in order to meet growing demands for skills [7, p. 43]. Cabinetmakers, joiners and hobbyists began specializing in repair work, which ultimately led to the development of the furniture conservation profession.

Due to the large volume of material, this review examines selectively trade publications, account books, cabinetmakers manuals and how-to books; and it traces the early development of the furniture conservation profession through a series of articles, published and unpublished, and documents of professional conservation organizations.

Joiners and Cabinetmakers as Repairmen

In the second half of the fifteenth century, the sculptor and woodworker Benedetto da Maiano reputedly made two inlaid chests for King Matthias Corvinus of Hungary [8]. According to Giorgio Vasari the chests were transported to Hungary by ship. The high humidity levels at sea during the journey, likely combined with slow travel and inadequate packing methods, apparently caused much of the inlay to fall out. It is said that Benedetto repaired the damage in situ at the Hungarian court [8].

It might be presumed that the first choice for having broken furniture repaired would be the craftsman like Benedetto da Maiano who had originally created it or if he is no longer around for the duty at hand, perhaps a close relative or an apprentice familiar with the master's work. Thus, in 1540 Angelo da Piacenza, a pupil of Lorenzo and Cristoforo da Lendinara, was called upon to do the first documented restoration of the wooden choir in the Duomo of Modena, made by the Lendinara brothers between 1461 and 1465 [9]. According to the chronicler [10], Jacopo De'Bianchi Angelo made the choir chairs look like new with some water that he washed them with and then he varnished them with amber.

Repair work and restoration of wooden objects have continued over the centuries in virtually every culture. This is evident from trade cards, newspaper advertisements, diary entries and account books [11–16]. Many of the records pertaining to the activities of cabinetmakers in the eighteenth and nineteenth centuries reveal that repair work of furniture was a relatively common practice among their daily duties [16–21]. Account books, ledgers, diaries and personal papers, for example, may provide useful information on the nature of repair work. The account book of an industrious joiner in Philadelphia, John Head, shows that between 1718 and 1753 he repaired a wide variety of furniture as part of his daily business [15]. Tables, chairs, cabinets, 'a Looking Glass & varnishen' and 'picter' frames were mended for various clients [15, pp. 40, 78]. The account books of the Dominy family of East Hampton, New York reveal that repairs of furniture and household objects were carried out on a regular basis between 1765 and 1820 [22]. In 1775, for example, Nathaniel Dominy II was paid fifteen shillings for 'repairing a Chest of Drawers throu[ghou]t' [22, p. 358], which implies that he must have done a very thorough job. Often, however, it is not clear from account-book entries the extent of repair work, and only occasionally were details of the work written down. Vernacular furniture and royal furnishings alike were subject to neglect, mistreatment, abuse and of course natural ageing, as well as to comprehensive restorations and alterations, which were routinely performed by cabinetmakers in Europe and the United States. George Nix of London supplied a large number of items to the Earl of Dysart in Ham House, Dorset, between 1729 and 1734 [23]. During the same period Nix was also engaged in repairing many items at Ham, which included strong boxes, candle stands, a cabinet with silver mounts, a billiard table and a dressing box [11, p. 649]. He received a payment for 'mending and pollishing a Rosewood Dressing Box, and a New Lock Ketch and key' [23, p. 181; Figures 111, 148]. In 1730 Nix also sliced off the top of a Japanese-export lacquer cabinet, altered and newly gilded the cabinet-support frame, then used the sawed-off top for constructing a new table.

> For Sawing the top of an India Cabinett, and putting on a Deale top, and Japaning the top, and New Pollishing the Cabinet and Lackering all the brass work £3.10.0. For altering the Cabinett frame and New Gilding it £4.10.0. For making a Table of the top of a Cabinett and a neat Japaned frame for the Table £2.15.0 [11, p. 649; 23, p. 181].

In Paris, on 29 December 1759, ébeniste S. Joubert delivered a bureau de travail to the Cabinet Intérieur du Roi in the Petits Appartements at Versailles for the use of Louis XV [24]. The writ-

ing desk was finished with red and gold lacquer and decorated with gilt bronze mounts and a black velvet top. It was restored in 1787, a year after the desk had changed hands to Louis XV's brother, the Comte de Province. Three craftsmen were paid for the job 'Pour avoir fait restaurer à neuf un bureau en table', which implies that the desk was restored like new [24, p. 47]. The craftsmen included Benneman and Gosseling, who were paid 'Pour restauration de l'ébenisterie. Maroquin neuf avec bordure doré'. The metalworker, Galle, was paid 'Pour avoir desgressé les bronzes et les avoir repassés à la couleur de l'or moulu et rebrunis à neuf' [24, p. 47]. Even the celebrated cabinetmaker Jean- Henri Riesener occasionally was engaged in cleaning mounts, scraping marquetry and re-polishing furniture for Louis XV [25, 26].

Between 1772 and 1775, John Shaw, a Scottish cabinetmaker who had settled in Annapolis (Maryland) and ran a successful woodworking business, repaired furniture for James Brice, which included a tea table, a mahogany chair, the claw of a table, a bird cage and a gunstock [20, p. 14]. In one instance he was paid five shillings for 'putting a new top rail on a Mahogany Chair' [20, p. 14]. Interestingly, more than a century later in 1892 another cabinetmaker in Annapolis, M.C.K. Basil, repaired a sideboard made by John Shaw, which Shaw had signed and dated in 1796 [20, pp. 112–115].

It seems that it had become increasingly fashionable for cabinetmakers to identify their hand on the furniture that they had repaired, a practice that was not isolated within America. German conservator Erich Werwein restored a late eighteenth-century dressing table by David Roentgen in the 1970s and discovered writing on the construction wood, indicating that it had been repaired twice before: once in 1802 by Ludwig Muntz and again in 1887 by Max Seydel [27, p. 35]. The great French cylinder-top desk at Waddesdon Manor (UK) of circa 1777–1781 was also repaired at least twice in the nineteenth century: once in 1832 by J. Wood and again in 1853 by E.C. Souter, as is evident from their pencil inscriptions [28, pp. 313–314].

During the late 1820s at the court of George IV, a comprehensive refurbishing campaign of the private apartments at Windsor Castle prompted the repair of many pieces of furniture in the Royal Collection [29]. Nicholas Morel, a successful cabinetmaker who had supplied furniture to Windsor Castle from the 1790s, was charged with the design and execution of this vastly expensive project. Morel first personally inspected the existing furniture and furnishings that were stored at various palaces to determine which pieces could be incorporated into his plans [29, pp. 29–31] and in partnership with George Seddon, their workmen sorted out the holdings, repairing a large selection of pieces. Exceptionally, their work was recorded in fair detail.

> To taking off rechasing and regilding the whole of the ormoulu mountings of 5 Indian cabinets, thoroughly repairing the woodwork scraping off the old japanning from some of the panels, and rejapanning them in a very superior style with landscape & other devises of rich raised gold work on a highly polished black ground, restoring the raised gold ornaments of the old parts, adding new black and gold speckled borders & highly polishing the whole refixing the ormoulu mountings, adding new locks... [29, pp. 240–241].

Notes from cabinetmakers of a more personal nature have also provided clues about the dates and circumstances of intervention, and about the craftsmen involved. In 1877 Luigi Rizzo left a note in a concealed pocket within one of the entrance doors to the Metropolitan Museum's Gubbio Studiolo, which was discovered in the mid 1990s during conservation treatment [10, p. 145]. The note identified Rizzo as the principal restorer and indicated that the work had taken place in Frascati, Rome, at the home of the studiolo's new owner. A joyous note written by restorer L. Hatfield was contained in the great desk made for Louis XV by Oeben and Riesener, stating that its restora-

tion had been completed in the Louvre during the week that Paris was liberated in 1944 [30].

Although contextual evidence is plentiful, documentation of work techniques is rather scarce. The materials used for repairs were not generally recorded.

Traditional Repair and the Dissemination of Ideas

Starting at the end of the seventeenth century, but mostly toward the middle of the eighteenth and throughout the nineteenth century, a wide range of technical books appeared in print, which made trade 'secrets' available to a wide audience. These books ranged from recipe and design books to treatises on practical aspects of various trades. The best known publications included Félibien's Des Principes de l'architecture, de la sculpture, de la peinture (1676) [31], Moxon's Mechanick Exercises (1677) [32], Stalker and Parker's Treatise of Japanning and Varnishing (1688) [33], Plumier's L'Art de tourner (1701) [34], Diderot's Encyclopédie (1751–1765) [35], Chippendale's The Gentleman and Cabinetmaker's Director (1754) [36], Dossie's The Handmaid to the Arts (1764) [37], Roubo's L'Art du menuisier (1769–1775) [38] and Watin's L'Art du peintre, doreur, vernisseur (1773) [39].

These 'science' or 'trade' publications made their information available to craftsmen and laymen alike and by-passed the eroding guild tradition of handing down information from master to apprentice. According to Weber, 'Nothing is more calculated to improve the mechanical arts than giving publicity to the various processes used among workmen in their several trades' [40, iii]. Many trade publications that were popular in Europe found their way across the Atlantic. The gentry and craftsmen in Virginia, for instance, owned and used a large variety of books on building practice, architecture and furniture design in the eighteenth century [41]. In Williamsburg, the cabinetmaker Edmund Dickinson owned a copy of Chippendale's The Gentleman and Cabinetmaker's Director in 1778 [41, 42, p. 67]. While further south, Daniel McBean, a local cabinet-, and chairmaker of Davidson County, Tennessee owned the second volume of The Handmaid to the Arts and a two-volume copy of either The Cabinet-Maker's Assistant or The Cabinet-Maker's Guide at the time of his death in 1815 [16, pp. 324–325]. McBean may have owned one of the earliest known English-language recipe books for cabinetmakers, which was first printed in London in 1809 [40]. This small recipe and methods book, written by cabinetmaker and 'ebonist', Peter Weber, has been the source for an astonishing stream of plagiarized copies throughout the nineteenth century and well into the twentieth century, bearing testimony to the need among crafts- and laymen for such 'secret' practical information [40, p. xiii].

Trade secrets increasingly became common knowledge among cabinetmakers. Ansel Phelps in Greenfield, Massachusetts printed the first American version of the Cabinet-Maker's Guide in 1825 [43]. Based on Weber's edition, it contains various directions on mending and cleaning objects, along with methods for removing 'bruises in furniture', for 'cleaning and polishing old furniture', for 'cleaning and restoring the elasticity of cane', and for taking 'ink spots out of mahogany' [43]. Some of these methods, it may be presumed, were familiar to Edward Carpenter by the time he repaired his desk in 1845 [2]. Another printing of The Cabinet-Maker's Guide appeared in Concord, New Hampshire in 1827 [40, p. xiii]. Ten years later in London, a 'new' version went on sale and now G.A. Siddons was given as its author [44]. In addition to the aforementioned repair methods, the book also contained a newly listed practice 'to raise old veneers'

> In repairing old cabinets, and other furniture...First wash the surface with boiling water and course cloth, to remove any dirt or grease, then place it before the fire, or heat it with a caul, oil its surface with common linseed oil, place it again to the fire, and the heat will make the oil penetrate

Fig. 1 Cabinet, in two sections. French, c. 1640–1660, ebony, ivory, gilt bronze, 189.2 167.6 58.4 cm (741/2 66 23 in). (Metropolitan Museum of Art, Gift of Mrs Harold Fowler, 1931, 31.66 ab

> quite through the veneer and soften the glue underneath, then whilst it is hot raise the edge gently with a chisel, and you will find it separate completely from the ground... [44, pp. 7–8].

Parts of the original 'methods' were recycled in the very popular edition by J. Stokes, The Cabinet-Maker and Upholsterer's Companion, which was reprinted at least fourteen times1 in Philadelphia between 1850 and 1909 [45]. As well as methods for lifting veneer, the Companion also contained some directions for re-polishing furniture.

> In order to apply this process with facility, you will find it needful to disunite the various parts of each article. If your job be a wardrobe, take off the doors by unfastening their hinges; remove all the screw nails; take off the cornice; lift the wings or carcases from the base; and then separate the mouldings and other carved ornaments from the frames and panels on the doors [45, p. 174].

Such thoroughness has been, and is, a typical characteristic of traditional craftsmen tasked with restoring furniture. Issues, for example, of preserving authenticity – in its many varieties of interpretation – were not obvious concerns. The restored object had to be sound and functional. This ethos has prevailed across many, if not all, woodworking trades.

Repair and Commercial Enterprise

As woodworking businesses grew during the nineteenth century, large and successful companies were also involved in repairing furniture, ranging from simple vernacular pieces to those of the highest quality. In 1884–1885 the Herter Brothers Company, which was established by the German immigrants Gustave and Christian Herter in New York City twenty years earlier, restored a French cabinet that is now in the collection of the Metropolitan Museum of Art in New York (see Figure 1). From the outside, this ebony cabinet is a beautiful example of a mid-seventeenth-century piece of furniture. However, when viewing the inside from the back and especially after examining the drawers, there is clear evidence of thorough restoration. The fine quality of workmanship suggests nineteenth-century craftsmanship and strongly reflects the Company's new cabinetwork of that period. The workmen identified their work by marking and dating the back of the cabinet twice

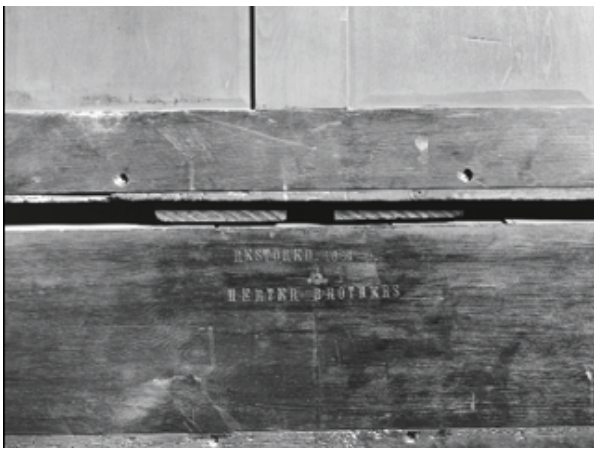

Fig. 2 Detail of Figure 1. (Metropolitan Museum of Art, Gift of Mrs. Harold Fowler, 1931, 31.66 ab)

Fig. 3 Chair menders at work, c. 1930. (© Hulton-Deutsch Collection/Corbis)

(see Figure 2). Although, in this instance, the exterior of the cabinet had been preserved fairly well, significant parts of the structure, the drawer construction and elements of the interior theatre had been replaced and/or changed. Some new parts of the theatre were carefully integrated with the original elements, demonstrating the sensitivity of the craftsmen to the design elements but not to the importance of the original fabric.

From the second half of the nineteenth century there may have been enough demand for repair work that some businesses began specializing as restorers. In Paris in 1859, Maison Andre was founded as an establishment for the restoration of art objects, including furniture [46]. There was also a corresponding growth in the market for furniture repair in America, due in part to the transport of goods from Europe.

Furniture and wooden objects that crossed the Atlantic in increasing numbers were prone to damage caused by adverse climatic conditions. Charles Leland in 1896 identified transatlantic traffic as the main cause of furniture damage on the east coast of the United States [47]. 'There is no country in the world in which the art of mending is so much required as in the Unites States of North America. The reason for this is the extraordinary and sudden changes in temperature, causing the expansion and contraction of cells and fibre, especially in wood, which results in cracks' [47, p. 50].

Leland stated in the opening of his book *Mending and Repairing* that 'he has distinctly shown that mending or repairing, which has hitherto been regarded as a mere adjunct to other arts, is really an art by itself, if not a science, since it is based on chemical and other principles...' [47, p. vii]. He felt that this new art could be learned by those 'who are gifted with some small allowance of 'ingenuity', tact, art, or common-sense to consider that Mending or Restoring is a calling very easily learned by a little practice, and one by which a living can be made, even in its humblest branches, as is shown by the umbrella-menders and chair-caners in the streets' [47, p. xvi] (see Figure 3).

Leland's writing reflected a more general expectation that restored furniture had to be sound, functional and goodlooking, which prevailed well into the twentieth century. Despite this deep-rooted tradition, during the late nineteenth century a historic conscience emerged with a few professional woodworkers disapproving of dubious practices of antiques dealers and restorers. David Denning complained in *The Art and Craft of Cabinet-Making* of 1891 about the questionable practices of restorers who 'improved' or embellished plain oak furniture with carving [48]. 'That some of these [restorers] may be conscientious in their work I do not deny, but it is a lamentable fact that mostly

they do far too much of what can only be called by courtesy restoration and repairing' [48, p. 20]. Forty years later in 1930, Homer E. Keyes, the first editor of Antiques magazine, noted in the foreword of Henry H. Taylor's book *Knowing, Collecting and Restoring Early American Furniture* that '...in the restoring of antique furniture there is, or should be, an attainable golden mean, a sensible and temperate procedure, which, without countenancing misguided attempts at rejuvenation, will nevertheless accord to age its appropriate revelation of native vitality and inherent beauty' [49, p. 6]. Overzealous restorers scraping off original finishes had horrified Keyes, and while he also disliked severely deteriorated furniture, he felt the latter to be less disastrous.

Educated art historians, mostly born to affluent families with good-quality art collections, were among the first group of professionals to openly vocalize their opinion on the nature and extent of restorations in furniture. Ralph Edwards stated in a *Country Life* article of 1959 entitled 'Repairing furniture from historic houses' that 'Restoration, where more than simple, straightforward repairs are concerned, presents in many cases a difficult problem, involving issues of both ethics and taste' [50, p. 1136]. However, at this time there was neither a general consensus about the kinds of permissible treatment nor agreement on how the authenticity of an object was to be best preserved. Ethical frameworks, such as the American Institute for Conservation's *Code of Ethics and Guidelines for Practice* [51], did not yet exist. Research of furniture materials in general and the specific analyses of materials and techniques for solving particular conservation problems was not the domain of the furniture restorer. The restorer's voice was barely, if at all, considered in the decision-making process, which largely depended on the personal perspectives of curators and administrators. Edwards went on to say that 'It may be agreed that the structure of any dilapidated piece should in general be put into sound condition, and damaged members repaired, wherever possible without renewal; if parts be missing, they should be restored with salient details, carved, inlaid or painted, affecting the design' [50, p. 1136]. Edwards was cautious of preserving original surfaces and gilding; he summarized that '...too little should be done rather than too much' [50, p. 1136]. An unpublished memorandum of the Victoria and Albert Museum (V&A) in London from 1970 states 'that conservation was seen as an essential technical part of the institution's work, and was subject throughout to the principle that the curator and not the restoring staff had the ultimate responsibility for the result' [52].

Furniture Restoration— Pastime and Profession

Joseph Moxon affirmed in his preface of the 1703 edition of *Mechanick Exercises* that '...it is very well known, that many Gentlemen in this Nation, of good Rank and high Quality, are conversant in Handy-Works: And other Nations exceed us in numbers of such' [32, preface]. Given this observation, it should not be surprising that copies of Moxon had found their way into the various libraries of gentlemen, including the vast collection of Samuel Pepys, who also owned copies of Félibien [31] and Stalker and Parker [53], and that branches of woodworking, especially ornamental woodturning, had been a popular pastime in certain circles of high society and royal families. Aficionados of the mechanical lathe included Tsar Peter the Great of Russia, Queen Sophie- Magdalene of Denmark, George III of England, Louis XVI of France and Friedrich-Wilhelm I of Prussia [54]. Learning a trade had become part of educating princes in the spirit of the Enlightenment and to that end, royals received instruction for improving their dexterity and understanding of mechanics and read books on the subjects of their interest. Peter the Great, who incidentally also had dabbled in ship carpentry, owned a copy of Plumier's treatise on turning [34] and had translations made in Russian and Dutch [54].

Those less privileged but equally dexterous – like Edward Carpenter, the cabinetmaker's apprentice from Greenfield, Massachusetts – spent leisure time 'loafing around', reading books, taking danc-

ing lessons and attending lectures on a variety of subjects, including phrenology [2]. The growing industrialization and mechanization in the workplace that took place during Carpenter's lifetime dramatically transformed the social and economic landscape in Europe and the United States [55]. The complex changes were manifold and, among other things, gave birth to a new order of educated middle-class citizens. Shorter working hours meant increased leisure time, which became an economically interesting commodity, especially in the twentieth century. 'Now, as far as time is concerned, it may be pointed out at once that the most hard-worked man has his Saturday half-holiday and the Bank-holidays, to say nothing of the summer evenings when there is light enough for handicraft work even after 9 o'clock....' [56, p. 8].

The new middle class gained access to an incredible array of manuals for self-education about the rapidly evolving world around them and for advancing socially and economically. Among these were builders' assistants, cabinetmakers' and upholsterers' guides and carpenters' companions, written for craftsmen and laymen alike. The French philosopher Jacques Maritain observed in 1958 in *Reflections on America* that 'Everybody is working, and working hard. In this sense all are fundamentally equal, as working people (and people burdened by mortgages and deferred payment systems) who work to make a living, and who, after their daily hours, busy themselves again with any kind of task-handicrafts, improving their houses...and they are more proud of their hobbies than of their jobs' [57, p. 155]. Publishing houses discovered a new and copious audience of readers eager to find a practical pastime, capitalizing on the perception that it was sinful to let time pass by wasted. Various popular branches of woodworking were explored and proved extremely suitable for the new 'home handyman'. Francis Chilton-Young proclaimed in the preface of *Every Man His Own Mechanic* of 1882 that its pages were seeking '....to furnish the Amateur Artisan with hints and suggestions regarding all that he may undertake in Constructive and Decorative Work at home...' [56, p. vii]. While filled with basic woodworking projects of all sorts (bearing in mind that complicated work remained the domain of trained craftsmen) the amateur was also directed in making his own repairs: 'Yes, reader, mend your broken chairs and crippled furniture...' [56, p. 8]. Similar publications aimed at hobbyist woodworkers and professionals alike appeared on the market and included, for example, *Domestic Jobbing* by Paul Hasluck (1907) and *Furniture Repairing and Re-upholstery* by Charles Taylor (1919) [58, 59].

In a parallel progression with professional cabinetmakers, amateur woodworkers began to restore furniture, ranging from the vernacular to high-quality museum pieces. One such amateur was Henry H. Taylor, who was an avid collector and hobbyist restorer of American furniture. Taylor relayed his experience in Knowing, *Collecting and Restoring Early American Furniture* [49], which was published during the Depression in 1930. His perspective on furniture repair and refinishing strongly reflects his personal taste as well as a practical collector's point of view that antiques had to be functional in the home. Taylor felt that 'Household furniture will be put to strenuous daily service, while the furniture of a museum is for inspection only' [49, p. 22]. While he may have possessed the sophistication to differentiate between restoration philosophies based on ownership and might have been concerned with preserving evidence of age, many of his working methods were thorough and ensured that objects were sound and functional after restoration. The various finishing techniques described would have destroyed many original surfaces. For example, Taylor cautions the reader against using lye but then gives several examples of how he used it on his furniture.

Taylor provides some fictive examples in order to show the difference between the 'wrong and right' approach in restoring early American furniture. Referring to the 'right' approach he commented that 'The whole table is cleaned with varnish remover, possibly leaving a bit of old paint in the turnings, about pins, or under the top' [49, p. 108]. After

several steps of sanding, light scraping and another rubbing with steel wool, he envisioned the table to be finished with shellac and wax. 'The result is a table which still appears old, but is clean and sound, and glows with a subdued and honest finish' [49, p. 108]. Thus the imaginary furniture restored by Taylor became transformed into objects with well-groomed surfaces.

Around the same time, between 1936 and 1939, Edward Minns published a series of articles in the *American Collector*, which were then combined in a book entitled *The Art of Restoring and Refinishing Antique Furniture* [60]. Minns, a professional cabinetmaker who had received 'rigorous' training in England, was deeply rooted in his trade and he appears to be less understanding of antique furniture as historic objects than Taylor. 'Such pieces [in museum collections] should simply be thoroughly cleaned-oiled-woodfilled-waxed, and kept waxed' [60, p. 3]. Minns' book was also aimed at amateur woodworkers and his concepts were comparable to those set forth by Taylor. However, there were some marked differences. In contract to Taylor, for example, he did not recommend lye for removing finishes because he found it difficult to wash off and he warned correctly that it darkened wood [60, p. 74]. It is interesting to observe that both Taylor and Minns expressed concern with keeping the 'age' of furniture that they had refinished, but their practices betrayed that ideology: '...the idea of refinishing is not to make it look like new but to retain the appearance of age, consistent with being in clean and usable condition' [60, p. 9].

While the books by Taylor and Minns serve as fairly isolated examples from the 1930s, growing economies and post-war optimism prompted a flurry of publications for professional and amateur furniture-makers and restorers. The publications are given in Table 1, not as a complete record, but as examples of the industry between 1943 and 1978.

Whether written by a hobbyist or a by a professional cabinetmaker, the books listed in Table 1 are largely the synthesis of Taylor's and Minns' earlier publications [49, 60]. The common denominator of all the authors is their analysis of restoration problems without respect for the intrinsic historic value or cultural significance of the object. There is an absence of material analyses and a lack of consideration for future use and/or restoration needs. The treatment descriptions are generally very thorough and emphasize usability above all else. Examples of restoration cover all aspects of furniture, such as wooden elements, hardware, clear and painted finishes, upholstery, gilding and Urushi lacquer surfaces. Some of the authors (Kinney [65] serves as a good example) were not averse to embellishing furniture, to changing proportions and hardware and to complete refinishing. Many of the authors were professional cabinetmakers with plenty of experience in beautifying or altering. A demonstration of how a Victorian chest of drawers could be transformed into Sheraton(ish) piece was given by Crawley in 1971 [79, pp. 75–99]. It is important to consider that the literature was essentially the only material available to restorers working on high-quality furniture in private and museum collections until the late 1970s.

The Onset of Change

The development of the museum conservation profession has been a direct consequence of rapidly expanding – and at the same time – deteriorating collections in Europe and the United States during the nineteenth and twentieth centuries [93–100]. Chemists, artists and craftsmen became engaged in various aspects of restoration, while many larger museums with extensive furniture collections employed cabinetmakers as repairmen and restorers. In the early days of the museum conservation profession, attention was predominantly directed at preserving antiquities, architecture, archaeological material, paintings and sculpture. Restorers formed professional organizations such as the International Council of Museums (ICOM) Committee for the Care of Paintings, which was formed in 1948. The International Institute for Conservation of Historic and Artistic Works (IIC) was founded in 1950; the Arbeitsgemeinschaft des Technischen

Museumpersonals (ATM) in 1956; the International Centre for the Study of the Preservation and Restoration of Cultural Property in Rome (now called ICCROM) in 1959; and the American Institute for Conservation of Historic and Artistic Works (AIC) in 1972. The *raison d'être* for each was to provide a forum for sharing information on research, scientific study and treatments, as well as for discussing philosophical issues. In addition to the aforementioned disciplines, other groups such as paper, textiles, musical instruments and ethnographic material were also included. Furniture conservation, however, lagged behind in development.

Norman Brommelle, a metallurgist and painting conservator and the first Keeper of Conservation at the V&A in London (1960–1978), stated in 1963 that a much-needed study of the technical history of furniture was about fifty years behind that of paintings [101, p. 2]. Furniture restorers worked in isolated basement workshops and were generally not integrated with the restoration laboratories that began to take shape in museums in the first half of the twentieth century. A notable exception was the V&A where, under Brommelle's direction in the early 1960s, the 'art workshops' were reorganized. The newly created Conservation Department fully integrated furniture conservation. Many of the furniture restorers at the V&A had been recruited as 'repairers' from the joiners' shop in the late 1950s, with little or no training in conservation. In 1967, however, they had gained sufficient knowledge and skill to be part of an international conservation effort to restore wooden objects that had been damaged in the Florence flood [102, 103].

It was not until the early 1960s that an international effort was made to bring the field of furniture conservation onto an equal footing with other conservation disciplines. During the joint meeting of the ICOM Committee for Scientific Laboratories and the ICOM Sub-Committee for the Care of Paintings in Barcelona in 1961, an investigation was initiated in the Deterioration and Conservation of Furniture [104, p. 1], which was later referred to as a study of the Conservation of Woodwork [105]. 'Woodwork' was divided in four categories: 1) interior woodwork, particularly furniture; 2) movable wooden sculpture; 3) fixed wooden structures; and 4) waterlogged wood.

The study was conducted under the direction of Norman Brommelle, because, as he stated, the V&A possessed 'one of the largest collections of furniture in the world, with a staff of seven furniture restorers' [105, p. 1]. Brommelle collaborated for some of the research with his wife Joyce Plesters, Conservation Scientist at the National Gallery of Art in London (1949–1986), and with organic chemist Tony Werner, Keeper of Conservation at the British Museum (1959–1975). Anne Moncrieff and Josephine Darrah, retired research scientists at the V&A, compiled bibliographies relating to the nature and behaviour of wood. Progress reports were presented at various joint ICOM Committee for Scientific Laboratories and Sub- Committee for the Care of Paintings (later renamed ICOM-CC) meetings in Leningrad and Moscow (1963) [101], Washington and New York (1965) [104], Brussels (1967) [105], Amsterdam (1969) [106] and finally in Madrid (1972) [107].

The first report of 1963 focused on the conservation of interior woodwork, but it also put an emphasis on furniture [101]. Fluctuating humidity levels were recognized as the main contributing factor of deterioration in furniture. Brommelle stated that 'The conservation of interior woodwork is dominated by one factor, namely the shrinkage and swelling of wood under the influence of its gross- and micro-structure and the stresses induced by methods of assembly' [101, p. 1]. Biological degradation was seen as a subsidiary factor and as 'easily controllable' by modern methods. Interestingly, considering that man is an agent of creation, restoration and destruction were not considered when defining the problems of conservation in furniture and woodwork.

In the early 1960s, the craft tradition in furniture restoration also dominated the conservation of

museum objects. Brommelle observed that furniture restoration was a disappointing field for the museum scientist since the materials and methods of traditional craftsmanship seemed adequate for conservation [101]. The committee viewed the main responsibility of furniture conservators as hands-on-restorers, stating that 'The chief tasks of the furniture restorer, apart from the treatment of loosened and broken joints and the replacement of missing parts, are the treatment of cracks and warping' [101, p. 28; 108, p. 104]. This perspective of the committee members on the furniture conservation field was further underscored by Brommelle, who stated that, 'It is pointless to apply science where science is not required' [101, p. 1]. Despite this prejudice, the main areas for research in furniture conservation were identified as: 1) the history of techniques and materials as an aid to conservation and art-historical research; 2) the chief forms of deterioration; and 3) the principles of restoration [101, p. 1].

None of these three areas, in fact, were studied systematically as Brommelle had envisioned. Although progress had been made, during the Madrid ICOM-CC conference in 1972 his frustration can be sensed. 'There is still no reasonable comprehensive book on the restoration of furniture as it is practiced by a museum restorer conscious of the objects both as an example of applied art and as an authentic historical document' [107, p. iii].

In the mid 1960s, Paul Philippot, Adjunct Director/ Director of ICCROM (1959–1977), circulated a questionnaire to museums and private restorers concerned with 'woodwork of all types', including furniture restoration. The questionnaire was aimed at gathering information about the general nature of collections, environmental control in storerooms and exhibition spaces, the chief forms of deterioration encountered on objects, and the methods and materials used in the restoration of wooden art objects. This author has not been able to establish how many questionnaires were mailed. However, thirteen recipients responded and some suggested useful reference material, which included (among other books) the works by Taylor, Sloane, Lorini, Ormsbee, Kinney, Blanchard, Pinto and Rodd [49, 61, 63–68, 106]. The response by conservation staff at the Metropolitan Museum of Art in New York included references to Roubo, Watin, Hinckley and Klatt [38, 39, 106, 109, 110], which

Table 1 Publications from the furniture-makers and restorers, 1943 to 1978

date	*title*
1943	*Revive Your Old Furniture* [61]
1948	*How to Restore Furniture* [62]
1949	*How to Restore Antique Furniture* [63]
1949	*Care and Repair of Antiques* [64]
1965	*The Complete Book of Furniture Repair and Refinishing* [65] (multiple reprints)
1952	*How to Restore and Decorate Chairs* [66]
1955	*Repairing and Restoring Antique Furniture* [67] (multiple reprints)
1955	*The Care of Woodwork in the Home* [68]
1957	*Cabinetmaker's Manual for Amateurs and Professionals* [69]
1959	*The Easy Expert in Collecting and Restoring American Antiques* [70]
1962	*The Furniture Doctor* [71]
1973	*Collecting & Looking After Antiques* [72]
1965	*The Homemaker's Guide to Refinishing and Restoring Antiques* [73]
1969	*Rénovez et réparez vous-même vos meubles et objects anciens* [74]
1969	*Restoring and Preserving Antiques* [75]
1970	*Comment restaurer les meubles antiques* [76]
1970	*The Encyclopedia of Furniture Making* [77]
1971	*All About Antiquing and Restoring Furniture* [78]
1971	*Is it Genuine?* [79]
1971	*The Practical Handbook of Furniture Refinishing Restyling and Repair* [80]
1972	*Mending and Restoring Furniture* [81]
1974	*Restoring Antique Furniture: A Practical Guide* [82]
1975	*Restoring Antique Furniture* [83]
1976	*Antique Furniture Repairs* [84]
1976	*Restoring and Renovating Antique Furniture* [85]
1976	*Collecting & Restoring Wicker Furniture* [86]
1976	*Off Your Rocker – The Art of Repairing and Refinishing Antique Furniture* [87]
1977	*Care and Repair of Furniture* [88]
1977	*Gamle Møbler – en Bog om Bevaring og Restaurering* [89]
1977	*How to Restore, Repair and Finish Almost Everything* [90]
1978	*La Restauration des meubles rustiques* [91]
1978	*Restoring Furniture* [92]

indicates that there was an interest in historical research. The summary of answers in the questionnaire shed further light on practices of the day. Eight respondents kept records of documented restoration interventions. Five institutions kept records of examination and repairs that were accompanied by photographs. According to the survey, wood to wood repairs were glued with a variety of adhesives, including animal glue, gelatine, casein glue, PVA (PVAC), PVC, wax and resin mixture, unspecified synthetic glues, urea resin glues, contact cement, polyester resin and epoxy resin. Wood to metal bonds were created with animal glue, with or without garlic juice, cellulose acetate cement 'Duro' and 'Durofix', epoxy resin, PVA (PVAC) emulsion, synthetic rubber adhesive 'Evostick' and 'Tetrabond 404' [106]. Warped panels were treated by humidification and clamping, attaching veneer to one side, 'enlarging and filling of grain on back of panel', impregnating with a mixture of shellac, ethyl glycol and methylated spirit, sawing the back and filling with wood slivers, and by applying dovetail cleats or keys [106].

In 1969, the annual conference at The Henry Francis du Pont Winterthur Museum in Winterthur, Delaware entitled *Country Cabinet Work and Simple City Furniture*, included a formal discussion concerning the preservation and restoration of furniture, which mostly focused on problems with finishes [111]. Jonathan Fairbanks, who was then Associate Curator in Charge of Conservation at the Winterthur, opened the panel discussion with the observation that 'Theories about furniture care are as varied as the numerous waxes, varnishes, oils, and miracle polishes currently on the market. Insofar as a systematic study is concerned, this is a neglected area that needs a great deal of basic research...' [111, p. 294]. His remarks reflect Brommelle's earlier view of 1963, but they were more focused on the philosophical and practical concerns of furniture care and conservation. Fairbanks raised four main points as initial guidelines for furniture conservation:

1) treatment should increase the lifetime and stability of all components

2) materials should be reversible

3) thorough documentation should be kept, and

4) restoration should unify an object and not deceive the viewer [111].

At the end of his comments Fairbanks posed a valuable question, asking 'How far should we go in trying to restore an object to what we believe was its original appearance, fully aware that in doing so we may unconsciously be imposing our twentieth-century values and taste?' [111, p. 295]. In the field of furniture conservation this may very well have been the first time that this important issue was raised in a public discussion. In the discussion that followed the conference participants covered a variety of subjects but focused on finishes, which must have been a heated topic at the Winterthur at that time. The furniture restorers/conservators at the museum had been using a linseed-oil mixture, known as furniture reviver, between 1946 and 1967 for their annual maintenance of the collections [111, pp. 303–304; 112, p. 59]. Considering the history of such revivers, this was a serious issue for the preservation of furniture collections worldwide. The debate marked a departure from traditional approaches in furniture conservation and laid the foundation for alternative cleaning methods, which were developed at the Winterthur during the 1980s.

Residues left by the reviver mixture, which generally consists of equal parts of raw linseed oil, turpentine, malt vinegar and some methylated spirits, tend to darken over time and form a layer that is difficult to remove [112]. Many variations of reviver exist, sometimes incorporating boiled (heat-bodied) linseed oil and occasionally including different amounts of methylated spirit. Furniture revivers of varying formulas have been popular with cabinetmakers and furniture restorers since the nineteenth century for revitalizing deteriorated finishes [45, 113–117] and they are recommended

'for modest use' in Plenderleith's *The Conservation of Antiquities and Works of Art* (first edition 1956), which for many generations of restorers/conservators was the most authoritative literature in the field [118, 119]. 'For cleaning polished furniture, of whatever kind, a suitable emulsion can be made by shaking together, vigorously, half a pint each of linseed oil, turpentine, and vinegar, to which is added a small teaspoonful of methylated spirit. This mixture is comparatively inexpensive; it removes dirt and polishes in the same operation, and is harmless if applied in moderation' [118, p. 133; 119, p. 141]. Furniture reviver continued to be used in major museum collections on both sides of the Atlantic at least until the early 1980s, despite the serious drawbacks and warnings against its application [112].

Materials Research for Furniture

The ICOM meetings held in the 1960s and 70s had not gone unnoticed by conservators in Western Europe and the United States. Tentatively, furniture materials and furniture conservation techniques became subjects of research. Wood-species analyses, for example, had been recognized as a valuable means for identifying unknown wood types in art objects. Wood identification in furniture had been discussed during the seminar addressing the *Application of Science in Examination of Works of Art* in Boston in 1958, although according to William Stern it was antique dealers who had predominantly requested it [120]. It should also be noted that despite the increasing use of wood-species analysis by conservators of polychrome sculpture, musical instruments and wooden archaeological material, furniture conservators working in museum collections were less inclined to take advantage of this analytical tool.

Then in 1974, Dietger Grosser published an important article in *Maltechnik Restauro* on the applications of wood species analyses entitled 'Holzanatomische Untersuchungsverfahren an kunstgeschichtlichen, kulturgeschichtlichen und archäologischen Objekten', in which the author discussed panel paintings, wooden sculpture, musical instruments, ethnographic objects and archaeological material, but significantly, excluded furniture [121].&

Wood-species analyses had been carried out on furniture in isolated instances, but at this time it certainly was not a common practice. In 1973 an article by Hans Michaelsen on the restoration of the Haldenstein room, a Swiss interior of 1548 [122], included a useful section on wood analyses (see below) and in the late 1970s, identification of furniture woods was employed in the examination of English-Canadian furniture as part of a scholarly study [123]. In 1975 and 1976, Grosser published more articles on wood-species analyses of European woods in *Maltechnik Restauro*, although there continued to be a clear focus on wood used in panel paintings and sculpture [124–126]. Nonetheless, these excellent contributions were beneficial for all conservators working with wood, including those working on furniture. Eventually, by the early 1980s the identification of unknown wood types had become a fairly standard practice in the furniture conservation field.

Dating as far back as 1953, there had been some published case studies of furniture conservation, but these mostly dealt with surface problems of painted furniture and panel paintings, such as *cassone* fragments [127–131]. Edwin Gorton, Chief Furniture Conservator at the V&A, first discussed the restoration of case furniture; he described the repair of an eighteenth-century mahogany writing table in *Studies in Conservation* in 1961 [132]. In this same article, V&A Furniture Restorer J. Jarosz is said to have removed dents from the surface of a mahogany desk using a century-old method of applying steam to the recessed areas [132]. This method for removing bruises from furniture had appeared in print as early as 1825 in Phelps's edition of *The Cabinetmaker's Guide* [43, p. 13] and has appeared in virtually every copied version since. Holes in the writing table were filled with 'boat-shaped' mahogany patches, selected for colour and grain with the preconceived goal

to make them blend in with the existing wood, a practice described by Kinney in 1950 [65].

Developments in continental Europe

In former East Germany, restorers/conservators were active in restoring important war-damaged furniture, especially at Schloß Köpenick in Berlin. The work and articles of Manfred Becker and Hans Michaelsen, published throughout the 1970s in *Neue Museumskunde*, made substantial contributions to the development of the profession [133–135]. Becker's article on the restoration of an extraordinary cabinet of c. 1780 by David Roentgen made for Wilhelm II of Prussia was exemplary for its clarity and description of process [133]. During the twoyear restoration period, historic materials and marquetry techniques were researched (no material analyses was reported) and the restoration process was comprehensively recorded. Hans Michaelsen's publications of 1973, 1975 and 1978 cover various pieces of European furniture as well as the Haldenstein room; they also demonstrate a strong interest in researching historic materials and techniques [122, 134, 135]. For example, microscopic wood identification was performed on structural and decorative timber of the Swiss room so that replacement woods could be accurately matched with the original material [122].

In the former West Germany, several broadly trained art historians/conservators began publishing the results of their research on historic furniture materials in *Maltechnik Restauro*, encouraging furniture restorers to write about their treatments. In 1978 Thomas Brachert, Head of the Institut für Kunsttechnik und Konservierung at the Germanischen Nationalmuseum in Nuremberg (1974–1993) published a series of articles on historic furniture finishes [136–139]. Brachert had trained as a cabinetmaker before his studies in art history and painting conservation, hence his interdisciplinary interest [140]. Brachert has been a driving force in the development of the furniture conservation field in Germany and indirectly of the field at large. He encouraged several of his staff in Nuremberg to publish on furniture history, materials used in fine furniture, historic wood stains, the use of tortoiseshell and on a variety of conservation treatments in *Maltechnik Restauro* which, due to their popularity were bundled in a book in 1986 [141]. The museum also began formally admitting students to their workshops for a three-year training programme.

In France, curator Daniel Alcouffe published *Restauration du mobilier* in 1977 [25], which was simultaneously made available in German and English and which incorporated some important principles, although restoration practices hinged on a traditional approach. '*La restauration oblige souvent à décaper la surface du meuble du revêtement dont on l'a pourvue afin da le décorer ou de la protéger'* [25, p. 35]. The furniture reviver mentioned by Alcouffe, for example, contained alcohol, turpentine, oil, sulphuric acid, vinegar, tripoli and benzoin [25, p. 80]. Alcouffe expressed concern that too much restoration or refinishing of wood surfaces would create an imbalance between other aged furniture elements, such as bronzes and fabric: '*Il faut respecter ce vieillissement naturel qui fait partie de la vie et de l'historie de l'object. En outre, si l'on rajeunissait trop le bois, il ne serait plus en accord avec les matériaux qui l'accompagnent éventuellement et ont passé aussi: bronzes, garnitures d'étoffes*' [25, p. 12]. Alcouffe's book was one of the first publications on furniture conservation to include a section on care and maintenance, and to summarize measures for climate control. The bibliography included references to traditional literature such as Roubo [38] and Watin [39], contemporary conservation sources such as Kühn [142], Moncrieff [143] and Plenderleith [118, 119], as well as the books by Rodd [67] and Wenn [83].

Conferences

The IIC Congress in 1978 in Oxford, entitled *The Conservation of Wood in Painting and The Decorative Arts*, was in many respects a landmark meeting. It was the first time that furniture conservators from major museums, cultural institutions

and private practice delivered case studies for an international audience of their peers [144]. Sporadic reports of furniture conservation had been previously published in *Studies in Conservation, Antiques, Neue Museumskunde and The Connoisseur*, but never had there been an international assembly of furniture-conservation experts as there was during the Oxford Congress. However, the papers presented by the furniture conservators during the meeting illustrate that Brommelle's three points—those discussed during the ICOM–CC Leningrad Conference—for research had been largely neglected. While the furniture papers were informative, little consideration was given to the history of techniques.

Although some thought was given to the chief forms of deterioration, some principles of museum conservation (such as reversibility) were largely ignored. For example, S.N. Hlopoff describes the flattening of a fairly thin pine panel that had been veneered at one side with mahogany by cutting a series of grooves and filling them with slightly tapered strips [145]. This method reflects a traditional solution for warp reversal that had been the subject of discussion and experiments in panel painting since the 1940s [146]. Victor von Reventlow's solution to correct warping in the substrate wood of a small nineteenthcentury Italian marquetry table top involved replacing the pine boards with a piece of mahogany multiply [147].

The great merit of the Oxford Congress was the exposure of furniture restorers to other professionals whose shared concern was the conservation of wooden objects. The influence of other conservation disciplines was already noticeable. Several of the participants described the use of such relatively novel materials as B-72 in their treatment [147, 148]. Von Reventlow used it to adhere tiny strips of 'facing' tissue on a small marquetry table that had been damaged during transport at sea. B-72 had been introduced as a polymer for various conservation applications in the 1950s and was rather belatedly applied to furniture. Also notable was the application of high magnification microscopy —visible light, UV-fluorescence and scanning electron microscopy (SEM)—for examining stratification layers and coatings, which would become a highly visited topic with furniture conservators from the mid 1980s onward [149].

In former West Germany, a first gathering of professional furniture conservators took place in the Stuttgarter Landesmuseum at the initiative of Martin Marquard in 1979. This national meeting was significant because it marked the formation of the Fachgruppe Möbel und Holzobjekte within the Arbeitsgemeinschaft des Technischen Museumpersonals (ATM) renamed in 1984 as the Arbeitsgemeinschaft der Restauratoren (AdR), and incorporated in 2001 into the Verband der Restauratoren (VDR) [150, 151]. While no written proceedings resulted from this meeting, furniture conservators began publishing regularly from 1980 in the *Arbeitsblätter für Restauratoren*, a professional journal founded in 1968 [152].

The next international gathering, held in July 1980 at the Canadian Conservation Institute (CCI) in Ottawa, was a two-day meeting that dealt exclusively with the conservation of furniture and wooden objects [153]. Papers were presented on a variety of subjects and, much more than in Oxford, attention was given to the three aspects of research proposed by Brommelle. Robert Mussey presented his research on 'Transparent furniture finishes in New England 1700–1820', which made an especially important contribution to the understanding of finishing materials used in the north-eastern United States [154]. In the closing address of the conference Philip Ward, then Director of Conservation Services at CCI, stressed the importance of collaboration between scientists and conservators. However, he also emphasized that skill and craftsmanship are paramount when it comes to the conservation of furniture. 'Although no different from any other aspect of conservation in its need for scholarly support from scientists, connoisseurs and historians, it has always depended—and one hopes it always will—upon a core of traditional craftsmanship, skill and ex-

perience which can never be replaced by any of the sophisticated tools which are now available to us' [153, p. 147]. There had certainly been progress, even since the late 1970s, when conservation science and conservation practice in the field of wooden objects and furniture conservation were separate. It is clear that during the 1980s the disciplines had rapidly become more integrated.

Professional training for furniture conservators

During the late 1970s and early 1980s graduate-level training programmes specifically dedicated to the conservation of wooden objects were launched across Europe and in the United States. Non-degree training courses in furniture restoration had begun in Europe as early as the mid 1950s. The Goering Institute in Munich, for instance, began in 1953 while in England in around 1956 furniture-repair classes were offered at the headquarters of the Rural Industries Bureau at Wimbledon Common [50, 155]. In his article of 1959 Ralph Edwards observed that 'At this workshop two highly-skilled craftsmen with long experience conduct the instruction classes, and are also responsible for carrying out, under my supervision, the restoration of furniture in what may be called the museum category from historic houses...' [50, p. 1136]. The ICOM questionnaire (discussed above) indicates that the restorers at the Rural Industries Bureau practiced conventional restoration techniques, using both traditional and contemporary materials [106]. They were familiar with John Rodd's 1955 book [67] and kept written and visual documentation of their work [106]. Since the 1960s, the conservation department at the V&A has offered training in conservation for its own staff and has accepted up to six student internships for a four-year period [52].

It was typical throughout Europe in both museum-based and academic training programmes that older and highly skilled craftsmen/restorers assumed responsibility for training young conservators. Practical instruction was combined with a curriculum that included a wide variety of courses such as art history, applied science, chemistry and conservation ethics. By the late 1970s, several formal undergraduate and graduate-level (furniture) conservation programmes had been introduced by various institutions across the globe—including those offered through The Henry Francis du Pont Winterthur Museum and the University of Delaware, The London College of Furniture, L'Opificio delle Pietre Dure in Florence, the Institut Français de Restauration des Oeuvres d'Art (IFROA) in Paris (recently renamed the Institut National du Patrimoine (INP)), and the Opleiding voor Restauratoren in Amsterdam. As a result, graduates from such training programmes began to appear in the field in the next decade. Whereas older generations of furniture conservators had worked in a fairly isolated environment, the new wave of academically trained conservators sought the stage with confidence, aiming to become equal partners in discussions with art historians, curators, administrators and conservation scientists.

Conclusion

For centuries furniture repair and restoration has been the domain of journeymen, cabinetmakers and amateur woodworkers. Influenced by progress in emerging conservation disciplines and with the support of professional organizations such as ICOM, IIC, ATM and CCI, furniture conservation firmly established itself during the late 1970s and early 1980s. It is the intention of this author to review developments in the furniture conservation profession from c. 1980 in a subsequent contribution to this journal.

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Image #1: Detail showing the lower center of the PMA console table. The areas of gesso loss have been sized with 15% bismuth oxide W / V in stock rabbit skin glue in preparation for gesso fills.

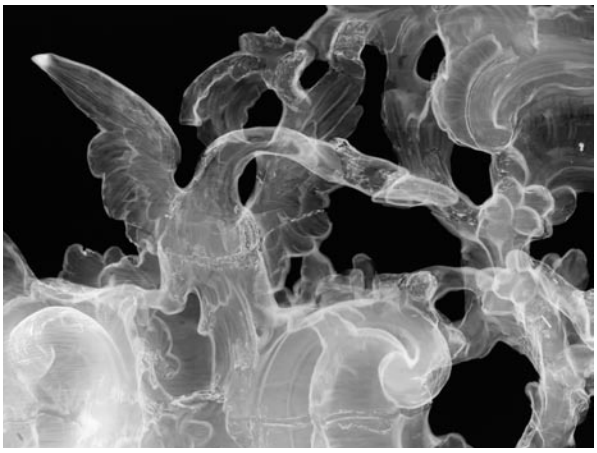

Image #2: The bismuth oxide sized areas in image #1 are clearly discernible in this x-radiograph.

Image #3: Detail showing the lower center of the PMA console table. The areas of gesso loss have been sized with 15% bismuth oxide W / V in stock rabbit skin glue and filled with (50%–35%–15% calcium carbonate- zinc oxide-bismuth oxide) gesso. glue and filled with (50%–35%–15% calcium carbonate-zinc oxide- bismuth oxide) gesso. glue and filled with (50%–35%–15% calcium carbonate- zinc oxide- bismuth oxide) gesso.

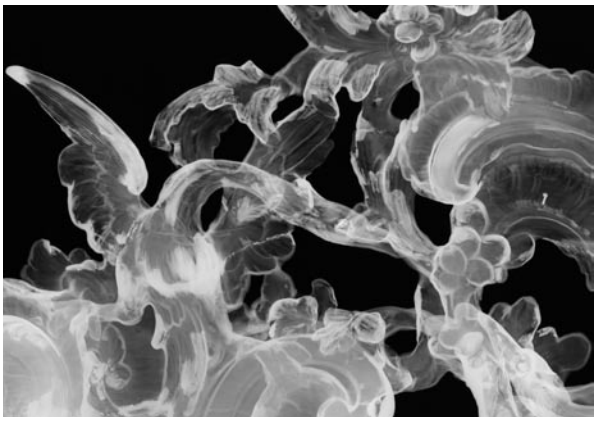

Image #4: In this x-radiograph taken after the gesso fills the areas of fill are clearly visible.

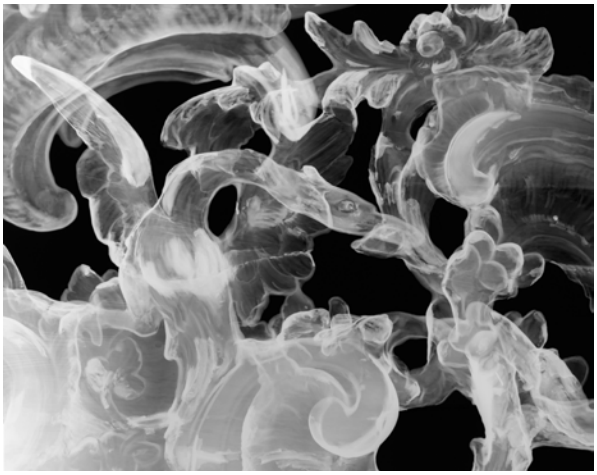

Image #5: This x-radiograph was taken after bole and gold leaf have been applied to the areas of loss. There is no perceptible difference between this x-radiograph and the one with only gesso in image #4.

Formulating Gesso Fills With Bismuth Oxide for Discrimination by X-radiography

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Abstract

This paper discusses investigation of the use of different gesso formulations and techniques to allow the discrimination of fill materials from the original gesso. Test panels were prepared to observe the effects of pigment composition and gesso thickness on the appearance of x-radiographs. The first test panel was prepared using twelve gessoes formulated with varying proportions of calcium carbonate (Ca CO3), zinc oxide (ZnO), and bismuth oxide (Bi2O3). The zinc and bismuth pigments were chosen because they are stronger x-ray absorbers than the traditional calcium pigments such as calcium carbonate and calcium sulfate (Ca SO4), which are widely available and inert. Additional tests were carried out to investigate gesso formulations based on calcium sulfate and to assess the effect of a bole layer. The paper will discuss the results obtained from the test panels as well as from the gesso fills used in objects.

Introduction

We have been developing modified gesso fill materials that can be distinguished from original gesso on gilded objects by using x-radiography. In 2002, we reported that bismuth oxide (Bi2O3) and zinc oxide (ZnO) could be added to a calcium carbonate (CaCO3) gesso in rabbit skin glue to impart greater x-ray density (Salimnejad, American Institute of Conservation 2002 Conference WAG Postprints). After evaluating a number of gesso formulations containing these oxides, we found that 10% bismuth oxide, 35% zinc oxide and 55% calcium carbonate in rabbit skin glue (RSG) exhibited the greatest increase in x-ray density without adversely affecting the working properties of the modified gesso material. This formulation was applied successfully to an 18th-century French console table at the Philadelphia Museum of Art (PMA), and the fills were discriminated easily from the table's original gesso by x-radiography. In this paper, we present photographic documentation (Images 1-5) of this earlier work as well as our recent studies on the use of bismuth oxide alone in several other traditional gesso materials.

Objectives

In our earlier work, the modified gesso fills were tailored for the treatment of the 18th-century French console table. In several areas of the console table, the gesso lacked colored bole and was exposed due to wear. Therefore for this console table, zinc oxide pigment was used to make the bismuth oxide-modified gesso fills whiter in appearance, and more compatible with the color of the original gesso. On the other hand, for many other objects with colored boles and intact gilding, the addition of zinc oxide would not be necessary. Consequently, one of our objectives in this study was to determine if gesso fills modified with Bi2O3 pigment alone could be discriminated from original gesso by x-radiography.

Since we had confined our earlier study to only one type of gesso material, calcium carbonate, our second objective was to determine how other types of commonly used gesso materials would behave in x-radiography studies. Accordingly, this investigation included both the calcium carbonates and sulfates as listed

in Table 1.[1][1] In addition to these materials, we also examined the performance of English China clay, a white, kaolin clay that is favored as an additive to gesso by some conservators and gilders.

Lastly, in our earlier work we observed that precipitated barium sulfate (BaSO4) did not perform well. Even at relatively low concentrations, the working properties of the BaSO4 gesso suffered and the x-ray density did not change appreciably over a range of concentrations (up to 20%). As a result, our third objective was to examine a different source of BaSO4 – blanc fixe, mined – to see if a better performance could be achieved.

Materials and Methods

Two test panels were prepared. Each panel consisted of a ¾" x 14" x 18" Medex ® board on which were routed 12 parallel tapered mortises. Each mortise was made to be gradually deeper when moving from right to left along the length of the mortise, with the shallow end being 1/16" deep and the lower end being ¼" deep. The mortises were numbered 1-12 from top to bottom. A different gesso fill was poured into each mortise, allowed to dry for 5 days and sanded to a uniform thickness using a jig. All of the test materials were formulated with 100g pigment in 50mL of rabbit skin glue.[2][2] The materials used to make the gesso fills are listed in Table 1.[3][3]

Each panel was examined by x-radiography with a Picker SN262 x-ray instrument for 60 seconds at 23.5 kV x 5 mA x 60 seconds. Kodak Industrex MX-125 x-ray film was used and developed at the maximum development time (Kodak manual developer).

Table 1. Materials Used to Make Gesso Fills

Common Name	Chemical Name	Chemical Formula
Alabaster plaster	Anhydrite	$CaSO_4$
Anhydrite plaster	Anhydrite	$CaSO_4$
Barium sulfate	Barium sulfate*	$BaSO_4$
Bismuth oxide	Bismuth oxide*	Bi_2O_3
Blanc fixe	Barium sulfate, mined	$BaSO_4$
Bologna chalk	Calcium carbonate + Calcium sulfate dihydrate	$CaCO_3 + CaSO_4{\cdot}2H_2O$
Calcium carbonate	Calcium carbonate + calcium magnesium carbonate	$CaCO_3 + CaMg(CO_3)_2$
Calcium sulfate	Anhydrite*	$CaSO_4$
Chalk from Champagne, France	Calcium carbonate + Silicon dioxide	$CaCO_3 + SiO_2$
English China clay	Aluminum hydroxide silicate	$Al_2(OH)_4Si_2O_5$
Marble dust, extra fine grind	Calcium carbonate	$CaCO_3$
Sarti chalk	Calcium carbonate + anhydrite	$CaCO_3 + CaSO_4$
Terra alba gypsum	Calcium sulfate dehydrate + Anhydrite	$CaSO_4{\cdot}2H_2O + CaSO_4$

*Denotes Fischer Chemical Products, not assayed by XRPDA

Results and Discussion

Test Panel #1

The first test panel compared the x-ray densities of several traditional gesso materials without added pigments (mortises 3-10). This panel also tested the two different forms of barium sulfate when added to calcium carbonate against the two highest concentrations of bismuth oxide used in the previous tests. Test panel #1 contained the formulations shown in Table 2.

The x-radiography image of this panel is shown in Image # 6. Considerable cracking was observed when 20% precipitated barium sulfate was formulated with calcium carbonate (mortise 1), a result consistent with our 2002 observations. Interestingly, the same concentration of blanc fixe, which is a mined barium sulfate, caused much less cracking as seen in mortise 12. However, the two forms of barium sulfate had similar small effects on the x-ray density of the gesso when compared to the bismuth oxide samples shown in mortises 2 and 11.

Mortises 3-10 show that the traditional gesso fill materials have very slight but perceptible differences in x-ray density. The differences are clearly not great enough to discriminate them as fills without added x-ray dense pigment. Of these gessoes, the anhydrite plaster in mortise 8 exhibited the greatest x-ray density, and therefore was used as a control in the development of the bismuth oxide-modified gessoes.

Test Panel #2

The second panel (Table 3) shows the effects of different concentrations of bismuth oxide in a calcium carbonate gesso (5-20% by weight based on the weight of the pigment plus carbonate). It also tested x-ray density of the Champagne chalk (a late arriver which did not make it for panel #1) and the effectiveness of the China clay as a gesso material alone as well as a fill material with anhydrite plaster.

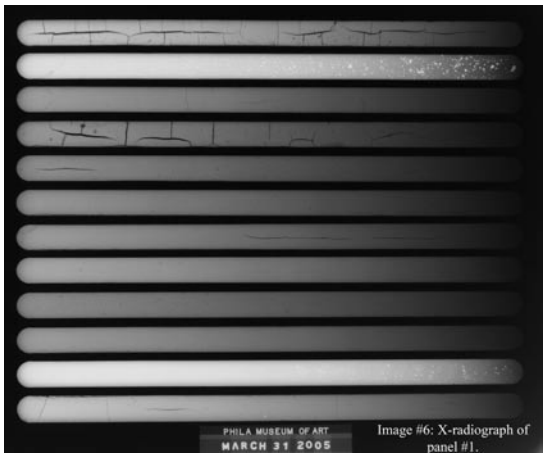


Image # 6.

Table 2. Test Panel #1 Gesso Formulations in 50 mL Rabbit Skin Glue

Mortise #	Filler (# of Grams)	Pigment (# of Grams)
1	Calcium carbonate (80 g)	Precipitated barium sulfate (20 g)
2	Calcium carbonate (85 g)	Bismuth oxide (15 g)
3	Sarti Chalk (100 g)	-
4	Alabaster plaster (100 g)	-
5	Terra alba gypsum (100 g)	-
6	Calcium carbonate (100 g)	-
7	Bologna chalk (100 g)	-
8	Anhydrite plaster (100 g)	-
9	Calcium sulfate (100 g)	-
10	Marble dust, extra fine grind (100 g)	-
11	Calcium carbonate (80 g)	Bismuth oxide (20 g)
12	Calcium carbonate (80 g)	Blanc fixe [mined barium sulfate] (20 g)

Table 3. Test Panel #2 Gesso Formulations in 50 mL Rabbit Skin Glue

Mortise #	Filler (# of grams)	Pigment (# of grams)
1	Chalk From Champagne France (100 g)	-
2	English China Clay (100 g)	-
3	Anhydrite Plaster (50 g)	English China Clay (50 g)
4	Anhydrite Plaster (100 g)	-
5	Calcium carbonate (95 g)	Bismuth Oxide (5 g)
6	Anhydrite Plaster (100 g)	-
7	Calcium Carbonate (90 g)	Bismuth Oxide (10 g)
8	Anhydrite Plaster (100 g)	-
9	Calcium Carbonate (85 g)	Bismuth Oxide (15 g)
10	Anhydrite Plaster (100 g)	-
11	Calcium carbonate (80 g)	Bismuth oxide (20 g)
12	Anhydrite Plaster (100 g)	Blank fixe (20 g)

The x-radiography image of this panel is shown in Image #7.

Image #7.

The x-ray density of the Champagne chalk (mortise #1) is similar to other chalks tested. The China clay did not perform well as a gesso material alone, as evidenced by the complete loss of fill in mortise 2, nor did it perform well as a filler, as evidenced by the cracks visible in mortise 3.

As mentioned earlier, 100% anhydrite plaster was the densest gesso material from Test Panel 1 and, as such, served as the control in alternating mortises. Though x-ray density increases with as little as 5% bismuth oxide (mortise 5), the differences become much more pronounced as the oxide concentrations are increased from 10 to 20% (mortises 7, 9 and 11). Gessoes modified with a higher level of bismuth oxide appear to be useful for discriminating these fills from original gessoes while maintaining optimal working properties.

The x-ray density of the bismuth oxide-modified gesso at 5% is perceptibly different from the control anhydrite plaster along 95% of the length of the mortises, which range from 1/16" to ¼" thick. However, at 10% concentration of bismuth oxide, the fill can be discriminated from the control along 100% of the length of the mortise, although weakly at the thin end. At 15% the difference becomes more pronounced, and at 20% concentration the fill can be discriminated quite easily along 100% of the length of mortise.

Conclusion

Barium sulfate in its precipitated form had failed in our earlier studies. We found that the use of a different form of barium sulfate – blanc fixe – improved the working properties of the material. However, its effect on x-ray density was inferior to bismuth oxide.

We also had reported earlier that when bismuth oxide and zinc oxide were both added to a calcium carbonate gesso in rabbit skin glue, the modified gesso was easy to distinguish from original gesso by x-radiography. We have now expanded our study

to a number of traditional gesso materials, which turn out to have similar x-ray densities, with anhydrite plaster being slightly densest.

We were able to modify a calcium carbonate gesso by adding bismuth oxide pigment at various concentrations ranging from 5 to 20%. At these concentrations, the modified gesso could be distinguished readily from anhydrite plaster, except when the application was very thin (under about 1/8"). The addition of the bismuth oxide did not alter the working properties of the material. Notably, we were able to achieve this greater x-ray density without the zinc oxide used in our 2002 research, which had a whitening effect on the gesso and may be undesirable for some objects.

English China clay was found to be a poor performer, both as a substitute for the more traditional gesso materials and as an additive.

Future studies could include assessment of long-term stability of the formulated fill materials.

Acknowledgements

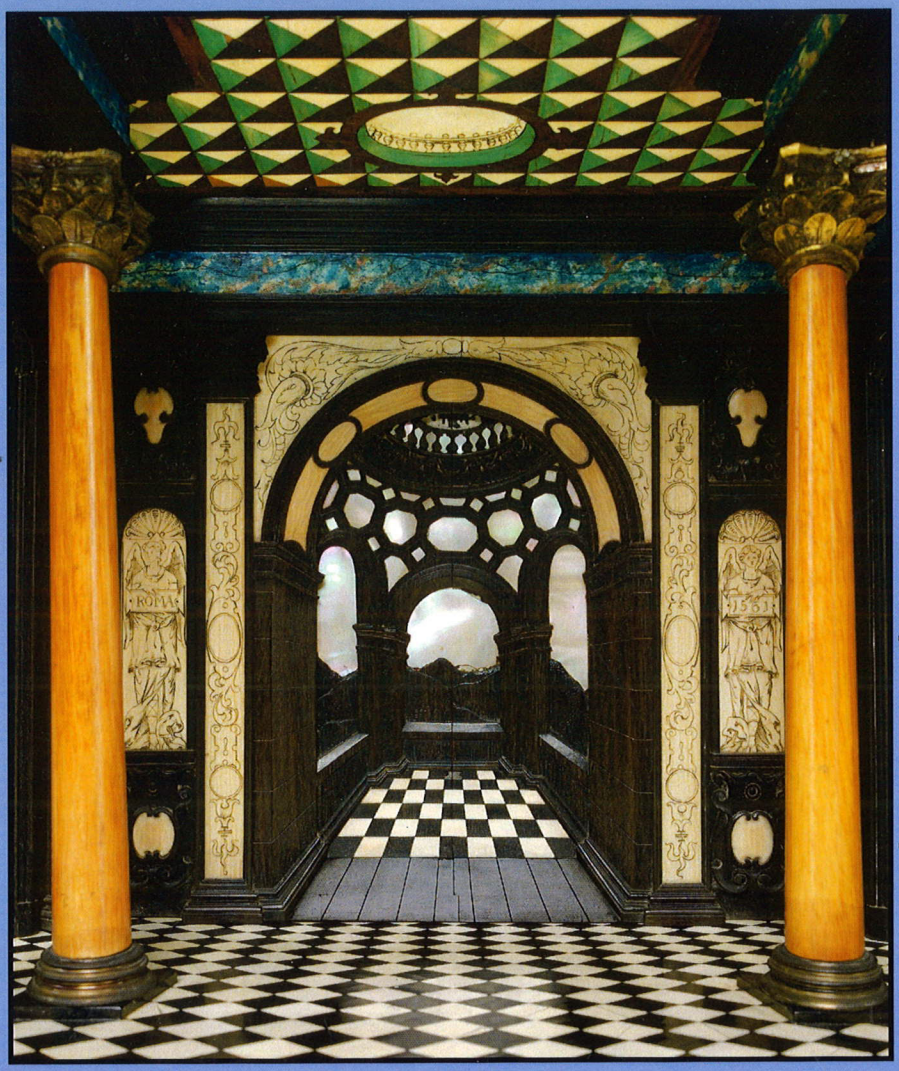
I would like to thank David deMuzio for his input in design and implementation of this study; Andrew Lins, Beth Price, and Ken Sutherland for analysis of the materials used; and Joe Mikuliak for x-radiography and photography.

Endnotes

1 [1] The compositions of these materials were verified by using Fourier transform infrared spectroscopy and x-ray diffraction analyses, which were performed by Andrew Lins, Beth Price, and Ken Sutherland. The instrumental conditions, sample preparation information, and data are on file at the PMA and are available upon request.

2 [2] The stock solution of rabbit skin glue was made by dissolving 45 grams of ground rabbit skin glue in 1000 ml of distilled water.

3 [3] The suppliers for test materials were: Kremer Pigments, Fischer Chemical Products, Fluka Chemical Corp, Sepp Leaf Products, and Del-Val Pottery Supply.



Joseph Coscia, The Metropolitan Museum of Art

Left and below: Detail of Parisian ebony cabinet-on-stand, mid-17th century. The Metropolitan Museum of Art.

Front cover: Detail and x-ray detail of French 18th century console table. The Philadelphia Museum of Art.

Joseph Coscia, The Metropolitan Museum of Art