THE METROPOLITAN MUSEUM OF ART BULLETIN WINTER 1993/94 0

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# THE CHANGING IMAGE

#### Studies in Paintings Conservation



The Metropolitan Museum of Art



THE METROPOLITAN MUSEUM OF ART BULLETIN

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FRONT COVER: Giovanni Battista Moroni, Bartolommeo Bongbi, after restoration with a black-and-white inset from an X-radiograph. See pages 18-23.

TITLE PAGE: The studio of the Sherman Fairchild Paintings Conservation Center at The Metropolitan Museum of Art. Pictured: foreground, Christopher McGlinchey, research chemist; at back (standing), Charlotte Hale, associate conservator; seated at middle, Julie Barten, Samuel H. Kress Foundation fellow.

BACK COVER: Some of the tools used in paintings conservation.

#### Director's Note

he expertise and knowledge of the Museum's paintings conservation staff as demonstrated in this issue of the Bulletin are certainly a far cry from those present during the early years of the Metropolitan's history. Then paintings were sent out of the building to independent restorers and even-during the early 1900s-worked on personally by such eminent curators as Roger Fry and Bryson Burroughs. In fact there was no separate department until 1941, when Murray Pease was appointed technical advisor and began the first survey of the conditions of works of art in our collections. In 1949 the department, known as the Technical Laboratory, was raised to full curatorial standing, and Pease was named curator. Seven years later the Laboratory was renamed the Conservation Department, and in 1962 paintings conservation was moved to the European Paintings Department. In 1970, upon the departure of Kate C. Lefferts, who had succeeded Murray Pease, the conservator of paintings, Hubert von Sonnenburg, became head of the Conservation Department, a post that he held for four years. During his tenure conservation was broken down into separate departments for paintings, works on paper, objects, and textiles. In 1974 von Sonnenburg left to become director of the Doerner Institute in Munich, and John Brealey, an Englishman who had gained an international reputation for his considerable skills in restoration and cleaning of paintings (including the Royal Collection), became conservator in 1975 and chairman in 1983. In 1988 Brealey was the first recipient of an endowed chair in the department, a position known as the Sherman Fairchild Chairman of Paintings Conservation,

A serious illness forced his retirement in 1990. We were pleased to be able to convince Hubert von Sonnenburg, by then director general of the Bavarian State Galleries, to return to New York in November of that year to assume the Sherman Fairchild chairmanship. A conservator of unparalled experience, he is an invaluable resource to this institution as well as to the students who work with him in our graduate intern program.

The endowment of this chair is just one of many gifts that the Sherman Fairchild Foundation Inc. has made to the Metropolitan. In the late 1970s the Foundation helped the Museum remain open on Tuesdays, after the temporary closings during the City's 1975 financial crisis. In 1979 the Foundation awarded a grant for the construction and equipping of a modernized paintings conservation center to be named in memory of Mr. Fairchild, founder of the Fairchild Camera and Instrument Corporation and of Fairchild Industries Inc., who died in 1971. The new facility, completed in 1980, also serves as a postgraduate training center. In 1988 the Foundation awarded an additional grant to the Metropolitan for the construction of a new objects conservation center. We wish to thank the Sherman Fairchild Foundation for its continued major funding; and the Rowland Foundation and the Dyson Foundation for their gifts to the Paintings Conservation Center this year. We are grateful for such generous support for its day-to-day operations as well as for our teaching and research programs.

Philippe de Montebello Director



#### Introduction

The contributions to this issue of the *Bulletin* are by staff members of the Museum's Sherman Fairchild Paintings Conservation Center. The articles have been united under the title "The Changing Image," an appropriate term, perhaps, for the majority of artworks passing through the hands of our conservators. From all of the paintings examined or treated at the Museum during the last two years, we have chosen examples that illustrate how works are altered by later hands, how they themselves change due to instabilities of technique or medium, and how they look under various atmospheric or lighting conditions.

Although not discussed here, two recent interventions on well-known works should be mentioned, as the paintings now differ from their appearance in widely circulated reproductions. In preparation for the forthcoming exhibition of works of the early Flemish artist Petrus Christus, nonauthentic gilded haloes were removed from his portrait of a Carthusian and from the goldsmith's head in the painting in the Robert Lehman Collection that is considered to be a representation of Saint Eligius, patron of goldsmiths. These pious additions from an unspecified period might be interpreted as an attempt to give a religious character to these originally secular paintings, but at the same time their presence prevented a proper reading of the surrounding backgrounds.

For the majority of early easel paintings, the cycle of change began with discoloration of the original varnish. In former centuries especially, removal of this first surface coating often resulted in irreversible damage to the paint layers because of the limited, mostly corrosive, cleaning agents then available. Subsequent repairs or repaints caused new changes, and eventually these had to be removed in the hope of recovering more of the original paint underneath.

Changes of ownership, private or institutional, can initiate yet other interventions. Many paintings have had to endure a great number of recurring treatments, thereby losing a bit







Portrait of a Carthusian after restoration.

Petrus Christus, Flemish, active by 1444, d. 1475/76. *Portrait of a Cartbusian*, 1446. Oil on oak,  $11\frac{1}{2} \times 8$  in.  $(29.2 \times 20.3 \text{ cm})$ . The Jules Bache Collection, 1949 (49.7.19)

of their original substance each time. Often alterations are caused by faulty work on a panel support or during the relining of a painting on canvas.

A good preservation policy seeks to avoid treatment that has only a small chance of effecting an improvement and aims at increasing the intervals between the more extensive restorations in order to prolong the life of the work of art. A necessary treatment therefore has to be carried out as expertly as possible so that it will last for at least another generation before being repeated. One might say that perhaps with the exception of necessary repairs to problematic panel and canvas supports—the original substance of a painting is likely to survive for many years even without ideal environmental conditions.

The restorer's retouchings, however, are considerably thinner than the original paint layers and thus more vulnerable to the deteriorating effects of light. Under excessive exposure they frequently turn gray or almost white, a distortion worse than darkening that might necessitate a premature renewal of all the restorations. It is therefore not surprising that it is foremost in the interest of conservation departments to take the initiative in establishing standards for gallery lighting to protect their work. How to exhibit works of art is a more problematic issue because it involves, above all, taste. Lighting is an essential aspect of taste, and the use of glaring spotlights often eliminates the subtleties of paintings in a darker color range. In such cases conservators' efforts are sometimes rendered absolutely useless.

The Museum's Paintings Conservation Center operates with nine staff members and five interns in a duplex facility of approximately 18,000 square feet, which includes a twostory studio with two full walls of lightboards for the study of X-rays. A steadily growing reference library reflects the interdisciplinary approach to paintings conservation. Of primary concern to us is the care of paintings in all the curatorial departments of this encyclopedic museum, with the exception of Asian works, which are entrusted to experts in the field. Petrus Christus. Saint Eligius, 1449 (detail). Oil on oak, 38%×33½ in. (98×85 cm). Robert Lehman Collection, 1975 (1975.1.110)

Only conservation students who have completed their postgraduate work at a recognized training institution or conservators who already hold museum positions are eligible to apply for our internship program for paintings conservation. The department has a conservator on staff who is specifically trained to cope with the often complex problems of panel paintings. Such expertise, which combines technical and aesthetic considerations, is sought after by museums in North America and Europe and adds to the desirability of our program. Rather unusual in the conservation department of any museum is the presence of a small group, consisting of an art historian, a part-time research associate, and an annual graduate-student intern, exclusively devoted to the study of paintings by infrared reflectography. The focus of this interdisciplinary research has been on the investigation of the working methods of northern Renaissance painters. The program's high point promises to be the Petrus Christus exhibition.

The department's scientific laboratories are run by a research chemist, who is assisted by a research intern and a part-time student. Our chemist cooperates with colleagues in the Objects Conservation laboratory. Some paintings under treatment in the studio are sampled, but only if they pose interesting questions of condition, technique, or authenticity.

Combining the resources of eye and science is certain to advance the art of paintings restoration. However, an undue emphasis during training on scientific punctiliousness is likely to produce practitioners so engrossed with new materials and technologies that they tend to make an old picture look as immaculate as if it had come from the dry cleaner. Missing is the assessment of the aesthetics of the work as a whole. What we are trying to avoid in our training program is a single-minded approach. By making an effort to communicate a sense of history, we hope to educate the new conservators so they will not judge the past by present fashions in the field.





Detail of Saint Eligius after restoration.

Hubert von Sonnenburg

#### A Case of Recurring Deception

HUBERT VON SONNENBURG Sherman Fairchild Chairman of Paintings Conservation

In 1974, barely a month after acquiring the Man of Sorrows, the Metropolitan Museum received the shocking news that the Courtauld Institute in London had just declared the painting to be a modern forgery. No museum is pleased by such news, and the panel was ultimately sent into storage, where it remained, unaccessioned and forgotten, for almost twenty years. In 1992 interest in it was revived, and the Man of Sorrows was put to further testing, with some surprising results.

Christ as the Man of Sorrows is the subject of a panel painting of moderate dimensions by an unknown Flemish artist and formerly dated 1420–40 (fig. 1). The oak support has been stripped of its original molding so that the unpainted margins on all four sides are exposed. The figure of Christ occupies almost the full height of the picture's center. He is unclothed except for a thin loincloth, and he wears a crown of thorns and halo. With his right hand he holds open the wound on his side from which blood streams; his left arm embraces the cross. Several of the instruments of the Passion (cloth for the entombment, scourge, whip, and lance) are composed around him, including the column of the flagellation held by a kneeling angel. In the foreground to the left kneels a monk, clad in the original dark habit of the Benedictine order, his cowl pulled halfway up over his tonsured head. He holds an open breviary. The mystical trend in the late Middle Ages resulted in a growing number of devotional objects and paintings of this kind, destined for individual use. Very likely, the monk commissioned this panel for his private contemplation to draw religious inspiration from it.

The Man of Sorrows was first published and illustrated by Édouard Michel, a renowned Belgian art historian, in the Gazette des Beaux-Arts in 1924. At the time it belonged to Emile Renders of Bruges, but Michel mentions that it originally came from Liège before a Bruges dealer sold it to Renders. Banker, private scholar, and draftsman as well as a collector and close acquaintance of the famed restorer Jan Van der Veken, Renders, in collaboration with the archivist Jos. De Smet, wrote several books on the founders of the Netherlandish School of painting, in which they discussed Jan van Eyck's brother Hubert as a legendary figure. Along with the great connoisseur Max Friedländer, Renders appealed to the "technical art critics" for a solution to the enigma of the Master of Flémalle, whose identi-



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1. Unknown Flemish artist. Man of Sorrows, late 15th century with modern additions. Oil and tempera on wood. Painted surface,  $17\% \times 12$  in. ( $45.3 \times 30.5$  cm). The Cloisters Collection, 1974 (1974.392)



2. Master Francke, German (Hamburg), active early 15th century. *Man of Sorrows*, ca. 1400. Tempera on wood,  $16^{3/4} \times 12^{3/6}$  in. ( $42.5 \times 31.3$  cm) with original frame. Museum der Bildenden Kunst, Leipzig. Inv. no. I 243

fication with Robert Campin remains an open question, as does the stylistic distinction of this master's works from those of his presumed pupil, Rogier van der Weyden.

The eminent Flemish art historian Georges Hulin de Loo, with whom Renders sometimes disagreed, wrote an introduction to the catalogue of Renders's collection in 1927, when it was part of an exhibition of Flemish and Belgian art at Burlington House in London. Hulin de Loo describes the Man of Sorrows as a "problem for every art student," alluding to stylistic and iconographic incongruities that show a debt both to Franco-Flemish illuminations and to the International Gothic style of the early fifteenth century. The painting is featured prominently, with a colorplate in the catalogue. Illustrated among the sixteen early Flemish panels, the majority dating from the fifteenth century, is another Man of Sorrows by the Master of Saint Veronica (now in the Royal Museum, Antwerp).

The Metropolitan Museum's panel was not shown again until 1969, when it appeared in an exhibition at the Kunsthalle Hamburg devoted to the works of the early fifteenth-century Hamburg painter Master Francke and the art of about 1400. By that time





3, 4. Kneeling angels, details of the Master Francke (left) and Metropolitan (right) panels.

the panel was in the possession of Hester Diamond, a New York collector. Surprisingly, the curator advocating the purchase of the picture for The Cloisters was unaware that it had been in the vicinity of the Metropolitan for several years. The work was judged instead on the basis of photographs.

Most frequently referred to in art-historical literature is the angel in the lower right with drapery slung over its wings (fig. 4). It is almost a mirror image of the angel in the lower left corner of Master Francke's *Man of Sorrows* (Museum der Bildenden Kunste, Leipzig; figs. 2, 3). This similarity was first recognized and illustrated by Bella Martens in her monograph on Master Francke published in 1929. However, she went even further by suggesting that the figure in the Renders panel possibly records yet another angel from a lost composition by Master Francke, and apparently disregarded the angel in the lower right of the Leipzig painting who also supports a leaning column.

A peculiarity of our painting is the colorful background with its repeated diamond pattern enriched with decorative devices (a Greek cross, fleur-de-lis, and smaller diamond with a tiny Greek cross inside; fig. 5). The paired letters "CS" and "PB" can be read from left to right in double horizontal rows (fig. 6). In 1927 Édouard Michel suggested in the *Gazette des Beaux-Arts* that they may be interpreted as meaning *Crux Sancti Patris Benedicti* (Cross of the Holy Father Benedict), adding to the distinctly Benedictine character of the work. No other example of such a cryptogram is known.

Moreover, the perspective of the pavement was considered a recent innovation, moving the date of origin closer to the time when the influence of the van Eycks began to be widely felt. But instead of being composed of lines that move toward a horizontal line in the center of the picture—it was thought that the van Eycks used one-point perspective—the tiles are in proper perspective only from a point to the right of center. These intriguing details of the panel proved to be quite a challenge to specialists in the field. The painting was believed to be a rare example of the early fifteenth-century period just before the emergence of the great Flemish painters.

In the star-studded deep blue sky with its golden rays and the multicolored and richly patterned field of the lower background wall and stone floor, scholars saw a vivid reflection of the Parisian and Burgundian miniatures of about 1400. The angel, however, has distinctly Rhenish features. Michel



5. Detail of the background of the Metropolitan's Man of Sorrows.



6. The cryptogram in the background design is read by focusing on a row of crosses between two rows of horizontal fleurs-de-lis. (Drawing by Dan Kershaw)

elaborated on the contrast between this slightly archaic touch and a "wholly realistic, vigorous side, a certain excess of affirmation, a force tending to strike rather than to charm" in the figures of Christ and the distinctly individualized donor. Others considered this panel one of the works produced by an oldfashioned artist in the days when the van Eycks were creating their great innovations. The discrepancy between the strange sudden narrowing of Christ's waistline and the otherwise assured drawing and modeling was explained away by suggesting that an ancient image of Byzantine origins might have influenced the artist's conception.

The acquisition of the panel was proposed by a curator of The Cloisters in 1974 to fill a gap in the paintings collection of the Museum that existed from the earliest of our fifteenth-century Flemish works up to the paintings by Jan van Eyck and the Master of Flémalle. Subsequently, the *Man of Sorrows* was purchased at auction in London.

One month after the auction the panel was called a "modern forgery beyond doubt." This shocking information resulted from a twelve-point examination report by the Courtauld Institute, which had been asked to look at the painting in London before it was restored. The Courtauld had identified the presence of cerulean blue (not introduced before 1860) in major areas of the background and, most importantly, in the kneeling angel. Even the oak panel support was believed to be of relatively modern origin. False cracks were traced in scattered areas, deceptively scratched into the dry paint and subsequently filled with black paint.

Other arguments were based on microscopic examination and were not sufficiently substantiated. In spite of the fact that the examiners were frequently led astray by later additions, their altogether rather negative verdict provoked further research, and for that reason the report can be considered a step in the right direction. Subsequently, the Metropolitan Museum had additional analytical pigment tests made, and at Brookhaven National Laboratory the new technique of autoradiography, which was then all the rage, was applied. Apparently, no new insights could be garnered, and the Courtauld's verdict was endorsed. The panel was unmasked as not authentic, and as a result the Man of Sorrows effectively ceased to exist. It was not even accessioned until very recently.

Our painting surfaced again in 1992, on the occasion of the Museum's lecture series, "Understanding Fakes." Right from the start there had been reservations about the conclusion reached by the Courtauld report that the *Man of Sorrows* had been manufactured from the bottom up in modern times.

The X-radiograph and the 1974 report agreed that the ground and paint layers lie directly on the oak panel. Especially apparent in the body of Christ is the orientation of the irregular vertical cracks, which exactly follow the wavy movement of the growth rings (fig. 7). These are most clearly seen in the Xradiograph (fig. 8). (The interval between the cracks corresponds to the incremental annual growth of the tree.) Such cracks in the rigid paint layer are the result of a slow, natural aging process of the oak panel, which is influenced by the expansion and shrinkage with changes in relative humidity.

In genuine early Flemish paintings, as a rule, the surfaces of the areas of pigment, or "islands," surrounded by the cracks are concave and their edges sloped, while in faked ones these islands are flat. So far none of the known artificial aging processes were able to produce cracks as seen in *Man of Sorrows*. Additionally, pigment analysis confirmed the presence of azurite, madder lake pigment, lead white, and vermilion in the flesh tones of Christ, pigments that are consistent with an early date of origin.

It is perhaps a curious coincidence that the muchdiscussed distinction between genuine and imitation Flemish "primitives" was the subject of an informative article published by Renders in the Burlington Magazine in 1928. What is even more surprising is that he illustrated several details of the Man of Sorrows, then in his collection, in raking light to prove his point that the cracks are the result of natural aging. Interestingly, the rather extensive repaints and false cracks seem to have escaped his attention; it was for the Courtauld to discover that they contained a modern pigment. This may have been a matter of timing. In the detection of nonauthentic retouchings and forgeries, pigment analysis was to play an increasingly important role only after the publication of Marten de Wild's groundbreaking 1928 dissertation, "The Scientific Examination of Paintings."

Dendrochronology (tree-ring dating) proved to be extremely helpful in suggesting the approximate age of the painting. The panel was analyzed in 1992 by the leading specialist in this field, Dr. Peter Klein, of Hamburg University, where a master chronology of oak trees of West Germany and the Netherlands has been established. The perfectly flat panel of the Man of Sorrows consists of two boards of moderate thickness (9 cm) joined together with dowels. The astonishingly smooth finish of the back, we are told by the specialist, is not an exception among fifteenth-century Netherlandish paintings. Under the assumption that the wood was stored for two years after the tree was felled, Klein established the absolute earliest possible date of origin of this oak panel as 1469 or later. To be on the safe side, however, it would be plausible to think in more flexible terms, that is, the last quarter of the fifteenth century. Consistent with this date and characteristic of early panel paintings with plain wood borders would be the "lipped" paint edge (also termed "la barbe"), which is partly preserved, especially along the top and bottom edges.

By now, sufficient evidence had been gathered to support the view that we were faced with a late fifteenth-century panel painting that had been restored in a highly deceptive manner. Of the original composition, the figures of Christ with the cross and



7, 8. Details of the body of Christ showing vertical cracks that correspond to treegrowth rings, which are more clearly evident in the X-radiograph at the right.



9, 10. Details of Christ's left leg and head.

the donor are for the most part authentic. They are tightly enclosed, however, by a background of modern origin based on stylistic elements found in paintings of the early fifteenth century. These additions sit on top of the remains of the original chalk ground, which can clearly be seen in a closeup of Christ's left leg, where a piece of the green-yellow patterned background has chipped off (fig. 9). The pronounced pattern of the cracks of the flesh paint does not continue into this repainted area. Only in the lower left of our detail have the cracks been transmitted more visibly from the original ground beneath.

The undisturbed, precise original contour of the leg on the right recedes into the dark and enhances the modeling. In comparison, the fuzzy edges of the painted background on the left provide a poor substitute for the original outline, which it partly covers. The background painfully lacks the illusion of continuing behind the leg, and the peculiarly soft and somewhat doughy consistency of the paint helps to distinguish it from the crispness and transparency







11, 12, 13. Christ's head and upper chest shown in a photograph (top left), in an X-radiograph (above), and in ultraviolet light (bottom left).

of the original layers, which are on the whole more thinly brushed.

The pockmarked surface calls to mind the moonlike craters that sometimes develop in tempera layers upon drying. In areas where the original paint is still preserved, but damaged and abraded, the restorer's intervention is quite clearly recognizable under ultraviolet light (fig. 13). The face of Christ, for example, appears considerably darker under UV because the pale yellow-green fluorescence of the original flesh paint, such as that in the chest area below, is covered up with thin scumbles that represent an attempt to put back some of the lost modeling. The touch-up is kept sufficiently transparent to let the authentic cracks show through, but it proved necessary to retrace many of these cracks by scratching with a sharp instrument. Subsequently, the false cracks had been filled with black paint and are only distinguishable from the genuine cracks under considerable magnification because of their splintered edges (fig. 14). Christ's hands and toes have been extensively reworked (fig. 15). Rather stiffly scratched are the cracks to the left and right of the nose, an indication that they are actually invented rather than simply retraced.

In the X-radiograph the losses within the flesh paint appear very dark with jagged edges, such as the area along Christ's collarbones, whereas more recent fills with lead-based pigment show up stark white, including that on the nonauthentic tip of the nose (fig. 12).

The observation that "the comparatively weak films produced by the browns and blacks [here in particular on the cross] are almost perfect in their preservation, whereas the tough body-colors are much distressed" led the examiners at the Courtauld to the conclusion that the alleged "fakers overlooked a commonplace elementary technicality." This assumption, however, proved to be erroneous. The deceptive "perfection" was created by a semitransparent glaze applied over the worn original



14. A greatly enlarged detail shows a residue of black paint used to stain the false cracks.



15. Christ's left hand shows extensive reworking.

paint layer of the cross, an area of which is uncovered above Christ's halo. Recently, the modern glaze was completely removed from the black habit of the donor (fig. 16).

In this search for surviving original passages, Christopher McGlinchey, research chemist in the Museum's Paintings Conservation Center, analyzed paint cross sections and pigments. These proved to be most helpful. Accordingly, the patterned backdrop consists essentially of three layers: green (lead white and green earth), dark blue (calcite, lead white, natural ultramarine, and cobalt blue), and yellow (yellow ocher and lead white). Its modern origin is confirmed by the use of cobalt blue, not introduced until the beginning of the nineteenth century. The additional occurrence of cerulean blue established the modern origin of the sky and angel. Zinc white, introduced around 1850, is another modern pigment identified in the deceptive restoration of this panel. It was used in combination with lead white especially in the cloth draped over the cross. We were not able to ascertain whether this distinctive Arma Christi motif (instruments of the Passion) was altogether invented or based on the remains of an original design. Because the surviving original layers were apparently sanded down to provide a smoother surface for the new paint, the possibility of misinterpretation is great.

To complicate matters even further, the same curious, pockmarked surface that is observed in the yellow background pattern is also found in the more thickly painted patterns and borderlines of the white cloth. This suggests the use of the same binding medium, but its identification is now only of minor interest in view of the other findings. Moreover, the panel had been subjected to an infusion of wax and possibly of other types of adhesives. This was probably prompted by flaking problems in the past as well as all the manipulations required for its transformation. These would be hardly ideal conditions for taking samples and accurately identifying the medium used as a binder.

Surprisingly, the tiled floor with its false cracks beneath the surface relief decoration (according to the observation in the Courtauld report) was made with pigments known to have been used in Old Master paintings: lead white, vermilion, and madder lake for orange highlights; lead white and very small quantities of yellow ocher and smalt for yellowish highlights. While the choice of pigments may be authentic, the changing methods of preparing and



16. The donor after removal of the modern glaze.



handling them make it possible to distinguish between hand-ground and factory-milled pigments. The latter, of more modern origin, were used in our case. Only through the application of a variety of examination methods can accurate interpretations be made.

The Museum's reexamination of the panel established that it is not an outright forgery, but rather a cunningly restored original, with surviving authentic components (figs. 17, 18). In retrospect, this partial rehabilitation makes the error of its acquisition appear not as serious as once thought. Ironically, at the same time, the dendrochronological examination of the oak panel clearly eliminated a primary argument for acquisition: its once-presumed earlier date of origin.

There is no clue as to the original appearance of the background. Insignificant remnants beneath the modern additions suggest that it was gilded and partly covered with a transparent red lake comparable to the original left half of Christ's halo. In any event, on the occasion of the anonymous restorer's major intervention, the background was not consid-



17, 18. Man of Sorrows in its present state and with only the remaining original elements of the composition.



19. Master of Saint Veronica, German. Man of Sorrows, early 15th century. Oil on wood,  $47\frac{1}{8} \times 25\frac{3}{8}$  in. (119.6 × 64.6 cm). Heinz Kisters Collection, Kreuzlingen

ered worth preserving. It was abusively scraped and sandpapered to form a suitable basis for the newly painted, more archaic design meant to upgrade an otherwise quite ordinary and probably not very salable *Man of Sorrows*.

This very deceptive stylistic transformation was achieved with astounding technical skill and arthistorical knowledge. It remained undetected for many years, and there are still lingering doubts as to the interpretation of some of the minor details. Because the painting was never recorded before the alteration, it is tempting to speculate when and by whom these additions might have been done. In the earliest photographs, published in 1924, a few losses are seen; more have occurred since then because of an inherent flaking problem, possibly accelerated by the drastic intervention. Such a challenging undertaking required a highly skilled restorer. The choices of materials and the methods employed are very characteristic of the early part of this century, when a renewed interest in the techniques of the early Netherlandish painters flourished. It was the firmthough misinformed-belief of a select group of practitioners that these masters used tempera instead of oil, which is evident in the additions to our Man of Sorrows. An ardent promoter of the use of tempera was the restorer Jan Van der Veken, who made a copy (to replace the stolen original) of one of the double-sided panels of Jan van Eyck's Ghent Altarpiece in tempera with finishing oil glazes. Begun in 1938, it was completed in 1951, around the time (1953) that advanced analytical methods at the Brussels Central Laboratory had established that the early Flemish masters used an oil-based medium.

Man of Sorrows with its considerable modern additions is a curious hybrid. General agreement was reached at the Museum that the painting nevertheless serves a useful teaching purpose and will be kept available for study. After the misleading additions have been blocked out photographically, the principal elements of the scene still relate to the traditional representation of the Man of Sorrows that has been popular since the fourteenth century. This vision of the living Christ, the *Imago Pietatis*, originated in Flanders in the early fifteenth century, replacing the fourteenth-century French iconography of the dead Christ reclining in the arms of mourning angels.

The figure of the Savior conforms to the miraculous vision that came to Pope Gregory the Great during Mass: the actual body of Christ pouring blood appeared as a testimony of the change of the



20. Unknown Spanish artist. *The Mass of Saint Gregory*, ca. 1500. Oil on wood. Painted surface,  $28\frac{3}{8} \times 21\frac{7}{8}$  in. (72.1×55.6 cm). Bequest of Harry Sperling, 1971 (1976.100.24)

eucharistic elements from bread and wine into the body and blood of Christ, a continually recurring miracle at every mass (fig. 20).

The full-length figure of the bleeding Christ usually stands in front of the cross and is surrounded by the instruments of the Passion. The additional presence of a kneeling donor at Christ's feet is rare in painted examples, but more frequent in sculptures that functioned as memorial stones for the deceased. An early fifteenth-century example of a painted Man of Sorrows whose arms are raised, shown with a diminutive donor, is a considerably larger panel in the Kisters Collection, Kreuzlingen (fig. 19). It exemplifies a modification of the theme that seems to have spread throughout the Cologne region from about 1400 to 1430.

During the fifteenth century and even later, versions of the Man of Sorrows included the Arma *Christi* in their backgrounds. Undoubtedly, this was once the case with our painting. In its photographically stripped condition (fig. 18), the composition now lacks a balancing element on the right side, and it seems fair to assume that the column of the flagellation, aside from the cross the most important and indispensable attribute of the Man of Sorrows, stood there originally. The restorer who supposedly removed the column subsequently reintroduced it together with the kneeling angel. The authentic background was replaced by a more intriguing design, which successfully misled scholars for years.

There are numerous iconographical intricacies relating to the Man of Sorrows theme. In view of the absence of an original background, even the question whether or not our painting was originally a single, independent devotional panel or part of a triptych with a saint on each side will remain unanswered.

## Restoring Bartolommeo Bonghi

CHARLOTTE HALE

Associate Conservator



 Giovanni Battista Moroni, Italian (Lombard), ca. 1524–1578. Bartolommeo Bongbi (d. 1584), ca. 1553–63. Oil on canvas, 40×32¼ in. (101.6×81.9 cm). Purchase, Joseph Pulitzer Bequest, 1913 (13.77). The painting before restoration.

The conservation of *Bartolommeo Bongbi*, a portrait by Giovanni Battista Moroni, the leading Lombard painter of the third quarter of the sixteenth century, presented a challenging and unusual dilemma: how to approach early additions—in this case an inscription and coat of arms—painted in after the artist's death (fig. 1). These additions conveyed significant information but substantially altered the painting's composition. The decision to remove them, made jointly by conservation and curatorial departments, was based on careful consideration of aesthetic, historical, and technical issues.

Bartolommeo Bonghi is a work of Moroni's early maturity and has been dated variously between 1553 and 1563. The sitter, a member of a prominent Bergamesque family, was a doctor of canon and civil law and a noted jurist, who held several ecclesiastic positions and served from 1552 to 1553 as rector of the University of Pavia. The book he holds in the painting is a commentary on Justinian's *Pandects* (codification of Roman civil law) by Camillo Plauzio Pezzoni, a colleague at the university who dedicated the book to Bonghi in 1553, which may date the portrait to the same year.

The view through the open window is of the Torre Communale of Bergamo. For reasons that remain unclear, Moroni chose to depict the tower as it looked before its restoration in 1551–52. The lower part of the same tower is seen in Moroni's Mystic Marriage of Saint Catherine (ca. 1550; Ashmolean Museum, Oxford), and it also appears in his portrait of Pietro Secco Suardo (1563; Uffizi, Florence).

The date of the inscription on the portrait of Bonghi was that of his death, 1584—by which time Moroni had been dead for six years. Together with the coat of arms it must have been added, probably by his family, to memorialize the name and achieve-





2. Bartolommeo Bongbi after the 1991 conservation treatment, which included removal of the later additionsthe inscription and coat of arms.

ment of this respected member of an illustrious dynasty. The inscription read: BARTHOLOMEVS BONGVS. I.V.D. / CANvs. ET PRIMICERvs. CATH[EDRALIS]. BERG[OMI]. / PRO-THONOT[ARIVS]. AP[OSTO]LICVS. COMES ET ÆQUes. / ANNO. D[OMI]NI. MDLXXXIV (Bartolommeo Bonghi, doctor of laws, canon and dean of the cathedral of Bergamo, apostolic prothonotary, count and knight, in the year of Our Lord 1584). To create enough wall space for the inscription, the lower part of the window frame was painted over. A contemporary copy of the portrait by a follower of Moroni, Enea Talpino (called Salmeggia), shows the painting prior to the additions, with a deeply sloping window ledge (National Gallery, Prague; fig. 3). An X-radiograph of the Museum's painting confirmed the presence of the window ledge exactly as seen in the Prague copy (fig. 3). A similar ledge is depicted in the Mystic Marriage of Saint Catherine.

Bartolommeo Bonghi came to the Metropolitan Museum's Paintings Conservation studio to be cleaned in November 1991. Last restored in 1938, it had a coating of natural resin varnish that had oxidized and discolored. Moroni's paintings, like those of fellow Lombard artists Moretto da Brescia and Girolamo Romanino, have a cool palette that can be distorted by a yellowed varnish. The Museum's portrait had been retouched over the years in the vicinity of the inscription and the coat of arms, and these areas were also discolored. On close examination, the retouches were found to be over many small areas of lost paint. Apparently, the additions had been painted over at some point in the portrait's history, and when this second layer of overpaint was scraped off, the losses had occurred.

Apart from these losses and some minor damage at the edges, the portrait was in good condition, testifying to Moroni's very sound technique. *Bartolommeo Bongbi* is painted on a relatively coarse



3. Enea Talpino (called Salmeggia), Italian (Lombard), ca. 1558–1626. Copy after Moroni's *Bartolommeo Bongbi*. National Gallery, Prague. Inv. no. 0-8323. Photograph: Vladimir Fyman



4. Photograph of X-radiograph mosaic of *Bartolommeo Bongbi*, showing the upper two-thirds of the painting before treatment. Beneath the overpainted inscription is the sloping window ledge seen in the Salmeggia copy. The pale gridlike shape is an image of the stretcher.

twill canvas, which Moroni employed early in his career. Later he used finer, plainly woven varieties. Unlike his Venetian contemporaries, Titian, Tintoretto, and Veronese, who exploited the robust texture of their canvases to enliven their brushwork, Moroni handled the medium in a smooth, thin, and descriptive manner, with a high degree of finish.

Cleaning of the discolored varnish and retouches presented no problems and benefited the painting greatly (fig. 5). However, once cleaned the coarsely painted inscription and coat of arms looked even more distracting than before. At this point the idea of removing the additions was discussed.

During the Renaissance portraits were prized as commemorative as well as biographical records, and it was not uncommon for inscriptions to be included on them. These might give the sitter's name and his or her age, or the date the portrait was painted, or they might present a favorite motto. Usually, such inscriptions are incidental to the composition, but in the case of Moroni's works they were frequently conceived as part of the overall design. In the Metropolitan's portrait of the abbess Lucrezia Agliardi Vertova (fig. 6), for example, a lengthy inscription appears on a fictive scroll attached to a parapet on which the abbess rests her prayer book.

In comparing the Prague copy of Bartolommeo Bonghi with the original, it is clear that painting out the window ledge to accommodate the inscription meant the loss of a large, light, rectilinear architectural element. Compositionally, this area played against the dark, curving forms and various textures of the seated figure-his dark beard and hair, the soft fur trim, and dark cloth of his robe and the arm of the chair. In painting out the ledge, no account was taken of the effect this would have on the perspective of the window or on the fall of light that comes through it. Also, after cleaning the varnish the discrepancy between the cool gray color and lively brushwork of Moroni's wall on the right and the warmer tone and lack of modulation in the gray overpaint that extended down the wall on the left became apparent. While the grays probably matched originally, the overpaint was now considerably yellowed compared to the original. The structure of Moroni's paint layers, which were over the brown ground, differed from the painted addition, over the grays of Moroni's window ledge and wall, and this added to the discrepancy between the two areas.

While the coat of arms was less of an intrusion in the composition, it interrupted the bold expanse of



5. Bartolommeo Bongbi during treatment, after cleaning of the varnish and old retouches and before removal of the additions.



6. Giovanni Battista Moroni. Abbess Lucrezia Agliardi Vertova (b. 1490). Oil on canvas,  $35\frac{1}{2} \times 26\frac{3}{8}$  in. (90.2 × 67 cm). The inscription, which is original to the painting, translates as "Lucretia, daughter of the most noble Alessio Agliardi of Bergamo, wife of the most honorable Francesco Cataneo Vertova, herself founded the church of Saint Anne at Albino. 1557." Theodore M. Davis Collection, Bequest of Theodore M. Davis, 1915 (30.95.255)

bare wall down the right side of the painting and introduced a distracting range of colors, notably the bright red, yellow, and blue of the shield, which were not at all in keeping with the artist's restrained palette. The red was particularly glaring in contrast to the crimson of the sitter's collar and cuffs.

A case could be made, of course, for maintaining the inscription and coat of arms on the grounds of historic interest. The additions were commissioned; they identify and commemorate the sitter and were put on only a few years after Moroni's death. They are part of the way the painting has been known and described for over four hundred years. However, from an aesthetic standpoint the additions constituted a major alteration to Moroni's original composition and detracted from its appearance. It was the decision of both conservators and curators that the historic interest of the additions was far outweighed by the aesthetic dictates of the picture. Given that, one course of action might have been to paint out the additions so that the painting would read as the artist intended but the inscription and coat of arms could be uncovered at a later date. We are inevitably subject to the tastes and prejudices of our time, and in this way a decision could be made while leaving options open. However, the subtle handling and the fall of light would have been hard to imitate convincingly, and a further overpainting would have been one more step away from Moroni's original paint.

It could already be seen from the X-radiograph that the original paint below the additions was in good condition. Analysis of the painting's structure revealed the presence of a very old (conceivably the original) varnish layer beneath them. A datable historic varnish represents a significant find, and moreover, by isolating the additions this varnish would facilitate recovery of the original paint surface.

After full photo documentation, the additions were removed by using a combination of techniques. The layer of separating varnish was not affected by these processes. The painting was revealed to be exceptionally well preserved. After the application of a thin layer of varnish, very little retouching was necessary.

*Bartolommeo Bongbi* is back on the wall in the Northern Italian Renaissance galleries and can now be studied and appreciated in a state that corresponds much more closely to the time when it left Moroni's studio (fig. 2).



# A Note on the Dimensions of *Juan de Pareja*

HUBERT VON SONNENBURG Sherman Fairchild Chairman of Paintings Conservation

2. The unfolded canvas of the Metropolitan's Velázquez, with the top corner missing, as seen from the back.

In 1971, when the Metropolitan Museum acquired Velázquez's portrait of Juan de Pareja, an article in the June *Bulletin* described how the canvas was unfolded and restored to the original dimensions of the composition intended by the artist (fig. 1). At the time, only one scholar, José Lopez-Rey in his *Catalogue Raisonné* of 1963, had correctly recognized that portions of the canvas covered with original paint -3.5 cm at the top, 5.7 cm at the right side, and 0.4 cm at the bottom—had been folded under. Just why this alteration had occurred is left to speculation. It may be that the portrait fell victim to the frequent and prosaic activity of "fitting" a larger canvas into a smaller frame. Or it may have been a case of artistic license, in which a taste for the

classical demanded that the sitter be "centered" in the composition. Lopez-Rey described this practice as "a mischief which has befallen other Velázquez portraits."

Fortunately, even the original unpainted margins of the canvas are still preserved; the only real loss has been a square piece in the top right corner, which had been cut off to facilitate the folding (fig. 2). The painted surface was found to run in a straight line, and from this evidence it was concluded that the canvas's wavy threads are original and not later distortions caused by restretching. Most likely, the finished canvas had remained on its original support, a strainer, for a long time before it was removed to be folded under. (A strainer, unlike a





1. Diego Velázquez, Spanish, 1599–1660. Juan de Pareja (ca. 1610–1670), ca. 1650. Oil on canvas,  $32 \times 27\frac{1}{2}$  in. (81.3 × 69.9 cm). Fletcher Fund, Rogers Fund, and bequest of Miss Adelaide Milton de Groot (1876–1967), by exchange, supplemented by gifts from friends of the Museum, 1971 (1971.86)



3. Juan de Pareja, ca. 1800. Oil on canvas, 29<sup>1</sup>/<sub>8</sub> × 23<sup>5</sup>/<sub>8</sub> in. (74 × 60 cm). Courtesy of the Hispanic Society of America, New York

stretcher, has rigidly joined corners and cannot be expanded to tighten the canvas.)

The folding of *Juan de Pareja* provoked some interesting debate among scholars and proved the value of replicas and copies of such pictures in resolving these debates. Until a few years ago, the finest and best-known copy of this painting was the one in the Hispanic Society of America, New York (fig. 3). The Hispanic Society's copy must have been painted after the original had been reduced in size, most likely when the original entered the collection (by 1811) of the earl of Radnor at Longford Castle, Wiltshire, because the dimensions of the copy correspond to those of the original painting after it had been folded.

Despite such evidence, the noted art historian Sir John Pope-Hennessy, former chairman of European Paintings at the Metropolitan Museum, actually suggested in his autobiography (1991) that the canvas had been folded by Velázquez himself, and that "this was a common practice of Velázquez's." Pope-Hennessy deplored the fact that the painting had not



4. Juan de Pareja. Oil on canvas 32<sup>1</sup>/<sub>4</sub>×27<sup>1</sup>/<sub>2</sub> in. (82×69.8 cm). Sold at Christie's, London, May 29, 1992, as "Circle of . . . Velázquez" and now in a private collection. The image represents this painting's proportions and slightly off-center composition, which are the same as those of the Metropolitan's Juan de Pareja.

been folded back after cleaning, "with the result that Pareja's head is off-center and the effect made by the image is less dynamic than it used to be." He cited just one other example to support his "common practice" argument: Velázquez's portrait of Cardinal Massimi (The National Trust at Kingston Lacy, London; fig. 5), which in his opinion "is treated in precisely the same way."

Pope-Hennessy referred to a technical report by Herbert Lank in *Burlington Magazine* (July 1983), which stated that "the original size of the canvas on which Velázquez painted [*Cardinal Massimi*] extended at least another 1.75 cm on the left-hand edge." According to this report, "the painter turned down this edge to centralize the composition. This is apparent from the fact that the brown-grey background extends only to the edge of the present format of the painting. It does not cover the turned-over strip which still shows the red paint (a curtain? a chair?) which was initially painted behind the left side of the figure."

This example is not a particularly good compari-



5. Diego Velázquez. Cardinal Camillo Massimi, 1649–51. Oil on canvas, 29<sup>3</sup>/<sub>8</sub> × 23<sup>3</sup>/<sub>8</sub> in. (74.6 × 59.6 cm). The National Trust, Bankes Collection, Kingston Lacy, London



6. This detail of a 1665 engraving by Lieven Cruyl (ca. 1640-ca. 1720) represents the piazza of the Pantheon. The Metropolitan's *Juan de Pareja* was shown in the annual exhibition of 1650 organized by the Congregazione dei Virtuosi, which took place under the colonnade of the portico on March 19, the feast day of Saint Joseph. Velázquez, then on his second visit to Rome, received such admiration for this picture that he was unanimously elected a member of the Roman Academy. From Cesare D'Onofrio's *Roma nel Seicento*, Florence, 1969. The Thomas J. Watson Library

son because Velázquez did not make any compositional changes in *Juan de Pareja*. Furthermore, it is extremely unlikely that Velázquez would bother to take the canvas off the strainer just to fold over neatly such a narrow strip, a practice that is more in keeping with modern conservation methods. More likely, he revised the background along this edge after *Cardinal Massimi* had been put in a frame. In any event the change of color was probably of greater concern than the slight shifting.

There is abundant evidence that over the centuries paintings on canvas have been abused frequently during the routine process of lining and relining. As a rule, however, the original margins were lost, and, more often than not, peripheral areas of paint along with them. More substantial losses occurred when works were reframed, relocated, regrouped, or matched with other pictures in different collections. These interventions might involve enlargements instead of reductions, commissioned by an artist's patrons, for example, usually after the artist's death.

The study of stretch marks, or "cusping," in Xradiographics often helps to establish the approximate original dimensions of canvases that have been trimmed along the edges. The increasing awareness of such changes has often resulted in the very "tight" framing noticed in the Metropolitan's paintings collection. In many instances the recess beneath the sight edge of the frame (rebate or rabbet) covers as little as possible of the canvas.

An exhaustive study of Velázquez's canvases at the Prado in Madrid (*Velázquez: Técnica y Evolución*, 1992), carried out by Carmen Garrido, chief of the technical department, determined that in some cases the artist himself apparently expanded his canvases during the painting process. There is no evidence, however, that he habitually removed and restretched his canvases to make compositional adjustments. The numerous changes he made, especially in his large paintings, were strictly within the confines of the original format. Other Baroque painters, such as Rembrandt and Rubens, frequently enlarged their compositions, sometimes years after completing them.



 Diego Velázquez. Pope Innocent X, 1649–50. Oil on canvas, 551/8×48 in. (140×121.9 cm). Galleria Doria-Pamphili, Rome

Part of the history of *Juan de Pareja* helps to confirm its original dimensions according to the composition. In 1648 Velázquez and Pareja, his studioassistant, had gone to Rome, where the artist was to paint a portrait of Pope Innocent X (Galleria Doria-Pamphili, Rome; fig. 7). Velázquez's chronicler, Antonio Palomino, wrote that the artist "made Pareja's portrait as an exercise before portraying the Pope." Apparently, the painter chose to position Pareja slightly to the left of center, a composition he then repeated in his portrait of the pope.

Recently, the otherwise unchallenged presentation of the Museum's portrait with the canvas unfolded was conclusively confirmed by the surprising emergence at auction of the only version known so far that matches exactly in size and composition our painting before it was altered (Christie's London, May 19, 1992, lot 321; now in a private collection; fig. 4). The approximate date of this picture needs to be established, but a comparison of the brushwork on the two collars leaves no doubt that this newly discovered painting shares practically every detail of our *Juan de Pareja*.

## A New Look at a Seventeenth-Century Dutch Still Life

DOROTHY MAHON Conservator

mong a group of paintings acquired by the Metropolitan Museum soon after incorporation in 1870 was a still life by the seventeenth-century Dutch painter Jacob Vosmaer. It is a rare example of an early flower painting depicting a bouquet of tulips, irises, peonies, and roses in an earthenware pot. Executed in oil on wood panel between 1615 and 1620, it is one of fewer than six known works by the artist. The painting illustrates particular problems of condition, a discussion of which reveals difficulties often faced by the conservator.

When the painting was brought to the conservation department for examination, it appeared that the background had been completely painted over in a previous restoration. On the whole the flowers seemed to be in excellent condition, well defined and skillfully rendered, and were all recognizable botanical species. It therefore seemed peculiar that a truncated thick green stalk would project from the middle of an otherwise quite beautiful bouquet. An Xradiograph confirmed what had been suspected: The panel had been cut down and there were flowers in the background that had been covered with paint.

It is fortunate, considering Vosmaer's limited oeuvre, that there exists in a private collection in Amsterdam another painting by him that relates very closely to the one in the Metropolitan (figs. 2, 3). This better-preserved composition serves as a valuable visual indication of the extent to which the Museum's painting has been altered. A significant loss is the startling crown imperial, a type of Fritillaria, seen projecting from the top of the arrangement in the Amsterdam panel in a lively and highly mannered passage that is quite important to the original composition of both paintings. Sadly, only fragments of the lower part of the flower and stalk remain in the Metropolitan's version. Also lost is the top half of the purple iris at right and the top portion of a stalk of pink double hollyhocks at left. The crown imperial, double hollyhock, and the fresh, vibrant yellow-orange flame tulip, located in the center just below the crown imperial, are three hybrid varieties that had just been introduced in the Netherlands, no





1. Jacob Vosmaer, Dutch, 1584–1641. A Vase with Flowers. Oil on wood,  $33\frac{1}{2} \times 24\frac{1}{2}$  in. (85 × 62 cm). Purchase, 1871 (71.5). Painting before restoration.

doubt included here for their novelty. Not insignificant is the loss of the stone niche, which played a major part in creating the space around this energized display of flowers.

A direct comparison of the two paintings reveals that the compositions were once the same size. The Museum's Vosmaer has lost 25 cm from the top and 8.5 cm from each side, a reduction of more than one third from its original size. There are several flowers that are virtually identical, although their positions vary. It may seem unusual that the two works are so close. These paintings, however, illustrate the common artistic practice employed by still-life painters, who put together many different compositions based on working models. This method had many advantages when creating images with this kind of painstaking detail, not the least of which was that it allowed the painter to represent flowers from various seasons in the same arrangement.

During treatment the overpaint was removed, revealing that the work had not just been cut down but the background had been largely scraped away, leaving only fragments of the flowers and exposing much of the light gray underpainting. It seems likely that the background had been sanded to obliterate the impastoed relief that was a result of the buildup of medium during the painting process.

One can only speculate as to why the painting was so drastically altered. Sometimes paintings were cut down because there was severe structural damage to the wood panel. In this case there is evidence of damage from wood-boring insects, particularly along the left edge. Often in the past it was considered more expedient to cut away damage rather than to tackle painstaking repairs. It is also possible that the painting was reduced to fit a particular frame. Since still lifes were less esteemed than other categories of painting and were often considered merely decorative such alterations may have been made more freely.

Dutch and Flemish flower pieces of this kind were frequently meant to be appreciated in part for their elaborate symbolism. A bouquet of cut flowers in various stages of decay and the chipped or worn stone of the setting would remind seventeenth-



2. The Metropolitan's A Vase with Flowers after restoration.



3. Jacob Vosmaer. Flower Piece with a Crown Imperial. Oil on wood,  $43\frac{3}{8} \times 31\frac{1}{8}$  in. ( $110 \times 79$  cm). M.P.W. Collection, Amsterdam



4. Detail, A Vase with Flowers. The butterfly and thorned rose were exceptionally well preserved. Filling in the arrangement are a type of Fritillaria commonly called a snake's head and an anemone.

century viewers that worldly existence is transitory. Flowers of different seasons suggest the passage of time, and some particular species were common Christian symbols. For instance, the iris had long been associated with the Virgin, and the peony and thorned rose were emblematic of the Passion of Christ. Because of its metamorphosis the butterfly referred to the soul or to the Resurrection, while the lizard served as a reminder of the serpent in the Garden of Eden or of the devil himself. In the eighteenth century these edifying vanitas themes became less familiar, and flower paintings had a more exclusively decorative appeal. It may be that the person who had the panel cut down was editing the composition in accordance with a later period's aesthetic preferences, unaware that the alteration interfered with iconographical elements.

The conservator must decide what to do with a painting that has been so drastically altered. Many different approaches to the restoration must be considered. For instance, during the previous restora-

tion, undertaken probably during the nineteenth century, the fragmentary aspects of the work were eliminated completely so that the painting would be seen as a cohesive whole. From the point of view of a museum collection this falsification of the panel's state is not necessary or desirable. Another tactic would be to expand the panel to its original size by adding wood strips. Most of the missing components could then be reproduced using the other quite similar version as a model. However, some invention of major elements would be necessary; for example, the missing top half of the hollyhock stalk, which does not appear in the other version. With this approach, the viewer would be presented with a work that was more than one third fabrication, and, taking into account the retouching necessary to complete the background, the amount of restoration would be almost fifty percent of the total, an unacceptibly high proportion.

While it is always difficult to find a solution that is satisfactory from all points of view, of primary con-



5. Detail, A Vase with Flowers. Remarkably, the flame tulips retain the delicate transparent yellow-lake glaze that contributes to their glistening luminosity.

cern should be that the strength and beauty of the artist's creation come to the fore, despite flaws in its condition. After considering all possible approaches, the restoration proceeded in stages, with the understanding that as the reconstruction progressed, retouching would be undertaken only if it was absolutely necessary to maintain the integrity of the original work. Pursuing restoration in this manner allows for evaluation of each step in relation to the whole. Every aspect can be examined in sequence, allowing for constant adjustments rather than imposing a preconceived outcome on the work of art.

In this instance, after documentary photographs were taken, the first step was to retouch the severely damaged gray background. Working from surviving fragments it was possible to regain the subtle shading of light to dark in the niche and recover the sense of space behind the still life, enhancing the bouquet. After restoring the background and other isolated damages, the conservator focused on the traces of the light pink hollyhock scattered throughout the background at upper left and the fragment of the crown imperial at top. The intense flame-orange color and prominent location of the partial crown imperial proved very distracting, as it seemed to become a rather abstract element quite apart from the whole. In order to integrate this fragment into the composition, the lower part of the flower was restored based on the Amsterdam panel. At this point the patches of the hollyhock that remained became more noticeable. These traces were toned down to incorporate them into the shadows.

The painting now is unified as a composition that does not draw attention to the damaged parts. The fact that the panel has been cut down is revealed mainly in the crown imperial, which is cut off at the top. It is hoped that this painting, while fragmentary, can still be enjoyed for its outstanding quality, and appreciated for those areas that remain in an excellent state of preservation. The Effects of Time: Georgia O'Keeffe's Black Hollyhock, Blue Larkspur

> LUCY BELLOLI Conservator



Georgia O'Keeffe had a great interest in flowers, and about 1923 she began painting them in series. In 1924 she enlarged the flowers to focus attention on their details, which are often overlooked. *Black Hollybock, Blue Larkspur*, painted in 1929, belongs to a modest series of two, both of which have the same title and were painted in Taos on O'Keeffe's first trip to New Mexico as a mature artist. Although the subject matter is the same in both works, the Metropolitan's canvas is the simpler and more naturalistic of the two. It was acquired by the Museum in 1934 by purchase from Alfred Stieglitz and was the first O'Keeffe to enter the collection. The companion painting is presently in a private collection.

In the early 1980s it was noted that the black hollyhock in our painting seemed to be changing; a whitish haze had appeared in certain parts of the flower. By 1991 the change was so great that a comparison with a photograph of it taken in 1937 might lead to the conclusion that these were two different works (figs. 1, 2).

The white haze has developed primarily in the transitional areas between the dark core of the flower and the lighter black and rust-colored outer petals. The form it takes seems quite painterly, and without knowing how the picture originally looked it might seem that O'Keeffe chose to accentuate these areas in this way in order to flatten the hollyhock and make it more abstract. The whiteness, however, is an optical phenomenon occurring where the surface of the paint has become rough. Light hitting these areas is prevented from entering the matrix of the black paint, which results in a perceptibly lighter area where white light is bounced off the surface (see fig. 3). The cause of this roughening is not clear at this time but it seems to be a degeneration of the oilpaint film and not due to interaction with material

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1. Opposite: Georgia O'Keeffe, American, 1887–1986. Black Hollybock, Blue Larkspur, 1929. Oil on canvas,  $36 \times 30$  in. (91.4 × 76.2 cm). George A. Hearn Fund, 1934 (34.51). Photograph taken in 1937, three years after the painting entered the Metropolitan Museum collection.

2. Photograph of *Black Hollybock*, *Blue Larkspur* taken in 1992. The changes that have occurred in the black hollyhock are readily apparent. The form of the flower has flattened and become more stylized.



3. The white haze as it appears in a detail of one section of the hollyhock.



from the outside environment. The most likely cause is the degradation of a paint film of low oil content when exposed to light.

The Metropolitan Museum has sixteen canvases by O'Keeffe painted between 1923 and 1944. Of these, nine fall into the period from the late 1920s to the early 1930s. After examining this group of nine, it was found that four have a similar whitening of their surfaces in circumscribed areas. Of the four, one, *Corn*, *Dark I*, was varnished and thus the change was not immediately visible, but the phenomenon was found under magnification.

Based on photographic evidence it seems that the surface breakdown in the Museum's *Black Hollybock* 

has stopped or significantly decreased since 1987. The change, however, has seriously altered the threedimensional quality of the flower (fig. 4). The current hollyhock is a different flower from what it was in 1937. Consequently, various techniques were considered to return it to its original state, or at least something closer.

Solvents were used on the broken-up and roughened areas of the surface of the painting to reintegrate it. This treatment, carried out in small areas, although initially successful, proved to be ineffective; the areas that responded well regained their hazy look after three months. Another technique employed was polishing the roughened areas to smooth 4. Opposite: A Kodachrome taken in 1993 shows the elaborate pattern of white forms developing in the transitional areas of the Metropolitan's hollyhock.

5. Georgia O'Keeffe. Black Hollybock, Blue Larkspur, 1929. Oil on canvas,  $30 \times 40$  in.  $(76.2 \times 101.6$  cm). Private collection. Kodachrome taken in 1988. In spite of being a more formal painting, the hollyhock itself is more naturalistic than the Metropolitan's in its present state.



them and allow light to penetrate. This was effective in tests on minute portions of the canvas; however, in a paint film with little oil content polishing compresses the loose pigment particles, and this results in an optical intensification of the color. Therefore, the well-preserved areas would also optically darken when polished. As it was impossible to pinpoint the treatment to just the hazy areas, the possibility of altering the flower in a new way proved too great a risk to take.

With reluctance, the addition of a varnish was considered. Mentioned previously was *Corn*, *Dark I*, which had been varnished, and although it had areas of surface disruption they were not apparent to the naked eye. The varnish saturates the surface and makes it smooth, allowing light to enter so that the haziness disappears. The other *Black Hollybock*, *Blue Larkspur* (fig. 5) has been varnished twice and does not show any sign of haziness.

O'Keeffe used paint directly from the tube without additives such as stand oil or dammar varnish. Her grounds tend to be porous. This combination gives her paintings a matte, dense, and flat surface. As her works began to show the effects of time and handling, such as dirt, fingerprints, and cracks, she sought ways of protecting them. An unmarred image became of paramount importance to her. She chose to have her paintings varnished, even though





6a,b. Flaking along the weave of the canvas in two areas of the larkspur in the Museum's version.

when saturated with a resin the paint quality is quite changed. The color is intensified and color relationships gain in contrast. This in turn makes the forms harder and more precise. Nevertheless, this resinous layer shields the painting from penetrating dirt and makes easier the removal of fingerprints and superficial grime. In the 1970s and 1980s she regularly authorized the varnishing of her paintings. As early as 1949, when as executrix for Alfred Stieglitz's estate she donated a number of her paintings to the Metropolitan Museum, they had all been varnished. From statements she made it seems clear that she did not like a varnished look but felt that this was necessary to keep her paintings unblemished.

We are fortunate to have *Black Hollybock*, *Blue Larkspur* in its original, unvarnished state. It entered the collection five years after it was painted, and it represents the type of surface and textural quality that O'Keeffe wanted. If this painting were varnished, the surface disruption would be minimized, and the hollyhock would again show some of its original three-dimensionality. Although the painting would regain depth it would lose its dry, sensuous quality, a characteristic and very appealing aspect of this work. The dry paint film would absorb the varnish, and the latter, having become part of this film, would not be removable.

This painting also has a serious structural problem. In the 1980s paint began to flake off in the larkspurs and the green leaf (fig. 6). O'Keeffe kept oil in her paints to a minimum so that her works would look dry and velvety; but oil is what holds a paint film together. When it is reduced, the paint is vulnerable to vibration and expansion and shrinkage in the canvas caused by fluctuations in humidity. This vulnerability is greater in thinly painted areas but other areas are progressively affected as well.

The flaking has been regularly treated with a locally applied adhesive that does not saturate the paint film and change it optically, but the bond of paint to canvas has become so weak that there is concern that particles may be dislodged in trying to re-adhere them. A method of adequately securing the paint would result in an adhesive-saturated area. This local area would then have a varnished look, which would necessitate the varnishing of the entire painting.

It is interesting to note that both problems — that is, the degeneration resulting in the white haze and the flaking — are, in part, results of the low oil content of the work. The dry, matte surface that results from minimal use of oil is characteristic of many modern paintings, and the problems presented here are frequently found in other contemporary works.

After weighing various possible solutions to the two problems, it was decided to put Black Hollybock, Blue Larkspur in a hermetically sealed box that contains silica-gel pellets. These pellets alternately absorb and give off moisture and thus maintain a constant humidity. Such boxes are frequently used in museums for art that can be adversely affected by changes in humidity. The box fits inside the frame so that the viewer sees only the frame and the glass covering the painting (fig. 7). The silica gel will stabilize the canvas and so reduce the stress on the paint film that has caused it to flake. Although we do not understand the mechanism behind the haze formation, by placing the painting in a protective setting we can reduce the influence of the outside environment.

Because this painting is exhibited and stored under glass it is not in danger of collecting fingerprints or other dirt, and although it has changed, the changes seem to have stabilized. While flaking may continue without the use of a saturating adhesive, placing the canvas in the sealed box will slow the process enough that it is possible to refrain from treatment that would further alter its appearance. It is exhibited amid contemporary and later O'Keeffes that have been varnished at her request and represents the characteristic and uncompromised O'Keeffe surface. By choosing the solution described above we have gained stability for the canvas without losing the original surface. In the future it may be necessary to turn to options such as varnishing. For now, however, we can enjoy a painting that reflects more of the artist's intent than the conservator's adjustments.

Auminum Frame with Nonreflective Glass Painting

7. The Metropolitan's Black Hollybock, Blue Larkspur in box and frame. (Drawing by Dan Kershaw)



1. The Metropolitan Museum of Art, facing northeast

#### Color and Light in the Museum Environment

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rtworks displayed in museums come from a variety of origins. Consequently, it is impossible to reproduce the design elements from their original settings and still maintain a coherent display in a new museum environment. Lighting, however, can subtly tie together an arrangement of works of art with diverse provenances. Furthermore, for museum-goers who wish to examine closely an artist's technical execution and style, light that is carefully balanced for each picture is required to render these elements visible. Proper lighting will optimize the viewer's ability to see nuances of artistic intent without distraction or eye fatigue and at the same time will minimize detriment to the physical state of the work. This brief essay will discuss varieties of lighting, how they affect our perception of paintings, and what constraints museums must operate under to provide illumination that will not damage the art.

The sun is the standard against which other light sources are measured. However, the illumination cre-

ated by sunlight is very difficult to characterize in only one way since the sun's position in the sky and its interaction with the earth's atmosphere produce a wide range of light qualities. This range is contingent upon the dynamic relationships between the sun, the illuminated objects, and the viewer. Cloud cover is an additional factor that, when present, also modifies the quality of daylight. The standard, however, is based on the fact that the sun is a universal source of light. Fortunately, the sun emits a continuous band of radiation throughout the entire visible light spectrum. ("Visible light" is the term generally used to denote wavelengths perceptible to the human eye, although other species of animals may be able to discern light of wavelengths we cannot see.) Evidence of the continuous and broad range of colors in sunlight can be seen in rainbows.

In order for any color to be accurately registered by the eye it is necessary for light of that particular wavelength to be present in the light source. For instance, a green object seen in red light will appear





2. Attic space above the Nineteenth-Century European Paintings and Sculpture Galleries. As direct sunlight comes through the skylight (upper left) it is diffused through translucent panels (center top) to maintain an even distribution of light in the galleries as the sun changes position. Supplemental fluorescent lights (left) are reflected off the panels into the gallery space below to supplement skylight when natural light is low. Spotlights (center bottom) are directed at the artworks below. (Note: The actual color of the fluorescent lamps is a warm yellow. Because a variety of light sources had to be accounted for, the film used for this photograph created an apparent green color shift in recording the fluorescent light.)



3. Manet Gallery in the exhibition space of the Nineteenth-Century European Paintings and Sculpture Galleries. Here Manet's paintings are displayed on all four walls. Fortunately, from nearly every vantage point in the gallery glare has been eliminated so that the works can be compared instantly, without viewers having to reposition themselves.



gray, while in white light, which is actually composed of all colors, whether the source is natural or man-made, the object will appear green, as it can then reflect the green component of the light. Because of its continuous range of wavelengths, illumination from the sun provides unbiased color registration for all colors. Although the time of day, season, and type of weather alter natural light, the human eye, to a certain extent, can adapt to these changes and maintain the accurate perception of an object's color.

The most drastic alteration in sunlight's appearance is caused by molecules in the atmosphere that are capable of scattering the sun's radiation. These molecules can be anything from the gases that are the basis of Earth's atmosphere and those produced by living plants to various particles suspended in the 4. The visible light distribution of late-afternoon summer daylight, from readings taken from the rooftop of the Metropolitan: top, detector facing east (skylight); bottom, detector facing west (sunlight).

The background of each graph is the color of the portion of the sky from which the measurement was taken. As the background color suggests, the curve of the top figure (skylight) shows relatively more blue than yellow, while the bottom graph (sunlight) indicates slightly less blue, hence somewhat more yellow, light.



The blueness of distant hills was faithfully depicted by artists, as demonstrated in this detail, long before scientists could explain what caused the effect. Although Leonardo da Vinci (1452–1519) showed by experiment that water vapor scatters light, it was not until John William Strutt, third baron Rayleigh (1842–1919), a noted British physicist, demonstrated the relationship between wavelengths of light and scattering that this phenomenon was fully understood.

air, such as microscopic dust and other matter. The only requisite for this phenomenon is that the molecules be within a certain size range, which even at the high end is still below the detection limits of the unaided human eye. The degree to which light is scattered depends upon its wavelength, with the shortest wavelength, that is, blue, undergoing the greatest scattering. Consequently, once the sun's rays enter Earth's atmosphere, the blue component will be scattered away from the straight line between the sun and the earth. (Leonardo da Vinci noted that there is often sufficient atmosphere between a viewer and distant mountains to make them appear bluer than closer mountains; see fig. 5.) Scattered blue light (called skylight) forms the color of Earth's sky, while the subtraction of this blue component from the direct light path makes the remaining sunlight



and the sun itself appear yellow. Together, sunlight and skylight constitute daylight (fig. 4).

At nearly any time of day it is possible to illuminate an object with a particular color of light, formed by sunlight or skylight, by adjusting how the object is positioned relative to the sun. For example, since in the northern hemisphere the sun travels through the southern sky, windows facing north will always transmit a consistent blue (often referred to as cool) skylight rather than sunlight. By contrast, illumination based upon sunlight (that is, from southern windows) will vary in color as the sun moves from east to west. Additionally, walls facing eastern exposures will appear warm in morning light and cool in afternoon light, while for those opposite western windows the reverse is true. It is perhaps artists' desire for consistent light that usually makes northern exposures the preferred natural light source for those in this hemisphere.

In galleries that use daylight as a source of illumination, a painting's appearance can alter throughout the day. The extent of this change is dependent upon the conditions mentioned above, on how natural light is directed by the architecture of the space, and on the artist's palette and painting technique. If the artist's palette is restricted to certain colors, what is referred to as a color trait or key becomes apparent; that is, the painting will have a predominantly cool or warm tone, or may show a preponderance of a specific individual color. The technique of juxtaposing colors can affect the color trait. For example, small highlights of warm or cool pigments adjoining a neutral white area will make the entire white passage appear, respectively, warmer or cooler. Illu-



6. Georges de La Tour, French, 1593-1652. *The Penitent Magdalen*, ca. 1638-43. Oil on canvas,  $52\frac{1}{2} \times 40\frac{1}{4}$  in. (133.4 × 102.2 cm). Gift of Mr. and Mrs. Charles Wrightsman, 1978 (1978.517)

In this painting La Tour was restricted to a warm palette since the candle and its mirror image are the sole illuminants for the scene. All of the elements in this picture, from the subject's skin tone and garments to the symbolic objects, contain small amounts of yellow, orange, or red pigments added to shift these elements to a warm tone. With his technique and palette, La Tour convinces the viewer that the light from the candle does not extend far beyond the boundaries of the frame and that there is no stray light from other sources.

mination conditions can either augment or diminish such chromatic leitmotifs. A painting in cool tones directly illuminated by natural light from western windows, for instance, is likely to appear more vibrant in the morning than in the afternoon, since in the early hours the illumination will be cool skylight. The reverse would be true for a work in warm tones under the same conditions. Thus, in order to emphasize subtle colorations, regardless of whether or not the natural light of any particular moment supports them, properly colored supplemental lights can be directed on the painting. In this respect, the objective of gallery lighting, whether natural, artificial, or a mixture, is to provide sufficient colormatch in the wavelengths from the light source that the tone of the painting as originally intended by the artist is always apparent.

Incandescent lights produce light based on the same fundamental principles as sunlight. Elements within the bulb, or lamp, are heated to a high enough temperature that they begin to glow—the higher the temperature the bluer, or cooler, the appearance of the light. This concept is well known to photographers, who often have to know the color "temperature" of a subject's illumination so that they can use the corresponding film. A low color temperature implies a warm, or yellow, light, while a high temperature indicates a whiter light. Although



7. Johannes Vermeer, Dutch, 1632-1675. Young Woman with a Water Jug, early 1660s. Oil on canvas,  $18 \times 16$  in.  $(45.7 \times 40.6$  cm). Gift of Henry G. Marquand, 1889 (89.15.21)

In this painting Vermeer uses a predominantly cool palette. The skylight from the window cools the highlights in the young woman's skin. Her hood and collar have a crispness that was achieved by adding a small amount of blue pigment to the white garment: a cool blue light is also transmitted through the hood to provide a faint outline of the back of her head. The surfaces of the silver tray and jug that face the window or the reflective blue fabric are clearly shifted toward blue and the blue geometric pattern of the oriental rug is so intense it is difficult for the viewer to focus on it and the adjacent orange at the same time.

incandescent sources are good at mimicking direct sunlight they are still incapable of re-creating the bluish cast of skylight because of the insufficient distance, and hence atmospheric scattering, between the source and the viewer. Tungsten lamps filled with inert gaseous halogens (tungsten-halogen), which can burn efficiently at higher temperatures than conventional light bulbs, produce the whitest light available from incandescent sources; however, even these lamps cannot reproduce blue, northern skylight. If desired, it is possible to vary the appearance of incandescent light by transmitting it through bluetinted filters or by reflecting it off walls that have a cool tint. Fluorescent lights create illumination on a principle different from that of either sunlight or incandescent sources. The coatings inside fluorescent lamps absorb high-energy ultraviolet (UV) radiation from mercury vapor inside the tube and emit visible light at discrete wavelengths. In fluorescent light these discrete wavelength emissions correspond to different colors of visible light. The inner coating can be modified so that the resulting colors can add up to a light that appears similar to different types of daylight (fig. 8). For instance, there are several fluorescent tubes available that give off a moderately low-wattage, cool, northern or warm, southern type of light.



The ability of fluorescent lights to render colors correctly is a different issue. For example, if the intrinsic color of an object or pigment is poorly represented in the light source, that color will appear muted. Conversely, if the light emits an overabundance of that wavelength, the color will be amplified. This is especially a problem for red colors that are often poorly represented in the light source. To render a color accurately, light of that specific range must be present in correct proportion relative to the overall illumination. Because of the gaps in the wavelengths produced by fluorescence, accurate color rendering cannot always be achieved. Despite its limitations as a sole illuminant, however, fluorescent light can be used as an ambient source in the viewer's peripheral vision to suggest satisfactorily either a northern or southern light.

In addition to using lighting that supports the tone

8. The visible light distribution of cool (top) and warm (bottom) fluorescent light. The background of each graph is the color of the fluorescent source from which the measurement was taken. The cool light source is slightly better at rendering color because it consists of roughly equal proportions of colors throughout the visible spectrum, while the warm light source contains predominantly yelloworange light. However, for both sources poor color rendering exists for objects whose colors predominate where there are voids in the visible light distribution.



of a painting, it is necessary for museums to employ lighting appropriate to the needs of works that contain fugitive or unstable materials. For example, the vellowing of some varnishes is slowed considerably when they are no longer exposed to UV radiation. Fortunately, properly filtered UV radiation is nearly imperceptible to the human eye and consequently it is general practice to eliminate it from the gallery setting. However, even when UV is filtered out, fugitive dyes may be only marginally buffered from damage, since these dyes will fade after exposure to a critical dosage of visible light. By cutting the illumination intensity or exposure to visible light in half, in principle one doubles the lifetime for that particular dye's color. Paintings with fugitive materials are normally exhibited separately in galleries that have absolute minimal visible light levels and are usually displayed on a rotating basis. Distinguishing un-



stable materials from those that are lightfast requires either knowledge of the artist's palette or technical examination.

Gallery lighting usually consists of a combination of direct and diffused light. These two sources contribute to the light level at the surface of the painting. Paintings illuminated with excessive light, aside from the issue of fading, can be just as difficult to decipher as paintings that have insufficient light. Paintings illuminated with too much direct (spot) light, particularly varnished ones, from some vantage points may reflect specular "hot spots" of the light source rather than the image of the painting. This can be remedied by moving the light source so that the glossy reflection is directed away from the viewer's line of sight. When diffused light is excessive or improperly located, it has the tendency to cause certain paintings to lack depth and appear washed out or gray. Again, varnished paintings suffer the most dramatic effects when this illumination is not rectified; because they have a smooth surface they will reflect light primarily from the top surface of the varnish and not from the pigmented depth of the paint layer as they should. This condition may be difficult to perceive because the lack of darkness (or saturation) is even across the entire surface, the diffuse light causing a white sheen over the whole, and therefore the work could be mistakenly thought to have been painted with lighter colors. However, when the lighting is properly adjusted, the depth of the painting is immediately apparent through subtle contrasts, most easily noted in darker passages.

Ideally, therefore, a gallery should contain two types of lighting. There should be an over-all scheme that settles on an illumination that underscores the common traits found within an arrangement of paintings. Once this base has been established individual paintings, where necessary, should receive supplemental lighting that enlivens aspects otherwise imperceptible to the viewer. It is also necessary to use illumination with minimal or no UV at levels beneath a visible light threshold considered safe for the media on display.

Especially successful lighting schemes can be seen in several galleries throughout the Museum. For example, in the Robert Lehman Collection, in the gallery where Goya's *The Countess of Altamira and Her Daughter* and other paintings are displayed, the works are mostly rendered in a cool key, and the lighting is designed to reflect back to the viewer

from cool gray walls. Although the room is illuminated by both warm and cool light, the gray walls absorb the warm components and allow the cooler illumination to envelop the paintings, while the warm (in this case, fluorescent) light is only apparent at the ceiling. One can peruse passages in these paintings without any significant distraction from warm light reflected by the wall. This use of warm and cool lighting creates an agreeable interior space. The warm tone at the ceiling establishes it as a horizontal plane clearly distinguished from the vertical (wall) surfaces, without which differentiation the room would appear flat and less inviting. In the adjoining gallery, where fifteenth-century Italian paintings are on display, the opposite lighting configuration is required due to the warm tone of these pictures. There cool light is retained at the ceiling and warm light, reflected from the red velvet walls, surrounds the paintings (fig. 9). The newly installed Nineteenth-Century European Paintings and Sculpture Galleries also offer excellent examples of lighting used to optimize enjoyment of the works of art (see fig. 3). Here the Museum's lighting designer, Zack Zanolli, has satisfied both curatorial and conservation needs. The relatively shallow attic space required translucent diffusers to harness the arc of sunlight throughout the day and redirect it consistently downward. By using such panels Zanolli was able to create a dynamic natural light that concentrates on the floor rather than the walls, where raking light would cause disturbing glare on the paintings at certain times of day. During the construction process, materials with the best UV-absorbing qualities were selected. The result is an exhibition space that provides vistas of glare-free paintings in galleries where harmful UV radiation has been effectively eliminated. Clearly sensitivity to these details fosters an environment that welcomes viewers and helps create an atmosphere where they are encouraged to look at paintings in a relaxed manner.

With all these considerations in mind, museum specialists decode, as it were, the specific lighting needs encrypted within each artwork. For the large and diverse collections of the Metropolitan there are many unique lighting solutions. Perhaps the greatest challenge is to specify changes in lighting from gallery to gallery so that the variations are only briefly noted, if at all. By achieving this goal, museumgoers' attention will remain focused on the collection rather than the installation. STATEMENT OF OWNERSHIP MANAGEMENT AND CIRCULATION

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