PROCEEDINGS

Conserving Outdoor Painted Sculpture

Proceedings from the interim meeting of the Modern Materials and Contemporary Art Working Group of ICOM-CC

Kröller-Müller Museum, Otterlo, The Netherlands, June 4–5, 2013

The Getty Conservation Institute

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Edited by Lydia Beerkens and Tom Learner

The Getty Conservation Institute
Los Angeles

The Getty Conservation Institute works internationally to advance conservation practice in the visual arts, broadly interpreted to include objects, collections, architecture, and sites. It serves the conservation community through scientific research, education and training, model field projects, and the broad dissemination of the results of both its own work and the work of others in the field. In all its endeavors, it focuses on the creation and dissemination of knowledge that will benefit professionals and organizations responsible for the conservation of the world's cultural heritage.

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Front cover: Robert Indiana, *Love*. © 2014 Morgan Art Foundation / Artists Rights Society (ARS), New York. Photo: Tom Learner.

The International Council of Museums (ICOM), created in 1946, is the world organization representing museums and museum professionals, committed to the promotion and protection of natural and cultural heritage, present and future, tangible and intangible. With approximately 30,000 members in 137 countries, ICOM is a unique network of museum professionals acting in a wide range of museum-and heritage-related disciplines.

The Committee for Conservation of ICOM (ICOM-CC) aims to promote the conservation of culturally and historically significant works and to further the goals of the conservation profession. With over 2000 members, ICOM-CC is comprised of twenty-one specialist Working Groups, which actively communicate with members through newsletters, meetings, and at the Triennial Conference. The Coordinators of these Working Groups and the members of the Directory Board are conservation professionals who are elected to their posts by the general membership and who donate their time to ICOM-CC over a three-year cycle.

The Modern Materials and Contemporary Art Working Group of ICOM-CC aims to promote and facilitate the dissemination of research, discussion, and thinking on the full range of conservation issues and implications for modern and contemporary art. Specifically, the group aims to provide an effective platform for those professionals involved in this area of conservation to network and share information, and to ensure the rapid circulation of details on relevant conferences, seminars, events, and publications.

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Preface

The world's great cities, museums, and sculpture gardens own and display outdoor painted sculpture by some of the most influential artists of the twentieth century, among them Alexander Calder, Niki de Saint-Phalle, Jean Dubuffet, Sol LeWitt, Roy Lichtenstein, and Claes Oldenburg. Such outdoor pieces, however, require frequent conservation treatments because of the harsh environments to which they are exposed, including intense light/UV radiation and adverse weather conditions, as well as vandalism and accidental damage.

Clearly, outdoor painted surfaces cannot be protected to the same degree as a painting or sculpture that is housed indoors, where these factors can be more effectively controlled. Nevertheless, conservation strategies for these works are still a necessity. Conservation treatments are usually major and expensive undertakings, especially if the need has gone beyond local consolidation and inpainting. Such treatments frequently involve full repainting of the sculpture, which is often preceded by complete removal of all prior coats of paint in order to ensure proper adhesion of the replacement coating, allowing optimum protection to the substrate underneath. In practice, such treatments are generally executed by specialists in the paint industry who are knowledgeable about the application of paints and coatings in outdoor environments. This approach is common around the world and strongly guided by the desire to preserve the original aesthetic qualities of the sculpture itself.

These important, and often iconic, works of art therefore pose difficult practical and ethical choices for conservators, who need to balance factors such as appearance, durability, and respect for the artist's intent against the more widely adopted practice in the conservation profession of retaining original materials on works of art. Although most conservators understand the need to work closely with artists or their respective estates and/or foundations, no real protocols are in place for ensuring that the color and surface of replacement paint systems match the paints that the artist initially used, and discussion of this issue is not widespread among the conservation profession. In addition, there is often uncertainty about the exact role a conservator plays in the decision-making process with the range of professionals involved in such an undertaking.

One recent element of the Getty Conservation Institute's Modern and Contemporary Art Research Initiative has been to assess the needs of conservators working on outdoor painted sculpture. Building off the outcomes of a focus meeting organized by the GCI and held in June 2012 at the Metropolitan Museum of Art (the report of which can be found here: http://www.getty.edu/conservation/our_projects/science/outdoor/outdoor_focus_mtg.pdf), this assessment has involved a broad approach that includes improving analytical methods of identifying the various types of coatings used, exploring the practicalities of producing swatches of agreed color and surfaces for specific artists that could be made available to conservators, undertaking selected case studies, and helping to disseminate the ongoing work in the field to the broader conservation community. These proceedings fall squarely into this last category.

The symposium *Conserving Outdoor Painted Sculpture* took place in June 2013 at the Kröller-Müller Museum (KMM) in Otterlo, the Netherlands, with approximately one hundred professionals in attendance. It was the interim meeting of the Modern Materials and Contemporary Art working group of the International Council of Museums—Committee for Conservation (ICOM-CC), in collaboration with the KMM, the GCI, and INCCA (the International Network for the Conservation of Contemporary Art), and was one of the ideas suggested at the 2012 focus meeting in New York. The purpose was to bring together a group of international conservators, fabricators, paint manufacturers, scientists, artists' foundations, and curators—all of whom are engaged in this area of conservation—and to provide them with a forum for presenting their own work, as well as foster more in-depth discussions about key issues and challenges. The large sculpture garden at the KMM, with its 150 outdoor artworks, presented a perfect setting for the symposium, one that allowed delegates to view works that had recently been studied and/or conserved and to engage in discussions in situ.

The papers in this volume are in the same order as delivered at the symposium. Many of the presentations were individual case studies from a number of artworks from the KMM collection itself and from other locations across Europe, North America, and Asia, including works by Alexander Calder, Christo, John Hoskin, Roy Lichtenstein, Claes Oldenburg, Nam June Paik, Shinkichi Tajiri, and Franz West. Papers were also delivered on broader technical aspects, such as how specific paints or coatings can be developed or tailored to conservators' or artists' needs, and the factors that the paint industry and fabricators must consider when developing or recommending new paint systems or assisting artists in the creation of their concept. Other presentations focused on the main issues facing conservators of outdoor painted sculpture—ethical/philosophical, technical/material, legal, management and communication/information exchange—and possible responses, how the conservation of variable media art shares similarities in approaches to outdoor painted sculpture, and the complex issues of managing large public art collections.

This symposium would not have been possible without all the wonderful help from the Kröller-Müller Museum, especially Liz Kreijn, assistant director, collection and presentation, and Susanne Kensche, head of the Sculpture and Contemporary Art Conservation Department. Special thanks also to Lydia Beerkens of Stichting Restauratie Atelier Limburg (SRAL) Art Conservation and Research, Maastricht, who coordinated the symposium and coedited the papers in this publication, and to Karolien Withofs for her editorial contributions.

I would like to mention Karen te Brake Baldock of INCCA and Paulien 't Hoen of the Dutch Foundation for the Conservation of Contemporary Art (SBMK) for their assistance with the organization of the meeting. Finally, I wish to acknowledge Cynthia Godlewski and Gary Mattison from the GCI, who coordinated the publication of these proceedings.

Tom Learner
Head of Science
The Getty Conservation Institute

Introduction: The Kröller-Müller Museum

Liz Kreijn

It was my great pleasure to welcome all the delegates to the symposium *Conserving Outdoor Painted Sculpture* at the Kröller-Müller Museum, Otterlo, the Netherlands, in June 2013, the interim meeting of the Modern Materials and Contemporary Art (MMCA) working group of the International Council of Museums—Committee for Conservation (ICOM-CC). And it is with equal pleasure that I write to acknowledge the work of the organizers and how important this symposium and publication is for the field.

The Kröller-Müller Museum is a museum for modern and contemporary art, located in the center of the National Park de Hoge Veluwe in Otterlo, the Netherlands. The museum collection consists of around 21,000 works of art, with approximately 1,500 of those being sculptures, and of those, roughly 170 are installed in the sculpture garden. Some twenty sculptures are situated on the grounds of the National Park, which are also maintained by the museum. The materials used in the sculptures vary from marble, stone, and bronze to Corten steel, lead, and cement, and—perhaps most important to this meeting and publication—many of the works are painted, including iconic pieces by artists such as Christo, Mark Di Suvero, Jean Dubuffet, Claes Oldenburg, and Auguste Rodin (fig. 1).

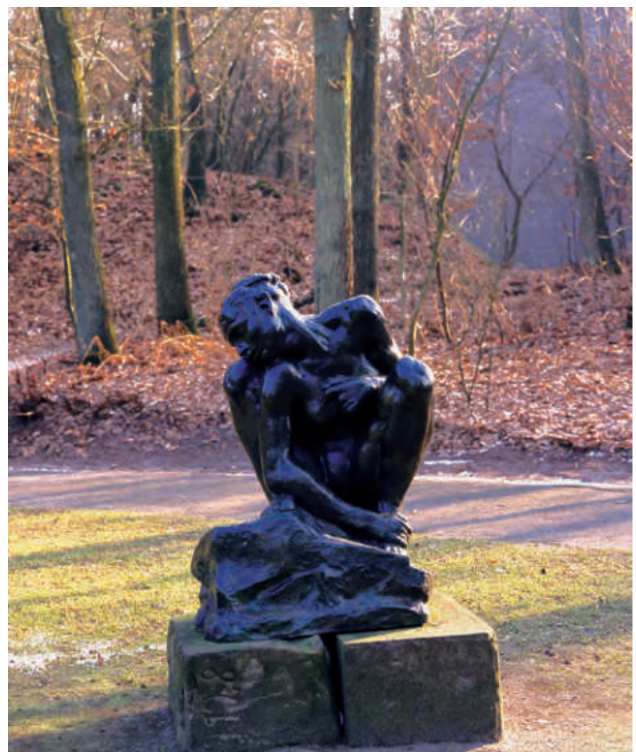

Figure 1 Auguste Rodin, *Femme accroupie*, 1882. Bronze. © Kröller-Müller Museum, Otterlo. Photo: Cary Markerink, Amsterdam.

The original design of the sculpture garden was conceived by landscape architect J. T. P. Bijhouwer. Marta Pan was the first artist commissioned to create a special work for the garden: her *Sculpture Flottante—Otterlo* (Floating Sculpture—Otterlo) is still one of its most famous artworks (fig. 2). The garden was enlarged in 1965 and again in 2002 into one of Europe's largest, at 25 hectares. This location, where nature and art have been so beautifully combined, is very special, as most of us are accustomed to seeing museums of contemporary art in the middle of a dynamic city.

Over the years the directors of the Kröller-Müller Museum have hewed to a clear vision in the spirit of

Figure 2 Marta Pan, *Sculpture Flottante—Otterlo* (Floating Sculpture—Otterlo), 1960–61. Pond, glass fiber–reinforced polyester resin, aluminum. © Fondation Marta Pan & Andre Wogenscky. Courtesy Pierre Lagard, President, Fondation Marta Pan & Andre Wogenscky. Kröller-Müller Museum, Otterlo. Photo: Cary Markerink, Amsterdam.

the museum's founder, Helene Kröller-Müller: sober artworks that offer the visitor a fresh look at nature, and images that express a fascination for the relationship between nature and culture. These include Claes Oldenburg's *Trowel*, Jean Dubuffet's *Jardin d'émail*, Kenneth Snelson's *Needle Tower II*, and Richard Serra's *Spin out*, *for Robert Smithson* (fig. 3).

The Kröller-Müller Museum had 311,000 visitors in 2012, most of whom also came to visit our sculpture garden. The area around the museum is designed and "artificial"; later expansions are "wilder," with rhododendron bushes and a forest. On one side the sculpture garden has a natural boundary (the so-called French Mountain, actually not higher than a small hill). In total 25 hectares are fenced in.

Adriaan Geuze, of West 8 landscape architects, is the museum's adviser on renovation and restoration of the garden, an ongoing process. Two pavilions have

Figure 3 Richard Serra, *Spin out, for Robert Smithson*, 1972–73. Corten steel. © 2014 Richard Serra / Artists Rights Society (ARS), New York. © Kröller-Müller Museum, Otterlo. Photo: Cary Markerink, Amsterdam.

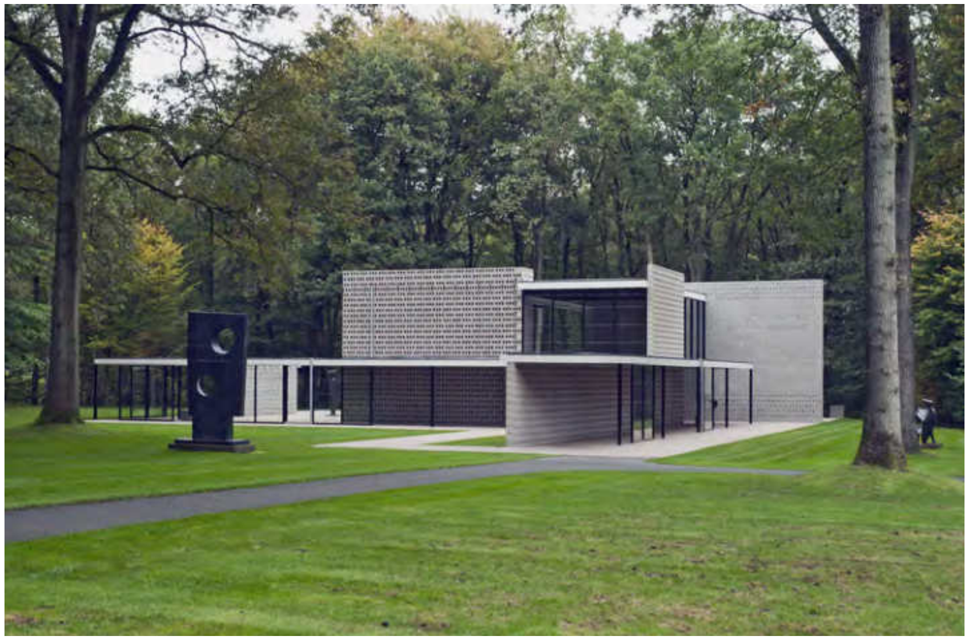

Figure 4 The Rietveld pavilion at the Kröller-Müller Museum, designed by Gerrit Rietveld. Photo: Marjon Gemmeke.

been added, originally designed and built for the open-air Sonsbeek sculpture exhibition in nearby Arnhem. The Rietveld pavilion was designed by Gerrit Rietveld in 1954–55 as a temporary exhibition building for Sonsbeek (fig. 4). Ten years later it was rebuilt here and renovated in 2010. Inside and around are works mainly by Dame Barbara Hepworth. The other pavilion was designed by Aldo van Eyck, also for Sonsbeek in 1965–66, and rebuilt here in 2005; it houses smaller works.

Works in the sculpture garden date from the seventeenth century (Japanese lanterns) to recent acquisitions from 2010. The size of objects varies from small busts (the *Chapters* of Jan Fabre) to very large—Dubuffet's *Jardin d'émail* measures 10 × 20 × 30 meters. The presentation in the sculpture garden is permanent. Since 2002 we have had an outside space for temporary exhibitions. Originally, entrance to the sculpture garden was seasonal, as it was closed during winter. Beginning in 2000, the garden has been open year round for visitors, but we do make the objects "ready for winter" by bringing some of them indoors and building protection for others.

Maintenance of the garden and the objects is year round, utilizing a very small staff. A staff of four is assigned to the garden. Looking after the objects are 2.5 full-time equivalents (FTEs) in total for sculpture (indoors and outdoors): a conservator of sculpture and modern art (for both indoor and outdoor sculpture) and a conservation technician (especially for sculpture). We have a permanent collections manager and occasionally conservation interns.

Outdoor painted sculpture presents complex conservation problems that must be dealt with on a daily basis. All of the sculptures are exposed to the outdoor climate (although some more fragile pieces are brought indoors for the winter), to crawling mammals and insects, and to visitors who sometimes touch the objects, step on them, or climb on them. We understand there are no quick fixes to this genre of art, but wouldn't life be dull without it? Collectors must adapt to and accept the implications for buying and installing these painted pieces, and conservators need to take the challenges seriously. The recent interest in outdoor painted sculpture must be welcomed, and as such we were thrilled to serve as host for this symposium.

Please enjoy the proceedings. They reflect on a wonderful and enjoyable meeting that was also blessed with beautiful weather! To those interested in seeing the sculptures in person, I extend a cordial welcome to our beautiful museum and sculpture garden.

Conservation of Outdoor Painted Sculpture at the Hirshhorn: Taking Lessons from the Preservation of Variable Media Art

Gwynne Ryan

Abstract: *The Hirshhorn Museum and Sculpture Garden is home to a modern and contemporary art collection encompassing a wide range of media. Familiar with the challenges encountered in the preservation of variable media—a category that includes conceptual, installation, time-based media, and electronic art—staff conservators are identifying parallels in the care of outdoor painted sculpture, specifically those relating to the inherent requirement that physical components need to be periodically replaced. This paper aims to illustrate that the tools being developed for variable media preservation can assist in navigating the challenges encountered in the treatment of painted outdoor sculptures.*

Introduction

The Hirshhorn Museum and Sculpture Garden is one of the museums of the Smithsonian Institution and houses a collection that consists primarily of modern and contemporary art. Although the overall collection is relatively small by Smithsonian standards, its art holdings feature a wide range of media, from traditional sculpture and paintings to the highly unconventional, with a fair share of installation and time-based artworks. As the name suggests, the museum also has an outdoor sculpture garden, which is located on the National Mall in Washington, DC. At present, more than one hundred outdoor pieces from the collection are on display in the garden, some on loan to various affiliates and institutions across the United States. The painted outdoor sculptures, which make up about 20 percent of all outdoor works at the Hirshhorn, consist mainly of steel and aluminum construction and run the gamut in terms of their condition.

Working within a contemporary art collection, the museum's conservation staff is accustomed to the challenges that come with preserving not only the physical components of an artwork but also the intangible and conceptual aspects. The need to preserve the intangible is most evident in dealings with variable media, a category that includes conceptual, installation, time-based, and electronic art. This paper explores the similarities between the challenges of conserving outdoor painted sculpture and conserving variable media in terms of preservation criteria, and proposes that looking to the tools and decision-making models that are being developed for variable media art may assist in determining the approach to any given treatment of a painted outdoor work.

Parallels in the Preservation of Outdoor Painted Sculpture and Variable Media

There are arguably many parallels in the preservation of painted outdoor sculpture and the preservation of variable media. Both challenge the core conservation notions of preservation of original materials. One of the most obvious ethical hurdles that both genres share is the inherent need to replace or replenish visible components that are essential to the way in which a viewer sees and experiences the artwork. This need is apparent in the painted steel artwork *Agricola I* by David Smith (fig. 1), in which the failing paint requires regular

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Figure 1 David Smith, *Agricola I*, 1951–52, 66.4638. Painted steel. Paint layer as applied in 2006. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. Art © Estate of David Smith / Licensed by VAGA, New York, NY. www.vagarights.com.

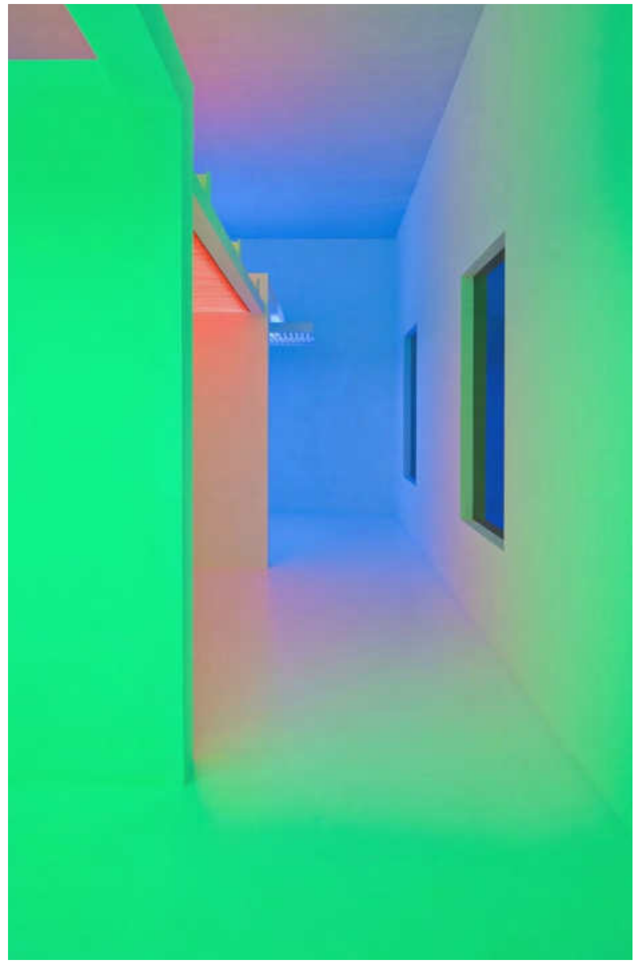

Figure 2 Carlos Cruz-Diez, *Chromosaturation*, 1965 (refabricated 2012), 12.11. Light installation. © 2014 Artists Rights Society (ARS), New York / ADAGP, Paris.

replacement, and in the recently acquired installation *Chromosaturation* by Carlos Cruz-Diez (fig. 2), in which the materials that provide the visible color—in this case, fluorescent bulbs—must be swapped out on a regular basis to keep the artwork functioning.

The term *iteration* is used frequently with variable media to delineate alterations in installation configuration or to demarcate when tangible modifications have been made to an artwork. In working with outdoor painted sculpture, parallels can be made in approach as each repainting treatment may be considered similar to an iteration of any other variable media artwork. The insights to be gained from these parallels can be found in the types of documentation required, in the incorporation of the artist's studio or foundation into the conversation, and in the importance of establishing cross-disciplinary collaborations.

David Smith's *Agricola I*

The painted steel sculpture *Agricola I* was first completed in 1952. By 1982, all of the original artist-applied paint layers had been stripped down to bare metal by museum staff. Acquired by the Hirshhorn in 1966, it has been repainted numerous times with colors ranging from a dark oxide, almost brown color to a cherry red. This example of the necessity of repainting highlights one of the greatest fears that conservators carry, and one that is shared by stakeholders in the preservation of time-based media and variable art: that with the necessary replacement of components as an inherent quality of the work, the artwork will drift further and further from the desired appearance. With this comes the high risk of the loss of any evidence relating to the artist's methodology, tools, and techniques. Unfortunately, the approach of stripping away original paint, with little documentation of the layers removed and insufficient discussion relating to the new application, was a commonality at the Hirshhorn about thirty years ago, when repainting of the sculpture often fell under the auspices of the building maintenance crew.

In 2012, *Agricola I* was slated for display in a permanent collection exhibition. As the paint was beginning to show signs of failure and the color had become a chalky pink in the six years since it was last painted (fig. 3), the impending treatment was seen as an opportunity to reexamine the way the repainting of this work had been approached and to address the larger questions relating to the ideal surface. Through curatorial input and discussions with the David Smith estate, along with literature research, it was discovered that, like many of the artist's works, this steel sculpture had originally been left unpainted by the artist when it was fabricated in 1951. Sometime prior to 1960, Smith applied a protective layer of paint as a means of keeping it from rusting in his field, where it was stored (Marshall 1995, 93). The original color applied was yellow, consistent with the zinc chromate primer that he often used on his sculpture. In 1962, the artist applied directly over this layer a color described by the estate as "brownish red," which remained the final color at the point that it entered Joseph Hirshhorn's collection later that year.[1]

Figure 3 *Agricola I* in 2012. The paint layer applied in 2006 (see fig. 1) has faded to a chalky pink color. Photo by Hirshhorn conservation staff. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. Art © Estate of David Smith / Licensed by VAGA, New York, NY. www.vagarights.com.

Unable to uncover any photos of the artwork in these various states, conservators at the Hirshhorn gathered cross sections, hoping these would reveal early paint layers, a process that only reinforced that the removal of the original paint in 1982 was thoroughly conducted. As a result, the choice was made to apply a new coat of red oxide, utilizing Smith's red oxide works painted at a similar time as a color reference. The method of application became a sticking point, however.

Effects of Changes in Technology

The benefits of high-performance paints in terms of their longevity in color and gloss retention cannot be denied. The large-scale work *Are Years What? (For Marianne Moore)* by Mark Di Suvero (1967) was painted with a high-performance Tnemec (F700R3404A Hydroflon) paint in 2006, a few years after acquisition by the Hirshhorn (fig. 4). When the sample drawdown, created at the time of repainting and subsequently stored in the conservation files, was compared against the paint on the sculpture in the spring of 2013, the retention of color was striking (fig. 5). It is important to note that this sculpture was painted the exact same year that *Agricola I* was painted cherry red with a roller-applied low-performance polyurethane paint, only to fade to chalky pink by 2012.

Considering the potential for an increased time span between paint treatments, the use of a high-performance paint can be deemed an acceptable choice for the work by Di Suvero in which the artist, while intimately involved in the welding of his constructions, had studio

Figure 4 Mark Di Suvero, *Are Years What? (For Marianne Moore)*, 1967, Collection of the Hirshhorn Museum and Sculpture Garden, 99.19. Painted steel. Installed on the grounds of the Hirshhorn Museum and Sculpture Garden. Paint layer as applied in 2006. Photo taken in 2013 by Hirshhorn conservation staff. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. © Mark Di Suvero / Spacetime C.C.

Figure 5 Detail of the paint drawdown in 2006 on *Are Years What? (For Marianne Moore)*, showing a minimal degree of color shift of the aged paint. Photo by Hirshhorn conservation staff, March 2013. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. © Mark Di Suvero / Spacetime C.C.

Figure 6 David Smith, *Aerial Construction*, 1936, 72.267. Painted iron. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. Art © Estate of David Smith / Licensed by VAGA, New York, NY. www.vagarights.com.

assistants apply the paint layer with the goal of adding a uniform color coating. However, there are many unresolved issues with the decision to utilize a similar paint system on *Agricola I*. It is well documented that Smith's hand was ever visible in the paint layers of his sculptures and that his technique and materials changed quite a bit over the course of his career (O'Hara 1961, 32) (figs. 6, 7). The resulting appearance of a high-performance paint, spray applied, can be assumed to be far different from that of the paint layers present at the time *Agricola I* was acquired, in 1966, and perhaps one that may be deemed inappropriate for Smith's human-scale sculptures with surfaces that are experienced in a more intimate manner than those of the oversize works of Di Suvero.

With outdoor painted sculpture, as with variable media artworks, the materials available to replace

Figure 7 David Smith, *Aerial Construction*, 1936, 72.267. Painted iron. Detail of paint application showing the artist's brushstrokes. Photo by Hirshhorn conservation staff, 2013. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. Art © Estate of David Smith / Licensed by VAGA, New York, NY. www.vagarights.com.

Figure 8 Olafur Eliasson, *Round Rainbow*, 2005, 05.22. Acrylic glass, HMI spotlight, motor, tripod. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. Courtesy Olafur Eliasson and Tanya Bonakdar Gallery, New York.

degraded elements often change in manufacture and functionality. Paint formulations are modified in response to advancements in technology or as a result of changing government regulations. This is similar to the evolution in lightbulb technologies, where one can anticipate an increased risk of color shift and alteration to overall physical appearance of the bulbs themselves over time. For example, the dedicated lamp in an installation piece titled *Round Rainbow*, by the artist Olafur Eliasson (fig. 8), is one used in the movie and theater industries; today, however, it is available only with an external ballast that must sit on the floor next to the lamp. Only a few years after its creation, the physical appearance of the original is no longer possible to achieve.

Clearly, alteration of the original appearance is also an issue with media art. Artworks that were originally created in 16 mm film may need to be migrated to videotape or to digital formats for exhibition. With each new migration, the artifacts of the original technology are inherently altered. The complex nature of these issues makes the exploration of treatment options an ongoing process for artworks whose evolution over time is inevitable but where the direction of future advancements in technology cannot be fully anticipated. In light of the potential risks to the integrity of the artwork, documentation takes a high level of priority.

The Importance of the Artist's Voice

Artists and their estates and/or foundations are an essential component in the development of sufficient conservation documentation, as has been the case with each artwork referenced in this article. The input of the artist has been acknowledged by those working with variable media as an essential tool in navigating the care and preservation of artworks where change is inherent. An artist interview program was initiated by the Hirshhorn Museum's conservation department in 2012 and relies on museum-wide collaboration as initial interviews are becoming an established part of the acquisition protocol for works entering the collection. Dialogue does not need to be structured within a formalized program, however, to be effective. Working on-site with an artist provides an ideal opportunity to review the importance of the look and positioning of the bolts and the variables of display with the fabricators and studio crew.

Whereas incorporation of the artist's voice is ideal in any preservation protocol, access to the artist is not always an option. In the absence of the artist's input and with the lack of sufficient documentation relating to the original paint layer in Smith's *Agricola I*, any replication of his paint strokes by hand would remain as conjecture. The decision to approach this current repainting cycle of *Agricola I* as an iteration of a variable media artwork necessitated the use of additional documentation principles of variable media conservation: that is, documenting not only the new paint that is used and how it is applied but also the decision-making process that led to that outcome.

While documentation practices for time-based media are rapidly evolving, the creation of iteration reports is becoming common practice for many conservators working with media arts who seek to track the inevitable changes that occur with each installation of a media piece. These reports often contain detailed discussions indicating who made the relevant decisions and what factors were at play. Was a change to a material due to the fact that it was the only option available? Were there time constraints or economic constraints, or was the decision perhaps advised by the artist? This section of the documentation records also includes what would have been done differently if certain conditions were different and what issues could be anticipated to arise in the future. In this way, each iteration and treatment intervention is viewed as an opportunity to revisit some of the long-standing issues. The repainting cycles of outdoor painted sculpture lend themselves to this model as the relatively frequent rates of intervention, similar to those of time-based media, allow for reevaluation of past treatments to occur on a regular basis and increase the foundation of knowledge behind each particular work.

With variable media, adequate documentation necessarily moves beyond the textual report. Video documentation can take center stage as a means of capturing the subjective aspects of the experience of viewing an artwork that may not be efficiently captured through descriptive text or even through standard photography. This is an especially useful tool in capturing an artist's working technique and in the documenting process with artworks that require re-creation or reenactment. This application extends to outdoor painted sculpture, recently employed to document the unexpected flexibility inherent in a particular large-scale sculpture, a quality encountered only in the process of its assembly. The Hirshhorn Museum's artist materials archive, a natural part of any contemporary art conservation lab, was haphazardly started in the 1970s and was only recently reorganized as a searchable documentation and reference tool (fig. 9). The archive houses a diverse range of ephemera, including spare parts, artist's samples, conservation mock-ups, and old elements from sculptures that have been replaced with new. This "artifact as documentation" practice has naturally bled into the

Figure 9 The artist materials archive at the Hirshhorn Museum's conservation laboratory organizes a diverse range of ephemera.

protocols for outdoor painted sculpture preservation with the creation of labeled boxes of sample bolts from earlier installations and paint drawdowns of previous and current paint systems employed on particular sculptures. These act as a tangible reference for the look of the sculpture at a certain moment in its life.

Reliance on Outside Expertise

Despite the broad range of documentation tools at hand, moving into alternative technologies and materials can still be met with unforeseen consequences. Even if one accepts that the available materials for displaying an artwork will change and that the benefits of the new technologies can be many, what can be more difficult to accept is that the expertise and knowledge about these new choices, and their performance as well as the process of applying them to the artwork, is often held in another industry. These industries are often accompanied by goals, priorities, and skill sets that lie far outside those of art conservation and of the artist's own expertise. As has been alluded to, an artist's degree of involvement and level of expertise with each technology can vary considerably. Artists working in large-scale outdoor sculpture may be very hands on or may rely heavily on their fabricator or studio assistants in the actual realization of their artwork. With digital or time-based media, it is not uncommon for an artist to have only partial knowledge pertaining to the very technologies on which his or her artwork is based.

Unlike the application of alkyd or oil-based paints, high-performance and industrial paints that give the most durable and long-lasting results outdoors typically require application by technicians who are specially trained and certified in that particular paint system. In trying to make educated decisions about paint options, conservators often must wade through the technological specifications of a myriad of proprietary paint systems phrased in the manufacturer's marketing language. This can be a challenge similar to the process of wading through specifications for software systems and projectors for time-based media artworks. Understanding the product's long-term benefits in the application for which it is being used by the conservator—which is often different from what the product is ideally designed for—is not clear-cut and usually requires significant translation. In addition, the conservator frequently is not the one conducting the actual alteration of the artwork; the treatment is executed off-site by a professional who is familiar with the technology but not necessarily with the aesthetics or the nuances that may occur in the overall functionality of the artwork. The results can sometimes be undesirable, as conservators at the Hirshhorn have encountered in both the media arts and outdoor painted sculpture.

In one instance, a contracted photographer who was trained in slide duplication unnecessarily altered exhibition copies of a projection-based installation piece in an attempt to "correct" the artist's intentional color shift. The photographer's goal was to match industry standards for color representation as opposed to the standards applied by the artist. Similarly, during treatment of a partially painted stainless-steel outdoor sculpture, professional technicians were familiar with the particular paint system used, but only as it applied to bridges and construction-related equipment, not to an artwork. Their primary professional goal was to achieve paint industry standards of a cohesive application and, despite the supervision of Hirshhorn conservators and the artist's current fabricator, the aesthetic standards were markedly insufficient. Although both of these examples are situations that can be rectified in theory, the reality of departmental budgets and exhibition time constraints limits an institution's ability to do so prior to the work being installed on schedule.

The reliance on outside contractors underscores the importance of locating professionals who have worked with conservators, artists, and museums. Just as in time-based media, specialists who have formed ties with the preservation community are few and far between but are worth seeking out in order to establish well-founded professional relationships and future partnerships in larger collaborative research projects. The Hirshhorn has formed many successful collaborations with American Stripping Company (ASCo), based in Manassas, Virginia. ASCo staff are very knowledgeable in a wide range of paint systems, with a strong commitment to and history of working with conservators. They have an established relationship with the Tony Smith Foundation and are actively participating in a research project headed by the National Gallery of Art in Washington, DC, involving the development of a paint system for Tony Smith's outdoor painted sculpture. This collaboration made ASCo the logical choice not only for the repainting treatment of the Hirshhorn's Tony Smith sculpture *Throwback* in 2010 (figs. 10, 11) but also for a large majority of the outdoor painted sculptures in the museum's collection.

Figure 10 Tony Smith, *Throwback*, 1976–79, 80.3. Painted aluminum. Installed on the grounds of the Hirshhorn Museum and Sculpture Garden. Photo courtesy of the Hirshhorn Museum and Sculpture Garden. © 2014 Estate of Tony Smith / Artists Rights Society (ARS), New York.

Figure 11 Technicians work on *Throwback* at ASCo during the repainting process. The artwork was rolled outside after each paint application for examination. Photo by Hirshhorn conservation staff, 2011. Photograph courtesy of the Hirshhorn Museum and Sculpture Garden. © 2014 Estate of Tony Smith / Artists Rights Society (ARS), New York.

Interdisciplinary Collaborations

Unlike many contract-conservator projects that terminate when the repainting is done, ASCo's active involvement in long-term cross-disciplinary research projects places the company in a highly unique category and allowed for their much-needed participation in a project initiated by the International Network for the Conservation of Contemporary Art—North America (INCCA–NA) and Glenstone in Potomac, MD, examining the conservation of outdoor painted sculpture by Tony Smith. This session assembled a diverse interdisciplinary group of professionals for a two-day summit in which the Hirshhorn was fortunate enough to be able to participate. Paint technicians, paint manufacturers, art historians, conservators, scientists, fabricators, and representatives from the artist's foundation came together around one table with the goal of prioritizing the areas of research that were in greatest need. This experimental endeavor adhered to the collaborative preservation model that has been established by variable media conservation stakeholders, providing an essential platform for the exchange of information between a wide range of professionals. While the long-lasting effects of this summit are yet to be realized, it adds an interesting layer to a variable media model designed to assist in the navigation of complex preservation challenges.

Conclusion

Much can be gained in the conservation of outdoor painted sculpture by looking to the practices emerging in variable media preservation. Forging relationships with the artists and with experts outside the field of conservation is a key component of contemporary art conservation, regardless of media. In addition, new modes of documentation and systems of information exchange are being explored that address the issues inherent to artworks requiring replacement of components. These new modes can be applicable whether the artwork is reliant on projector technologies or those of high-performance paints.

Notes

1. Timeline of paint coatings and colors provided by Peter Stevens of the David Smith estate, correspondence with the author, February 6, 2012.

References

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Conserving Outdoor Painted Sculpture: Outcomes from a Focus Meeting

Tom Learner and Rachel Rivenc

Abstract: *This paper reports on the findings from a focus meeting held in 2012 at which issues and challenges posed by the conservation of twentieth-century outdoor painted sculpture (OPS) were discussed among an invited group of conservators, artist's estates/foundations and studios, representatives from the paint industry, collections managers, and curators. OPS presents a particular challenge to conservators due to the often held aspiration that the painted surface should retain the original aesthetic qualities of the sculpture, as well as provide optimal protection to the substrate, despite its exposure to uncontrolled environments, adverse weather conditions, and damage by vandalism or accident. In addition to discussing the various philosophical, technical, legal, management, and communication issues and concerns, the participants attempted to identify and prioritize potential responses. By gathering the key points discussed at the meeting into a single document, it is hoped that the meeting report will serve as a useful starting point for the profession to consider how best to advance the conservation practice of OPS.*

Introduction

In June 2012, the Getty Conservation Institute (GCI) organized a focus meeting—hosted by the Metropolitan Museum of Art in New York—to discuss the many issues and challenges posed by the conservation of twentieth-century outdoor painted sculpture (OPS). The meeting was attended by thirty invited participants representing a cross section of relevant professions, namely conservators (from both private and institutional sectors); artist's estates, foundations, and studios (EFSs); the paint industry; and collections managers and curators (fig. 1).

By definition, all outdoor sculpture is exposed to uncontrolled environments, including intense light, UV radiation, and adverse weather conditions, as well as damage by vandalism or accident. Many outdoor painted works made in the 1970s and 1980s are now thirty to forty years old, an age by which major treatment is often needed. Painted works present a particular challenge to conservators due to the aspiration that the painted surface should retain the original aesthetic qualities of the sculpture, as well as provide optimal protection to the substrate, in particular when it is metal that has to be protected from corrosion (fig. 2). As such, conservation treatment on OPS often involves full repainting, frequently preceded by complete removal (i.e., stripping) of all earlier coats of paint. Although this approach would be considered highly unusual in other areas of conservation, it is reasonably common to all OPS around the world. It is also an expensive undertaking—one more reason to attempt to drastically reduce the frequency of such interventions.

The broad goals of the meeting were to discuss the main issues faced by the field over the conservation of OPS and to explore collectively some possible responses. It was hoped the meeting might specifically initiate and cultivate a dialogue between conservators dealing with OPS and between conservators, the paint industry, and artist's EFSs. The meeting was structured

Figure 1 Participants in the 2012 GCI focus meeting at the Metropolitan Museum of Art pose in front of a work by Mark Di Suvero on Governors Island in New York. Mark Di Suvero, *Chonk On*, 2000. Steel. 19 ft. 6 in. × 32 ft. × 14 ft. 3 in. (5.9 × 9.8 × 4.3 m). © Mark Di Suvero / Spacetime C.C. Photo: Gary Mattison. For a full list of attendees, go to: http://www.getty.edu/conservation/our_projects/science/outdoor/outdoor_focus_mtg.html.

Figure 2 Alexander Liberman, *Olympic Iliad*, 1984. Painted steel. Seattle, Washington. Commissioned by the Seattle Office of Arts and Cultural Affairs, with funding from the Seattle Center One Percent for Art Bond Issue, the Seattle Center Foundation, and private donors. A common aspiration in OPS conservation is to keep the sculpture looking pristine. This requires regular maintenance and frequent campaigns of repainting. Crosby Coughlin Fine Arts. © 2014 Alexander Liberman Trust. Photo: Amy Louise Herndon.

in three different sessions: (1) Issues, (2) Responses, and (3) Priorities. The results are summarized below. It should be remembered that the contents reflect the proposals and conversations that took place among the small group of invited participants, and should therefore not be viewed as anything more formal. However, it is hoped that by gathering the key points discussed at the meeting into a single place, the meeting report will serve as a useful starting point for the profession to consider how best to advance the conservation practice of OPS.

Issues

In the meeting's first session, Issues, participants were divided into small groups. Members of each group were asked to draw from their own professional experiences to identify the main issues related to the conservation of twentieth-century outdoor painted sculpture, and to classify them into broad categories (figs. 3, 4). Five such categories were identified: ethical/philosophical, material/technical, legal, management, and communication/information exchange.

Figure 3 Members of a breakout group at the focus meeting draw on professional experience to discuss issues related to OPS conservation. Photo: Tom Learner.

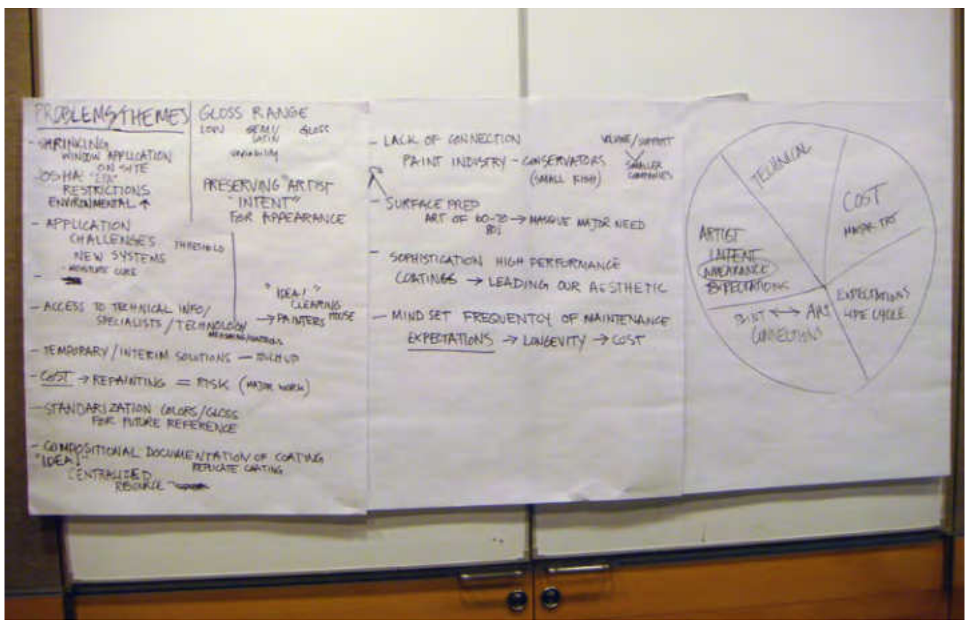


Figure 4 Notes from one group's brainstorming session. Photo: Tom Learner.

Ethical and Philosophical Issues

The participants expressed that there is a clear need to promote understanding and acceptance of the methods of conserving outdoor painted sculpture to a wider audience, both within and beyond the conservation profession: specifically, that stripping earlier paint systems and repainting is often necessary and expected for objects intended for an outdoor setting. That said, the historical and technological value of original and earlier paint systems—which are completely lost when paint stripping occurs—should not be completely overlooked.

It was noted that there is still widespread surprise when presenting this type of approach at conservation conferences and the like, and it was suggested that a statement could be prepared to address this, which would include the following points:

- All OPS requires repainting at some point.
- The guiding principle to date has been to preserve the original appearance of the sculpture (i.e., the artist's intent) rather than the original coating/material.
- Paint layers play an important protective function for the substrate. Any form of damage, such as cracks, losses, or delamination, can quickly cause corrosion.
- Consequently, the stripping of paint layers and subsequent recoating is accepted as a valid (and ethical) conservation treatment.

It was agreed that in general, the conservation profession now accepts the difficulties in establishing a reliable description of "artist's intent" when dealing with all forms of modern and contemporary art—and OPS is no different. Complications arise in particular when artists change their opinions or when materials and/or application methods alter over time. If repainting is to be carried out, further considerations might be viewed as belonging to the realm of ethical or philosophical decisions:

- Deciding the precise point at which repainting becomes necessary. Such a decision is in part technical (i.e., at what point does the coating stop fulfilling its protective function?) and in part aesthetic and philosophical (i.e., what is our tolerance threshold for damage, and when do we start veering from the artist's intent to an unacceptable extent?).
- Deciding whether original imperfections in the paint or the application method (wrinkling or drips and splashes) should be replicated when repainting, or if the appearance should be improved.
- Deciding, when a sculpture is to be recoated, whether to choose materials similar to the original coatings, even if they had poor aging properties, or to choose more stable but different materials to improve its longevity.
- Deciding whether it is ever acceptable to modify or even replace/refabricate a sculpture's substrate if that might lead to improved longevity of the paint layers and/or reduced structural complications. What would be the status of such a work of art?

Material and Technical Issues

There are a great many issues regarding performance and materiality of the paints used on OPS. Paint systems fail for any number of reasons related to paint composition, application methods, and exposure to harsh outdoor environments, as well as vandalism, and there is much uncertainty surrounding the longevity of currently available paint systems (figs. 5, 6). Although life expectancy is a concept used within the paint industry for generic classes of paints, many industry standards that are applied to the durability of coatings are relevant only to a particular set of application methods and aging conditions, and hence are not always directly applicable to OPS. This is also true due to the higher aesthetic standards typically required for OPS. For example, any change in gloss or color may come well before the point of failure of the protective coating.

Symposium participants felt there is a significant amount of knowledge in the paint industry about paints used for outdoor use, but this information is not well known by conservators (and owners). This would include information on the performance of coatings, on the variability of final appearance, on best application techniques, on availability in different geographic regions, and on environmental regulations (fig. 7). However, even in the paint industry there is no universally accepted method for measuring gloss, texture, color, and composition of coatings, which is problem-

Figure 5 Detail of a work by Tano Festa, showing damage to the black latex paint on concrete from light exposure, rain, and graffiti. Tano Festa, *Monumento per un Poeta Morto*, 1989 (detail). Situated in Fiumara d'Arte, Sicily. Courtesy Fondazione Fiumara d'Arte. Photo: Tom Learner.

Figure 6 Reverse face of water-damaged painted steel. Pristine paint is not just an aesthetic consideration. Failing paint layers can quickly lead to water penetration. On steel sculptures, this can result in rusting and structural weakness. Photo: Tom Learner.

Figure 7 Various black paints are compared to help determine the most appropriate paint for a Tony Smith sculpture. Such comparisons call on the expertise not only of paint manufacturers and applicators but also of conservators and artist's estates.

atic when it comes to documenting paint surfaces and appearance or replicating colors.

Another perceived drawback is the severe lack of options available to the conservator for local treatments; in many cases, it is a question of doing nothing or entirely repainting, or stripping and repainting. In practice a conservator is often called in very late in the deterioration process, once there is an urgent need for intervention, by which time options for local retouching already may be inappropriate. It was recognized that local retouching would become a more attractive option as the performance of primers improves. A number of specific practical issues arose regarding conservation treatments on OPS:

- Difficulties in modifying the color of industrial paints to match an existing color or an aged/degraded coating (Most repainting is carried out straight from the tin.)
- Some brands, lines, or products (e.g., fluoropolymers) offering only a limited range of colors
- Difficulties in treating the substrate / interior structure of a sculpture
- Unknown effects (both chemical and mechanical) of different substrates on paint such as steel, aluminum, concrete, and fiberglass

Special attention was given to the difficulties in treating large-scale sculptures, which have their own set of problems. The pros and cons of getting access to the surface for painting in situ, compared to the wear and tear of deinstallation on both the structure and surface, were discussed. The logistics of either option are complicated and highly expensive, and this clearly also falls under management issues (see next page).

Legal Issues

The lack of clarity on the precise roles, function, and authority of artist's EFSs was perceived as problematic; specifically, the legality of whether EFSs are able to comment on or recommend treatment due to liability concerns and the possibility of enhancing the value of privately owned pieces. It is also unclear how legally binding artist's instructions are, especially for owners. This led to the broader question of who ultimately has the legal and moral "right" to make the decision on a treatment.

Figure 8 Detail of a work by Antonio Di Palma, showing bleaching of the blue paint. Visitors are allowed to walk underneath and on top of this work of public art. The subsequent wear and tear, as well as exposure to extreme sunlight and rain, has led to the bleached appearance of the paint. Antonio Di Palma, *Energia Mediterranea*, 1990 (detail). Situated in Fiumara d'Arte, Sicily. Courtesy Fondazione Fiumara d'Arte. Photo: Tom Learner.

Management Issues

Management issues are clearly essential to the preservation of outdoor sculptures in general (figs. 8, 9). Among the critical issues identified during the meeting was how best to deal with public interaction with the sculpture (including touching, climbing, vandalism, and skateboarding), as well as how best to implement preventive conservation strategies, such as landscaping. A strong need was identified to inform existing and potential owners more effectively about the true conservation implications of acquiring and installing OPS. This would include museum directors, gallery owners, and public art administrators. The high cost of most treatments, and the difficulty in procuring resources and funding, is often one of the major obstacles encountered by OPS custodians.

Participants in the meeting also felt overall that there was a lack of established maintenance programs (or the budgets to implement them) in the public arena, compared to that of many museum collections. It would be desirable to advise artists, fabricators, and other stakeholders on options for improved fabrication *before* works are made, when possible. The legal issue of how binding artist's instructions are was mentioned as a management issue—very stringent requirements from an artist can be time-consuming, expensive, and often even impossible to follow. Finally, the issue of how to respond to the current pressure to use powder coatings as a "onetime" fix, which is also a technical issue, was discussed.

Figure 9 Detail of *Energia Mediterranea*, showing clear evidence of previous, darker paint layers beneath the existing faded blue, alongside deterioration products of the paint and concrete. Photo: Tom Learner.

Communication and Information Exchange Issues

Unfortunately, there is no centralized information hub from which conservators can access information about OPS. All unpublished information, knowledge, accumulated experience, and know-how tend to be stored locally by conservators, fabricators, and owners, and no process is in place to facilitate information exchange. As a result, this information is hardly accessible to the conservation community. In addition, there is very little sharing of knowledge among conservators and related industries, specifically among the paint industry, conservators, fabricators, EFSs, curators, and artists.

Acquiring information from the paint industry was mentioned as particularly problematic. It was stressed that although there is an enormous wealth of knowledge in the paint industry, it is often information that is difficult for conservators to access. Conservators need information on the best choices for coatings, paint composition, and look, color, and gloss, as well as for application procedures and techniques. One of the problems lies in the fact that the conservation field is not a major client, so there are no financial incentives for the paint industry to get involved. In addition, conservators often lack good contacts in the paint industry and have no way of knowing how to get in touch with the appropriate individuals; that is, there is no "Press # for conservation advice" on phone menus!

Certain categories of useful information were also deemed especially hard to share. For example, specifics on treatments are difficult to obtain from conservators, due to liability fears as well as a general unwillingness to talk about failures. Similarly, fabricators wishing to protect trade secrets are often reluctant to share technical information. The meeting participants agreed that there was a need for information from EFSs such as guidelines for treatments and useful contacts in order to facilitate the discussion of treatment options and approaches. Ideally, this information would be available on estate and foundation websites.

Responses

At the end of the symposium's second day, participants were asked to determine ways in which the field might respond to the issues reviewed above and, again, to put these ideas into broad categories. Three categories were proposed: documentation, material and technical, and communication / information sharing. For this paper, suggestions of responses within each category are given as a series of bullet points.

Responses to Documentation Issues

- A system of reference paint swatches for individual artist's paint finishes (for both existing paint materials and more historic coatings) should be developed that can be used to inform paint finishes now and in the future:
  - The paint swatches are to be produced in consultation with EFSs and fabricators as soon as possible in order to take advantage of EFS recollections and memory (fig. 10).
  - Matches with historic coatings need to be made with available paints.
  - It is important that the creation of the swatches be standardized as much as possible (e.g., choice of substrate, size of paint swatch).
  - A clear description and understanding of the limitations of the swatches' use should also be made (e.g., if significant modification occurs to the paint color or texture on application).
- Fabricators, EFSs, and conservators should document examples of failures and unacceptable (to artists) results, as well as results that were successful, as this helps enormously in understanding the artist's intent.
- A central repository of samples and accompanying information should be established:
  - Determine where this repository should be located, for both physical paint samples and accompanying documentation/archival information, specifically the number of sets of paint swatch samples (there should be

Figure 10 Comparison of trial paint swatches from Roy Lichtenstein's studio and a fabricator. The creation of sets of such paint coupons, made to an agreed-upon size and format, was identified during the symposium as a priority of the field.

multiples) and appropriate locations (e.g., individual EFSs, owner of each work).
    – Suggestions for locations include universities, the GCI, the International Network for the Conservation of Contemporary Art (INCCA), and art history or conservation programs.
    – Ensure that no one institution holds all ownership of knowledge / intellectual property and so forth, to ensure easy access to the field.
- Conservators should establish a list of the information they require to replicate a coating.
- EFSs should initiate descriptions or overviews of their artist's original intent and preferences to establish an "overarching philosophy" and/or "aesthetic guidelines" to act as a guide in conservation decision making (fig. 11).
- Conservators should establish a list of significant paint properties (primarily optical/aesthetic).
- Access to archives and files is needed from conservators, especially those who are now retired or less active in the field.
- Conservators should undertake oral histories with fabricators and solicit access to their records. It is important to begin immediately while direct links to deceased artists are still available.
- A series of OPS artist studies should be undertaken and published.

Figure 11 Conservator Frederike Breder (*right of center, in black top*) in discussion with Sophie Webel (*center, with red scarf*), director of the Fondation Dubuffet, as they stand on Dubuffet's sculpture *Jardin d'émail* at the Kröller-Müller Museum. Such communication between conservators and foundations is needed to document artists' original intent and preferences. Photo: Tom Learner.

Responses to Material and Technical Issues

- Develop improved contact points with the paint industry by establishing a small think tank and organizing further meetings with industry leaders to discuss specific issues.
- Establish agreed-upon definitions of gloss, color, and paint failure.
- Access compositional information on paints.
- Develop improved partial touch-up treatments; in theory, these will become more common as the durability of primers is improved.
- Although information is needed on all the paints available, it is important to establish priorities (e.g., what paint materials conservators need to know about).
- Tap into existing technical information on paint systems (the National Association of Corrosion Engineers [NACE], the Society for Protective Coatings [SSPC]).
- Develop a more universally adopted method for describing color with the industry than code numbers (maybe the L*a*b system, or an interface between that system and those used by paint companies).
- Develop improved methods for analyzing existing paint layers (fig. 12).
- Clarify hazardous-material issues.
- Establish methods and guidelines for shipping paint nationally and internationally.
- Develop a series of professional workshops for conservators on, for example, paint choice and basic information on the various classes of paint, and methods of paint application and their effect on appearance.

Responses to Communication and Information Sharing Issues

- Utilize high-profile international projects to entice interest from the paint industry. Interest could also be generated using the fact that outdoor painted sculptures are different and more

Figure 12 Rachel Rivenc takes a measurement of paint layers using a handheld FTIR instrument on Roy Lichtenstein's sculpture *Three Brushstrokes*. © Estate of Roy Lichtenstein.

challenging than the usual applications. It was agreed that one should not underestimate or overlook the power derived from the prestige of art institutions!

- Utilize awareness of local OPS in towns where large paint companies have offices or factories.
- Engage a broader range of expertise: professional applicators, paint designers, and coatings inspectors, needed because OPS conservators mostly function as contractors and facilitators.
- Create simple instructions on paint application and how to interpret datasheets and other information from the paint industry.
- Develop common language to facilitate communication between the paint industry and conservators.
- Develop workshops for conservators on how to document surfaces.
- Disseminate results of the 2012 focus meeting.
- Create a specialty group, perhaps a subgroup on OPS within the Objects Specialty Group of the American Institute for Conservation or within INCCA.
- Use existing online resources, such as INCCA and conservation lists, to promote information sharing between conservators through web platforms and discussion groups. Identify shortcomings.
- Tap into public art management resources.
- Educate stewards of the works about the need to involve conservators.
- Provide access to information that could have the added benefit of influencing living artists and current public art.

Possible Priorities

Finally, drawing from the list of responses, participants were asked to identify priorities for the field, split into short-term, more easily achievable undertakings, and longer-term projects. It is likely that different parts of the profession will have different priorities, so this section is not intended to be a definitive statement for the conservation profession. Rather, it records the particular thoughts of the group and is intended as a starting point.

Short-Term Projects

- Explore the possibility of developing standards and guidelines for producing paint coupons and swatches (size, substrate, etc.).
- Develop guidelines for characterizing and documenting these coupons and swatches (gloss, color, etc.).
- Conduct a broad survey of coatings used on OPS.
- Develop contacts within the paint industry of those interested in forming collaborations.
- Compile a list of EFSs with up-to-date contact information.
- Create and circulate a statement about the specific needs and expectations of conserving OPS and raising awareness in the conservation

field and among related professions and stakeholders.
- Create a basic OPS bibliography to be circulated online and expanded with the field.
- Work with individual EFSs to collect information on each artist, including published articles, archival information, photos, paint samples, and conservation reports.
- Design a questionnaire for artists and EFSs, highlighting the information conservators need, in order to replicate a coating.
- Establish a list of optical/aesthetic paint properties to aid EFSs in formulating aesthetic guidelines for the conservation field.

Long-Term Projects

- Create a central repository for all information needed for OPS conservation, including physical paint swatches and reference samples as well as supporting documentation and literature.
  - Create paint samples following agreed-upon protocols, in multiple editions and stored in appropriate, multiple locations.
  - Create an OPS database with information on artists, fabricators, and archives that is international, web-based, free, and fully searchable.
- Create a professional specialty group for OPS.
- Develop improved relationships with the paint industry.
- Develop improved techniques for local treatment and inpainting.
- Create a written, detailed pictorial standard of paint performance by generic class that can be used as a guide for coating selection.
- Develop workshops for conservators on the following suggested topics:
  - Working with the paint industry and interpreting datasheets
  - Paint application techniques and gloss/texture/color control
- Produce relevant publications such as the following:
  - Publications on individual artists (e.g., along the lines of the GCI series *The Artist's Materials*)
  - An overall book on OPS conservation issues and approaches
  - A booklet offering guidelines on basic care and maintenance of OPS (i.e., an owner's manual)—fabricators could help circulate the booklet as pieces are made

Conclusion

It is hoped that the discussions from this meeting will assist the conservation profession in moving forward. For a full report and list of participants, go to: http://www.getty.edu/conservation/our_projects/science/outdoor/outdoor_focus_mtg.html

As stated in the introduction to this paper, the results from the meeting simply reflect the proposals and conversations that took place between the invited participants, and should therefore not be viewed as anything more formal. However, by gathering the key discussion points into a single place, the report may serve as a useful starting point for the profession to consider how best to advance the conservation practice of OPS.

Participants certainly welcomed the opportunity to interact with colleagues and others in the field, to share their preoccupations and the issues they routinely face, and to brainstorm about possible responses. It was clear that improved dialogue is needed between conservators dealing with OPS and between conservators, the paint industry, and artist's estates, foundations, and studios. Some of the responses suggested will help the GCI devise its research agenda and strategy for its outdoor sculpture project in order to service the field as efficiently as possible. Other participants are pursuing their own research. This symposium definitely encouraged dialogue, synergy, and information sharing.

As Good as New: On the Recoating of Shinkichi Tajiri's *Square Knot* (1974) in Venlo, the Netherlands

Lydia Beerkens and Ryu Vinci Tajiri

Abstract: *The polyester sculpture* Square Knot *(1974), by Shinkichi Tajiri, had suffered from being outdoors for decades. Its white coating was so worn that the material—glass fiber–reinforced polyester (GRP)—had become compromised by water and dirt entering the inner construction. Regular cleaning and repainting were no longer sufficient. After consultation with the Tajiri family, an extensive treatment was decided upon that included sanding down all paint and ground layers. The applied high-performance epoxy filler has strengthened the GRP structure for the long term, while the new polyurethane white coating will last for at least ten to fifteen years.*

Background

Born in 1923 in Los Angeles to Japanese parents, the sculptor, photographer, and filmmaker Shinkichi Tajiri received his first training from the American sculptor Donal Hord (1902–1966) in 1941. Following the Japanese attack on Pearl Harbor on December 7, 1941, Tajiri was one of more than 100,000 Japanese and Japanese Americans forcibly incarcerated in detention camps beginning in 1942. In 1943 Tajiri was allowed to leave the camp Poston III in Arizona in order to join the 442nd Regimental Combat Team of the US Army. His unit was deployed to Italy and France during World War II. While serving in Italy, Tajiri was severely wounded and removed from combat. After being discharged from the army in 1946, Tajiri attended the Art Institute of Chicago on the GI Bill before moving to Paris in 1948 to study with the sculptor Ossip Zadkine and the painter Fernand Léger. He came into contact with the artists group Cobra and participated in the first International Exhibition of Experimental Art in 1949 at the Stedelijk Museum Amsterdam.

In the 1950s Tajiri began producing his Junk sculptures and One Day sculptures, utilizing material found at a metal scrap heap near the river Seine in Paris. He started experimenting and developed new casting techniques that resulted in the Drippings and the Red Molar Brick series of works. In 1956 Tajiri relocated to Amsterdam, where he lived and worked until 1962. The themes in Tajiri's work reference his wartime experience and his Japanese heritage and reflect the important changes occurring in society at the time. These themes are manifested in the subject matter of his Seed, Germination, Fighting Machines, Ronins, and Warriors series.

Tajiri once said that his "sculptures consist of three components: velocity, erotics, violence…in that order" (Stufkens et al. 2003, 59). His move to Castle Scheres in Baarlo, in the southeastern Netherlands, in 1962 gave him the space to make large-scale sculptures in various metals such as aluminum, bronze, brass, steel, and cast iron. He was aided by two assistants. Tajiri stated: "I wanted to make a sculptural statement that would cut through all the mystification I felt was invading the art world. Sculptures that would be instantly communicable to everyone and at the same time formally timeless" (Tajiri 1993, 74). At this time he began work on the Knots series. Always on the lookout for the latest in materials and industrial techniques, he developed a method to produce huge polyester Knots in 1967. Throughout the remainder of his career, Tajiri continued to revisit and explore the theme of the Knots in various media (Freed 1970) (fig. 1).

Demanding a bigger voice in school politics, students at the Hochschule der Künste Berlin (now Berlin University of the Arts) who had seen the artist's two large polyester Knots at Dokumenta 4 (1968) named him as a candidate for a newly opened teaching position. Tajiri was offered the professorship in 1969 and accepted it. During this twenty-year period of commuting between Baarlo and Berlin, he searched for a new medium that would yield the excitement of rapid results. He decided to investigate the possibilities of photography, which resulted in daguerreotypes, stereo- and panorama photography, and his Berlin Wall project. This body of work (1969–70) consists of 550 photographs and documents the entire 43 kilometers of the inner-city Berlin Wall.

In the mid-1990s Tajiri returned to the theme of the warrior/*guerrier*/samurai, albeit in a different form. When he received a commission from two interest groups for Dutch military personnel in connection with the abolition of conscription, Tajiri made a bronze Sentinel (1996), now facing the Ministry of Defense in The Hague. The theme of the warrior, which had served as a catharsis for the horrors of war, had come full circle. A pacifist, the artist erected this Sentinel as a peacekeeping guardian to make a universal antiwar statement. In 2007 Queen Beatrix of the Netherlands unveiled four large-scale (6 meters tall) cast-iron Sentinels overlooking both sides of the bridge over the Maas River, near Venlo (Vercauteren 2007). This landmark was Tajiri's last commission for public space. Although foremost a sculptor, he experimented and excelled in other artistic media throughout his career, including painting, filmmaking, video, computer arts, and printed matter. Tajiri passed away in 2009 at the age of eighty-five.

Tajiri's studio, archive, library, and workplace, including his machinery, materials, models, and molds, today remain at Castle Scheres, where he lived and worked for almost half a century, and are operated by

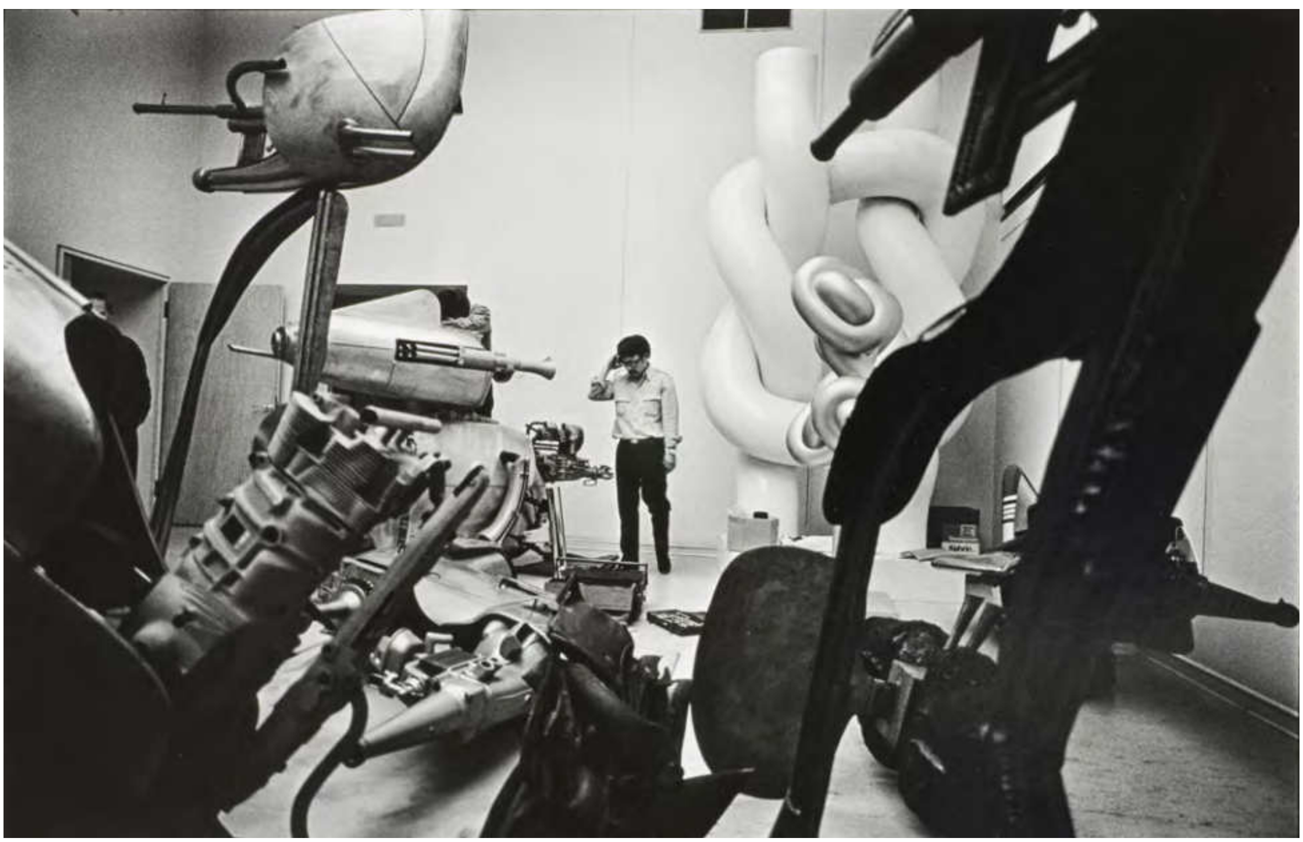


Figure 1 Shinkichi Tajiri among his Knots and Machines creations at the exhibition *Seltsame Spiele*, Stedelijk Museum Amsterdam, 1967. Courtesy Tajiri Foundation. Photo by © Leonard Freed / Magnum.

the Tajiri Foundation. Together they constitute a rich collection for research into the artistic life and work of Shinkichi Tajiri.[1]

Tajiri's Knots Series

The sculptural series Knots evolved from 1967 onward. The polyester sculpture *B.R.M.* (1967) marks a turning point in the development from Machines to Knots in both form and material. Tajiri constructed his Machines by welding together found material, steel, aluminum, and chrome parts salvaged from cars and motorcycles, adding in edgy elements such as colorful Plexiglas. At the end of the 1960s, when the new, stronger construction material GRP came on the market, Tajiri started to use it in his sculptures. This entailed an entirely different way of making sculptures, as the polyester constructions are fully handmade with the use of molds also produced by hand. Every sculpture was constructed piece by piece in Tajiri's studio at Castle Scheres, then assembled and finally painted on the courtyard.

Karl Kleimann, Tajiri's assistant, explained the production method in detail.[2] Following an initial design and sometimes a small clay model, extensive work was put into producing a scale model of plywood and chipboard elements. The wooden elements were then put to the test as the Knot was assembled by inserting disks of polystyrene foam to fit the connecting tubes together. Based on this scale model, molds for each geometric segment of the Knot were made, a separate mold for every curvature, every bend, and every straight part. Next, polyester tubes were produced in these molds, and the final sculpture was assembled by putting together all segments in a specific order. Tajiri and Kleimann referred to this working method as the "donut" technique.[3]

This system of curves and bends functioned in a modular way, allowing a variety of knot shapes. Kleimann explained that the Knots were produced with specific tube sizes in a diameter of 8, 15, or 40 centimeters depending on proportion and scale (fig. 2). An attempt at a 100-centimeter-diameter tube failed, as this size proved too large to handle.

The assemblage of every polyester segment into the adjacent ones was done by bridging the pieces temporarily on the outside with small plates and screws. After laminating the edges together with GRP from the inside, the bridging was removed and the remaining screw holes were filled in. A series of bolts and nuts on the inside fixed the two long vertical tubes exactly parallel in position. After painstakingly sanding down

Figure 2 Tajiri's assistant Karl Kleimann (*left*) and daughter Giotta work with the wooden model elements and the molds and tubes in GRP of different diameter sizes used in the production of the Knots. Photo: Lydia Beerkens.

Figure 3 Shinkichi Tajiri, *Square Knot*, 1974. Glass fiber–reinforced polyester. Ht.: 6 m. Venlo, the Netherlands. Photo: Lydia Beerkens.

Figure 4 Shinkichi Tajiri, *Friendship Knot*, 1980. Glass fiber–reinforced polyester. Ht.: 6 m. Little Tokyo, Los Angeles. Photo: Shinkichi Tajiri.

all surfaces until smooth, the gray ground layer and white surface coating were sprayed on, resulting in a high-gloss, perfectly smooth, bright white finish, as seen in Tajiri's 1981 photographs of *Square Knot* featuring nude model Joyce (Stufkens et al. 2003, pt. I, p. 62, photographs c, d). The production of one large polyester sculpture for outdoors would thus take three to four months of work. There was no reason for Tajiri to have a handicraft look neither in the GRP nor in the paint layer. It was essential for him to have the Knots resembling an actual knot in their final shape: "What you see is what it is" was his goal (Stufkens et al. 2003, pt. I, p. 9). A total of ten polyester Knot sculptures were produced from 1967 to 1975, including *Square Knot* (fig. 3). *Friendship Knot*, for Los Angeles, was made later, in 1980 (fig. 4).

Background of *Square Knot*

Square Knot was produced in 1974 following the technique outlined above. The 6-meter-tall sculpture is made as one piece, inclusive of its oval-shaped base, which allows the sculpture to be secured to a large concrete block under ground level. After residing in Tajiri's sculpture garden, *Square Knot* traveled to several international

Figure 5 Detail of *Square Knot*, showing wear and damage to the paint layers on the oval base. Photo: Lydia Beerkens.

Figure 6 Detail of *Square Knot*, showing wear on the top of the knot. Photo: Lydia Beerkens.

exhibitions and was installed in front of the America House in Berlin for some years. It finally was acquired by the city of Venlo in 1991 and positioned prominently at the entrance to Venlo's Museum van Bommel van Dam, devoted to modern art. Over time the surrounding trees deposited leaves and moss on the sculpture's top surfaces, while weather and rain left stains and green drippings right underneath the Knot. Gravel on the sidewalk induced wear and scratches on the polyester base, and dogs, bicycles, and graffiti damaged the paint layer up to 2 meters from ground level. In 2011 the paint coating was in such a poor state—cracks, lifting paint, air pockets, paint loss, and chalking of the surface and touched-up areas—that the appearance of *Square Knot* had changed from formal and strong to poor and dirty (figs. 5, 6).

Regular maintenance in the past by the city of Venlo included surface cleaning, spot repair, and repainting of the full surface. But with the danger of water intrusion into the GRP material, which only worsened the sculpture's condition, the urgency for a much more thorough intervention became clear.

The goal of an intervening restoration was twofold: to restore the white formal look of the piece for at least the next ten years, and to preserve the sculpture's GRP for the long term. A major treatment plan was developed in full agreement with the Tajiri Foundation and included complete removal of the original coating.

Treatment

Preparing *Square Knot* for the forthcoming decades outdoors required a new, stronger, sustainable coating of the highest quality available. To guarantee optimal adherence and long-term performance of the new coating, removal of all the old coating layers down to the GRP surface was inevitable. The sculpture's worn white paint and gray ground layer already showed signs of deterioration.

The sculpture was dismantled from its base and transported to a firm specializing in sandblasting.[4] Removing the paint revealed the GRP surface of *Square Knot*. The white original filling material visible between segments and in the screw holes indicated that the work had been created in parts (figs. 7, 8). By counting the lines in *Square Knot*, the work was determined to have been built up from more than forty separate elements

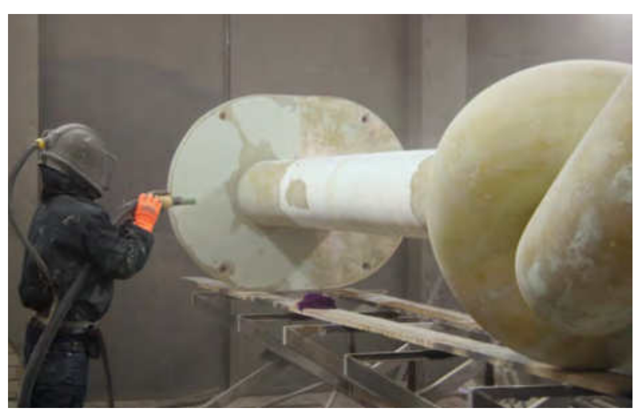


Figure 7 Sandblasting was used to remove the old paint layers. Photo: Lydia Beerkens.

Figure 8 *Square Knot*, after removal of the old paint coatings, revealing the GRP of the sculpture. The white original filling material between segments and in the screw holes shows that the work had been produced in parts. Photo: Lydia Beerkens.

Figure 9 Detail of *Square Knot* during recoating, showing ground layers in gray epoxy. Photo: Lydia Beerkens.

in GRP. The sculpture was then transferred to STALA Innovatie B.V. for recoating.[5]

Recoating *Square Knot*

Recoating an aged GRP structure for long-term outdoor conditions is a specialized job combining the best paint-coating system available with optimal execution by professionals. To achieve and guarantee the best results, the GRP object needs to be dry, with no enclosed moisture, and kept at a constant temperature and humidity equal to the working conditions for the spraying of the coatings. Proper spraying conditions and drying and curing times must be observed according to the warranty provided by the paint producer.

Upon arrival at STRATA Innovatie, *Square Knot* was kept for several days at a temperature of around 26 degrees Celsius to ensure the GRP was fully dry; moisture content was monitored during the process. To strengthen construction of the base, extra layers of glass fiber and polyester were applied on the base's worn-down surface. All old fillings and connections were checked for strength and condition.

The selected coating system for both the ground layers and the final white coating is the so-called Double Coat system produced by De IJssel Coatings B.V., a Dutch paint company specializing in coatings for outdoors and shipping and for protecting metals and GRP.[6] Several layers of two-component epoxy filler coating were sprayed on, interspersed with the meticulous sanding away of 80 to 90 percent of each layer to eliminate any unevenness, tiny flaw, or air pocket in order to maintain the perfectly round shape of the tubes and the knot in the artwork and a uniformly smooth surface on which to apply the white coating (fig. 9).

Applied in several layers, the white coating is a polyester polyurethane two-component lacquer system with a high scratch resistance and good color and gloss retention (fig. 10). During discussion of surface gloss, STRATA coating expert Cees van Rijen argued for a

Figure 10 *Square Knot* in the spraying booth after applying the new white coating. Photo: Cees van Rijen.

Figure 11 *Square Knot* after completion of recoating, at an exhibition at Castle Keukenhof in summer 2013. Photo: Lydia Beerkens.

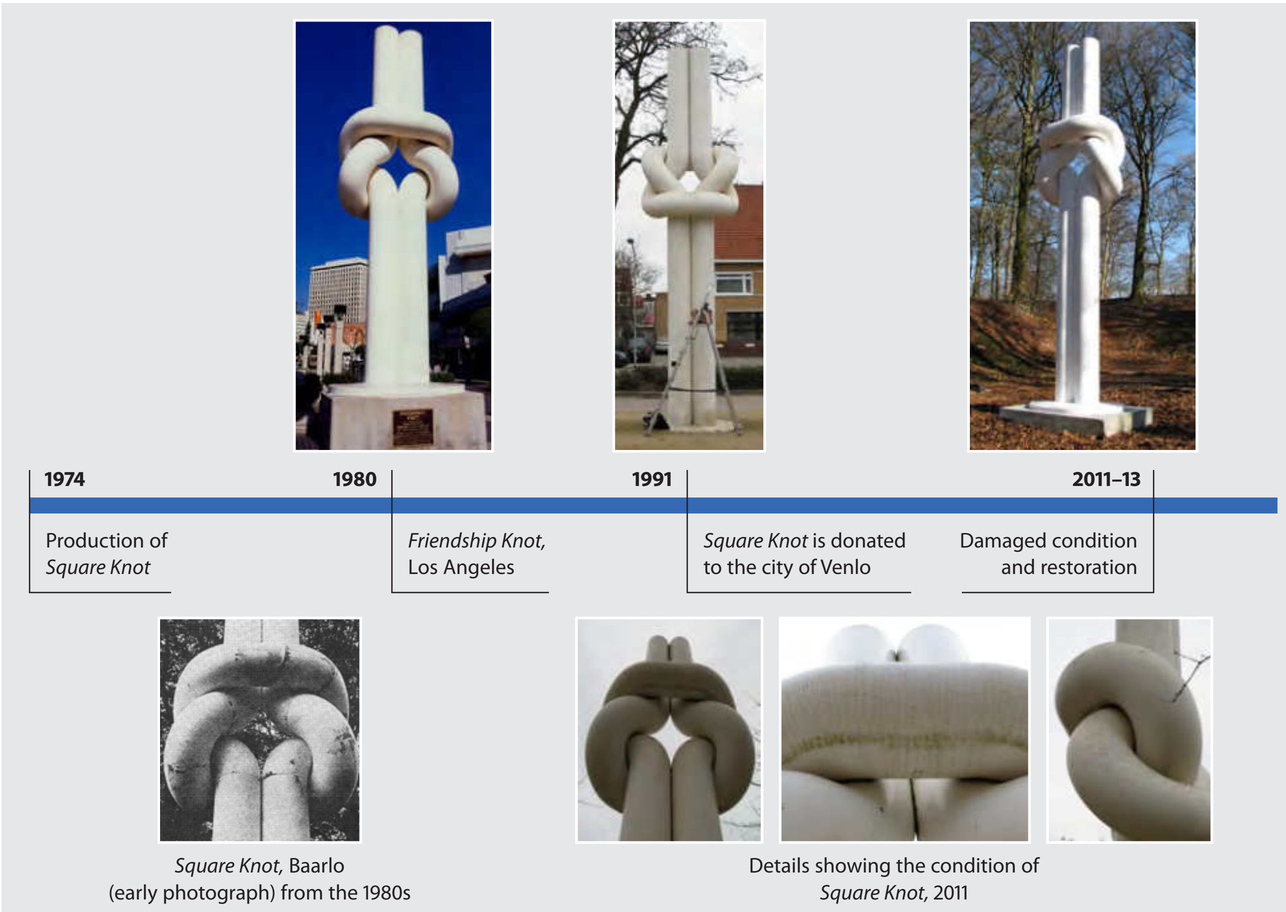
Figure 12 Detail of fig. 11, showing the new white coating.

semi-gloss rather than a matte coating. After a few years, the surface gloss of any paint coating outdoors diminishes slightly anyway; the higher the gloss, van Rijen explained, the more repellent the surface, resulting in higher resistance to developing green debris on the surface (figs. 11, 12). In this sense the sculpture will reach its optimal aesthetic appearance in a few years, extending the period of time before recoating becomes necessary. Regular maintenance, as in a simple yearly cleaning, will contribute as well.

Justifying a More Costly Solution

Over the last few years, the coating of *Square Knot* has started to show clear signs of deterioration, presenting as chalking, development of cracks, and blistering and delamination. However, the decision to implement a more invasive (and costly) treatment rather than painting over the surface in situ yet again took time and persuasion. The imminent risk of intrusion of rain and dirt into the glass fiber layering of the GRP, with the expected damage and dissembling of the artwork's inner material, proved to be the most convincing argument to forgo the regular maintenance approach in favor of the more expensive solution.

In general, all outdoor painted works—artworks, ships, bridges, and so forth—*do* need recoating every ten to fifteen years. In retrospect, *Square Knot* must have had similar intervals of cleaning and repainting. The key issue here is to correctly determine when the cleaning of a surface, followed by light sanding and an extra layer of paint, will suffice, and at what moment this layer-over-layer repainting tactic fails. The sum total of overpaint layers, once they are too thick, causes delamination of the whole package from the sculpture's surface in larger areas. This is the point of no return and marks the start of damage by water intrusion.



Timeline for Shinkichi Tajiri's *Square Knot* (1974).

Conclusion

In line with the ideas of Shinkichi Tajiri, the main goal for the artist's heirs was to restore *Square Knot* to pristine condition, as wear clearly reduces the aesthetics of the formal shape of the sculpture and ultimately endangers the entire artwork. Of importance to the city of Venlo, owner of the work, was having the artwork in lasting condition for the next decade. In the first years after restoration, there will be little adherence of dirt and green debris. As the paint surface wears slightly over time, cleaning and clearance of debris will provide good maintenance. Renewal of the paint may ultimately be necessary, but the two-component epoxy ground layer will stay strong and in good condition, strengthening and protecting the GRP permanently. From this perspective, the cycle of "repainting" every ten to fifteen years is reduced to recoating the surface only, eliminating the need to sandblast all coatings down to the GRP surface. This is an improvement over the spray-paint coating applied in 1974, when the work was made. The treatment can be applied to other Knot sculptures and possibly other GRP sculptures, as the epoxy ground layers available today are high performance and sustainable.

The role of the conservator is essential in deciding what course to take, in communicating with the industry, in assessing the overall aesthetic effect of a new paint layer on the artwork, and in collaborating with both the owner and the artist or the artist's representatives. Ultimately, the conservator advocates the long-term preservation of the outdoor painted artwork in terms of decades rather than in years.

Acknowledgments

The authors wish to thank Denise van Meegeren, city of Venlo, and Gabi Stoffels, Museum van Bommel van Dam, for their kind cooperation in the process prior to the conservation of *Square Knot*; Cees van Rijen, STALA Innovatie B.V., for his knowledge and advice during treatment; Karl Kleimann, for sharing inside information about the actual making process of the Knots; and finally, the Shinkichi Tajiri Foundation, especially Giotta Tajiri, for providing background documentation and archival photographs.

Notes

1. The Tajiri Foundation is represented by Tajiri's daughters, Giotta and Ryu. For more information, visit the Tajiri Foundation website at www.shinkichi-tajiri.com.
2. Karl Kleimann and Giotta and Ryu Tajiri, interview with the author, Baarlo, the Netherlands, August 23, 2013.
3. *Künstlerische Techniken* (Artists' Techniques), the 1970 documentary produced by Albert Korgmann for West German broadcasting on Nord-Deutscher Rundfunk (NDR), shows Tajiri and Kleimann at work in the studio at Castle Scheres, producing Knots from molds.
4. Removal of all paint layers by sandblasting was performed by Straalbedrijf Coppens, Bladel, using 6 bar pressure with a nozzle of 8 mm and a blasting mixture of dust and sand of 1 to 0.1 mm.
5. Recoating was carried out by STALA Innovatie B.V., Alphen, Noord-Brabant, the Netherlands (www.stala-innovatie.nl).
6. The coatings used by De IJssel (www.de-ijssel-coatings.nl) were High Build 2 Component Epoxy Coating and Double Coat Polyester DD Lacquer (Color DC 800 White).

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Conservation of Nam June Paik's *32 Cars for the 20th Century: Play Mozart's Requiem Quietly*

Zeeyoung Chin

Abstract: *From 2011 to 2013, the Conservation Department of Leeum, Samsung Museum of Art, in Seoul, Korea, undertook a restoration project of a grandiose work by Nam June Paik,* 32 Cars for the 20th Century: Play Mozart's Requiem Quietly. *This outdoor installation piece, dating from 1997, consists of thirty-two old American automobiles from the 1920s to the 1950s, painted silver and filled with plastic or wooden television casings and cathode-ray tubes from the artist's studio. These unusual materials, confronted with the challenges of the outdoor environment, necessitated a long process of decision making for restoration, future conservation, and presentation.*

Introduction

The work of the South Korean-born artist Nam June Paik (1932–2006) titled *32 Cars for the 20th Century: Play Mozart's Requiem Quietly* has raised many questions regarding its conservation in consequence of the complex elements that have come into play. The conservation of the variety of materials used, their deterioration in the work's outdoor environment, and the dilemmas of presentation were some of the challenges that museum conservators faced. The Conservation Department of Leeum, Samsung Museum of Art, in Seoul called attention to the deteriorated condition of the artwork and consulted with curators, registrars, and painters to decide on its future. The restoration project that began in August 2011 consisted of eliminating sources of further deterioration, restoring the appearance intended by the artist, and rethinking the presentation in its outdoor environment.

Background of the Artwork

Below is a timeline for the work.

- 1997: *32 Cars for the 20th Century: Play Mozart's Requiem Quietly* premieres in Münster, Germany.
- 1998: The work is accessioned by Leeum, Samsung Museum of Art, Seoul, and installed (on loan) at Samsung Transportation Museum, Yong In.
- 2000: The entire work is spray painted over with silver metallic paint.
- 2002: A selection of sixteen cars is loaned to Rockefeller Center in New York City, June 26 through September 2.
- 2003: Repairs and consolidations are made to some of the cars. General spray painting is done again with silver metallic paint.
- 2004: A selection of sixteen cars is loaned to the Sydney Festival, Australia, January to February.
- 2006: Repairs and consolidations are made to some of the cars; general spray painting with silver metallic paint.
- 2008: General spray painting with silver metallic paint.

Figure 1 Installation of *32 Cars for the 20th Century: Play Mozart's Requiem Quietly* in front of the Schloss as part of the exhibition *Skulptur Projekte*, 1997. The cars are installed in four groups according to year of production. Courtesy of the Nam June Paik Estate. Photo: Roman Mensing, artdoc.de.

- 2009: Repairs and consolidations are made to some of the cars; general spray painting with silver metallic paint.
- 2010: Localized overpainting is performed.
- 2010: A 1957 Metropolitan is on loan for the month of August at the Nam June Paik Art Center, Yong In.
- 2011: Restoration project commences in August and is completed in January 2013.

32 Cars for the 20th Century: Play Mozart's Requiem Quietly is an installation piece made for the decennial exhibition *Skulptur Projekte* in Münster, Germany, in 1997. Installed in front of the Schloss, a baroque castle built in the eighteenth century, the work was one of many presented by more than seventy participating artists (fig. 1).

The artwork consists of thirty-two old American automobiles, all painted with aluminum enamel paint of the type used on wire fences and radiators. The vehicles are arranged in four groups of eight according to year of production—1920s, 1930s, 1940s, and 1950s—in a circle, line, square, and triangle, respectively. They symbolize the revolutionary history of technology in the twentieth century (Buβmann, König, and Matzner 1997). The oldest is a 1924 Willy, the newest a 1959 Buick. If these cars are meant to represent the first half of the twentieth century, the elements installed inside the cars would represent the second half: the television age. The cars are filled with discarded electronic equipment from the artist's studio: glass cathode-ray tubes, disassembled TV sets, new and used television casings made of plastic, and television casings made of wood. These are stacked and piled on the front seats of the cars. Only the windshields are left unpainted to let the viewers see what is inside (fig. 2).

According to the artist's notes, Mozart's Requiem was to be played during the exhibition "from sundown to 11.30pm until people complain about it" (Buβmann, König, and Matzner 1997, 305). With this work, Paik himself had orchestrated his own majestic Requiem for the twentieth century as an homage to its greatest inventions.

The concept behind the piece has been well documented in a written interview with the artist in 2011 by Mark Patsfall, Paik's technical adviser and assistant for more than fifteen years who was in charge of the installation in Münster. He describes the installation process as follows:

> Nam June's instructions were to make a piece using 32 cars, 8 from the 20's, 8 from the 30's, 8 from the 40's and 8 from the 50's. The cars would have speakers placed in each group which would play Mozart's Requiem just loud enough to be heard when you approached each group. Myself and the artist's dealer, Carl Solway, travelled about the country, chose the vehicles, photo-

Figure 2 The windshield of each vehicle is left unpainted to allow viewers to see what is inside. Photo: Roman Mensing, artdoc.de.

Figure 3 A student (*foreground*) applies silver paint with a brush on one of the 32 cars during installation of Paik's work in Münster. Photo: Roman Mensing, artdoc.de.

graphed them, and upon the artist's approval purchased them. At this point the cars were shipped either to Cincinnati or LA, loaded into shipping containers and shipped to Bremen[,] Germany, from which they were trucked to Münster. The artist wished the cars painted to make the installation a "whole"; he did not want it to look like a junkyard. At first he wanted the cars painted black, but when it was pointed out that this would generate a tremendous amount of heat, both inside and outside the vehicles, he decided silver was better and would also make the cars appear like old tin toy cars, an idea which amused him. His instructions were to paint the cars totally (including tires and all windows except the windshield), by hand, with brushes and no spray paint was allowed [fig. 3]. Inside the cars we were to place the leftovers from his video sculptures, old cabinets and chassis from old TV's and radios. Some of this stuff came from his New York studio and some from his studio here [in Cincinnati]. The piece was to be a Requiem for the 20th century. Most of these installation instructions were conveyed to me at a meeting at his place in Miami in the winter of '96 or via phone calls, so really there are no notes or an "instruction" manual for the piece, although I still have the photos that we used to choose the cars from.[1]

After the 100-day exhibition in Münster ended, *32 Cars* was purchased by Leeum, Samsung Museum of Art.[2] It was installed on the front square of the Samsung Transportation Museum, an automobile museum in Yong In, 50 kilometers from Seoul, where it remains today on long-term loan.

Condition of the Artwork

In 2011 the condition of the artwork at the Samsung Transportation Museum (STM) was assessed. The cars' structures were found to have weakened considerably due to uncontrolled corroding of the metal body. In unprotected areas such as the underside, the interior, and the area under the hood, corrosion was so bad that the structural stability of the cars had been compromised (fig. 4). Paint was flaking in large areas where the underlying corrosion layers had expanded in size and volume. Moreover, the surfaces of the window glass and the chrome-plated parts were not sufficiently adherent for the paint, resulting in extensive flaking.

STM receives more than 300,000 visitors annually. A large percentage are students on school field trips; children pour out from buses and race toward Paik's cars in the museum square, climbing on and exploring the vehicles before they enter the museum itself (fig. 5). Small protruding elements have been easily damaged, and many children (and adults as well) are tempted to pull on the flaking paint. Because visitors are allowed to

Figure 4 View of the underside of a 1955 Pontiac, showing corrosion of the car body. Photo: Zeeyoung Chin.

Figure 5 Schoolchildren explore Paik's installation during a school field trip to the Samsung Transportation Museum on October 15, 2008. Photo: Zeeyoung Chin.

walk past and through the installation, as was the case in Münster, many naturally climb on the step boards, bumpers, and hoods to take photographs. The cars' structures weakened over time, putting not only the cars at risk but the safety of the visitors as well.

The climate in this area, like that in other parts of South Korea, changes drastically with the seasons. Winters can be especially harsh, with low temperatures

Figure 6 Views of Paik's installation under various climatological conditions. *Clockwise from top left:* winter (January 2011), summer (August 2010), summer (August 2010), and fall (November 2012). Photos: Zeeyoung Chin.

and heavy snowfalls. Summers bring torrential rains and high temperatures, and spring and fall see occasional yellow duststorms that come in from across the Yellow Sea (fig. 6). Data loggers installed inside two of the cars recorded relative humidity and temperature for one year. The fluctuations were impressive: the highest relative humidity was 97 percent, the lowest 9.4 percent. The highest temperature was almost 70 degrees Celsius, the lowest –19.7 degrees Celsius (figs. 7abcd).

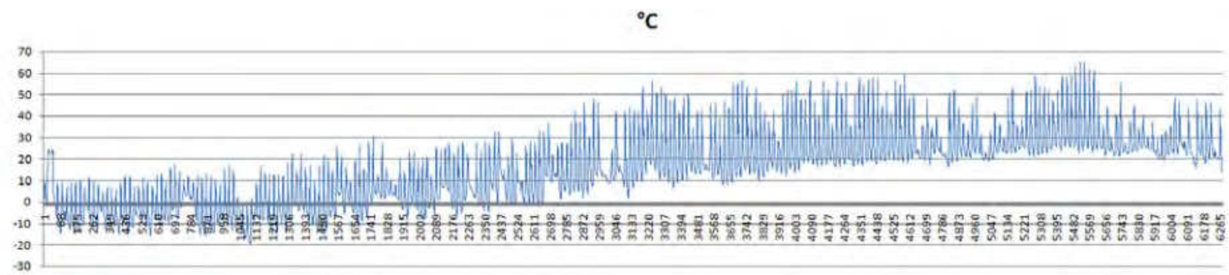

Figure 7a Temperature as recorded throughout the year of 2012 inside a 1939 Plymouth in Paik's installation.

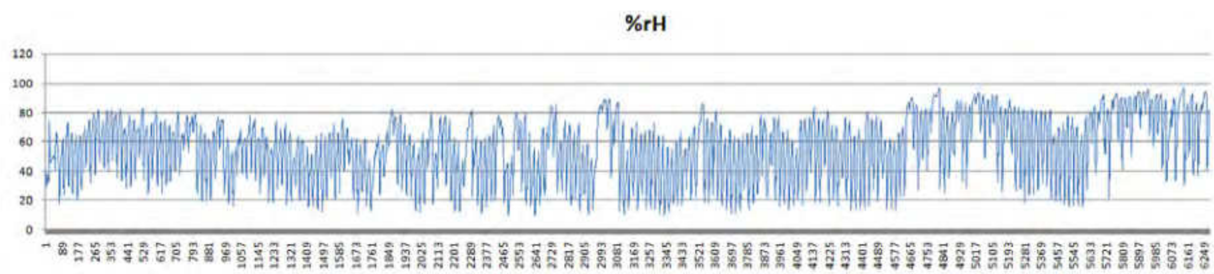

Figure 7b Relative humidity as recorded throughout the year of 2012 inside the same 1939 Plymouth.

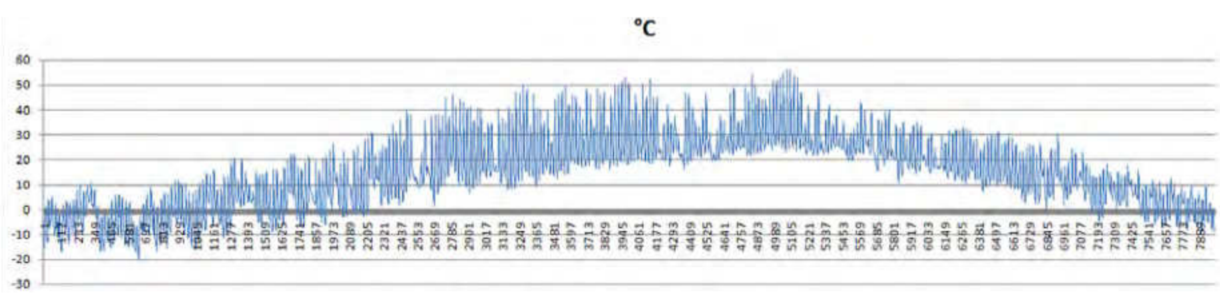

Figure 7c Temperature as recorded throughout the year of 2012 inside a 1937 Mercury in Paik's installation.

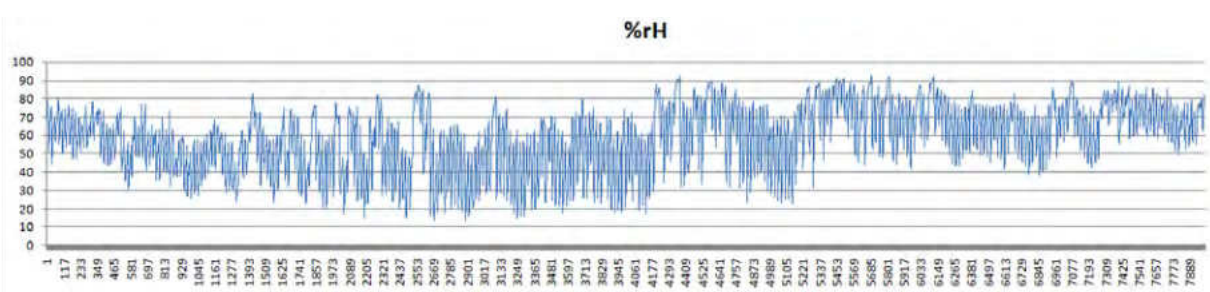

Figure 7d Relative humidity as recorded throughout the year of 2012 inside the same 1937 Mercury.

Figure 8 Flaking paint on a 1926 Ford T coupe in 2011, showing that covering over flaking and corrosion with more paint only worsened the deformation of the artwork. Photo: Zeeyoung Chin.

Figure 9 View of the interior of a 1937 Mercury during condition assessment. The elements were left unpacked over several years and were degrading. *Left:* Driver's side door. *Right:* Front passenger door. Photo: Zeeyoung Chin.

The cars had been spray painted with silver metallic paint approximately every two years since 1998 in an attempt to cover up the flaking and the corrosion. Predictably, this overpainting did not solve the fundamental problem of corrosion expanding at the metal-paint interface. The thickened paint, along with the flaking paint, had deformed the visual aspect of the artwork to a great extent (fig. 8).

Determining the Course of Treatment

Based on the condition assessment, the damage to the artwork had reached such a degree that regular maintenance of localized treatment or painting could no longer effectively cover up the deterioration. A more comprehensive approach involving consolidating the fragile structures and addressing the causes of deterioration was needed, and the cars were removed from their display positions to facilitate a more thorough examination and treatment. The present condition of the piece was brought to the attention of curators, conservators, registrars, and painters who would decide whether to conserve, how to conserve, and when and how long to conserve.

It was determined that the artwork was very poorly documented and had been badly neglected since its installation at STM almost fifteen years earlier. Some of the interior elements were still packed in their wrappings from 1997 and were in an advanced state of deterioration. Car seats were covered with mold, and the foam inside the seats was crumbling (fig. 9). Wooden floorings and structures were weakened and falling apart. Some doors remained sealed, others had never been opened. Furthermore, only a small number of photos and installation plans were located in the archives of Leeum, Samsung Museum of Art, and no detailed description of the installation had ever been passed on to the museum.

Museum staff were alarmed to see that the artwork was on its way to disappearing. It was incontestable that the artwork had an art historical, symbolic, and aesthetic value. Although Paik had chosen materials that were used, discarded, and already heavily corroded, it is not likely that he intended the work to be ephemeral, site specific, and "for single-use only." In fact, *32 Cars* had been presented at other venues such as New York City's Rockefeller Center in 2002 and the Sydney Opera House in 2004 with the artist's approval and participation. Sixteen of the thirty-two cars were featured at these exhibitions while the remainder stayed in Korea. Photographs of these exhibitions show that the cars were arranged differently for each event.

Through discussions and interviews with the artist's assistant and curators and by studying the history of the piece, it was concluded that the disintegrating process of the artwork was *not* a part of Nam June Paik's original intention. Mark Patsfall recalls Paik's views on the conservation of his works:

> Nam June felt the piece should be kept up as long as humanly possible, which was his idea also with his video pieces—technology could be upgraded as long as it did not change the character of the piece until this was no longer possible and the piece could then remain as a document of itself.[3]

It was evident that the corrosion of the automobiles and their weakened structures had to be treated. The conceivable treatments were (1) eliminating the corrosion layer and repainting the exterior; (2) consolidating the structure; (3) cleaning and protecting the car's interiors; and (4) putting the interior elements on display correctly by unwrapping, cleaning, and reinstalling them. These treatments most likely will protect the artwork and prolong its life to a certain degree but will not stop the degradation process completely. Degradation will continue and even accelerate, especially in an outdoor environment.

Would there come a time, then, when the artwork should be removed from the outdoor environment and protected and preserved in a safer, controlled environment? What would be the applicable options? The solution of displaying the work indoors was considered. Opinions also were voiced about partial display of one group of cars while storing and conserving the rest, as well as removing the entire artwork and conserving it in storage. Other preventive measures, such as limiting access of the public, putting the cars on plinths, and covering the area with a roof, were proposed. Most of these ideas, as legitimate as they were, could not be readily applied due to practical and financial reasons. For example, removing from display and conserving thirty-two cars in storage would mean building an entirely new structure just for this piece alone—a notion not conceivable now or in the near future.

A decision had to be made. Making regular maintenance possible by completing a thorough documentation of the work and implementing a plan to repair, repaint, and consolidate would allow the work to remain on view a while longer. If the artwork will inevitably disappear in fifty, seventy, or a hundred years, it deserves to be shown more frequently in its fullest form. What would remain of the artwork would serve as evidence of what it had been. After discussing these issues at length, conservators commenced with the restoration.

Restoration of the Work

The main goal of treatment was to eliminate the sources of deterioration as much as possible, to restore the badly damaged appearance of the artwork, to improve its durability, and most important, to enable regular maintenance in the outdoor environment.

The consolidating and repainting of the automobiles was undertaken by the Conservation Department of Leeum, Samsung Museum of Art, and Vividesign, a shop in Yong In specializing in automotive painting, with which the museum had worked on the repaint of other outdoor sculptures. The process was begun in August 2011.

Successive layers of paint were stripped down mechanically to bare metal, removing most of the corrosion layer (fig. 10a). Electric handheld grinding machines with different grades of abrasive paper were used. Archival photographs obtained from the accredited photographer of the *Skulptur Projekte* show that the cars already had a significant amount of corrosion before being painted with aluminum paint. It was determined that this layer had to be eliminated to ensure better adhesion of the newly applied paint. Potential openings that would allow moisture penetration were sealed with silicone caulking. The cars' structures were consolidated where needed by welding steel plates or pipes. Thick corrosion products that had accumulated under the cars and inside the engine rooms and trunks were brushed off, followed by application of a coating that would protect the surface from moisture. This spray-applied product, made for use on automobiles, is called undercoating and contains fiberglass, rubber, ceramics, silicone, and asphalt.

The paint system chosen for repainting consisted of a spray coat of urethane primer, followed by a brush coat of the same product to simulate the brush-painted texture of the original paint layer. Silver urethane paint was sprayed over the primer and a final coat of clear matte urethane resin was applied for protection (fig. 10b). Archival photographs from Münster aided in the selection of color, brightness, and gloss of the silver paint. Gloss was a topic of discussion because the protective

Figure 10a A 1940 DeSoto after successive layers of paint and corrosion were removed during restoration. Photo: Zeeyoung Chin.

Figure 10b A 1949 Buick Special after repainting. Photo: Zeeyoung Chin.

clear coat layer slightly diminished the brightness of the color. Several meetings were convened to decide on color, gloss, and texture of the paint. A few cans of the original paint were later found inside one of the cars during the restoration process and were compared with the color selected.

The cathode-ray tubes and television casings installed inside the cars were removed, cleaned, documented, and reinstalled (fig. 11). A "blind nut"—an aluminum nut that has a tapered wall and can be embedded in a metal sheet—was embedded in the car frame so the doors could be opened and closed when needed to facilitate maintenance of the cars' interiors. The previous system, which incorporated a plain screw, was not reusable because the holes in the metal were badly damaged.

Reinstallation at Samsung Transportation Museum

Restoration of the thirty-two cars was completed in January 2013. Other preventive measures were taken

Figure 11 Cathode-ray tubes and television casings inside the cars were removed, cleaned, and documented before reinstallation. Photo: Zeeyoung Chin.

Figure 12 *32 Cars for the 20th Century: Play Mozart's Requiem Quietly* after reinstallation at the Samsung Transportation Museum in 2013. Barriers were installed to limit visitor access. Photo: Zeeyoung Chin.

to ensure conservation of the piece. The lawn area on which eight of the cars were installed was reinforced with bricks to minimize corrosion induced by moisture from grass and soil. Height-adjustable supports, designed to bear the weight of the cars, were placed underneath. Low barriers were installed to limit visitor access by placing the cars just out of reach. This was done with care so as not to distract the viewer of the artwork (fig. 12).

At Münster, Mozart's Requiem was played through speakers installed inside some of the cars. As people approached the cars, they could hear the music "playing quietly." However, once the barriers were erected, visitors could no longer approach the artwork as freely as before. This was, without doubt, altering the experience of the viewer. What is the solution when the safety of the visitor is at risk and protection of the artwork is crucial? At present, the audio feature of Paik's work is not in place and is still a subject of discussion.

It was proposed by STM that the Requiem be played through the museum's main speakers twice a day. Currently, easy-listening classical or jazz music is broadcast through these speakers, welcoming visitors to the museum. Hearing funerary music instead was unthinkable for museum staff. Installing speakers inside the cars and letting visitors walk through the installation at given schedules of the day was a possible option. During these sessions the music playing through the main speakers would be paused and extra surveillance of the artwork would be needed. The work in its complete and intended form would be presented only at these limited times.

Mark Patsfall testified that at Münster, even though the artist had specified that the music play "from sundown to 11.30pm," staff at the Schloss complained so much that the music had to be played only during the daytime and the volume turned down on demand numerous times during the exhibition.[4] Concessions had already been made at its first presentation.

Conclusion

We realized the importance of recording the flow of opinions and ideas along with the final decisions. The ideas and propositions shared during the decision-making process of the current restoration project surely will need to be revisited in the near future.

Acknowledgments

The author wishes to thank Mark Patsfall for sharing precious information on the making of *32 Cars*; Roman Mensing, the accredited photographer at Münster, for providing photos of the 1997 installation; Hyung Min Paik of Vividesign for his brilliant ideas and enthusiasm; and lastly the staff at Leeum, Samsung Museum of Art, for their support.

Notes

1. Mark Patsfall, e-mail interview with the author, November 10, 2011.
2. Samsung Transportation Museum (http://www.stm.or.kr/english/html/main/main.html) is located in Yong In, Korea, and is run by the Samsung Insurance Company, an affiliate of the Samsung Group. Leeum, Samsung Museum of Art (http://leeum.samsungfoundation.org/html_eng/global/main.asp), is also an independent affiliate of the Samsung Group, with a collection comprising Korean traditional art and international modern and contemporary art.
3. Mark Patsfall, e-mail interview with the author, November 10, 2011.
4. Mark Patsfall, e-mail interview with the author, May 28, 2013.

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Buβmann, Klaus, Kasper König, and Florian Matzner. 1997. *Sculpture. Projects in Münster 1997*. Stuttgart: Verlag Gerd Hatje, pp. 305–11.

Three Brushstrokes: Re-creating Roy Lichtenstein's Early Techniques for Outdoor Painted Sculpture

Julie Wolfe

Abstract: *The paper will discuss the treatment of Roy Lichtenstein's sculpture* Three Brushstrokes *(1984), held at the J. Paul Getty Museum. The sculpture is a painted aluminum work that was originally brush coated with a studio-mixed paint system. When the museum acquired the sculpture, the work had been completely painted over by a restorer and the color fields differed significantly from the original intended appearance. The condition of the paint was poor and a full restoration was implemented after extensive research. The sculpture was repainted with the hands-on participation of Lichtenstein's studio assistant, who had painted the sculpture originally.*

Introduction

In 2005 the J. Paul Getty Museum acquired a sculpture by Roy Lichtenstein titled *Three Brushstrokes* as part of a large donation of outdoor sculpture from the Ray Stark Revocable Trust (fig. 1). From the beginning it was clear that a restoration had occurred in the past and that the existing paint colors did not fully represent the original appearance of the work.

Initially, a minimal treatment was carried out to stabilize pockets of failing paint and corrosion, along with an associated paint analysis (Bouchard et al. 2011; Considine et al. 2010, 70–73, 148–56; Cowart and Wolfe 2008; Learner et al. 2007; Rivenc et al. 2009). Later, in accordance with the proposal to repaint *Three Brushstrokes*, the Roy Lichtenstein Foundation facilitated the making of color reference swatches by Lichtenstein's studio assistant, James DePasquale, who had painted the surface originally. It was then confirmed that the yellow on the acquired sculpture was darker and warmer (more red) and the red brushstroke darker and less saturated (more green and blue) than the colors

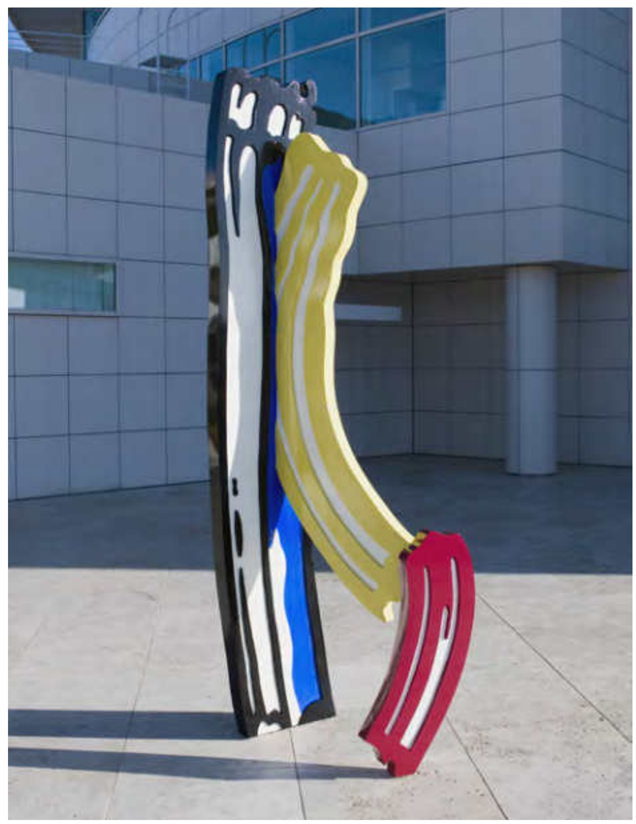

Figure 1 Roy Lichtenstein, *Three Brushstrokes*, 1984. Installed at the Getty Center in 2007 prior to treatment. © Estate of Roy Lichtenstein.

on the swatches (Wolfe 2011a). Research into the artist's materials was well timed because the Lichtenstein foundation had been actively documenting the artist's outdoor painted sculptures, of which there are known to be at least forty-three (Cowart, pers. comm. 2008). *Three Brushstrokes* was the impetus for the J. Paul Getty Museum and the Getty Conservation Institute to collaborate with the foundation and establish a timeline of paint systems. This paper demonstrates how the final treatment for *Three Brushstrokes* was greatly affected by the new resources: interview transcripts, photographs, and numerous color reference swatches.

Background

The Getty's *Three Brushstrokes* was created in 1984 and was the second of an edition of two. (The first edition is owned by a private collector.) Fabricated out of aluminum sheet metal, the sections are painted with red, yellow, blue, white, and black coatings. It stands approximately 10 feet high and is installed directly on the ground using threaded rods that extend from the bottom of the base. The sculpture was first acquired by Ray Stark, a Los Angeles art collector, from Leo Castelli in 1989 and was displayed at Stark's home in Santa Ynez, California, until his death in 2004. After the Getty Museum acquired the sculpture, it was installed on the entryway plaza of the Getty Research Institute at the Getty Center in 2007.

Making the Sculpture: From Concept to Paint

The sculptural process in Lichtenstein's studio involved many steps, passing through several assistants and employing fabricators to complete the work. The idea for *Three Brushstrokes* started as a quick pencil drawing with color notations. Lichtenstein also made a collage using Magna paint on paper. Tallix Fine Arts Foundry was contracted to re-create the work on a large scale out of welded aluminum. For this the studio made a small-scale wooden maquette painted with Magna colors for Tallix to use as a model. Tallix would have sprayed the aluminum construction overall with an epoxy primer. DePasquale came to the foundry and brushed Imron polyurethane for all color fields. For the red, blue, and yellow he used a top layer of studio-mixed paint, combining Bocour Magna solvent-soluble acrylic artists' paints with polyurethane clear coat. Tallix would have finished off by spraying a semi-gloss clear coat (DePasquale, interview 2007, 2011).

Considerations for Treatment

It is important to note that the technique originally used to paint *Three Brushstrokes* was discontinued around 1993, at which time peeling and chalking of the coatings had become evident and their durability questioned by the artist's studio (Milam Weisman, pers. comm. 2007). Lichtenstein strived to obtain a specific color palette using the top glaze of Magna polyurethane clear coat; however, for improved coating performance he compromised color perfection by changing paint systems to the Imron line from DuPont industrial polyurethane coatings. In general, he shifted toward using only Imron and later accepted Awlgrip, another paint system that was mostly spray applied, because it provided a better range of colors such as the blue (DePasquale, interview 2007). These spray-coated sculptures are impeccably smooth, glossy, and crisped by taped edges.

During Lichtenstein's lifetime and after his death in 1997, the later industrial paint systems were often used for restorations regardless of the original paint system. In fact, the first edition of *Three Brushstrokes* was recently restored using a spray application of Imron with Awlgrip for the blue section only. The reason for this type of approach is twofold: the reference material for the studio-mixed paints was not readily available, and the improved durability of the industrial coatings would result in a longer-lasting painted surface. This consideration is significant when recoating, as it is expensive and invasive.

Only a handful of sculptures still have the original early, studio-mixed paint and rarely on outdoor works due to restorations. The Getty decided to take an innovative approach to the treatment of *Three Brushstrokes* with the goal of re-creating the original surface as faithfully as possible using the original paint system. The intent was to strip the coatings completely and re-create the painted surface with the aluminum fabrication as a starting point. The corrosion, pustuling of paints, incorrect color, and bad interlayer adhesion of the coatings supported the argument that the primer was failing and the coatings were unstable. Repriming and, therefore, complete stripping were needed. The invasive treatment was also validated by the opportunity granted by Dorothy Lichtenstein that allowed DePasquale to come to the Getty and hand paint the final coats. Throughout the treatment, his technique and materials were extensively documented.

Color References

Before embarking on the treatment, the primary task was to create target color swatches for the repainting. The drawing, collage, maquette, and archives all served as reference materials in the form of writing or Magna paint; however, none of these can express the absolute visual and optical properties of the studio-mixed top coats.

The Lichtenstein foundation had three other existing swatch references in 2007, the earliest from a wall shelf with a range of mixed Magna or Mineral Spirit Acrylics (MSA) in glass jars labeled with color names as adopted by the artist's studio (fig. 2). At the foundation's request, DePasquale made a booklet of sixty-one index cards to distribute to researchers, painted with Magna or MSA that represent the full range of colors found on Lichtenstein's indoor paintings. Because these were more specific to the indoor painted surfaces, the Getty worked closely with the artist's foundation and estate to create standard color references for *Three Brushstrokes* and simultaneously for any other color found on his outdoor works.

In 2009 DePasquale created twelve color references for the artist's early outdoor works made with the studio-mixed paint system (fig. 3). He painted a grid of colors onto primed aluminum, each color field consisting of Imron base coats, half of which were then brushed with the studio-mixed paints using an existing supply of Sikkens semi-gloss clear coat and MSA in the studio. Swatches for the later works painted in Awlgrip are in progress at Amaral Custom Fabrications. For the treatment of *Three Brushstrokes*, the aim was to re-create the surface using the 2009 reference panel.

Color Measurements

The importance of capturing CIELAB values was an obvious means for communicating color in all aspects of the project, some of which have been published previously (Considine et al. 2010). A tristimulus handheld colorimeter was used to measure various references pertaining to the sculpture. A gloss meter was used to measure gloss units (GU) using three geometries at 20, 60, and 85 degrees. Both devices helped systematize and interpolate the differences between various color references relating to the originality of the painted surface on *Three Brushstrokes*.

Color measurements allow the difference in value for the color and gloss to be documented with greater accuracy. For the purpose of treatment documentation, a quantified comparison between the inaccurate restoration coating and the final re-creation by DePasquale can be a valuable reference. Therefore measurements were

Figure 2 Wall shelf in Lichtenstein's studio, holding original labeled jars of MSA paint for each color used in *Three Brushstrokes*. © Estate of Roy Lichtenstein. Photo by Julie Wolfe.

Figure 3 Lichtenstein's studio assistant, James DePasquale, making a color reference standard for all colors used on the artist's early outdoor sculptures having the MSA clear coat studio-mixed paint. © Estate of Roy Lichtenstein. Photo by Rachel Rivenc.

taken throughout treatment to monitor DePasquale's observations in color and gloss.[1] There is great use in collecting comparative measurements that should allow tolerance levels to be established for individual colors. As industrial coatings continue to change, the acceptable tolerance for Lichtenstein's sculpture can be defined by the foundation, conservators, and curators with consistency. The data can also serve as a dependable safeguard for all color swatches in case of loss or damage. If they need to be re-created, the color values are dependable.

Re-creating the Appearance of the Paint Standards

There are practical limitations to using original materials from 1984 in order to faithfully re-create the look of the original twenty-seven years later. The industrial and fine art paint industries are frequently modifying chemical compositions to comply with regulations. In fact, few of the original products used by Lichtenstein could be legally obtained in the state of California. The Bocour Magna range is no longer available—the product was discontinued even in Lichtenstein's lifetime—but the artist adopted a similar product manufactured by Golden Artist Colors called Mineral Spirit Acrylics (MSA) Conservation Paints. The realistic solution was to look at the analysis of the paint layers and find suitable modern equivalents, which are listed in table 1 (Bouchard et al. 2011).

Targeting References for Paint Replication

Using the equivalent modern-day products listed in table 1, the Getty prepared swatches for the base colors and a custom gloss for the clear coat to replicate the original appearance. The coatings were formulated by a local DuPont paint distributor who color matched using a proprietary color management system and specialized colorimeter. The colors were easily replicated with the Imron Industrial Strength (IIS) ultra low VOC polyurethane and the clear coat from that line (fig. 4). The estate, foundation, and curators approved their appearance prior to the start of treatment.

Examination Before Treatment

The sculpture was closely examined in the conservation lab. Paint was carefully excavated layer by layer to understand the stratigraphy on a larger scale and to double-check the layers from the cross sections used for the analysis. When the original paint layers for the red

Table 1. Coatings used in 1984 by Lichtenstein for *Three Brushstrokes*, and the modern-day equivalent used during the 2011 Getty restoration.

Layers	Original vs. Modern-Day Equivalent	Comments
Primer	Original: Sikkens (gray) epoxy Restoration: 1. Corlar LV SG gray (amido amine cured epoxy technology, very high solids) 2. Corlar 2.1PR-P gray (amido amine modified polyamide epoxy technology, high solids)	A two-layer system was chosen because it would provide better corrosion resistance.
Base coat	Original: Imron 5.0 Restoration: Imron Industrial Strength ultra low VOC polyurethane (styrene acrylic polyester urethane)	The current product does not have lead chromate pigments (Bouchard et al. 2011).
Studio-mixed top coat	Original: Magna (n-butyl methacrylate), Sikkens semi-gloss clear coat Restoration: Golden MSA (n-butyl methacrylate), Imron Industrial Strength low VOC polyurethane (styrene acrylic polyester urethane)	MSA's cadmium red medium is darker than Magna's. Black was added to compensate.
Clear coat	Original: Sikkens clear coat semi-gloss Restoration: Imron Industrial Strength low VOC polyurethane clear coat (styrene acrylic polyester urethane)	The product showed better compatibility, having the same line of products for all layers.

Figure 4 Color swatches prepared by the author, replicating the original appearance of *Three Brushstrokes* with modern-day equivalent materials. The swatches were approved by the estate prior to the 2011 Getty treatment. Photo by Julie Wolfe.

Figure 5 A section of the yellow color field on *Three Brushstrokes*, partially excavated to reveal the original paint layer underneath. © Estate of Roy Lichtenstein.

and yellow sections were revealed, the color appeared faded and dull but still similar to the targeted reference swatches. Additionally, the process uncovered some of the original brushstrokes (fig. 5). Excavations down to the original borders between color fields showed extreme overpainting by at least 1–2 millimeters in the restoration. The last layer of primer was, as suspected, extremely thin.

Paint Removal

When planning paint removal, the objective was to protect the fabricated surface, limit health risks, and comply with environmental regulations. Because of the hollow construction and welded seams, it was decided not to use any high-pressure blasting or air abrasives. The coatings on *Three Brushstrokes* were between 100 and 200 micrometers thick, a challenge even for chemical paint strippers. Also, the lower layers containing lead chromates had to be carefully contained. More than five different proprietary products were tested on the surface. Of these, Peel Away 7, manufactured by Dumond, Inc., performed the most effectively. The time and quantity of chemical use was decreased by supplementing with carbon dioxide pellet blasting.[2] Together the two techniques removed all paint after three working days. Still dusty and having some moderate surface debris left over from the final lead abatement rinse, the metal was cleaned overall with water at low pressure and immediately dried using cotton rags. Some of the porous seams were identified because they continued to weep water, and the sculpture was stored in a very dry climate room with high temperature and low relative humidity. The fully stripped fabrication can be seen in figure 6.

Considerations for Aluminum Surface Treatment

Even fully clean and dry, aluminum can be difficult to paint because coatings do not adhere well to the aluminum oxide surface film that naturally occurs upon exposure to air. For best corrosion resistance, as much oxide should be removed as possible to allow the first coating to bond. Oxides can build up instantaneously; therefore, conversion coatings were seriously considered for surface preparation. Industrial products based on siloxane technology have been developed to replace the toxic hexavalent chromium treatments that are now highly restricted. These act to convert the existing oxide to a stable film that is more easily coated. The decision was made to bypass the conversion treatments for numerous reasons that are beyond the scope of this paper. Instead, the surface was protected by choosing an appropriate primer with appropriate thickness.

Primer

The industrial paint industry was able to advise on appropriate primers to protect the aluminum from corrosion. A two-layered system was used for *Three Brushstrokes*, starting with the application of Corlar LV SG epoxy mastic. This coating forms a film on the surface that requires sanding overall prior to recoat. A secondary primer, Corlar 2.1, was applied, having greater working properties, increased sealing, and a smoother sprayed surface that does not require sanding. Only a minor amount of filler was used after priming and was limited to pits that would be susceptible to corrosion. Weld lines and surface imperfections would have been visible originally, in contrast to Lichtenstein's later works, which were heavily filled to hide the welds.

Painting Color Fields

The gray primer was given one base coat of white polyurethane as requested by DePasquale prior to his arrival at the Getty. This white layer was not done originally, but because it would not affect the final appearance, the compromise was acceptable. DePasquale explained that it is easier to paint over the color fields white than gray.

Figure 6 *Three Brushstrokes* after full stripping at the Getty. © Estate of Roy Lichtenstein.

After this, all of the paint layers were brush applied by DePasquale, who spent seven days finishing the work. With a steady hand, he began by brushing the base coats (fig. 7). The order of color field application was efficient and strategic: yellow, red, then blue, followed by black, then white. The sequence was repeated for all subsequent coats, allowing DePasquale to achieve sharp edges between the color fields. He moved from one color to the next without the aid of edge taping between color fields. He started all color fields by brushing the edges first with a ½-inch flat brush on which he bent the ferrule approximately 20 degrees to make the edges easier to reach. He used a 2-inch Gold Taklon flat brush for the flat planes (fig. 8).

Polyurethane is notably difficult to apply by brush because it cannot be brushed over repetitively, and without proper application it can tear apart or form bubbles. In 1984 DePasquale modified the Imron 5.0 for better brush performance and reported modifying the ratio of hardener to resin for a more fluid consistency, not knowing that in doing so full cure of the parts could be compromised. This modification allowed him to brush on the Imron in different directions and then go over the area in slow, even strokes for smoothing. The IIS, however, was mixed to the manufacturer's specification with 10 percent thinner, and the consistency was viscous and tended to break apart while brushing—called "tearing" in the paint industry—so the mixture was thinned to 15 percent, which was an improvement. The DuPont representative also suggested trying a rolling additive; this did not appear to help and occasionally left pinpoint-sized crevices. DePasquale adapted his technique and became more comfortable with the IIS. He found it helpful to "tip" the brush loaded with polyurethane in pure thinner prior to brushing, another suggestion from the DuPont representative (McDiarmid, pers. comm. 2011). Two layers were applied for each color except white, which had already been sprayed, and the base coats were finished.

After two coats of the IIS base colors, the red, blue, and yellow color fields were lightly sanded to dull the surface and make it easier to see the next application. The studio-mixed top coat was started by mixing the MSA paints with a palette knife to the desired color. DePasquale compared the color to the swatch panel he made in 2009. The IIS clear coat was combined separately and thoroughly mixed before being added slowly to the MSA one tablespoon at a time (fig. 9). The mixture was

Figure 7 DePasquale applying the first layers of Imron Industrial Strength (IIS) base coat. © Estate of Roy Lichtenstein. Photo by Julie Wolfe.

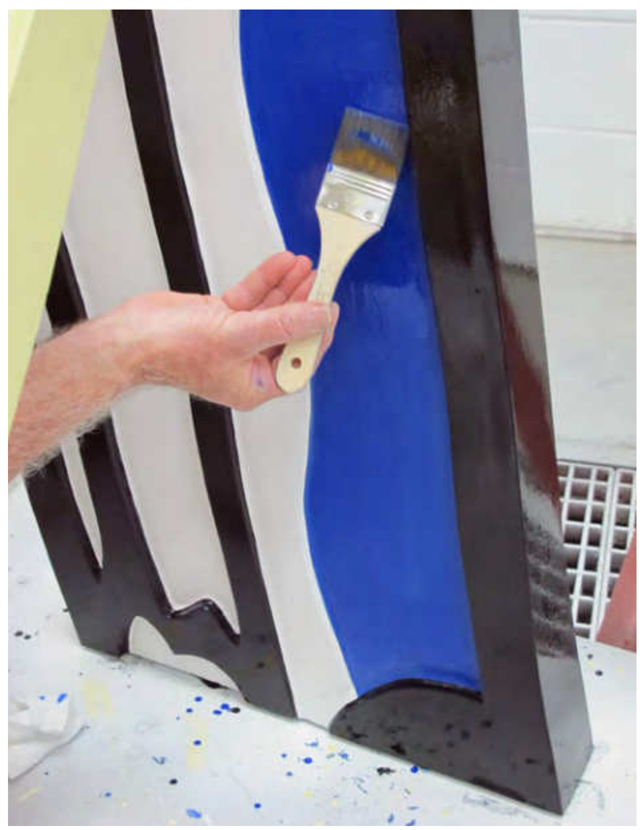

Figure 8 DePasquale applying a top coat of MSA clear coat in the blue color field using a Gold Taklon flat brush. The IIS base coat is still visible on the bottom. © Estate of Roy Lichtenstein. Photo by Julie Wolfe.

Figure 9 The MSA is mixed with the IIS clear coat to make the top glaze for the blue color field. © Estate of Roy Lichtenstein. Photo by Julie Wolfe.

stirred constantly using a palette knife. For the treatment records, each mixture was brushed onto Mylar. It was significant to note how translucent the film was compared with the IIS, particularly the blue. The translucency explained more clearly the studio's rationale for adding the Imron base coat underneath, making the top coat clearly a color-correcting glaze. Figure 8 shows the difference in the base and top coat with the MSA clear layer being applied.

Numerous modifications were made to the level of gloss for the IIS clear coat that was added to the MSA. The original intention was to use the custom blend of 1:1 satin and semi-gloss that was about 25 GU when brushed on Mylar and gave a final gloss level of 45 GU when sprayed over the glossy IIS black base coat. Full discussion of differences to the paint swatches will be discussed in a future publication, but in general DePasquale found the custom blend too matte for the red, yellow, and blue top coats. A standard mixture of semi-gloss was added to the custom mixture to bump up the gloss slightly. Lingering questions will be clarified later; for example, why would the gloss of the MSA clear coat—which, after two coats, ranged from 9 to 21 GU—matter when the plan was to spray the custom clear coat overall? The gloss range for the same three colors on the 2009 color reference panel is between 14 and 32 GU (Wolfe 2009). Technically, the final clear coat would bring the color fields to the same gloss level, as they did according to the final measurements of the finished restoration, shown in table 2. It is likely the saturation for each individual color would be enhanced when the final clear coat was applied.

Documentation

The process of restoring *Three Brushstrokes* to its original appearance has been extensively documented in order to broaden awareness of the complex considerations in the care and maintenance of outdoor painted works, even beyond the numerous works of Roy Lichtenstein. Already described are the numerous color measurements needed to capture any and all shifts in color and gloss (Phenix and Wolfe 2008; Wolfe 2011a, 2011b). The Getty Conservation Institute (GCI) made video recordings throughout the treatment, which were included in the GCI educational video *Outdoor Painted Sculpture* (2012). A time-lapse sequence was made by mounting a camera in the spray room, which condensed the repainting steps from twelve days of work to just over two minutes (Abraham 2011). Pages of interview transcripts document every aspect of the artist's sculptural technique for outdoor sculpture (DePasquale 2008, 2009, 2011; Cowart, pers. comm. 2008; Amaral, pers. comm. 2008). The most rewarding result of the collaboration

Table 2. Color and gloss measurements after the 2011 treatment of the Getty's *Three Brushstrokes*.

Measured Object/Location	L*(SCI)	a*(SCI)	b*(SCI)	GU 20°	GU 60°	GU 85°
Cadmium red medium	38.85	41.70	21.91	7.1	42.5	72.2
Light yellow	93.13	-6.39	35.72	7.4	40.6	71.9
Ultra blue	35.03	16.22	-47.39	7.4	41.5	67.5
White	95.04	-0.70	3.45	8.9	46.4	76.9
Black	24.83	-0.04	-0.79	8.6	44.8	76.7

was the creation and documentation of standard reference swatches for Lichtenstein's outdoor works, now stored with the Lichtenstein foundation and the Getty.

Conclusion

The process of restoring *Three Brushstrokes* to its original appearance demonstrated a successful case study that we hope will inspire the conservation profession and broaden awareness of considerations in the care and maintenance of outdoor painted works. The issues faced with *Three Brushstrokes* are not uncommon regarding outdoor painted works, and the extremes of an outdoor environment will deteriorate even the most durable paint systems. Conservators have to address the ethical challenges in ongoing maintenance, which predictably demand repainting to protect metal fabrications.

In *Three Brushstrokes*, the difference between the painted surface before and after treatment is substantial (figs. 10, 11). The sculpture was moved indoors to help preserve the coating. As the sculpture was never made for a specific location, and the scale of the work was small compared to the artist's later works, indoor exhibition was deemed a reasonable display option. *Three Brushstrokes* transformed into a rare example, having an original appearance of an early paint system, and it was decided to move the sculpture indoors to the lobby of the Getty Trust building, where it would be better protected from the environment (fig. 12). When we are no longer able to rely on the visual memory of Lichtenstein's assistants, *Three Brushstrokes* remains a document capturing an important aspect of the artist's legacy.

Acknowledgments

Treatment of *Three Brushstrokes* was made possible by the generous assistance of the Roy Lichtenstein Foundation, the Roy Lichtenstein Estate, and scientists at the Getty Conservation Institute. The author would like to acknowledge Jack Cowart, executive director of the Roy Lichtenstein Foundation, and Dorothy Lichtenstein and James DePasquale of the Roy Lichtenstein Estate.

Figure 10 Detail of *Three Brushstrokes* in 2007, prior to treatment, showing the incorrect color of a restoration paint. © Estate of Roy Lichtenstein.

Figure 11 The same location on *Three Brushstrokes* as seen in fig. 10, after repainting in 2011. The original paint appearance in color and gloss has been corrected. © Estate of Roy Lichtenstein.

Figure 12 *Three Brushstrokes* in 2011, reinstalled at the Getty Trust building after treatment was completed. © Estate of Roy Lichtenstein.

The project as a whole has been greatly enhanced by analytical work done by the Science Department at the Getty Conservation Institute, in particular head of science Tom Learner, senior scientist Alan Phenix, and associate scientist Rachel Rivenc. Thanks also to colleagues in the Decorative Arts and Sculpture Conservation Department at the J. Paul Getty Museum for their support: Brian Considine, Jane Bassett, Arlen Heginbotham, and Katrina Posner.

Notes

1. A Konica Minolta spectrophotometer RS-232C was calibrated using a standard, and setup was established to obtain CIE 1976 L*a*b* (CIELAB) values using a D65 standard illuminant and 10-degree geometry. The data listed per color is the mean of five readings. GUs were obtained using three geometries (20, 60, and 85 degrees) with a Konica Minolta Multigloss 268, which was calibrated using a standard, and an average of five measurements per sample were taken; the meter was rotated after each reading. All GUs provided in this paper are of the 60-degree geometry.
2. The carbon dioxide blasting was done with the Cold Jet Aero 30 with Praxair rice ice. A 2-inch medium-performance nozzle (rectangular) was used at first. Contractors then switched to a 1-inch nozzle for higher efficiency. Initial parameters were 3 lb/min. (mass feed) at 400 cfm for approximately 130 psi (particle speed), 90-degree blasting angle, and a working distance of 2 inches.

Materials and Suppliers

Brushes

Size 8, ½-inch flat brush: 1201 Faye LH, Silver Brush Limited, bleached white China bristle with aluminum ferrule and long wooden handles

2-inch flat brush: Gold Taklon (medium) brushes, Item RART-140, Royal Brush Manufacturing, Inc., Merrillville, IN 46410; www.Royalbrush.com

Size 12 brush: Royal White Taklon Shader Brush R159

DuPont Performance Coatings, Wilmington, DE 19898; 800-441-7515

First coat primer: Corlar LV SG (LF-63790P) cirrus gray base mixed in a 2:1 ratio with Corlar FG-090 activator. The mixture was diluted 5% using DuPont T-1021 thinner for spray application. When dry, it was sanded overall.

Second coat primer: Corlar 2.1PR-P (525-885 ANSI 61 grey) mixed 2:1 with Corlar FG-040 activator and thinned 10% using T-1021 for spray application.

Base coats: Imron Industrial Strength ultra low VOC polyurethane (high gloss) custom formulation. The enamel was mixed 4:1 with 9T00-A activator and thinned 15% using 9M01 thinner for spray application.

Clear coat: Imron Industrial Strength ultra low VOC polyurethane, custom gloss (1:1 satin:semi-gloss) mixed 8:1 with 9T00-A activator and thinned 5% using 9M01 thinner.

Mineral Spirit-borne Acrylic (MSA), Golden Artist Colors, 188 Bell Rd., New Berlin, NY 13411; 607-847-6154

Peel Away 7 (dibasic ester, N-Methyl-2-pyrrolidone), Dumond Chemicals, Inc., 83 General Warren Blvd., Ste. 190, Malvern, PA 19355; 609-655-7700

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Conservation of Christo's *56 barrels*: A Basis for Future Decision Making

Susanne Kensche

Abstract: *This article presents the initial investigation that has led to decisions regarding the conservation of* 56 barrels *(first version, 1968; second version, 1977) by Christo in the Kröller-Müller Museum. Up to this point the investigation has concentrated on research of the archival material as well as a provisional assessment of the current condition of the artwork. The complex treatment history of this outdoor painted sculpture has provided the basis for future conservation decision making. In a wider context, this research has revealed information on past common maintenance practice of outdoor sculpture in a museum environment and underlined the necessity of documenting all interventions and motivation.*

Introduction

The collection of the Kröller-Müller Museum (KMM), Otterlo, the Netherlands, currently contains about twenty outdoor painted sculptures dating from the 1960s to the present. Eleven are currently on permanent display in a unique location in the museum's sculpture garden. The majority of these are made of painted steel, including *Trowel* (1971) by Claes Oldenburg, *K-piece* (1972) by Mark Di Suvero, and *56 barrels* (1968/1977) by Christo. All of these works have specific conservation issues depending on their construction, the materials they are made of, the impact of visitors on the works, and their location. Long-term exposure to the outdoor environment has resulted in the degradation of the construction materials and paint layers. Most of these artworks have already undergone maintenance in the past, sometimes before entering the collection. On a few occasions they are exhibited indoors.

Today, when a conservator examines a work in order to make a decision about a new maintenance strategy, it is sometimes difficult to interpret what has been done in the past. Repainted surfaces often involve several paint layers in different shades, together with partly reconstructed or exchanged materials. All past interventions influence decisions regarding new maintenance strategies and must be taken into account. Knowledge about the treatment history is essential to be able to evaluate the changes from today's point of view.

56 barrels is a good example of how complex the history of an outdoor painted sculpture can be. Since its creation in 1968, several invasive alterations have been undertaken. The first version, titled *56 barrels, project for Bergeyk* (1968), made of old reused barrels, is no longer extant. For the KMM Christo made a second version in 1977, *56 barrels, project for Kröller-Müller Museum*, using new barrels. The work was entirely repainted in 1990 after corrosion of the steel and damage to the paint layers was found; some of the barrels also were replaced.

The past twenty-four years of exposure to outdoor conditions have clearly again left their mark on the work, and it is in urgent need of a new treatment. Looking to its treatment history, conservators are faced with the following questions: How far must the former approach of simply repainting and exchanging materials be followed? Do these far-reaching measures conflict with the artists' intention and conservation ethics?

In order to develop a well-considered plan on how ultimately to deal with this work and interpret the alterations, the KMM's archival material was studied intensively and the condition of the work was inspected. This has made it possible to formulate initial conclusions. The treatment options that lie between restoration and reconstruction will now be examined. Research is ongoing and no final decisions have been made. More in-depth materials testing has to be carried out, and consultation with Christo and those involved in the construction and treatment of the artwork is planned for the future.

Case Study: *56 barrels*

Since 1958 Christo and his wife and creative partner, Jeanne-Claude, have created works using oil barrels. Barrels proved to be suitable working material because of their sculptural effect and low cost, and they soon became a dominant factor in the artists' oeuvre (Christo and Jeanne-Claude 2013).[1] The second repainted version of *56 barrels* is, until now, the only outdoor project with barrels directly chosen by Christo that still exists and one of the last works in which he stacked barrels to form columns (Joosten 1978). It is also the only realized outdoor sculpture that he intended to be permanent from its initial concept. For this reason its history is also relevant for the other works that no longer exist.

The First Version: *56 barrels, project for Bergeyk* (1968)

In 1963 the Dutch collectors Martin and Mia Visser wrote to Christo asking him to make a large barrel structure for their garden in Bergeyk, like the one he had shown at Galerie J in Paris.[2] Christo responded enthusiastically and sent some documentation. The plans were settled when the artist visited the Vissers in the Netherlands in 1966 to prepare an exhibition (Bosch 2000, 98). The following year he made several study drawings that helped him approach the final form of the stacked barrel structure.

Christo worked in collaboration with the Dutch oil drum company Janus Vaten B.V. in Gorinchem. He visited the company's site several times during his stay in the Netherlands to draw inspiration and select the barrels. He chose old reused drums, a few of which had trade names visible. The colors were more or less faded, and the barrels were already affected by corrosion and deformations. White stripes painted around the middle of six of the large blue barrels were possibly added by Christo. The barrels were delivered by Janus, and *56 barrels, project for Bergeyk* was first installed in April 1968 at a temporary exhibition in front of the Van Abbemuseum (fig. 1). A few weeks later the barrels were transported to the Vissers' garden in Bergeyk and set up on a concrete base amid tall trees, a location chosen by Christo and the Vissers (fig. 2). In the years that followed, more rust appeared on the work. Neighbors appealed to the municipal council to have "that junk-heap" removed (Bosch 2000, 104).

In 1975, after consulting Christo, Martin Visser offered the piece to the KMM under the condition that the museum would transport and restore the work.[3] Rudi Oxenaar, director of the KMM at the time, accepted the offer, but in the final stages of negotiation restoration was declared pointless. The lids of the barrels had completely rusted away, and the artwork's entire structure was unstable.[4] Together with Christo it was decided to replace all the barrels with new ones, thus creating a completely new version for the KMM. In a letter to Visser, Oxenaar supposes "that the original version…

Figure 1 Temporary location of the first version of *56 barrels, project for Bergeyk*, installed in front of the Van Abbemuseum, 1968. Courtesy of the artist. Photo: Foto van den Bichelaer. Archive KMM.

Figure 2 The first version of *56 barrels, project for Bergeyk*, installed in Martin and Mia Visser's garden in Bergeyk, ca. 1968–1977. Courtesy of the artist. Archive KMM.

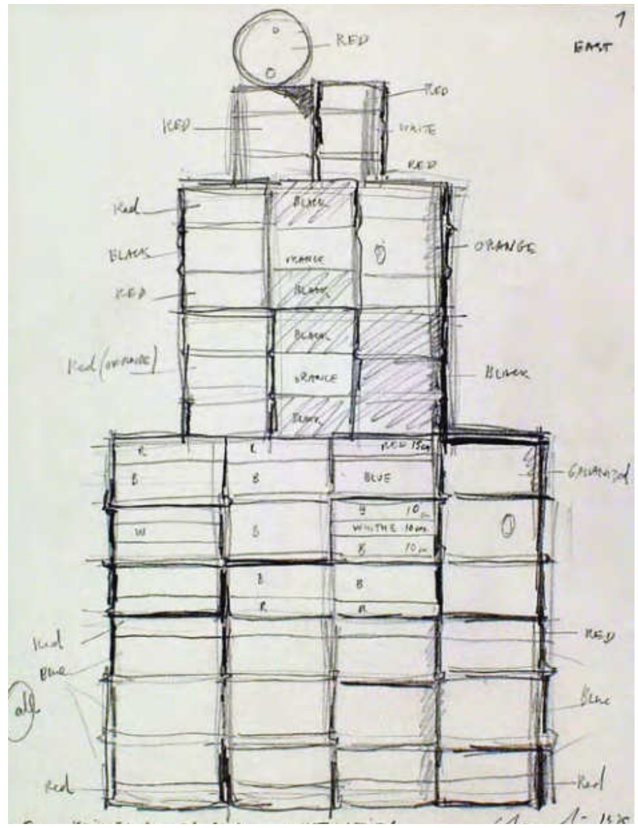


Figure 3 Christo, certificate (East side) with color specifications for the second version of *56 barrels, project for Kröller-Müller Museum*, 1975. Sign./date: *b.r. Christo 1975*. Inscription: *b.l. For Kröller-Müller Museum Installation*. Pencil on paper, 32.6 × 25 cm, KM 102.463, collection KMM. Courtesy of the artist.

will be destroyed as soon as the new version is a fact."[5] This was finally carried out in 1977, when the museum's technical staff brought the barrels to a scrap-iron dealer. Keeping the old barrels as "document" was not an issue at the time.[6]

The Second Version: *56 barrels, project for Kröller-Müller Museum* (1977)

In 1975 Christo made four situation sketches (East, South, West, North) for the planned new version of *56 barrels*. Each would be certified for installation at the KMM and the indicated color scheme should be followed (fig. 3). This version was nearly identical to the first. The barrels again came from Janus Vaten. Several consultations took place between the museum, the artist, and the barrel company. The entirely new version was fabricated strictly adhering to Christo's specifications. This time the barrels would be made of durable materials, with consideration for long-term conservation of the artwork by the artist and the museum.

Together with Oxenaar, Christo chose a new location, in the sculpture garden behind the new entrance of the museum in direct relation to the architecture of Wim Quist—"a lovely clearing in the woods, with a high awning of foliage above it" (Joosten 1978, unpaginated). The work was finally installed in 1977, at the same time the new museum wing was finished. Christo dedicated this version of *56 barrels* to the memory of Mia Visser, who had died shortly before the work was completed. After the installation, Christo made in situ four color drawings and collages of the new version, which relate the sculpture to its new environment (fig. 4).[7]

The invoice from Janus Vaten for the production of the second version provides technical information on materials used and production time.[8] The fifty-six barrels were newly made in three different sizes (200 L, 100 L, and 60 L) from galvanized steel plates. The small and medium barrels are more common, whereas the large 200-liter barrels were a special production. These large barrels have two rings that are welded on and originally enabled the heavy barrels to be rolled over the ground.[9] Initial research suggests they are no longer produced. Janus's documentation stated that the barrels were coated with two layers: "a primer and paint also used in the automobile industry, all in the colours specified by Christo." Unfortunately no descriptions were given as to composition, brand names, or RAL numbers. The invoice provides only a general indication of the quantity of paint used (50 kg primer, 50 kg lacquer, and thinner).[10]

There are monochrome as well as polychrome barrels in the work. The paint layers were generally sprayed on, while the stripes of white paint around the middle of six of the large barrels were applied with a wide brush on top of the blue surface, probably by Janus Vaten. On one of the four certificates, Christo specified the width of the white stripes to be 10 centimeters and the width of the red stripes around top and bottom of the large blue barrels to be 15 centimeters (see fig. 3). It is not certain if these dimensions were exactly followed, but old photographs clearly show the white stripes as narrower than the red ones. This seems to be an important visual factor. Old photographs cannot reveal whether the red stripes originally had a sharp edge or whether the transition from red to blue was smooth.

Finally, the fifty-six barrels were stacked in five levels on a concrete base of about 2.4 × 2.4 meters with a total height of approximately 4.9 meters (fig. 5). As the

Figure 4 Christo, drawing of the second version of *56 barrels*, after the installation in the sculpture garden, 1977. Sign./date: *b.l. Christo 1977*. Inscription: *b.m. 56 Barrels (Oil drums stacked—102 × 58cm dia, 57 × 38cm dia) Project For Rijksmuseum Kröller Müller, In Memory of Mia Visser*. Collage on paper, 71.2 × 55.5 cm, KM 109.408, collection KMM.

Figure 5 Christo, second version of *56 barrels*, during installation in KMM sculpture garden in 1985, before treatment. Painted steel, 489 × 240 × 240 cm, KM 112.295. Courtesy of the artist. Archive KMM.

work had to be installed during a very busy period, there was not enough time to build a proper foundation, and the base was more or less directly placed on the ground.[11]

Maintenance of *56 barrels*

From 1977 to 1990 the sculpture was regularly cleaned by KMM technical staff using water under unspecified high pressure. In winter the work was apparently covered with plastic. Over the years new damages appeared. Photographs taken in the late 1980s show serious corrosion on metal parts and large areas of damage in the paint layers, which also may have been caused by using water at too high a pressure.

In 1988 Christo was asked by then KMM curator Marianne Brouwer whether the museum might accept the offer of the Dutch barrel company Van Leer Packaging to "restore" the piece at the company's own expense.[12] The treatment was carried out in winter 1989–90. In May 1990 photos of the repainted and restacked artwork were sent to Christo, who was informed that "the restoration was complete and the work shines in its renewed splendour" (fig. 6). Jeanne-Claude answered that they were happy that "the barrel structure looks healthy again."[13]

A memorandum from Van Leer states that during the treatment "some drums were replaced by new ones,… all were galvanized and repainted in the original colours and the connection elements were renewed" (fig. 7).[14] However, it was not indicated whether all the barrels had been completely repainted and which ones had been exchanged. By comparing old photographs from before and after treatment and through visual observation of the barrels themselves, it can be assumed that at least the top barrel and most likely all the large blue barrels are originally from 1977. Old paint layers were apparently sanded to a certain degree prior to the

Figure 6 Detail of *56 barrels* during a test installation, 1990. The final coating was carried out after the connection points were welded to the lids. The orange on the barrel pictured is a lighter shade than prior to the final coat. Courtesy of the artist. Archive KMM.

Figure 7 *56 barrels* in 1990, after treatment. Courtesy of the artist. Archive KMM.

repainting process.[15] In general the new paint layers again were sprayed onto the barrels and the white stripes applied with a brush over the top.

A comparison of photographs of the artwork from 1977 and after treatment in 1990 reveal differences in appearance, which are mainly noticeable in the paint layers of the large barrels. The repainted 1990 version may even look more "perfect" than the 1977 version, the white stripes for instance being more precisely applied. The red and white stripes are almost equal in scale, with some red stripes being narrower than the white ones. This is an important difference to the indicated measurements on the certificates and the 1977 version. The red stripes were sprayed onto the large blue barrels such that fine color drops made the transition between red and blue very smooth. Color shades also may be slightly different to 1977. For example, underlying paint layers, which are visible in damaged areas of the present surface paint, are showing darker red.[16] On some of the large barrels, differences in level and glossiness of the paint layers suggest that the edge of the red stripe indeed was wider and had a sharp edge in 1977 (fig. 8).

Current Condition

The concrete base of *56 barrels* is cracked in several places and, as a result, the middle section of the work is caving in slightly. This has caused the barrels to lean awkwardly against one another and shift slightly. Apparently there is no proper foundation, resulting in drainage problems.

Rust is forming on the lids of the barrels, in the caps, and especially where the rings are connected to the large barrels (fig. 9). Some areas show significant mechanical damage, such as small deformations all over the barrels as well as deep scratches running through the paint layers and causing losses (fig. 10). The uppermost paint layer on the orange barrels is flaking and has almost completely lost its shine (fig. 11). Other colors may have faded.[17]

Until now, only the outer barrels of the structure have been inspected. In order to properly assess the condition of the eight inner barrels, the entire work will have to be disassembled. The condition of the inner barrels may be dramatically worse due to moisture and soil trapped between the structures (fig. 12).

56 barrels must be treated due to its poor condition. Conservators are faced with serious issues. How can conservators make use of the many technical possibilities while still taking into account the artist's intentions? Does the first version of *56 barrels* have significance in the decision-making process? What is the intended appearance of the artwork? Did the 1990 repainting follow closely enough the certificates and the "original look"?

The timeline on page 62 provides an overview of the chronology of *56 barrels* and the alterations it has undergone since 1968.

Figure 8 Detail of large blue barrel, showing underlying red paint layer and horizontal line indicating level difference. Photo: Susanne Kensche, 2013.

Figure 9 Detail of large blue barrel, showing corrosion at the rings. Photo: Susanne Kensche, 2013.

Figure 10 Detail showing damaged paint layer. Photo: Susanne Kensche, 2013.

Figure 11 Damages to paint layer on the orange barrels. Photo: Susanne Kensche, 2013.

Factors in the Decision-Making Process

In the case of *56 barrels*, the terms *original*, *a version, a reconstruction*, and *a remake* are not easy to define. From today's perspective—at least for conservators—the decision to create a completely new version of the work

Figure 12 Condition of *56 barrels* in 2012. Photo: Susanne Kensche, 2013.

and destroy the old one may be considered drastic. The appearance and perception of the first and the second versions are certainly very different. However, none of the documents in the museum archive mentions restoration or preservation of the first version as a realistic option, and the decision took place with mutual agreement of all parties.

It may be stated that through the donation the artwork had a chance to survive and have a new life. An initial conclusion could be that the intention or authenticity of the work is less about the original material and the barrels being old or new. The fact that Christo was involved in the decision making and personally supervised the production of the new version supports this point. The treatment history of the second version shows again that exchanging and repainting the barrels did not seem to go against the artist's intentions. What seems to be important for the work is, for instance, the specific color pattern and the size and shape of the barrels used, a factor valid for both the first and second versions. The work is also related to its environment in a certain way: both times the artist selected a location among tall deciduous trees. The relation of the second version to the architecture of Wim Quist and the dedication to Mia Visser makes the work unique and hence "original" to the KMM.

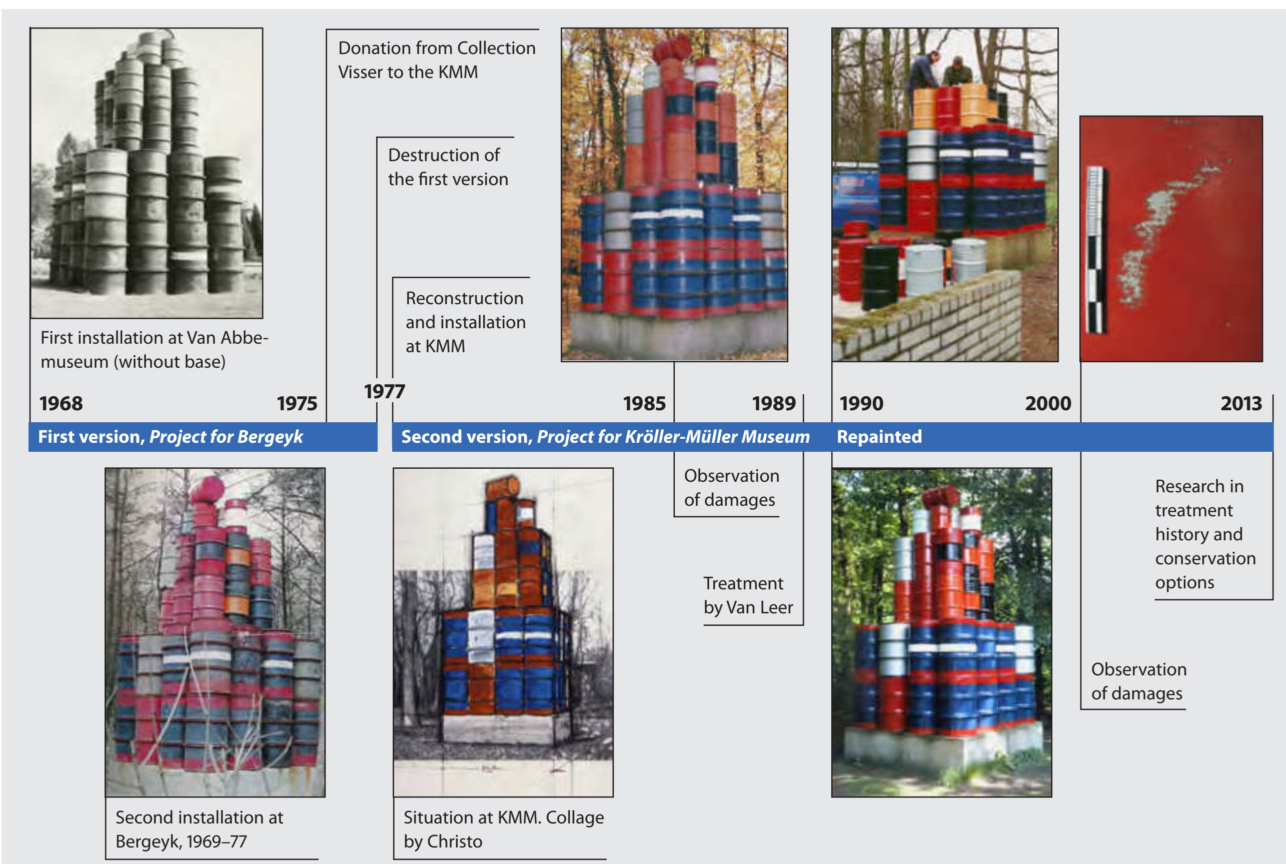
The conclusion for a new conservation treatment is that conservators must refer to the visual appearance of the artwork in 1977. The barrels and paint layers should not look used and rusty, as they were brand new in 1977. That means that corrosion and flaking paint layers, which may have been acceptable for the first version, are now disturbing the perception of the color pattern. Does that mean that exchanging corroded barrels and entirely repainting them is the only option? Or does the value of the original material gain more importance with a distance of thirty-seven years between the making of the second version? Is a certain patina acceptable, or should the work always look shiny and new?

Conservation Options

The following approaches may be possible for conservation of *56 barrels*. A new concrete base with a sufficient foundation will be necessary to provide a stable basis for the barrels. Corrosion is the most serious problem, and the barrels must be treated urgently; however, their current condition—at least that of the visible barrels—does not rationalize an exchange. As mentioned earlier, the large barrels with the metal rings are most likely no longer available. Perhaps with a look toward the future, one should even investigate the possibility of remaking this special barrel form.

Damages in the paint layers, such as scratches and losses, are potential areas for new corrosion, and together with the flaking upper paint layers of mainly the orange barrels, they disturb the perception of the color pattern. However, the overall condition of the paint layers on the large barrels seems rather stable, and losses are clear. It may be possible to treat the corrosion, perform fillings where necessary, and locally retouch them. Also, most of the damages in the paint layers of the smaller barrels can be treated locally. Although a retouching may be a technical and aesthetical challenge, more than 80 percent of a twenty-three-year-old paint layer could be preserved as such.[18]

What is problematic are the orange barrels. Besides the fact that a third of the upper paint layer is gone, the surface of these barrels is matte and not shiny as on the other ones. These probably will have to be repainted, and the task would be to find the right color



Background and treatment history of *56 barrels* (1968/1977), collection Kröller-Müller Museum.

shade and gloss to stay in harmony with the entire color scheme.

However, further investigation is called for if the 1990 repainting does not align with the artist's concept, for example the performance of the white and red stripes on the blue barrels. If that is the case, these paint layers may need to be reconstructed. *56 barrels* is more or less a polychrome artwork; the challenge of reconstructive repainting in this type of work is much greater than with monochrome painted sculptures, where it may be more easily accomplished.

Conclusion

For this research, the KMM archive provided a treasure of information that yielded insight into how decisions were made in the past and made it possible to extract subtle intentions. The treatment history of *56 barrels* is comparable to that of other outdoor painted sculptures in the museum's collection. Research has revealed that partial or complete repainting appears to have been common practice in the past and generally was carried out in intervals of eight to fifteen years with the aim of bringing the work back to a "perfect" condition. It was only in the late 1990s that the KMM established a permanent position for a conservator of sculpture and modern art. Until that time, decisions about treatments were made by the director or the curator working with the artist or collector and, where relevant, the museum technical staff. The large barrels might have been treated locally in 1990, but this was not an issue at that time. With a distance of decades, the value of original materials can increase because they are no longer easily obtained.

The research underlined the importance of good documentation of all past maintenance, treatments, and any former changes. While the recording of the restoration is a crucial point, the information about decision making is a key factor for an interpretation of the current state and the significance of alterations made. It is difficult to generalize whether exchange and repaint is against conservation ethics if these measures clearly are not contradictory to the concept of an artist. Therefore it remains necessary to look carefully at the individual history of each artwork.

As noted earlier, in order to decide how this complex work is ultimately to be treated, a more comprehensive examination is necessary. Choosing new, long-lasting materials and protective layers will require more research. Further materials testing (such as cross sections to enable analysis of paint samples) could reveal information about the composition of the (original) paint. However, before any major action takes place, now seems to be the right moment to contact Christo himself to possibly adjust or disprove the findings thus far. An interview with the artist would provide firsthand information on past decision making and shed light on the limits and possibilities of a new restoration or reconstruction.

Notes

1. Christo Vladimirov Javacheff (b. 1935) and his wife, Jeanne-Claude, born Jeanne-Claude Denat de Guillebon (1935–2009), worked together on their projects beginning in the late 1950s. By naming Christo throughout this article I am referring to both artists.
2. The artwork the Vissers were referring to was *Wall of Oil Barrels* (1962), a wall of reused barrels that divided the exhibition room of Galerie J. The Vissers met Christo and Jeanne-Claude in 1963 and became long-time friends. They had acquired works from Christo (including *Empaquetages*) previously.
3. R. W. D. Oxenaar, KMM director, letter to Martin Visser, November 15, 1975, archive KMM. Prior to this donation, smaller works of Christo had already entered the museum collection. Since the 1970s, the KMM has acquired on a regular basis artworks from the Vissers' private collection. Today the museum owns about four hundred works of different artists from the 1960s to the 1980s, which form an important part of the collection.
4. Steven van Beek, head of technical department, interview with the author, October 30, 2013.
5. R. W. D. Oxenaar, letter to Martin Visser, January 19, 1976, archive KMM. Several more letters between the museum, the collectors, and Janus Vaten document the decision making.

6. Steven van Beek, interview with the author, October 30, 2013.
7. Not all colors in the drawings are identical to the actual colors used; this can be interpreted as artistic freedom.
8. Invoice, Janus Vaten B.V. to KMM, December 15, 1976, archive KMM. The time needed to produce the barrels was estimated to be 160 hours of labor; spraying the paint would cost 80 hours of labor and mounting on-site 16 hours of labor. The barrels' total weight is approximately 2 tons.
9. Steven van Beek, interview with the author, April 2013.
10. A 5 kg paint can of yellow lacquer with the sticker "Janus Vaten B.V." is present in the museum. Further investigation may determine whether this paint was used on the artwork in 1977 and/or in 1990 and could yield important information about the paint composition.
11. Steven van Beek, interview with the author, October 30, 2013.
12. Marianne Brouwer, KMM curator, letter to Christo, October 18, 1988, archive KMM. Although no written answer is present in the archive, no maintenance was undertaken without the permission of Christo.
13. Jeanne-Claude, letter to M. Brouwer, May 21, 1990, archive KMM. Although the "restoration" was apparently acknowledged by the artist, it is not known if Christo saw it in person.
14. Van Leer Packaging Company, letter to M. Brouwer, March 22, 1990, archive KMM. Van Leer Packaging had a good working relationship with Janus Vaten B.V. According to Steven van Beek, the paint was specially mixed for the artwork. It is possible that information about the original paint was exchanged, although it is questionable if the original colors were available after thirteen years.
15. Steven van Beek, interview with the author, October 30, 2013. At areas of corrosion the sanding down was carried out with caution and was stopped at a certain point to avoid further damage. The fact that the large barrels were difficult to replace already had been determined.
16. It is also apparent that the former blue barrel, for example, appears to have been sprayed gray, and vice versa.
17. Here the adhesion between layers is insufficient. This damage may have been exacerbated by the use of excessively high-pressure water when the work was cleaned in the past.
18. Promising results on this issue are given in Nikki van Basten's MA thesis and article, "Retouching Monochrome Painted Metal Outdoor Sculptures: Tests for Claes Oldenburg's *Trowel*," University of Amsterdam, 2013.

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Preserving Artistic Style and Authentic Appearance in Hand-Painted Outdoor Sculptures

Frederike Breder

***Abstract**: Recoating of outdoor sculptures may become inevitable. If parameters such as color and gloss are known, it is possible to recoat a sculpture according to the artist's intent. Hand-painted sculptures present an additional concern.* Lifesaver Fountain*, by Niki de Saint-Phalle, is an example of the decision making and technical execution involved in a minor intervening treatment. Hand-painted works such as the walkable sculpture* Jardin d'émail*, by Jean Dubuffet, however, may also require a full repaint. After several such repaints, knowledge of the artist's approach and desires may become lost. Research on Dubuffet's painting technique will be presented in this paper, as well as how the characteristic appearance of hand-painted artworks may be maintained.*

Introduction

Conservators generally accept that recoating paint layers on an outdoor painted sculpture is inevitable because of the environment to which they are exposed. If parameters such as color, gloss, and application technique are known for the sculpture, it is often possible to recoat according to the artist's intent. Recoating of monochrome surfaces with the appropriate industrial coating is a reasonably straightforward philosophy to follow, but what about hand-painted sculptures? Hand-painted sculptures show a unique artistic style. The surfaces are designed with fine or broad brushstrokes. The application of paint is sometimes opaque or translucent and may show smooth or rough edges—specific characteristics that may be difficult to imitate. With this in mind, how much deviation from the artist's hand should be tolerated? The two case studies discussed here involve hand-painted sculptures by Niki de Saint-Phalle and Jean Dubuffet.

Restoring *Lifesaver Fountain*

In 2009 *Lifesaver Fountain*, by Niki de Saint-Phalle (1930–2002), was restored by Restaurierungsatelier "Die Schmiede" GmbH.[1] The sculpture dates from 1993; its dimensions are 7.65 meters high by 5 meters wide by 3.2 meters deep (Brockhaus 1999; Niki Charitable Art Foundation 2007–12). The production was carried out by Haligon, a French company with which Saint-Phalle often worked. Even though the enlargement of the artist's model was realized by assistants, Saint-Phalle was actively involved in the process and was in control of the results.

The fountain is located in a public plaza in Duisburg, Germany (figs. 1, 2), and had incurred serious structural problems. The focus of the restoration project was on strengthening the inner structure. It was clear from the beginning, however, that the painted surface also needed treatment. As it is a fountain, the paint layer is highly stressed by chlorinated water and lime scale. The surfaces showed cracks and flaking paint. In the case of three other sculptures by Saint-Phalle in Germany, the paint layer of each had been removed completely. An additional layer of glass fiber and resin was then applied, and a complete repaint of the sculptures was carried out by a company specializing in the production of fiber plastic composites (Herbst 2007). With this in mind,

Figure 1 Niki de Saint-Phalle, *Lifesaver Fountain,* 1993. Duisburg. © 2014 Niki Charitable Art Foundation. All rights reserved / ARS, NY / ADAGP, Paris. Photo: Werner Lüken, 2010.

Figure 2 Detail of paint layer on *Lifesaver Fountain,* showing visible brushstrokes. Photo: Frederike Breder / Restaurierungsatelier "Die Schmiede" GmbH, 2009.

which was the appropriate path for *Lifesaver Fountain:* retouching or repainting?

Lifesaver Fountain had never before been restored, and after fifteen years its condition was good enough to preserve the original paint. It is much easier to retouch a colorful paint layer than a monochrome coated surface. The conservators were able to convince Duisburg city officials to save the original paint layer, particularly because consolidation and retouching would not incur higher costs than repainting.

Approach to Treatment for *Lifesaver Fountain*

In developing a plan for durable restoration of the paint, the first step was the analysis of binding mediums, fillers, and pigments in order to determine which materials were originally used. This would help avoid retouchings that eventually would become visible because of different aging.

First, the surface was cleaned with water and a neutral cleaning agent, which removed calcium deposits with 20 percent citric acid. A secondary cleaning with only water followed (fig. 3). Consolidation of the paint layer was carried out using a stable, clear, easy-to-use one-component polyurethane (fig. 4). Losses were filled using a two-component acrylic filler, which was not easy to find in white because most fillers—such as those used in automotive painting—are gray; the surfaces were then smoothed with a micro-grinding machine (fig. 5).

The paint for retouching was mixed with a one-component acrylic lacquer and pigments. Whereas the original clear coat consisted of acrylic, it was decided to use a two-component polyurethane, as it lasts longer under the given conditions: mechanic and chemical stress caused by fountain water runoff and people climbing on the lower parts of the sculpture. Polyurethane clear coats show resistance to chemical, water, and yellowing and are mainly used to meet the highest requirements in terms of durability if the use of thermosetting coatings is not possible (Brock 2009). Finally, it was possible to save the original paint layer with durable conservation materials.

Restoration was completed in 2010 (fig. 6). Apart from the materials used, the surface of *Lifesaver Fountain* was treated with methods known from painting conservation. But what if a conservation treatment is no longer applicable because the condition of the artwork is much worse than originally determined? If hand-painted surfaces are of special value, is it impossible to repaint hand-painted sculptures?

Figure 3 A conservator cleans *Lifesaver Fountain*, the first step in the restoration of the sculpture. Photo: Frederike Breder / Restaurierungsatelier "Die Schmiede" GmbH, 2009.

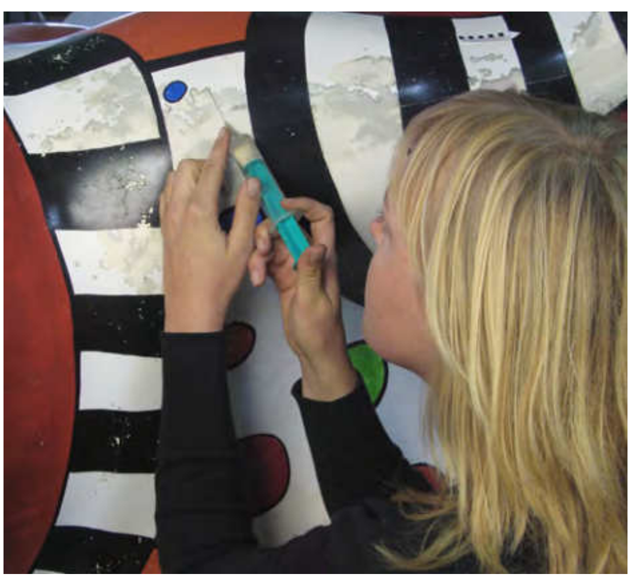

Figure 4 A one-component polyurethane was used to consolidate the paint layer. Photo: Frederike Breder / Restaurierungsatelier "Die Schmiede" GmbH 2009.

Figure 5 Losses were filled with a two-component acrylic filler, then smoothed with a micro-grinding machine. Photo: Frederike Breder / Restaurierungsatelier "Die Schmiede" GmbH, 2009.

Figure 6 Condition of *Lifesaver Fountain* before (*left*) and after treatment. Photo: Frederike Breder / Restaurierungsatelier "Die Schmiede" GmbH, 2009/2010.

Background of *Jardin d'émail*

For a walkable hand-painted sculpture—in this case, *Jardin d'émail,* by Jean Dubuffet (1901–1985)—a regular repaint can also become common practice. Regular repainting can greatly affect the appearance of an artwork, especially if the artist's specifications have faded from memory.

Jardin d'émail dates from 1974 and is installed on the grounds of the Kröller-Müller Museum in Otterlo, the Netherlands (fig. 7). It is made of concrete and glass

Figure 7 Jean Dubuffet, *Jardin d'émail*, 1974. Kröller-Müller Museum. Courtesy Fondation Dubuffet, Paris. Collection Kröller-Müller Museum, Otterlo, the Netherlands. Photo: Frederike Breder, 2006.

fiber–reinforced epoxy resin. The work is 10 meters high by 30 meters wide by 20 meters deep, and is painted white with black lines. Visitors to the museum are allowed to walk on the structured ground. An architectural model (2 × 3 meters) made of glass fiber–reinforced polyester resin was the basis for this realization (van Kooten and Bloemheuvel 2007). The model dates from 1966–68 and can be regarded as an artwork itself.

For the enlargements of his sculptures, Dubuffet worked with an architect. Based on constructional drawings, the artificial landscape was built by a Dutch construction company. The elements made of epoxy resin—the tree with the door as the entrance to the garden, and the two smaller bushes farther from the tree—were realized and painted in Dubuffet's ateliers in France. A polyurethane paint was developed and produced by Sikkens Company in the Netherlands. For Dubuffet it was important to acquire a very matte paint. After the white paint was sprayed on, two of his assistants came to the Kröller-Müller Museum to apply the black lines using a paintbrush and the model as a guide (fig. 8). Dubuffet arrived at the museum to examine the results and make some final changes.

Figure 8 One of Jean Dubuffet's assistants executes the black lines of *Jardin d'émail* in April 1974. Photo: Archive Kröller-Müller Museum, 1974.

Due to weathering and the impact of visitors walking on its surface, *Jardin d'émail* requires regular care. The sculpture has been repainted three times in the forty years since its creation (table 1).

Table 1. History of repaint of *Jardin d'émail*.

1974	1979	1988	1999–2000
Original paint (polyurethane)	First repaint (epoxy)	Second repaint (polyvinyl chloride–based)	Third repaint (polyvinyl chloride–based)

Samples of the paint layers were analyzed, and eight different types of binding mediums were identified. The last repaint was completed in 2000 using a polyvinyl chloride (PVC) paint. This layer is now fourteen years old and shows numerous local repairs (fig. 9).

Changes to the Sculpture's Original Appearance

It is remarkable that the large top part of the tree still retains the original polyurethane paint layer from 1974. The artwork remains impressive, but the appearance of its black lines has changed. The pathways of the lines have diverted from their original course, and the fact that the lines were made with the aid of a paintbrush is no longer recognizable (fig. 10). When the artwork was repainted in 1999, adhesive tape was attached on both edges of the black lines. The course stayed visible this time, but the slightly irregular structure of a freehand painted line was lost. If one studies the work of Dubuffet, however, it becomes apparent that these aspects are of enormous importance. The course of the lines should not always follow the course of the formed landscape in order to achieve an interplay between visual and physical experience. Dubuffet originally was a painter, and he sometimes described his sculptures as "monumentalized" paintings. It is important that the brushstrokes are visible.

During research in France, other sculptures by Dubuffet were studied, including the restored *Closerie Falbala* in Périgny-sur-Yerres (fig. 11). Sophie Webel, director of the Fondation Dubuffet, and Richard Dhoet, the artist's former assistant, provided the information needed to clarify technical questions concerning a repaint. Dhoet reported, for example, that the white paint is normally applied by a paintbrush not only because of the visible effect but also because of the better adhesion created between paint and ground. Beyond that, the very matte paint does not work on the walkable parts of Dubuffet sculptures because it gets dirty and damaged too quickly. In this regard, change might be possible (Breder 2006).

Figure 9 View of *Jardin d'émail,* showing numerous local paint repairs. Photo: Frederike Breder, 2012.

Figure 10 *Jardin d'émail* in 1974 (*left*) and 2006, showing migration of the black lines over time. Photo (*left*): Archive Kröller-Müller Museum 1974. Photo (*right*): Frederike Breder, 2006.

Figure 11 *From left:* Sanneke Stigter (then conservator at the Kröller-Müller Museum), Richard Dhoet (Fondation Dubuffet), and Sophie Webel (Fondation Dubuffet) consult at *Closerie Falbala* in Périgny-sur-Yerres. Photo: Frederike Breder, 2006.

Aside from the technical questions concerning concrete refurbishment and paint mediums, the concept for the necessary repaint was clear: with the aid of old photos and the model, the original course and appearance of the black lines would be reconstructed. Restoration of the entire work is planned, but its immense size requires considerable financial support. At present, only partial restoration is affordable.

Conclusion

The original paint layer of any hand-painted sculpture carries all the information that indicates the desired effect of the artwork. If the work is to be repainted, there is a high risk of losing its main aspects. Artists all over the world produce enlargements based on models, collaborating with various assistants and various companies. At the time of their production, the works already may differ in appearance compared to one another and their models. Nevertheless, hand-painted works should get all the care possible, because the authentic appearance of the time the work dates from is indeed of great value. By overpainting the artwork, intrinsic information about aesthetics and paint technique may be lost forever.

As conservators, we need concepts for dealing with hand-painted outdoor sculptures. We are already at a point where we can no longer ask the artist, and there will not always be an artist's foundation to consult.

Of course, it is possible that conservators, painters, and varnishers will be able to repaint a hand-painted sculpture as long as the execution is based on research into factors such as artist intent, design, style, choice of color, gloss level, opacity, thickness, structure, chemical composition, and the buildup of layers. However, if the persons in charge do not collect the necessary information and do not respect the authentic appearance, the repaint is in danger of failing.

Notes

1. For more information, contact Martin Kaufmann, head of conservation, Restaurierungsatelier "Die Schmiede" GmbH (www.schmiede-duisburg.de).

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Retouching Monochrome Outdoor Painted Metal Sculptures: Tests for Claes Oldenburg's *Trowel*

Nikki van Basten, Sanneke Stigter, Susanne Kensche, and René Peschar

Abstract: *This study aims to investigate the possibilities of retouching as a solution to addressing local damages on monochrome outdoor painted metal sculptures.* Trowel *by Claes Oldenburg was selected as a case study. Four paints were tested on application and manipulation of gloss and color, then artificially aged with an Atlas Ci5000 Xenon Weather-Ometer. Good results were obtained with Sikkens Redox PUR Finish Gloss, an industrial paint, which was modified with Deuteron KM-F6 (micronized polymethyl urea matting agent), and Sikkens Redox PUR Finish Mix colorant paste, applied with an airbrush. Additional testing in an outdoor environment is suggested to confirm the outcome.*

Introduction

Degradation of paint layers on outdoor painted metal sculptures is a well-known problem (Considine et al. 2010; Pullen and Heuman 2007). Not only are the aesthetics of the artwork disturbed, but damages in the paint layer also facilitate and accelerate further degradation by allowing the metal structure underneath to corrode (Schweitzer 2006, 60). Although the overall repainting of outdoor metal sculptures is still common practice (Coddington 2007, 38; Considine et al. 2010, 134–43) and recent research has focused on high-quality industrial paint systems for this purpose (Mack 2002, 923–26), the importance of local treatment is generally recognized in the field as being a desirable approach in many cases. In 2012 a focus meeting on outdoor painted sculpture, organized by the Getty Conservation Institute (GCI), emphasized the "lack of options available to the conservator, especially for local treatments" as a priority need for conservators (Getty Conservation Institute 2013).

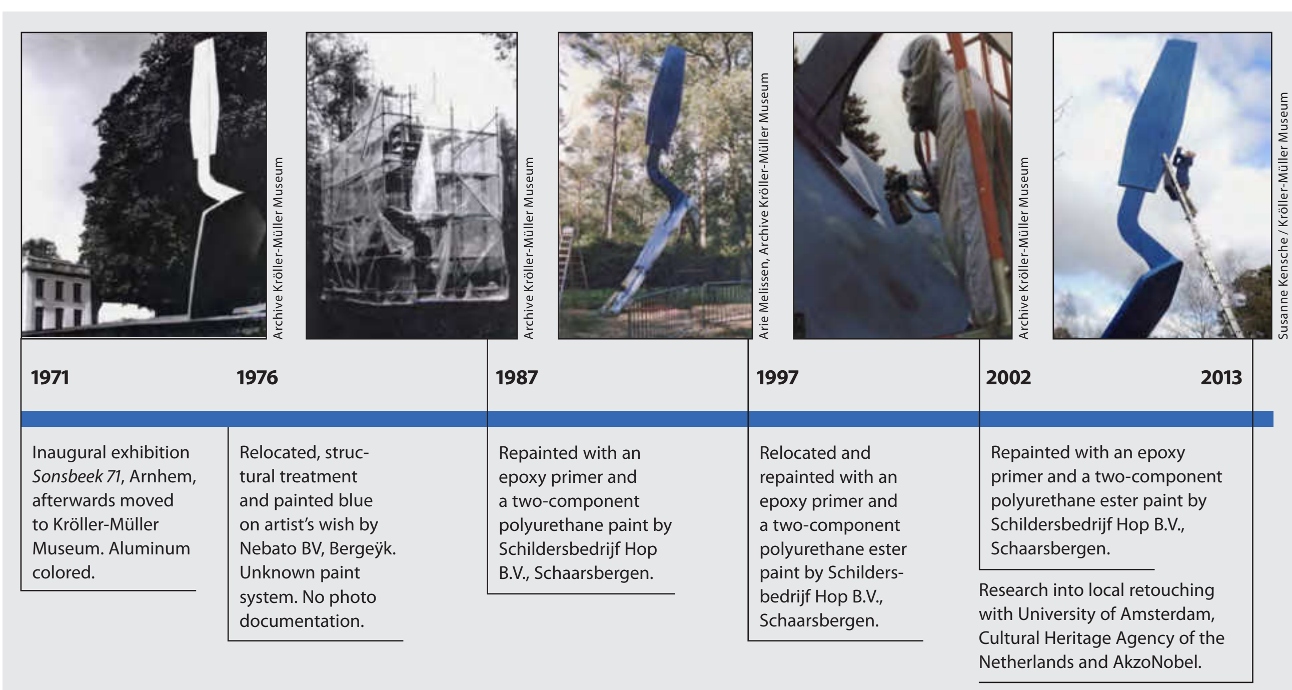
Local treatment of damages or losses in the paint layer is attractive for various reasons. Minimal intervention complies with conservation-restoration ethics, and local treatment often can be carried out immediately, thereby preventing further damage to the sculpture in the short term. Furthermore, local treatment normally costs a fraction of a total repainting campaign, both in itself and by extending the period of time before a more invasive, complete renewal of paint layers becomes necessary. Of the steps typically involved in undertaking a local repair—namely corrosion elimination, priming, filling, and retouching—the last step is crucial. Retouching a monochrome paint layer on large outdoor sculptures is highly challenging and therefore rarely practiced or communicated (but see Esmay 2005 as an exception). Industrial paint systems with high outdoor stability are often difficult to manipulate and hard to apply locally without creating a visual discrepancy between the retouched areas and the existing paint layers.

The objective of this study was to investigate whether it is possible to carry out retouching as a local treatment to match a weathered paint surface and hence provide maximum visual improvement on the overall sculpture with a minimal amount of work. The outdoor painted metal sculpture *Trowel* (1971) by Claes Oldenburg (b. 1929), from the collection of the Kröller-Müller Museum (KMM), Otterlo, the Netherlands, was used as a case study for testing.[1] Several industrial paint systems and some products commonly used in conservation treatments were tested on workability and long-term behavior. In addition, gloss and color were manipulated with matting agents and pigment pastes, and several application techniques were tried. A selection of prepared paint samples was artificially aged according to standards from the paint industry (Schulz 2008). The results showed that retouching of painted metal sculptures is technically possible if a suitable paint and the proper additives are used. Taking the current paint system present on *Trowel* as reference, good results were achieved with an industrial paint based on a two-component polyurethane polymer. The gloss of this paint was easily modified with appropriate matting agents, while manipulation of the color was achieved by adding pigment paste to match local differences in the existing paint layer.

Figure 1 Claes T. Oldenburg and Coosje van Bruggen, *Trowel I*, 1971–76. Steel painted with polyurethane enamel, 41 ft. 9 in. × 11 ft. 3 in. × 14 ft. 7 in. (12.7 × 3.4 × 4.4 m). Sited: 38 ft. 5 in. × 11 ft. 3 in. × 7 ft. 5 in. (11.7 × 3.4 × 2.3 m). Collection Rijksmuseum Kröller-Müller, Otterlo, the Netherlands. KM122.342. © 1971–76 Claes Oldenburg and Coosje van Bruggen. Photo by Nikki van Basten.

Case Study: *Trowel*

Trowel is a nearly 12-meter-high outdoor painted metal sculpture (fig. 1). Claes Oldenburg is well known for his blown-up Pop art versions of objects from everyday life



Maintenance timeline for Claes Oldenburg's *Trowel*.

(Bruggen and Oldenburg 1995, 226). The work originally was aluminum colored when it was first exhibited, at the temporary outdoor exhibition *Sonsbeek 71* in Arnhem in 1971; at that time it was referred to as *Sculpture in the form of a trowel, stuck in the ground* (Beijeren and Kapteyn 1971, pt. 2:12).[2] In a program statement, Oldenburg called the object "a generalized version of the Trowel/Spade/Spatula called the Trowel" and specified, somewhat cryptically, the "color to be function of conditions of site" (Beijeren and Kapteyn 1971, pt. 1:54).

Later in 1971 *Trowel* was transferred to the Kröller-Müller Museum, which had financed the work (Kooten and Bloemheuvel 2007, 304). Oldenburg was not happy with the aluminum color in the sculpture's new environment, and when structural conservation treatment became necessary he proposed painting it a different color. He suggested red at first, but Rudi Oxenaar, director of the KMM at the time, thought this "too aggressive," and, in accordance with the artist, *Trowel* was painted blue in 1976 (Kooten and Bloemheuvel 2007, 305).

Since 1976 *Trowel* has been repainted about every eight years, starting in 1987, by the same local paint company, Schildersbedrijf Hop B.V., Schaarsbergen. For the past three overall treatments, a two-component epoxy primer was sprayed on top of the previous paint layers, lacunae were filled with a two-component filling, and a two-component high-gloss polyurethane coating was applied on top, a paint system manufactured by AkzoNobel.[3] Analyses indicated that the coating is a polyurethane ester.[4] The last treatment was carried out in 2002, and the overall condition of the paint layer currently is still relatively good, in spite of the outer paint layer showing some damage and delamination locally (fig. 2) and some local shifts in color and gloss.[5] The next treatment for the sculpture is approaching, which has prompted the KMM to look at alternatives to another overall treatment.

Selection of Paint Systems and Additives

After an initial literature survey and consultation with the paint industry, professional painters, and conservator-restorers, potential paints and additives to manipulate color and gloss were assessed, taking into account criteria such as compatibility, workability, reversibility, and outdoor stability. Initial tests led to a selection of four paint systems, details of which are given in table 1.

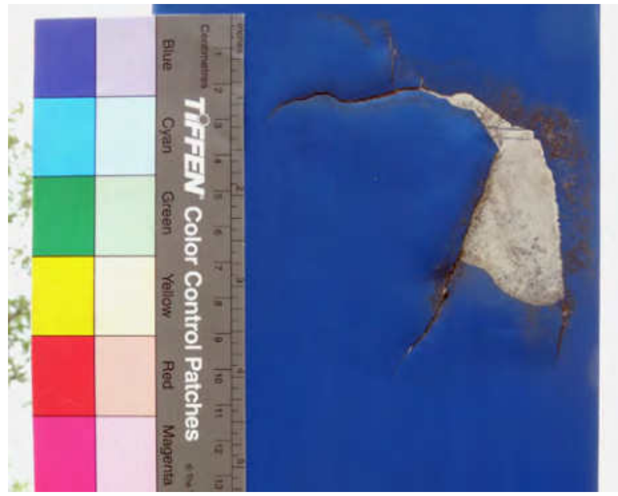


Figure 2 Detail of the back of *Trowel*, showing paint loss in the outer layer. Photo by Nikki van Basten.

Two industrial polyurethane-based paint systems for general outdoor use were selected, one acrylic paint and one type of Paraloid. The first paint was the same used on the current outer paint layer of *Trowel:* Sikkens Redox PUR Finish Gloss, a two-component polyurethane ester paint. This paint is known for its durability and can be painted over with the same paint system, making it compatible with the existing paint layer. However, the workability of a two-component paint is known to be difficult. The second system selected was Sikkens Rubbol BL Safira, a one-component polyurethane-based paint. For both paint systems, the paint manufacturer AkzoNobel suggested a matting agent, Deuteron MK-F6 (a micronized polymethyl urea), and two colorants, Sikkens Redox PUR Finish Mix (a colorant paste based on a polyurethane binding medium) and Acomix pigment paste. AkzoNobel proposed that these materials could be used to modify the overall surface finish of the paint system.

The third paint investigated was Golden Fluid Acrylics, an acrylic resin dispersion that is normally used only indoors by conservators and was therefore also tested with a protecting lacquer. Two lacquers were used: Zijdeglans Vernis PU (De IJssel Coatings B.V.), a polyurethane-based resin, and Paraloid B-48N (Rohm and Haas), a copolymer of methyl methacrylate and butyl acrylate dissolved in toluene (10 percent w/v). The fourth paint consisted of Paraloid B-48N resin dissolved in toluene (10 percent w/v) with copper phthalocyanine

Table 1. Four paint systems, modified with additives, were selected as potential retouching material for *Trowel*.

	Paint		Additives		Artificial Aging (1184 hrs)	
	Product	**Product type**	**Colorant 2.5% w/w**	**Matting agent 1% w/w**	**Loss of gloss (Gloss Units)**	**Color change (ΔE)**
1	**Sikkens Redox PUR Finish Gloss**	Two-component polyurethane ester	Sikkens Redox PUR Finish Mix, colorant paste based on polyurethane binding media	Deuteron MK-F6, micronized polymethyl urea	2.3	2.3
				Scotchlite™ S22, glass micro-balloons	NP*	NP*
2	**Sikkens Rubbol BL Safira**	One-component polyurethane	AcoMix, water-based pigment paste	Deuteron MK-F6, micronized polymethyl urea	+0.4**	2.4
				Scotchlite™ S22, glass micro-balloons	NP*	NP*
3a	**Golden Fluid Acrylics**	Acrylic resin dispersion	Golden Fluid Acrylics, acrylic resin dispersion	—	+1.5**	2.9
	+ De IJssel PU Zijdeglans Vernis	One-component polyurethane	—	Deuteron MK-F6, micronized polymethyl urea	4.9	3.9
3b	**Golden Fluid Acrylics**	Acrylic resin dispersion	Golden Fluid Acrylics, acrylic resin dispersion	—	+1.5**	2.9
	+ Rohm and Haas Paraloid B-48N in toluene 10% w/v	Copolymer of methyl methacrylate and butyl acrylate	—	Deuteron MK-F6, micronized polymethyl urea	+3.5**	3.9
4	**Rohm and Haas Paraloid B-48N in toluene 10% w/v + pigments**	Copolymer of methyl methacrylate and butyl acrylate	Pigments copper phthalocyanine blue and barium sulfate white	Deuteron MK-F6, micronized polymethyl urea	NP*	NP*

* Not pursued because of poor performance

** Increase of gloss compared to the start of aging, possibly heat has evened out the surface

blue and barium sulfate white, the same pigments as those used in the paint system of the last integral conservation treatment of *Trowel*.[6]

Application on Test Plates

For each of the four paint systems, a steel test plate was prepared. These plates were cleaned with white spirit and a layer buildup was created similar to that of the last integral repainting of *Trowel*. This meant a pretreatment with Sikkens Redox EP Multi primer applied with a spray gun. To simulate lacunae in the paint layer, blank areas were created by adhering patches of tape to the test plate before the final paint, Sikkens Redox PUR Satin, was applied. The composition of this pigmented two-component polyurethane polymer is similar to that of Sikkens Redox PUR Finish Gloss, the paint used for the last integral repainting of *Trowel*, but the PUR Satin variant contains more matting agents. Optically the PUR Satin is a better match with the current paint layer of *Trowel*, as the PUR Finish Gloss has lost some of its gloss over time. To achieve a similar surface texture, the paint was sprayed on with a spray gun by the same professional painter who had performed the integral repainting of *Trowel* in the past.

The influence of additives such as matting agents and colorants on the retouching paint systems was assessed before applying them to the test plates in order to achieve a satisfactory match with the paint layer on the test plates (fig. 3). In the case of the two-component paint system, the colorant pastes were added before the

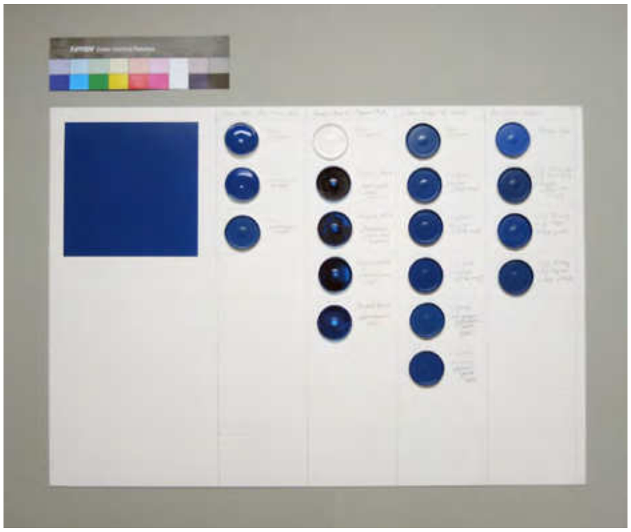


Figure 3 Additives such as matting agents and colorants were added to the paint systems to alter color and gloss. Photo by Nikki van Basten.

Figure 4 An automated robot was used to take color and gloss measurements during and after aging tests at AkzoNobel. Photo by Nikki van Basten.

hardener. Various application techniques were tested, including those involving brushes, sponges, rollers, and airbrushes. The use of an airbrush required diluting the paints with a thinner (approximately 20 percent v/v). For each application technique, several trials were carried out with the addition of colorants and matting agents until the color and gloss matched the base paint layer. During preparation and application of each paint system, its workability, preparation time, manipulation, drying speed or curing time, and overall opacity were recorded.

Artificial Aging

Three paint systems that yielded promising results were exposed to accelerated artificial aging to assess their outdoor durability and, in particular, to observe whether the additives affect the behavior of the paint in any way (see table 1, systems 1–3). For the aging tests, four smaller test plates were prepared for each paint system: one test plate with pure paint, one with the addition of colorants (2.5 percent w/w), one with the addition of a matting agent (1 percent w/w), and one with both (2.5 percent w/w colorants and 1 percent w/w matting agent).

The aging tests were conducted at the laboratories of AkzoNobel in Sassenheim, the Netherlands, utilizing an Atlas Ci5000 Xenon Weather-Ometer and aging standards ISO 11341 (Cycle A) and ISO 4892-2 (Method 1), commonly used by AkzoNobel to test the outdoor durability of paint systems. The Xenon Weather-Ometer exposes the test plates to cyclic variations of light intensity, temperature, and humidity. The aging test ran for more than one thousand hours, similar to tests normally run by AkzoNobel. Gloss and color measurements were carried out regularly with an automated robot setup during and after the test. Color was measured with a BYK-mac spectrophotometer using the CIELAB 1976 color space model, and gloss units were measured with a BYK Micro-tri-gloss meter (fig. 4). The paints also were inspected visually by microscope to detect any loss of adhesion or cracking of the paint during aging.

Results

The two industrial polyurethane paints, Sikkens Redox PUR Finish Gloss and Sikkens Rubbol BL Safira, showed good workability. Color adjustment of these paints using Sikkens Redox PUR Finish Mix colorant paste and AcoMix pigment paste, respectively, was possible but not easily achieved, as the color of both polyurethane paints tended to darken when curing. Gloss modification with Deuteron MK-F6 (micronized polymethyl urea particles) was not particularly difficult for either paint. The use of glass microballoons (29–53 microns in diameter) for this purpose did not work well, as the particles remained visible in the paint and created an irregular texture.

Color matching with acrylic resin dispersion was easily achieved. However, to obtain a good overall opacity, multiple applications were necessary. By adding transparent protective lacquers, the gloss could be modified to the desired extent without difficulty. After the practical tests, Paraloid B-48N with pigments was not pursued further because of its inappropriate texture, with pigment particles left visible and very poor adhesion to the primer.

The practical tests revealed that a uniform texture is feasible with three of the paint systems employed, and application with an airbrush with a 0.5-millimeter nozzle achieved the best results. The additives tested (micronized polymethyl urea and the colorants) did not affect workability with the airbrush.[7] Although a perfect match of color and gloss of a retouched area with the neighboring paint turned out to be nearly impossible, a negligible visual difference could be achieved if it is taken into account that large outdoor sculptures such as *Trowel* are normally viewed at a distance of at least a few meters.

The artificial aging test involving Sikkens Redox PUR Finish Gloss, Sikkens Rubbol BL Safira, and Golden Fluid Acrylics, protected with transparent lacquers on top, revealed that the presence of additives minimally influenced the performance compared to the pure paints. The PUR Finish Gloss performed best, with a relatively small change of gloss (fig. 5) and an acceptable small shift in color (ΔE < 2.5) in most cases (fig. 6). Judging from the similarity between the gloss unit curves and the ΔE curves, the presence of additives in this paint does not seem to have a significant effect on aging behavior.

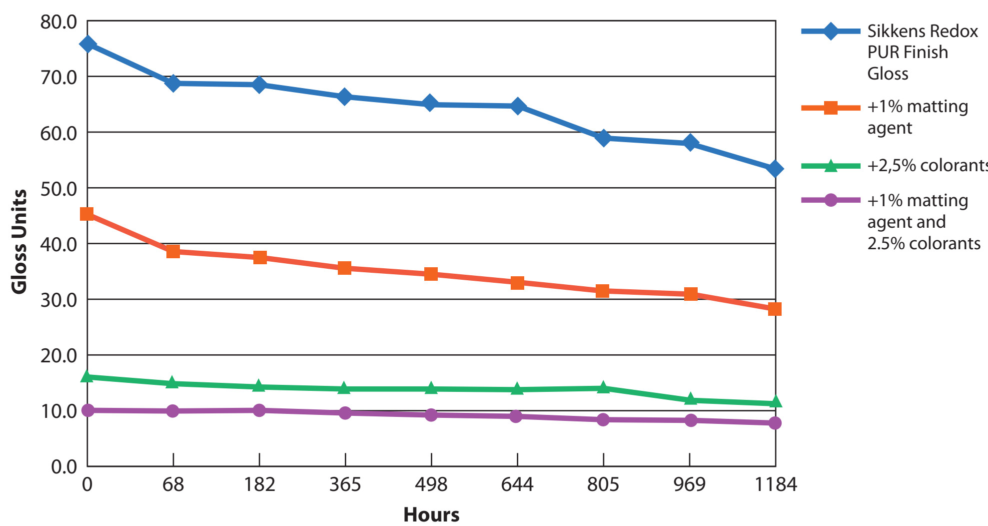


Figure 5 Graph showing change in gloss units of two-component polyurethane (ester) paints during the artificial aging test.

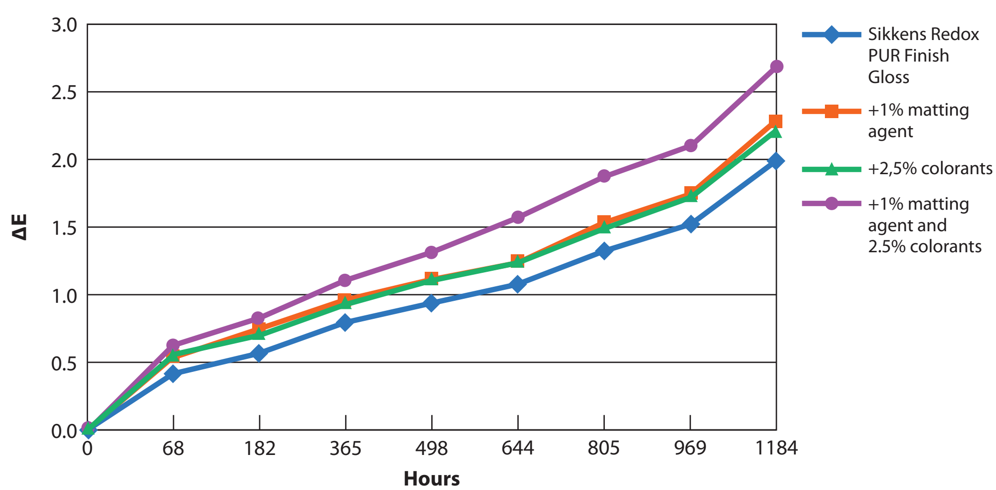


Figure 6 Graph showing change in color difference (ΔE) of two-component polyurethane (ester) paints during the artificial aging test.

The one-component polyurethane paint showed an equally acceptable minor gloss change and ΔE curves, but visual inspection revealed that some areas had lost adhesion as a result of artificial aging. The protective layer of De IJssel's Zijdeglans Vernis PU on top of Golden Fluid Acrylics showed cracks after aging. Interestingly, the Golden Fluid Acrylics resin dispersion paint turned out to be quite stable, even without either of the two protective layers on top, the shift in color being slightly higher (ΔE = in the range of 2 to 5) than for both polyurethane systems (ΔE < 2.5) (see table 1).

Discussion

During artificial aging, the paint samples were exposed to cyclic changes in climatic conditions; however, this artificially simulated environment cannot model the wide variations in real outdoor conditions. This means that comparison of paints on the basis of their aging behavior is only indicative and cannot be extrapolated to their potential durability in time. The practical tests were carried out in the conservation studio of the Kröller-Müller Museum under stable climate conditions and not in an outdoor situation of more extreme circumstances. Preparation and application of a paint system outdoors may be more problematic in practice. Furthermore, the simulated damages in this study were quite simple, whereas real defects can be shaped quite irregularly (see fig. 2). A nonuniform gloss and color in the existing monochrome paint layer around the lacunae would present an additional challenge in obtaining a good visual match.

Signs of delamination, as observed in *Trowel*, require a more complex treatment because corrosion products underneath the paint layer around the lacunae need to be treated as well, and the lacunae need to be filled before retouching. Furthermore, local treatments cannot be carried out infinitely. However, we can state that local treatment is legitimate when a sculpture risks further damage due to local losses while the majority of the paint layer still is intact to postpone an integral treatment. In the paint industry, a standard of 10 percent of surface defects is the norm before proceeding to treat an entire surface (Bonestroo and Smale 2008, 20). Similar standards could be introduced in the conservation of outdoor painted sculptures such as *Trowel*. Although local treatments can postpone an integral and more invasive treatment for a number of years, it is impossible to determine exactly how long, as this depends on the cause of the problem and variables in the outdoor environment.

Conclusion

Retouching monochrome painted metal sculptures locally is technically feasible if suitable paint, additives, and application techniques are used. Of the four paints tested as potential retouching material for Claes Oldenburg's *Trowel*, the best results were obtained with Sikkens Redox PUR Finish Gloss applied with an airbrush. This industrial paint, based on a two-component polyurethane polymer, is the same product that is currently used on the artwork, making it nonreversible from the existing paint layer. However, this paint is durable and compatible, and manipulation is feasible with Deuteron MK-F6 (micronized polymethyl urea particles) and Sikkens Redox PUR Finish Mix colorant paste. Their addition makes local manipulation of gloss and color possible.

Artificial aging revealed that the additives had little or no effect on the aging behavior of this paint. Moreover, the paint system can be repainted, validating the idea of re-treatability because integral treatment remains possible. Additional testing in a natural outdoor environment is needed to confirm the research results and to assess how long integral repainting can be postponed by local treatment in the case of Claes Oldenburg's *Trowel*.

Acknowledgments

The authors would like to thank Lydia Beerkens, who came up with the idea for this research; and the Kröller-Müller Museum, which provided access to Claes Oldenburg's *Trowel* and the opportunity for conducting research on their premises. We warmly thank professional painter Eric Hop, who assisted with setup and preparation of the test plates. The Cultural Heritage Agency of the Netherlands (RCE) is greatly acknowledged for assisting in instrumental analyses, as are Bill Wei for gloss and color measurements of the paint layer; Suzan de Groot, Henk van Keulen, and Luc Megens for analyzing the binding medium; and Matthijs de Keijzer for analyzing the pigments in the outer paint layer of *Trowel*. We are very grateful to Frank de Vries, Flip van

Heemst, Erik Zwarthoff, Jan Udema, Helen Veringmeier, John de Werff, and Ben Ouwehand of AkzoNobel for their hospitality, for providing test materials, and for offering their facilities and assistance during the technical investigation.

Notes

1. This article is based on research carried out as part of a master's thesis by Nikki van Basten. See Basten (2013) for full references and details on materials and suppliers.
2. Neither information from the Kröller-Müller Museum archive nor a paint sample cross section indicates that the aluminum color was a paint layer. Analysis was kindly carried out by Matthijs de Keijzer of the Cultural Heritage Agency of the Netherlands (RCE).
3. Information on the material history of *Trowel* (inventory number KM122.342) was gathered at the KMM archive. Additional details on application techniques were obtained by the authors' personal communication with Eric Hop, the professional painter who repainted *Trowel* in the past.
4. The binding medium of the outer paint layer was analyzed by Suzan de Groot, Henk van Keulen, and Luc Megens, RCE.
5. Current gloss and color condition of the paint layer was measured by Bill Wei, RCE, January 28, 2013. Adhesion of the paint layer was assessed by Erik Zwarthoff of AkzoNobel, February 13, 2013.
6. The pigments of the outer paint layer were analyzed by Matthijs de Keijzer, RCE. The pigments used for testing were kindly provided by AkzoNobel.
7. For additional details on application techniques and workability of the paints, preparation time, drying speed, and overall opacity, see Basten (2013).

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A Memory of Materials: From Production to Documentation of Outdoor Painted Sculptures

Julia Lütolf and Peter von Bartheld

Abstract: *The art foundry Kunstgiesserei St. Gallen AG in Switzerland is working closely with the Sitterwerk Foundation to develop a form of documentation that describes the process of producing an artwork as comprehensively as possible. Samples of materials used in tests and experiments during the production process are documented and archived. It is not only the final solutions and materials chosen that are of interest but also the steps in between, as these give valuable insights into the production process. The development of the internal Company Archive and the public Material Archive stimulates active exchange between different professions and creates a network that can offer valuable clues to the correlations and background of an artwork.*

Figure 1 Aerial view of the Kunstgiesserei art foundry and the Sitterwerk Foundation offices, situated in the Sittertal, St. Gallen, Switzerland. Photo by Katalin Deér.

Introduction

Felix Lehner established his Kunstgiesserei (art foundry) with a staff of two in Beinwil am See in Switzerland in 1983. In 1994 came the move into the larger work halls of the former Sittertal dye works on the outskirts of the city of St. Gallen. Today the operations include some fifty staff. As a result of the openness to new ideas and technologies, the Kunstgiesserei has continued to grow and has established itself as a specialist center for the production of three-dimensional artworks as well as for consultation relating to the restoration of artworks.

Over the years various noncommercial cultural initiatives and collaborations with the Kunstgiesserei were established: the Art Library, the Material Archive, the Studio House with guest studios for national and international artists, and the Kesselhaus Josephsohn. Ultimately these were united under one roof in August 2006 as the Stiftung Sitterwerk (Sitterwerk Foundation). In its close relationship with the Kunstgiesserei, the Sitterwerk Foundation sees itself as a center for art and production where traditional crafts and the most modern technologies are directly connected in both theory and practice (fig. 1).

The Production Process

From the very beginning, the Kunstgiesserei pushed the production of art pieces beyond the boundaries of the traditional craft of art casting. It shared the curiosity of contemporary artists to work with the latest materials and techniques to achieve the desired results. In addition

Figure 2 An aluminum alloy casting at the Kunstgiesserei St. Gallen. Photo by Katalin Deér.

Figure 3 A technician at work on a plaster reconstruction of an old fountain. Photo by Katalin Deér.

Figure 4 Rough cut of polystyrene by a 5-axis milling robot in the in-house milling center. Photo by Katalin Deér.

to producing castings in copper-based alloys, aluminum, and iron, the Kunstgiesserei investigates and pursues mechanical and digital solutions (figs. 2, 3). White-light scanning and computer tomography are used in the foundry's 3-D studio to digitize objects, which can then be altered through virtual modeling. From there, 3-D printing, laser sintering, stereolithography, and five-axis milling at the Kunstgiesserei's own milling center are used to create models of virtually any size or shape (fig. 4). Objects cast in larger dimensions or enchased by hand are produced at the company's subsidiary in Shanghai, Kunstgiesserei Sculpture and Production Co. Ltd.

The diverse skills of the Kunstgiesserei's staff ensure that each step in the production process is individually planned and thought out. Throughout all stages, the foundry team works with the artist, adapting methods to his or her wishes or suggesting alternative methods if these would serve the results intended. This way of working often leads to a controversial usage and combination of materials and techniques, especially when the finishing touch—the top coat of paint—is applied to the artwork.

Although most coats of paint play a primary role in protecting the substrate (especially in the case of outdoor objects), at the Kunstgiesserei the selection of exactly the right color, gloss factor, or surface structure for the object is at least as important as the protective role. In the case of most of the cast objects, the coat of paint is used to mimic the characteristics of materials other than that of the substrate; for example, the thick buildup of the 2K polyurethane coat of paint for Urs Fischer's monumental sculpture *Untitled (Lamp/Bear)* (2005–6) is intended to imitate the soft texture of a teddy bear (fig. 5). In contrast, the thin acrylic coating for Ugo Rondinone's series of sculptures titled *MOONRISE. east* (2005–6) is supposed to make the aluminum casts look as if they are made out of moist clay, without covering up the subtle fingerprints on their surface (fig. 6).

Because there are such high aesthetic demands on many coats of paint, which nonetheless still need to withstand the outdoor elements, the Kunstgiesserei often experiments with paints from the automotive and aviation industries. Although these paint systems are developed to be durable, the procedures for apply-

Figure 5 Urs Fischer, *Untitled (Lamp/Bear)*, 2005–6. Cast bronze, epoxy primer, urethane paint, acrylic polyurethane topcoat, acrylic glass, gas discharge lamp, stainless-steel framework, 700 × 650 × 750 cm. Private property. © Urs Fischer. Courtesy of the artist.

Figure 6 Ugo Rondinone, *MOONRISE. east* (sculpture series), 2005–6. Cast aluminum, epoxy primer, acrylic topcoat, diverse formats. Installed in front of Art Basel, Switzerland, 2008. © Ugo Rondinone. Photo by Katalin Deér.

Figure 7 Compilation of paint-coated samples related to Urs Fischer's *Untitled (Lamp/Bear)*, documenting the artistic, practical, and material-related process. © Urs Fischer. Courtesy of the artist.

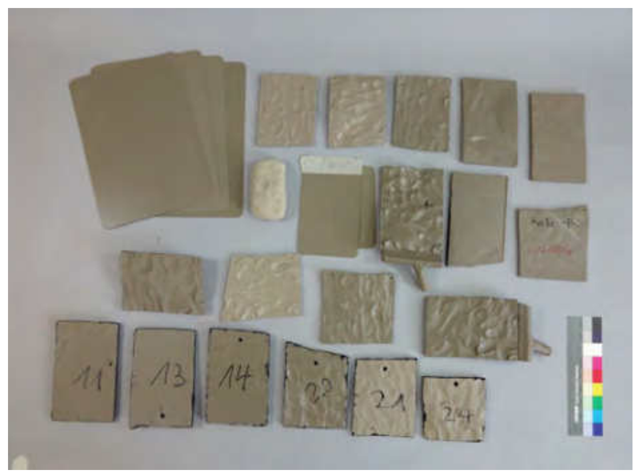

Figure 8 Compilation of paint-coated samples related to Ugo Rondinone's sculpture series *MOONRISE. east*, documenting the artistic, practical, and material-related process. Photo by Julia Lütolf.

ing them are often so strict that, when dealing with unusual surfaces, the final results are difficult to predict. Experiments are conducted in search of the right combination between what the artist desires and the functionality of the material. Sample paint coatings from these experiments have been collected and stored in the Company Archive and in the Sitterwerk Foundation's Material Archive for future scientific and inspirational reference (figs. 7, 8).

Documentation

The Company Archive of the Kunstgiesserei

In a company such as the Kunstgiesserei, where close collaboration with artists is a key factor in the creation of the artworks, the line between the input of the artist and that of the producer tends to be quite fine. For the documentation of the projects, it is therefore of great importance to try to define the artist's intention for the particular artwork.

At the Kunstgiesserei, work is under way on developing a form of documentation that will communicate the knowledge of the employees who experiment with materials within the framework of the projects commissioned, who conduct conversations with the artists, and who execute the technical realization as comprehensively as possible. This documentation will compile not only solutions and end products but also the intermediate steps that help comprehend the artistic, practical, and material-related decisions made during the process. In the production of art, the use and combination of materials is often unconventional, and it is not possible to standardize the sequence of operations in the production of individual pieces. To refer to and label the intermediate products that are created in the various production departments of the Kunstgiesserei, sample boxes are available as an aid. These contain the various casting molds, labeling material, and a form to which notes, recipes, and sketches of the material sample can be added (fig. 9).

After completion of a project, the information is brought together in the internal Company Archive. Photos of the existing material samples are linked to written details in an image database and supplemented with keywords. This facilitates flexible digital searches that can be used across projects.

The Material Archive of the Sitterwerk Foundation

In addition to the collection that serves as a reference work for artists, specific material samples from the production of artworks are in the publicly accessible Material Archive of the Sitterwerk, decoupled from the art project (fig. 10). They are present within a collection of materials being developed by the foundation in cooperation with seven other institutions in Switzerland, including three art schools, three schools of architecture, and one museum.[1] Material samples are collected and exchanged between all of these sites and made accessible to interested professionals from the fields of design, art, architecture, and conservation. Radio-frequency identification (RFID) chips are attached to the materials to allow direct access to background information in the database via a reading station.[2]

At the Sitterwerk, further information on the material and techniques for handling can be accessed in the Art Library. Housed in the same space as the Material Archive, the library has an inventory of 25,000

Figure 9 Sample box containing casting molds and labeling material. Photo by Julia Lütolf.

Figure 10 Material samples stored in the Sitterwerk Foundation's Material Archive. Photo by Katalin Deér.

Figure 11 The Art Library and the Material Archive at the Sitterwerk Foundation. Photo by Katalin Deér.

books dedicated to art (with a focus on sculpture and statuary), architecture, photography, material technology, conservation, and restoration (fig. 11). A special feature of the library is its dynamic system of order. Users specify the arrangement of the books on the shelves, as no fixed location is assigned to them. A robot identifies the location of the books with the help of RFID labels and continuously updates the catalog.[3] A combined search for books and materials can also take place on this digital level, allowing visitors to do multifaceted research (fig. 12).

In the surroundings of the library, in the production of artworks, and in active exchange with other institutions, stimulating references and discussions arise in the Material Archive and are made accessible to interested visitors through exhibitions and symposia.[4] The exhibition by Peter Fischli and David Weiss, *Books, Editions and the Like*, which was presented at the Sitterwerk in 2006, is one example of an interdisciplinary project that developed out of many years of collaboration and friendship between Fischli and Weiss. Works by this artist duo continue to be realized in the Kunstgiesserei. The exhibition provided further insights into their method of working and simultaneously cross-linked the topics of art, books, and materials.

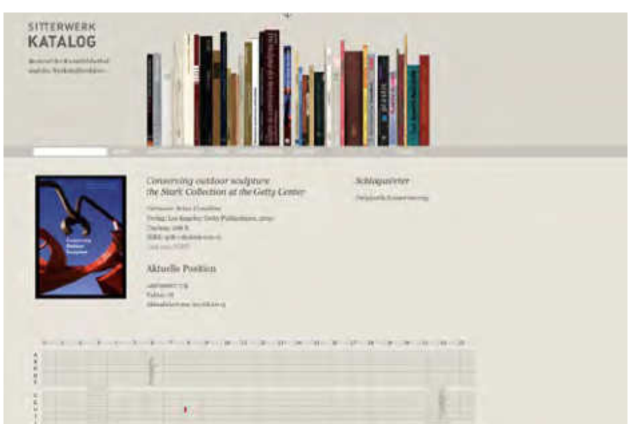

Figure 12 The web page for the Sitterwerk digital catalog. By conducting searches for books and materials online, visitors can perform multifaceted research. Photo by Julia Lütolf.

Content-related connections between the Material Archive, the Art Library, and the Kunstgiesserei and, correspondingly, with the artists are a central component of events and exhibitions at the Sitterwerk. The Kesselhaus Josephsohn should also be mentioned in this context. The exhibition and storage space where the plaster models and bronzes of the Swiss sculptor Hans Josephsohn are presented and mediated is another example of the foundation's approach to artistic work holistically over many years.

A Memory of Materials

In the course of examining how material samples can be documented and archived, two different collections are being developed. In the Company Archive, project-related reference samples are archived and, when supplemented by written information on the production process, make the very specific experiences and information tangible. This is of use not only to the

Kunstgiesserei itself but also to the artist who created the work as well as to conservators. In the publicly accessible Material Archive, superordinate subjects stand in the foreground. The extensive collection of materials is an indispensable tool for in-depth research on both the haptic and the digital levels.

Samples and associated texts are available to users who are active in the design field and wish to examine materials and approaches to working with them. The collection serves as a source of information and inspiration and has set a goal of raising awareness and increasing sensitivity to different material qualities.

The development of the two archives forms an important interface between the Kunstgiesserei and the Sitterwerk Foundation and promotes active exchange and collaboration between the various professional groups involved in the execution of art projects. This cross-linking reveals connections as well as the backgrounds of artworks and, in the case of conservation or restoration work, creates the basis for the prudent handling of objects.

Notes

1. The three art schools are Zürcher Hochschule der Künste, Hochschule Luzern Kunst und Design, and Hochschule der Künste Bern Fachbereich Konservierung und Restaurierung. The three architecture schools are Eidgenössische Technische Hochschule Zürich Baubibliothek, Hochschule Luzern Technik und Architektur, and Zürcher Hochschule für Angewandte Wissenschaften Departement Architektur. The museum is Gewerbemuseum in Winterthur.
2. The Material Archive can be accessed at www.materialarchiv.ch.
3. The catalog can be accessed at www.sitterwerk-katalog.ch.
4. The publication *Archive der Zukunft* (Archive of the Present) is a compilation of texts by various speakers who address the dynamic system of order in the Art Library and associated questions regarding how knowledge can be structured within the framework of the symposium of the same name.

Some Considerations in Determining New Paint Systems for Use in the Treatment of Painted Fiberglass and Steel Outdoor Sculptures

Paul L. Benson

Abstract: *Paint on outdoor sculptures provides protection against environmental elements as well as protection against physical interactions with visitors and wildlife. Improved paint systems are now available that can extend the life expectancy of this protective coating while maintaining the original appearance of the sculptures. Two case studies are presented involving the desire to remove the original paint from the highly textured fiberglass surfaces of Claes Oldenburg and Coosje van Bruggen's* Shuttlecocks *and from the steel sculpture* Rumi *by Mark Di Suvero. A sacrificial cathodic protection system for underground ferrous components such as base plates will also be described.*

Introduction

The two sculptures discussed in this paper, *Shuttlecocks* (1994) by Claes Oldenburg and Coosje van Bruggen, and *Rumi* (1991) by Mark Di Suvero, are located in the Donald J. Hall Sculpture Park at the Nelson-Atkins Museum of Art, Kansas City, Missouri. The 22-acre (9-hectare) site was dedicated in 1989 and holds thirty outdoor sculptures, including bronze works by Henry Moore and representative sculptures by artists such as Ursula von Rydingsvard, Magdalena Abakanowicz, George Segal, George Rickey, Judith Shea, Roxy Paine, Alexander Calder, and Auguste Rodin. Materials used include bronze, gilt bronze, painted fiber–reinforced plastic, painted steel, stainless steel, and wood.

Oldenburg and Van Bruggen's *Shuttlecocks*

Shuttlecocks was inspired by Claes Oldenburg and Coosje van Bruggen's visit to Kansas City at the invitation of the Nelson-Atkins Museum of Art in 1991. A local collector wished to commission a public work of art on behalf of his family and to make a donation to the museum's expanding collection of outdoor sculptures in the Hall Sculpture Park, including the great lawn on the south side of the museum building.

The great lawn reminded Oldenburg and van Bruggen of a playing field and, as such, suggested the need for a monumental work of art involving some type of sport, built in proportion to the scale of the lawn. Through many revisions, *Shuttlecocks* evolved. The unique orientation of its four individual elements, or "birdies"—three placed ball side down, the fourth inverted—makes them appear to be pieces in a game of badminton in progress, with the museum building representing the net.

After many months of intense and at times humorous public discussion concerning the placement of "modern art" within the confines of the museum's "classical" grounds, final approval was granted by the Kansas City Parks and Recreation Department, the then legal owners of the museum's grounds, for the installation of *Shuttlecocks*. Despite initial skepticism regarding how well the work would represent the state of the arts in Kansas City, the birdies have gone on to become the unofficial symbol of the museum. Articles and photographs of the shuttlecocks have appeared in numerous national and international publications. They are some of the most visited and photographed objects in the museum's collection, and their appearance and maintenance are of critical importance (figs. 1, 2).

Each of the four elements of *Shuttlecocks* consists of an aluminum ball with nine aluminum and fiber-reinforced plastic (hereafter referred to as fiberglass) feathers, and a fiberglass band encircling low on the feathers. Specifications are given in table 1.

Several problems affecting the paint occurred within weeks of installation of the *Shuttlecocks*. A brownish-orange liquid was observed seeping from small cracks between the quills and the feathers (fig. 3). Consultation with the fabricator and an independent structural engineer determined that the cracking was the result of a difference in the coefficient of thermal expansion of the aluminum quills and fiberglass feathers. This meant that on a typical summer day, an individual aluminum quill could expand by 1.2 millimeters in length, while the fiberglass feather portion could expand only

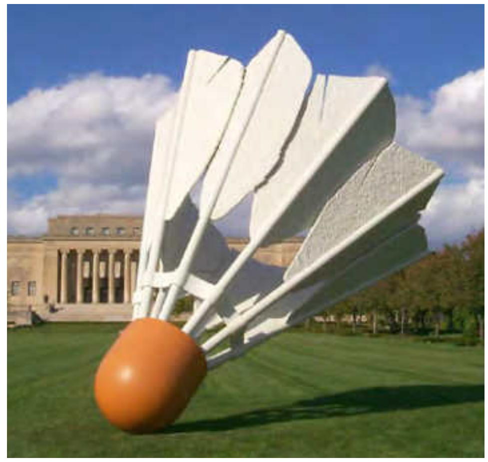

Figure 1 One of four *Shuttlecocks* (no. F94-1/4) on the great lawn of the Nelson-Atkins Museum of Art, Kansas City, Missouri. Claes Oldenburg and Coosje van Bruggen, *Shuttlecocks*, 1994. Aluminum and fiber-reinforced plastic; painted with polyurethane enamel. Each: 17 ft. 11 in. (5.5 m) high × 15 ft. 1 in. (4.6 m) crown diam. and 4 ft. (1.2 m) nose cone diam. Collection The Nelson-Atkins Museum of Art, Kansas City. © 1994 Claes Oldenburg and Coosje van Bruggen.

Figure 2 Three of the *Shuttlecocks*, 1994, nos. F94-1/1-3.

Table 1. *Shuttlecocks* specifications.

Dimensions (ht. × diam.)	Weight (kg)	Feather Material	Ball Material	Band Material	Quill Material	Original Paint System
5.85 m × 4.87 m	1,866	Tricel paper honeycomb core impregnated with a polyester resin, covered with fiberglass, polyester gel, and epoxy resin top coat	Type 6061-T6 aluminum	Balsa wood core covered with fiberglass and epoxy-based resin	Type 6061-T6 aluminum	U.S. Paint Awlgrip 545 #D8002 epoxy primer with U.S. Paint Awlgrip #8015 polyurethane top coat

Figure 3 Crack between an aluminum quill and a fiberglass feather observed on one of the *Shuttlecocks* shortly after their 1994 installation.

0.4 millimeters, thus causing the observed cracking. The situation cannot be improved upon; there will always be some cracking that needs to be repaired and painted.

In addition, some cracking appeared on the feathers themselves. These cracks were usually in the form of arms radiating outward from a central point and measuring up to several inches in length. Small areas of flaking paint also appeared on the feathers. These small areas grew in size when the lifting paint was removed to reveal sound, well-attached paint (fig. 4). Finally, additional damage to the paint occurred in spots where visitors had tried to climb the feathers and where string grass trimmers had come into contact with the quills on the one inverted *Shuttlecock*.

Chalking and fading of the orange paint on the balls became quite noticeable about three years after installation. Though the loss of gloss on the balls was extensive, periodic polishing and buffing was effective in returning the paint close to its original glossy finish. After about three years, however, it was no longer possible to achieve a glossy surface using this method, and any graffiti could no longer be completely removed (fig. 5). The white paint on the feathers also faded rapidly, but no attempt was made to buff them due to their heavy texture.

All of these areas of damage required repairs, of which the final step was repainting to blend the repaired area with the surrounding original paint surface. Touch-up paint was acquired from the fabricator at the time of installation, but conservators found that the paint had to be matted down (U.S. Paint flattening agent G3013) to match the faded appearance of the original paint. Eventually, the touch-up paint could not be matted down sufficiently, which meant that the *Shuttlecocks* presented a spotty glossy, semi-glossy, and matte appearance. As some of these repairs were quite extensive, the results were aesthetically displeasing (fig. 6). Paint touch-ups were made annually but became so frequent over just a few years that complete repainting of the *Shuttlecocks* was deemed necessary.

The contract with the artists stipulated that the *Shuttlecocks* were to be repainted every three years. Logistically, this would be extremely difficult to accomplish with the pieces in situ and expensive to carry out otherwise, as a crane would be needed to deinstall the pieces for transport to a paint shop. In retrospect, the time stipulation for repainting was well planned, as the first extensive flaking of the paint was noticed three years after the pieces were installed.

The flaking occurred between the epoxy primer and the urethane top coat. Minor flaking was treated by wet sanding the affected area with 600-grit sandpaper to remove loose flakes and taper the edges back to coherent

Figure 4 Flaking and lifting paint on a feather of one of the *Shuttlecocks*.

Figure 5 Chalked, faded orange paint and graffiti on one of the *Shuttlecock* balls about three years after installation. By this point, periodic polishing and buffing was no longer effective in remediating the damage.

Figure 6 Areas of touch-up on a feather of one of the *Shuttlecocks*. Over time the touch-up paint could not be matted down sufficiently to match, with aesthetically displeasing results.

paint. These areas were then primed with epoxy primer and top-coated with urethane paint. Over time, larger areas of flaking paint were observed on the pieces, requiring an extensive program of scraping, sanding, priming, and repainting (see fig. 4).

Assessment of Repainting Options

Once it was decided that the sculptures would need to be completely repainted, several options were considered:

1. Paint over the existing paint using the original paint specified by the artists.
2. Remove all paint down to the fiberglass and repaint using the original paint.
3. Remove the existing paint down to the primer using (a) chemical strippers and/or (b) mechanical blasting (incorporating walnut shells, baking soda, carbon dioxide, sponges, or other media).
4. Remove all paint, including the primer, and repaint with a higher-quality paint.
5. Remove the existing paint down to the primer and then apply a pH-specific polyacrylic acid–based primer tinted a contrasting color from the one used for the top coat and original primer. This primer would be water soluble but only at a specific pH; for example, water at a pH of 8.0. This pH would not be encountered in nature, so the paint could not be washed off during ambient environmental conditions. The top coat would have to be water-vapor permeable polyvinyl acrylic paint, which is readily available.
6. Paint over the existing paint using a more durable paint system.

The first option was rejected because it was determined that successive applications of the top-coat paint would gradually build up and flatten out the heavy texture of the feathers. Options 2, 3, and 4 also were rejected, as no mechanism could be found either to separate the urethane paint from the epoxy primer (which was in good condition) or to remove all of the paint layers without damaging the underlying fiberglass surface. Considerable time and effort was spent experimenting with different methods of removing the urethane paint without damaging the primer or the underlying fiberglass layer. Chemical stripping and mechanical blasting with a variety of media such as dry ice, starch, sodium carbonate, and ground sponges were attempted, but neither method could remove only the top coat without damaging the fiberglass to some extent. Consultation with the paint manufacturer confirmed that a chemical bond between the primer and top coat prevented them from being separated. Conservation scientist Richard Wolbers, of the Art Conservation Department at the University of Delaware, was able to formulate a gel that would remove the epoxy primer and urethane top coat from the fiberglass surface; however, this method was determined not to be economically feasible on the scale of *Shuttlecocks*. Wolbers suggested the method described in option 5 above, but this was deemed too expensive and experimental for the scale of the artworks.

The sixth and final option involved painting over the existing surface with a superior paint system that would not have to be renewed for a much longer length of time. Tnemec Company, Inc., of Kansas City was consulted and, after some discussion, recommended a fluorourethane paint that had the desired qualities. Tnemec had supplied a related paint system for Oldenburg and van Bruggen's *Spoonbridge and Cherry*, installed at Walker Art Center, Minneapolis, and so was already familiar with conservation concerns and requirements. The system consists of a 3-mil-thick epoxy primer, a

Table 2. Paint systems used on the *Shuttlecocks*.

	Primer	Intermediate	Top Coat
Original Paint	U.S. Paint Awlgrip #D8002 epoxy	None	U.S. Paint AwlGrip #D8015 polyurethane
New Paint	Tnemec Fascure Series 161 Polyamide Epoxy applied in a 3-mil-thick layer	Tnemec Endura-Shield Series 73 Aliphatic Acrylic Polyurethane applied in a 3-mil-thick layer	Tnemec Fluoronar Series 1070 Thermoset Solution Fluoropolymer applied in a 3-mil-thick layer

3-mil-thick intermediate layer, and a 3-mil-thick top coat. The primer is specially formulated to be applied over urethane paint, making it unnecessary to strip the original *Shuttlecocks* paint. On the positive side, the top coat has an additive that provides durability, longevity, flexibility, high gloss, and compatibility with a wide range of colors. This paint has been formulated to maintain the original gloss over its lifetime, about fifteen to twenty years. On the negative side, this paint is as difficult to remove from the *Shuttlecocks* as the original paint. However, when the fluoro-urethane paint has to be renewed, only a 3-mil-thick top coat needs to be applied. The various paint layers on the *Shuttlecocks* would then consist of the systems shown in table 2.

Total thickness of the new paint layer is 9 mils, or 0.009 inches, or 0.23 millimeters.

Although it was agreed that covering the original paint may not have been the most ethically correct choice, the particular condition of the original paint, and the fact that the contract with the artists did specify periodic repainting, influenced the decision to use the new paint system. The artists were consulted on this decision and concurred.

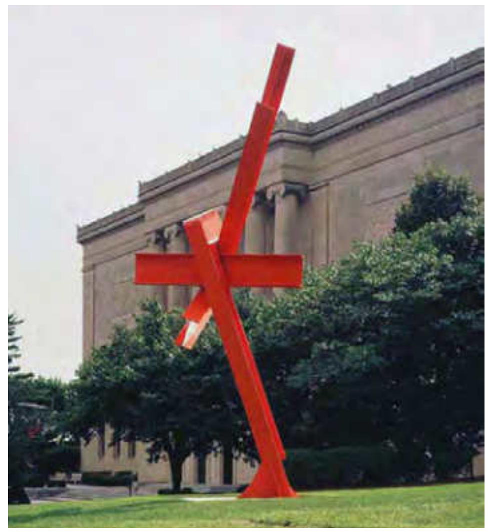

Figure 7 Mark Di Suvero, *Rumi,* 1991. Painted steel, 24 ft. × 8 ft. 9 in. × 7 ft. (7.2 × 2.7 × 2.1 m), no. F99-33/5. Installed in the Hall Sculpture Park of the Nelson-Atkins Museum. © Mark di Suvero / Spacetime C.C. Photo courtesy Nelson-Atkins Museum.

Mark Di Suvero's *Rumi*

Rumi (1991) by Mark Di Suvero was purchased by the Nelson-Atkins Museum in late 1995 (fig. 7). It had been freshly painted by the artist's studio after its return from the 1995 Venice Biennale. The sculpture is 7.32 meters tall and is made from five steel I-beams bolted together at various angles and painted a vivid red. The paint system applied by the Di Suvero studio consisted of DuPont Variprime Self-Etching Zinc Chromate primer and Dupont Centari Acrylic Enamel top coat.

In 1995, when *Rumi* was shipped to the museum on an open-bed truck, it arrived badly abraded by the straps used to secure it to the truck bed (fig. 8). The

Figure 8 Detail of *Rumi,* showing abrasions caused by the straps used to secure the sculpture during shipping from the Di Suvero studio to the Nelson-Atkins Museum in 1995.

Figure 9 (*Right*) Bottom surface of the base plate, showing heavy rust and missing paint. (*Far right*) Detail of the contact area between steel beams, showing heavy rust and missing paint.

paint on the sculpture was so badly damaged that *Rumi* could not be displayed as received. After discussion with the artist's studio, it was decided to repaint the piece. Further consultation with several painting contractors determined that the original primer, DuPont Variprime, did not offer sufficient protection of the steel beams because it is not impervious to moisture. Instead, two different primers were proposed: Tnemec Series 90-97 Aromatic Urethane, Zinc-Rich, and Tnemec Series 66 Epoxy.

The new zinc-rich primer was used where the straps had abraded the paint down to bare metal. This primer offered additional protection to the metal by acting as a sacrificial layer should the paint be scratched down to bare metal. The epoxy primer was applied over the original acrylic enamel top coat in areas where the top coat was still in good condition. The Centari acrylic enamel was used as the top coat (applied in two coats) because it had the gloss and color insisted upon by Di Suvero's studio.

The repainted sculpture was installed at the Nelson-Atkins in early 1996 but had to be deinstalled in 2005 during construction of an addition onto the museum. After the piece was disassembled, the buried base plate was found to be badly rusted, and the contact areas between the various elements of the sculpture either were rusty or were missing the top coat of paint (fig. 9).

Before the sculpture could be reinstalled, it had to be repainted yet again. This time an improved paint system was used: a zinc-rich primer (Tnemec Series 90-97 Aromatic Urethane, Zinc-Rich), an epoxy intermediate layer (Tnemec F.C. Typoxy Series 27 Polyamide Epoxy), a polyurethane top coat (Tnemec Endura-Shield Series 1075 Aliphatic Acrylic Polyurethane), and a clear coat (Tnemec Endura-Clear Series 76 Aliphatic Acrylic Polyurethane) for additional UV protection. The Endura-Clear is difficult to repair and was not applied until after the sculpture had been installed. This clear-coat line has since been discontinued because of improvements in the paint system.

Cathodic Protection System

As an additional protective measure, a cathodic protection system was installed on *Rumi*. Cathodic protection for metals has been in use for many years on ships and more recently on underground pipelines and storage tanks. It is a technique used to control the corrosion of a metal by placing a more easily corroded metal in contact with the metal to be protected in the presence of an electrolyte. The protected metal acts as the cathode while the sacrificial metal acts as the anode in this version of an electrochemical cell. This system protects only those metal parts that are underground or in contact with the ground and has no effect on parts aboveground, as the system needs an electrolyte to make the current flow.

In the case of *Rumi*, a total of 72 kilograms of high-potential magnesium powder in 9-kilogram bags were placed in a 60-centimeter-deep trench around the sculpture and connected by a series of wire cables (fig. 10a). All of the cable connections were made inside plastic connectors that were then filled with a bituminous material to waterproof the connections (figs. 10b, 10c). The cables were then connected to the top surface of the base of the sculpture through a process using a small thermite explosive charge inside a containment box (fig. 11a). The explosion produces an extremely high temperature so that any paint inside the containment box is instantly vaporized and the cables instantly welded to the clean metal surface. This type of connection is done to minimize damage to the paint or the metal, which would occur under standard welding. The welded connections are then covered with the bituminous material to make them waterproof (fig. 11b).

Once all of the wires are connected, a current should flow through the system, monitored by placing leads from a meter across the terminals of a test station

Figure 10a Installing a cathodic protection system on *Rumi*. Bags of magnesium powder are shown before being placed in the trench around the sculpture.

Figure 10b Plastic housing is used as a cable connection.

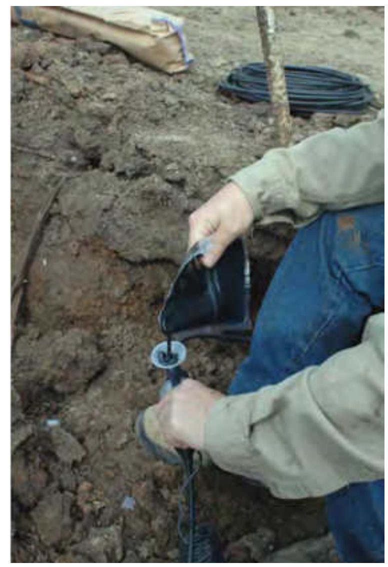

Figure 10c The cable connection housing is filled with a bituminous material to make the cable connections waterproof.

Figure 11a A thermite explosive charge is used to produce an extremely high temperature that bonds the cables instantly to the sculpture's clean metal surface.

Figure 11b The cable connections to the sculpture are coated with a bituminous material to make them waterproof.

Figure 12a The test station, consisting of a PVC tube buried in the ground near the sculpture. The cables are attached to a circuit board and placed inside the tube.

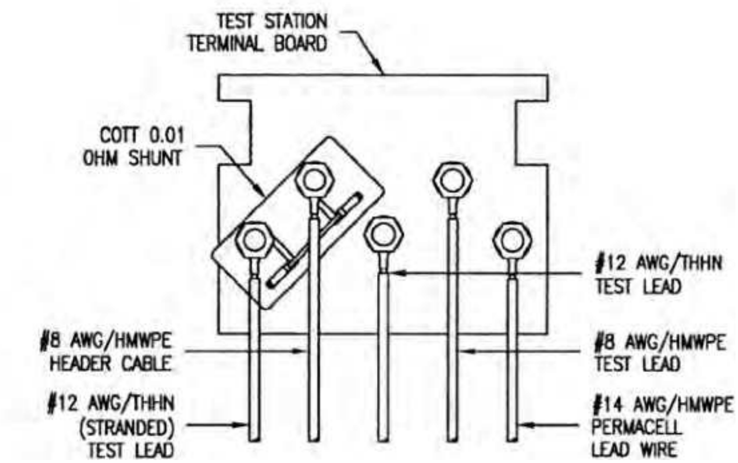

Figure 12b Test station circuit board used to monitor current flow.

circuit board (figs. 12a, 12b). Based on local soil and weather conditions, it is estimated that the anode material will last approximately eighteen years before having to be replenished.

Conclusion

It must be accepted that outdoor painted sculpture will eventually require repainting, as no paint system can withstand weathering indefinitely. Paint should be considered a sacrificial coating on outdoor sculpture. Because improvements are continuously being made to paint systems to upgrade their performance, paint specified by the original artist may not be the best choice for repainting. There is no one category of paint suitable for all materials and applications; manufacturers, not just suppliers and painting contractors, must be consulted to determine the optimum system. Complete repainting should be considered only when all other options have been vetted and the artist or the artist's representative has been consulted.

Materials and Suppliers

Cathodic Protection System, designed and installed by Corrpro Companies, Inc., 5750 S. 116th West Ave., Sand Springs, OK 74063; 918-245-8855

Tnemec Paint, Tnemec Company, Inc., 6800 Corporate Dr., Kansas City, MO 64120-1372; 800-863-6321

Where the Dutch Paint Industry Meets Contemporary Art

Hans Springvloet Dubbeld

Abstract: *This article gives an overview of the involvement of De IJssel Coatings B.V. in the contemporary arts industry in Europe. De IJssel Coatings is a privately owned Dutch company established in 1930. The company originally produced traditional paints; today it has grown into a sophisticated business specializing in the production of polyester, epoxy, and polyurethane products, including paint, pigment paste, filler, and glue. Its products are sold business to business and, in some markets, with the help of dealers.*

The company's expertise is based on the synergy it has created among a diverse client base. Because many of these clients are in the arts industry, De IJssel's sales engineers are familiar with the challenges inherent in, for example, the conservation of outdoor sculptures, such as weather conditions or color and texture matching. This article discusses the challenge involved in manufacturing a paint in exactly the same color or texture that is required, and how modern technology can help. The article also describes recent art projects in which De IJssel Coatings participated.

Introduction

For decades De IJssel Coatings B.V. has worked with clients from a wide variety of professions, including artists and conservators. These professionals purchase paints and other products made of synthetic resins such as polyurethane, epoxy, or polyester, which are manufactured by IJssel, and use these products to build, rework, or restore their artworks. The special bond we have with these clients lies in our expertise. Our philosophy of open communication has created a synergy that is the source of our know-how and has given us a competitive advantage in certain niche markets.

This paper provides a brief history of De IJssel Coatings and an overview of its products, explores the connection with modern and contemporary art, discusses the difficulties the company faces over the restoration of outdoor sculptures and how technology can help, and gives a brief summary of the paint systems recommended for outdoor sculptures.

History and Background

De IJssel Coatings had its beginnings in 1930 in a shed on the banks of the river Hollandse IJssel. There a diesel engine powered a machine belt connected to a paint production machine that could produce almost 30 kilograms of paint each day. The company launched under its original name, Machinale Verf- en Japanlak Fabriek De IJssel (Mechanical Paint and Japan Paint Factory) (fig. 1). From raw materials such as linseed oil and natural pigments such as umber, ocher, and sienna, the first paints were produced. Later, synthetic materials such as white lead and red lead were used.

The first milestone was reached in 1940, when an extension was built onto the original shed, doubling production capacity. A shortage in raw materials during World War II brought production to a standstill. Fortunately a new market was found for the production of shoe polish, mostly in black. Years later the residue of black polish remains visible in the factory. After the war, the production of paint resumed, and new raw materials

Figure 1 Inside De IJssel's first location, in a shed on the river Hollandse IJssel, 1930. Photo: Adri Joost Van der Eijk.

were introduced such as alkyd resins. Many formulations had to be adjusted, and a full-time chemist was employed.

As a new industry began to emerge—the glass fiber–reinforced polyester (GRP) boating industry—it became necessary for the company to increase production capacity. A new factory was built in 1965 in Moordrecht, at het Oosteinde. This factory was expanded in 1970 and later in 1980 to meet growing demand for materials. In 1990 construction began on another new factory, at 't Ambacht, also in Moordrecht. When this factory was completed, the name of the company was changed to De IJssel Coatings B.V. and a new logo was introduced.

The name of the company changed again, to Verf-Lak en Chemische Producten De IJssel N.V. (Paint, Varnish and Chemical Products De IJssel N.V.). The company prospered in growth and number of employees. Its new logo expressed the changes within the company in respect to products, markets, and customers. High-solid, solvent-free products were introduced. Colors were developed, produced, and controlled by computer. Investments were made in modern production equipment and methods and continuous quality control. Well-trained, motivated staff were committed to offering the best quality and service to a growing clientele.

To meet the logistic and environmental challenges, it was decided in 2006 to purchase a 10,000-square-meter plot of land on the new industrial estate Gouwe Park, in Moordrecht. In summer of 2008 construction began on a new factory, and the official opening took place in October 2009 (figs. 2, 3). De IJssel's storage of bulk materials, raw materials, and finished goods adhere to the latest state-of-the-art requirements. Spacious production areas, offices, and laboratories provide ample room to develop the products of the future. Over the past eighty years, De IJssel Coatings has adjusted to various changes in technology and the marketplace. The quill has been replaced by the computer, the handwritten letter has been supplanted by e-mail, linseed oil has been replaced by synthetic resins, and solvents are disappearing. As we make cooperating with our suppliers and customers our highest priority, the story of De IJssel Coatings will continue.

Figure 2 De IJssel Coatings B.V. today, in Moordrecht, the Netherlands. Photo: J. Springvloet Dubbeld.

Figure 3 The company relies on solar technology for a wide range of products. Photo: J. Springvloet Dubbeld.

Challenges Faced in Industrial Products Used in Modern Art

De IJssel Coatings produces a wide range of products, most of which are two-component polyester, polyurethane, or epoxy based. These serve, for example, as primers, fillers, and coatings, and as epoxy- or polyester-based glues and pigment pastes. The company serves a variety of industries, including manufacturers of boats, automobiles, trucks, and cranes; offshore companies; construction companies; companies in the entertainment industry; and amusement parks. But are these industries entirely different from one another? What is the difference, for example, between restoring a polyester boat (fig. 4) and a polyester sculpture (fig. 5)?

If both items are the same age, it is possible that they are made of the same materials. If the polyester sculpture is a floating object such as a boat, both may

Figure 4 A recently repainted polyester boat at John Joosse's shipyard near the harbor of Zierikzee. Photo: J. Springvloet Dubbeld.

Figure 5 Marta Pan, *Sculpture Flottante—Otterlo* (Floating Sculpture—Otterlo), 1960–61. Pond, glass fiber–reinforced polyester resin, aluminum. Kröller-Müller Museum, Otterlo, the Netherlands. © Fondation Marta Pan & Andre Wogenscky. Courtesy Pierre Lagard, President, Fondation Marta Pan & Andre Wogenscky.

even be subject to damage from the same elements of nature. The results may be comparable for both the industry and modern art.

Osmosis

A common problem in the GRP industry is osmosis, the result of which is often blistering of the polyester gelcoat caused by moisture in the polyester laminate. The amount of moisture in the laminate can be measured using a so-called nondestructive moisture meter. In order to apply any kind of product on top of the laminate, the laminate should not contain more than 12 percent moisture. Thus it is of extreme importance to know the percentage of moisture hidden in the laminate. Very often GRP outdoor sculptures have absorbed some moisture. The solution can be found in the professional boat-building industry. Professional boatbuilders often use the hot-vacuum method when a boat suffers from osmosis. However, first the gelcoat layer has to be removed and then the moisture forced out by hot vacuum.

Color and Metamerism

A second common problem involves color. The crane in figures 6 and 7 is made by a De IJssel client and is in use at New York City harbor. In winter, this crane unloads bulk carriers filled with salt to spread on the icy roads. This company also builds cranes for the Royal BAM Group, a Dutch company. All BAM machines are painted in the company colors of orange and green. The orange used is an extremely metameric color. Under one light source, the color might match the reference standard perfectly, but under another source, it might not. The difficulty in matching colors becomes even more complicated when the object is made of different materials.

Availability of Raw Materials

Availability of raw materials also presents a problem in the GRP industry, for example with pigments. Pigments have been used for millennia and are the basis of all paints. They are ground-colored material. Early pigments, which were simply ground earth or clay, were made into paint by combining with saliva or animal fat. Modern pigments are often sophisticated masterpieces of chemical engineering. Seen under a microscope, paintings and other painted objects consist simply of pigments suspended in a substance—like chips in a chocolate chip cookie. The substance can vary from oil or egg yolk in paintings or resins to plaster in frescoes or to sophisticated plastics in automobile finishes.

Not all pigments that were used in the past are still available today. Some simply no longer exist, while others—cadmium or lead pigment, for example—are banned from use for environmental reasons. Cadmium has been used, however, to make bright yellow paint,

Figure 6 The orange-and-green logo on a crane manufactured by PLM, a client of De IJssel. The colors used are extremely metameric and can be difficult to match. Photo: J. Springvloet Dubbeld.

Figure 7 Another view of the PLM crane. The difficulty in matching colors is further complicated when the object is made of different materials. Photo: J. Springvloet Dubbeld.

and without the use of cadmium it is not easy to make the exact same color. The same goes for orange, such as that used by PLM to manufacture the crane for the Royal BAM Group.

Using modern technology to help formulate colors, De IJssel was able to make this bright orange again. One of the devices employed to match exact colors is a spectrophotometer, a device that measures light intensity in different parts of the spectrum. The first commercial use of a spectrophotometer for measuring color was in the paint industry, which involved matching colors for touch-up, such as that performed in auto-body work. The device works in a very straightforward manner, starting with a dry, clean representative sample of the color to be measured. A flake of paint the size of a square centimeter is placed in front of the "eye" of the spectrophotometer, and the device then formulates the recipe for the exact color.

Glossiness of Surfaces

Apart from color, the glossiness of a surface is important to the appearance of an object. Environmental factors such as UV light and fluctuations in temperature and humidity affect the surface of a painted object (fig. 8).

A glossmeter is an instrument used to measure gloss of materials such as paint, plastic, and paper (fig. 9). Gloss is a measure of the proportion of light that has a specular reflection from the surface. A surface such as a mirror has a high gloss, whereas a surface such as chalk has a low gloss because the light reflected is diffused. Numerous international technical standards define the method of use and specifications of different types of glossmeters for different types of materials, including ceramic, paper, metal, and plastic. The automobile industry is a major user of glossmeters. It is almost impossible to make an invisible repair on a car even if the original paint is still available, largely because of the gloss differences between the new paint and an aged paint surface.

Resolving the Issues

The GRP industry can help support the maintenance of modern artworks by providing sophisticated paint systems in a wide range of colors for various surfaces and environments. A QUV accelerated weathering tester can be used during the client's decision-making process. This tester simulates the damaging effects of long-term outdoor exposure of materials and coatings by exposing test samples to varying conditions of the most aggressive components of weathering: UV radiation, moisture, and heat.

Imagine, for example, that a red automobile is a piece of modern art. The car is a little rusty and the client wants to repaint only a small area, but it is impossible to get a perfect match to make the repair invisible. An industrial worker might immediately suggest sandblasting all the paint off and starting over. The end result indeed would be better than before. A

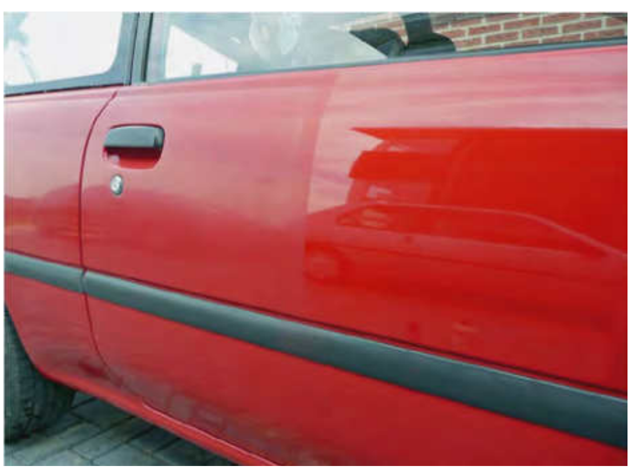

Figure 8 This image shows a variation in glossiness due to environmental factors. Photo: www.stylingspecialisten.nl.

Figure 9 A glossmeter is used to measure gloss of paint, plastic, paper, and other materials. The automobile industry is a primary user of glossmeters. Photo: J. Springvloet Dubbeld.

conservator, however, would prefer to apply every scientific method available to make the spot repair invisible. To make a good decision, the conservator would need to know what the artist had in mind when originally making the object, in order to resolve questions about color and texture. What is the condition of the surface? If it is wood, is it dry enough? What is the relative humidity? If there is an existing paint system, is it a one- or two-component system? If the object is displayed outdoors, what are the weather conditions in the area? All these factors help decide what paint system to use.

Types of Paint Systems for Outdoor Sculptures

For the restoration of outdoor sculptures made of metal, wood, or synthetic resin, De IJssel strongly advises two-component products: epoxy-based primers and polyurethane-based coatings. Obviously the surface must be compatible with a two-component system. The system the company uses most often, in any case, is a zinc phosphate epoxy primer, with a high-build epoxy primer and a polyurethane finish.

One example is a large sculpture of the late entertainer Michael Jackson. Nine of these statues were created for the performer's 1996 world tour. They were not built to last forever. One of the statues stands in the Netherlands, in Best, near a local McDonald's restaurant. Over the years it became weathered and damaged. Little was known about its surface because it had been repainted, and it was not known what products were used.

Upon consultation, De IJssel staff advised a complete refinish of the sculpture. The first step was to sandblast the object using sandblasting beads, which are small, manufactured spheres of glass that are forced through a blasting machine onto the intended surface. These beads offer an alternative finishing appearance on a number of different substrates, compared to common sand grit. In addition, the harmless glass spheres allow workers to use the blasting media indoors.

The advantage of this method is that it allows conservators to see where the laminate is damaged; in the case of the Jackson sculpture, the damage was quite severe. The statue was reinforced with two layers of glass fiber, each 300 grams per square meter. On top of that was placed one layer of epoxy zinc phosphate coating with a total thickness of 100 microns. This, in turn, was covered with three layers of epoxy high-build coating with a total thickness of approximately 250 microns. Finally, the statue received a three-layer finish of polyurethane coating at a total thickness of 150 microns.

Another example of restoration treatment by the GRP industry is the work done on *Flying Pins* (2000) by Claes Oldenburg and Coosje van Bruggen (fig. 10). The bowling ball in this installation has a diameter of 6.5 meters; the ten pins are each 7 meters high. The artists specifically chose a bright yellow for the pins to create a beautiful contrast with the often gray Netherlands

Figure 10 Claes Oldenburg and Coosje van Bruggen, *Flying Pins*, 2000. Steel, fiber-reinforced plastic, polyvinyl chloride foam; painted with polyester gelcoat and polyurethane enamel. Eleven elements in an area approximately 123 ft. (37.5 m) long × 65 ft. 7 in. (20 m) wide; 10 pins, each: 24 ft. 7 in. (7.5 m) high × 7 ft. 7 in. (2.3 m) widest diam.; ball: 9 ft. 2 in. (2.8 m) high × 22 ft. (6.7 m) diam. Collection intersection of John F. Kennedylaan and Fellenoord, Eindhoven, the Netherlands. © 2000 Claes Oldenburg and Coosje van Bruggen. Photo: J. Springvloet Dubbeld.

skies. Unfortunately the city of Eindhoven, where the work resides, made repairs over the years without matching the exact color. Cracks had also appeared in the work.

Restoration was finished in the summer of 2013. The surfaces of the pins and the ball were sanded with sanding paper to remove all the degraded layers of paint that had been applied over the years. About ten years ago the artwork was repainted for the first time. The two-component paint used was still in good condition, so De IJssel's paint system was applied on top of that layer. Three layers of De IJssel Double Coat (two-component polyurethane) were applied. This paint is well known in Europe for its superb quality in combination with GRP.

It was discovered that the first time the sculpture was repainted, the ball and the pins were painted in high gloss, and all subsequent painting applied on top of that layer was also high gloss. Originally the ball was semi-gloss and the pins high gloss. De IJssel's restoration followed these parameters in accordance with the artists' original intentions.

Conclusion

The title of this paper is "Where the Dutch Paint Industry Meets Contemporary Art." These two worlds clearly do converge when dealing with outdoor painted sculpture. Of course, there are many differences between them, but, as outlined in this paper, there are also many similarities. When professional individuals from these completely different worlds combine their strengths and try to learn from each other, it is amazing what they can achieve together.

Production and Conservation of a High-Gloss Outdoor Sculpture

Thomas Dempwolf

Abstract: *This paper summarizes the working methods of the Berlin-based artist Anselm Reyle and the process of developing a coating for one of his outdoor sculptures. This sculpture was designed with highly reflective surfaces coated with a mirror layer and varnished with a clear coat. Reyle's aspiration is the illusion of a "perfect" surface: in other words, viewers should not notice the object's coating. As a conservation layer, an oil polymer sealing was applied, which could be used as a reference in the conservation of other coated objects in outdoor settings.*

Introduction

Conservators are usually called in when an artwork is damaged, when climate conditions need to be defined or set up, or to document the causes of damage in a report. For conservators of contemporary materials, dealing directly with artists can also be commonplace.

The Berlin-based artist Anselm Reyle requested a report on the manufacturing techniques used for his sculptures, and on defining a methodology for monitoring the quality and durability of the surfaces being produced. Reyle's indoor sculptures are produced by modelers in foundries and in paint shops. After examining the technical and chemical processes involved, the artist then requested an investigation into developing a production procedure for similar reflective sculptures that would be more appropriate for an outdoor setting. This involved not only a different process but also the testing of coatings, one of which appeared to offer a significant improvement in durability for sculptures displayed in outdoor settings.

Indoor Sculpture: Materials and Processes

To create his sculptures that are displayed indoors, Reyle draws inspiration from objects of architecture and artisan craftwork; he edits their outlines, enlarges them, and gives them a different and more "noble" appearance by designing a reflective surface often combined with the vibrancy of transparent colors. Another important aesthetic aspect of his work is to create the illusion of a perfect surface. Several attempts are usually needed to produce a sculpture with a satisfactory smooth, highly reflective surface. If an area looks too matte or the top coat shows any imperfections in its application (resulting in, for example, an orange peel effect or dirt impurities), the work is rejected and has to be completely redone.

The application of the reflective layer and the top coat is a complex and highly delicate process. After the surface of a cast bronze or aluminum sculpture has been thoroughly pretreated by sanding, filling the pores, and priming, the reflective paint is applied using a process called chemical metal spraying (CMS).[1] In this process, silver salts and a reduction solution are applied with a two-component spray gun, leading to the precipitation of a thin layer of silver approximately 1 micron thick. At this point it becomes very clear whether the base was well prepared or not, as the smallest irregularity will be visible underneath the reflective paint (fig. 1).

Once it has dried, two layers of dyed clear lacquer are applied. Great dexterity and skill are required to produce a flawless flow of lacquer. Some painters develop special racks that turn on an axis while spraying. Others change the composition of the lacquer or meticulously

Figure 1 Anselm Reyle, *Harmony*, 2008 (detail). A thin layer of silver was applied to this bronze sculpture using CMS followed by a purple varnish, resulting in a brilliant surface. Used with permission of Anselm Reyle. Photo: Thomas Dempwolf.

adjust humidity and temperature in the immediate environment. Even the best painters, however, often need to make more than one attempt.

A crucial disadvantage of silvering using chemical metal spraying is that it is not suitable for objects that are exposed to outdoor environments, even if advertisements claim that it can be used to embellish cars and motorcycles. Its weakness is the susceptibility of the thin silver coat to corrosion. This can be caused by direct sunlight if the surface temperature rises to more than 50° C, as the structure of the coating becomes unstable and the silver coating runs the risk of tarnishing. The second cause of corrosion is the inadequate stability of the top coats used. In order to achieve as blemish-free a flow of paint as possible, a low-solid two-component polyurethane coating is used. This type of lacquer contains a fairly small amount of solid material and has a relatively low surface tension but is suitable only for outdoor use to a limited extent (Brock, Groetekaes, and Mischke 2010, 88f.).

Outdoor Sculpture: The *Philosophy* Project

Reyle's *Philosophy* project was the first large-scale reflective sculpture created in his Berlin studio for an outdoor setting. His previous experience in silvering sculptures for indoor settings was useful only up to a point, as the need to protect the object from corrosion and preserve the reflective surface in the long term places significantly higher demands on the design and construction of the sculpture as a whole. Some of the materials and techniques that work well for interior settings are unsuitable for outdoor use.

The shape of *Philosophy* is inspired by real-socialist architecture and typical architectural elements of buildings in the former German Democratic Republic (GDR). The starting point is a wall made of fifty complexly formed concrete blocks, located on a former industrial ground in the GDR and built to screen garbage containers from view. This system of blocks was produced serially for the construction of frontages, fountains, playgrounds, and the like. Reyle sees his work as an homage to this chapter of art, one wherein geometric forms are used as public art.

The *Philosophy* sculpture was designed as a construction of mirrored, shaped, preformed blocks whose smooth and complex surface would reflect and refract light. The artist's choice of material had to take into equal account several factors, including visual impact, function, and corrosion resistance. Reyle did not want to use chromium-nickel steel, which is weather resistant, because of its insufficient reflectivity. A galvanic coating with chromium or nickel was rejected because of the huge amount of work required to pretreat the substrate.

The decision was finally made to use a coating of vacuum-metallized aluminum using the physical vapor deposition procedure plus a chemical treatment to increase corrosion resistance. This Chrome-Optics© procedure was developed by master painter Matthias Koch, of Allendorf in Hessen, Germany. In the procedure, aluminum is sputtered onto the item in a vacuum chamber. Koch developed an additive treatment to prevent the aluminum from corroding when the clear top coat becomes porous or damaged. It was designed for

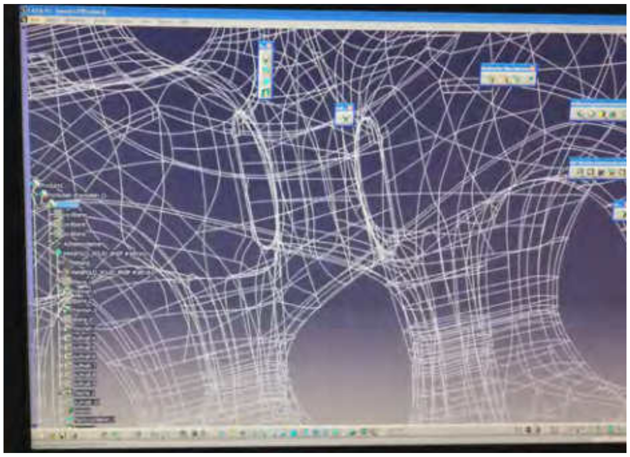

Figure 2 Screen view of the digital mesh used to mill the shape of a preformed block in Anselm Reyle's aluminum sculpture *Philosophy*, 2009. Used with permission of Anselm Reyle. Photo: Thomas Dempwolf.

application in the automobile and furniture industries with the ambitious goal that it ultimately would replace galvanic coatings such as chromium.

At the time *Philosophy* was being made, the procedure was still in the development phase, but Koch was keen to implement the project in cooperation with Reyle's studio.

To that end, a team was gathered to make the sculpture within a nine-month period. The individual steps of fabrication included the following:

- The shell of the block was reshaped, reproportioned, and digitally recorded before the final model was made.
- The design of the fastenings was developed.
- The blocks were cast in aluminum.
- The data of the laser scan were transferred into a manufacturing program, and final adjustments were made to match the manufacturing possibilities (fig. 2).
- The blocks were milled with 5-axial milling machines with a tolerance of 5/100 millimeters so that with the exception of the outer blocks, every block could be installed where desired (figs. 3, 4).

Development of the Coating

A special procedure was developed for the coating of the sculpture. First, the aluminum blanks had to be thoroughly cleaned after machining, and then the surface was sealed with two layers of powder coating. Any imperfections and blowholes were closed with fillers

Figure 3 A form block from *Philosophy* undergoing the first step, rough filing, during the 5-axial milling process. Used with permission of Anselm Reyle. Photo: Thomas Dempwolf.

Figure 4 Form blocks from *Philosophy*, mounted after milling. Used with permission of Anselm Reyle. Photo: Thomas Dempwolf.

and by leveling. The surface was smoothed in several stages. The aluminum was then vacuum metallized in the vacuum chambers and passivated using the Chrome-Optics© procedure.

A particular challenge was to develop a blemish-free coating using high-solid polyurethane lacquers, which are suitable for outdoor areas. These lacquers have a relatively high surface tension, which makes them prone to wetting defects such as orange peel effect on the surface. However, these defects would not have been acceptable for the *Philosophy* project; a practically blemish-free lacquer had to be developed. This took quite some time and involved many experiments and test series, for example the salt spray test (ISO 7253), saturated atmosphere test (ISO 6270), and cross-hatch adhesion test (ISO 2409).

Fortunately the trial phase had begun jointly with Matthias Koch one year prior. We had initially hoped for support from paint manufacturers but soon realized that the tiny amounts they would sell for a special product were of no interest to them. It was left to Koch to develop a practically blemish-free lacquer. He experimented with flow-control agents, anti-cratering additives, and other surface-active additives as well as with temperature and humidity settings of the spray booth until he achieved a satisfying result that could be reproduced for fifty blocks (Brock, Groetekaes, and Mischke 2010, 197–99) (fig. 5). Of course, the information he gathered and the precise composition of the lacquer remained his secret. When it comes to protecting trade secrets, ambitious painters are no different than ore casters and other artisans. To make sure that even

Figure 5 Form blocks from *Philosophy* after coating, in front of the paint shop. Used with permission of Anselm Reyle. Photo: Thomas Dempwolf.

an interested conservator is kept in the dark, all kinds of stories are told to keep such knowledge under wraps.

Sealing with Oil Polymers

Because of the great effort involved in coating the sculpture and the difficulty in its reproducibility, it was important to find a way to protect the surface for as long as possible. One idea was to apply an additional, transparent sealing to protect the sculpture from the environmental influences of an outdoor setting. Even though the sculpture already had state-of-the-art corrosion protection, the material still had a limited lifetime.

To gain a better understanding of what exactly is required of a transparent sealing, it is helpful to take a look at the lacquered surface through a microscope. One can see that it consists of thousands of tiny craters, which means that a much greater surface area is, in fact, being exposed to environmental influences. An effective sealing should therefore reduce the surface area and preferably be invisible; in other words, it should not impact the appearance of the object. Further, the sealing must bond with the lacquer and withstand the temperatures involved; this depends not least on the color of the object and the installation site. In order to be reversible, it is advantageous if the sealing wears off over time and exposes the original surface.

A review of preservative agents commonly used for conservation purposes showed that no proven sealing for lacquered surfaces in outdoor areas was available. Past and present projects have attempted to protect lacquered surfaces in outdoor settings with a microcrystalline wax sealing. In my experience this is not particularly effective and often can do more harm than good.

The search for high-quality sealings for outdoor areas inevitably leads to products made for the automobile industry. We came across a transparent oil polymer sealing procedure called DITEC, which has been in use for more than thirty-five years. The procedure was developed by a Scandinavian company that claims that it increases surface durability by 75 percent and gloss by 20 to 40 percent. The sealing, whose composition is merely noted as "oil polymers" in company documents, consists of two layers: a pore sealing "special fluid" and a top coat. This top coat wears off within one and a half years and should therefore be renewed every one and a half years. According to a telephone conversation with Peter Engler, DITEC's contact in Germany, it is possible to remove small areas of the sealing with a detergent in order to carry out repairs to the paint. The company offers a six-year gloss warranty for cars, during which the top coat has to be renewed three times.

The application procedure for DITEC oil polymer sealing consists of five steps:

1. Washing the surface
2. Polishing the surface and smoothing the peaks of the paint
3. Washing with a chemical detergent at a slight overpressure to clean the pores in the surface of the paint
4. Sealing the depths with special fluid (product #1)
5. Sealing the surface with the top coat (product #2)

The procedure may be carried out only by licensed companies. A test piece of *Philosophy* was submitted for sealing. The results were convincing: surface tension was so low that drops of water hardly stayed on the surface, dirt could be removed more easily, and hardness of the surface increased. The surface was also glossier, a welcome by-product in this case.

The entire sculpture was coated using the oil polymer sealing process. The treated surfaces have a denser and even appearance, and the sealing is clear and not visible despite the gloss increase. Maintenance, though still necessary, is easier to carry out (figs. 6, 7).

Figure 6 The finished work *Philosophy*, installed at Gagosian Gallery, New York, 2009. Reyle's sculpture *Eternity* (2009, bronze), also fabricated using the CMS technique, is at left. Photo: courtesy Robert McKeever / Gagosian Gallery.

Figure 7 *Philosophy* installed at Gagosian Gallery. Chrome-Optics© on aluminum. Photo: courtesy Robert McKeever / Gagosian Gallery.

Conclusion

For the purposes of sealing the surface of the *Philosophy* sculpture, the oil polymer sealing system seemed the most appropriate—a transparent sealing that wears off as a sacrificial layer due to environmental influences and protects the object itself. This method of conservation could be useful for other coated objects as well, but scientific studies are still needed from a conservator's perspective on exactly how this product works and its interactions with the substance of the object. This certainly could be a worthwhile approach to improving the weather resistance of coated objects placed outdoors, although it is recognized that all coatings ultimately fail outdoors, and repainting under the warranty of the paint manufacturer will remain the ultimate method of reversing the visual impact of severe deterioration on outdoor painted sculpture.

Notes

1. Chemical metal spraying involves mirrorizing nearly any surface with a thin layer of silver. The technique is used by paint shops in the production of automotive parts, helmets, decorative items, and artwork.

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A Kind of Blue: Selecting a New Paint System for Refinishing John Hoskin's *One for Bristol*

Calvin Winner

Abstract: One for Bristol *(1968) is a painted steel and aluminum sculpture by the artist John Hoskin, situated within parkland at the University of East Anglia in Norwich, England. The sculpture was in a poor state of repair with significant deterioration to the painted steel finish. This article explains the methodology used to develop a treatment plan aimed at restoring the sculpture in a way that communicates the artist's intention while at the same time accepting that the work is more than forty years old and not a "new sculpture." This paper explains the decision to refinish the painted steel and the selection of a new paint system.*

Introduction

John Hoskin (1921–1990) was born in Cheltenham, England, and initially trained as an architect's draughtsman before serving in the Royal Engineers during World War II. After the war, he became an artist and worked as an assistant to the sculptor Lynn Chadwick. Hoskin's work of this period is typically expressed in bronze, forged or welded metal, and wire. It is closely aligned with the style referred to as the "Geometry of Fear" by the critic Herbert Read, to which Chadwick was a leading exponent.

By 1960 this prevailing trend in sculpture was challenged by the English artist Anthony Caro, who, after spending time in the United States, shifted British sculpture out of the postwar monochrome world and into a new use of color and materials more associated with industry than with art. Caro taught at St. Martin's School of Art and was instrumental in the so-called New Generation of younger sculptors. Hoskin was to embrace these radical changes. His sculpture *One for Bristol* is one of a small group of works dating from the 1960s that clearly express these new tendencies of painted steel combined with aluminum and methods of construction. It is perhaps through the use of color as well as new materials that this represented a more radical shift in thinking. The title is a lighthearted reference to the sculpture's first exhibition, in a group show called *New British Sculpture* at the Arnolfini Gallery in Bristol, England.

One for Bristol consists of a forged steel T-bar framework, a cantilevered section 3 meters long with a further 2 meters on the return, which also tapers. The steel was finished in a uniform blue painted livery, understood to be nitrocellulose automobile paint. Four unpainted aluminum fins are attached to the framework in two locations with a series of steel brackets and secured by bolts. The inscriptions "A – D" and "TOP" appear in stenciled paint on the outermost fins. Four brackets attach the sculpture to a concrete pad; in high winds, the sculpture can sway, placing strain on the brackets. It is not entirely clear whether Hoskin had intended this particular work to be an outdoor sculpture (given its first showing was at the Arnolfini Gallery), but it is certainly true that sculptures from the "New British Sculpture" period were often placed outdoors even if this was not the original intent. Likewise, Hoskin may have naturally assumed his selected materials such as steel and aluminum made the work suitable for outdoors even if that was not necessarily his intent. Shortly after

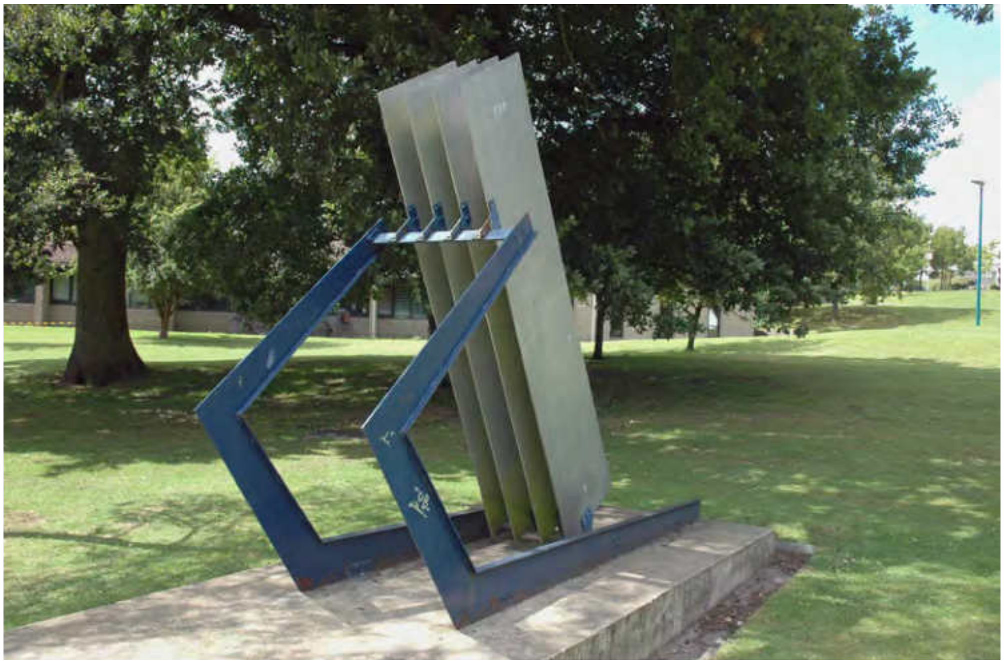

Figure 1 John Hoskin, *One for Bristol*, 1968. Painted steel and aluminum. Installed on the grounds of the University of East Anglia, Norwich, England. Photo taken in 2009 before treatment. © The Artist's estate.

the artist's death in 1990, the sculpture was donated to the University of East Anglia (UEA) and a site was selected in parkland on the university campus (fig. 1).

Condition of the Work

By 2008 *One for Bristol* was in a poor state of repair. A condition survey was conducted from which a treatment proposal could be formulated. The sculpture had deteriorated due to a number of factors including, most specifically, environmental factors associated with natural weathering, which in particular adversely affected the paint finish. In addition, the sculpture had been disfigured by accumulated surface dirt, tree resin, and vandalism to the aluminum fins, which had been graffitied in permanent marker. There were aspects of the original fabrication indicating that the sculpture had inherent weaknesses, most significant being the condition of the painted finish. For example, there was no priming or sealing layer prior to the final application of the finish (fig. 2).

Significant areas of paint loss and advanced corrosion of the underlying metal were observed, which caused further lifting, flaking, and falling away of paint. The initial inspection revealed the underlying metal had not been primed and that the paint finish provided the steel with insufficient protection against corrosion. The assessment was complicated by earlier attempts at restorations, which left large areas that were no longer the original color. The sculpture's history between 1968 and 1990 is uncertain, but it is known that restorations were carried out in 1990 prior to its installation on the campus, and again in 1993. These were performed rather crudely by brush and in a shade of blue darker than that used by Hoskin. Subsequent deterioration revealed evidence of several blues, all different from the original. Only after exploratory cleaning tests were a few areas of the original "Hoskin blue" revealed, located

Figure 2 Detail of *One for Bristol*, indicating paint loss and corrosion in 2010. © The Artist's estate.

on some smaller components that the earlier restorers had missed. Closer examination revealed a light blue undercoat followed by the dark blue finishing coat. It was possible to determine that the original paint layers were applied by spray, evident by a smooth, consistent application.

After the examination and discussion with the artist's estate, Pegg and Son, a specialist fabrication company experienced in outdoor sculpture, was consulted. Further consultation was undertaken with conservators and art historians, most notably Melanie Rolfe, senior sculpture conservator at Tate. A treatment plan was formulated with two central elements focusing on the painted finish: first, whether it was possible or even preferential to preserve the existing paint finish or to undertake a complete refinishing, and second, to address the question of the authenticity of the painted finish given that it was now a different blue from the one the artist originally intended.

The condition survey established that the paint finish had deteriorated beyond the point where it could be conserved in any meaningful way. Due to the extensive areas of losses, the option of a localized approach of consolidating areas of loose paint and filling in losses was ruled out. In addition, corrosion in the underlying metal meant that consolidation certainly would be compromised by further instability in the paint finish in the future. Given the color had shifted considerably after several historical campaigns of less accurate repainting, the most appropriate course of action was to plan for refinishing. However, this could be justified only if the new paint could accurately match the original color discovered on some of the smaller components.

Methodology

It was clear that if the sculpture were to communicate as the artist had wished, the surface would need to be refinished using a new paint system matched to the original color. Once this decision had been made, its success relied on two key factors: accuracy of the color match to the artist's original choice, and selection of the most appropriate paint system. These two factors were central to the treatment plan decision-making process.

Another vexing challenge was to develop a treatment plan that would produce harmonious results among various elements of the sculpture—specifically between the painted steel and aluminum. Refinishing would largely return the painted steel to the way it had looked in 1968, but what of the aluminum fins? Would they be refinished using abrasives to provide a pristine finish? Would this result in a sculpture that appeared essentially new rather than forty years old?

Donation documentation from the artist's estate in 1990 concerning the sculpture refers to "polished aluminum." However, the surface would have quickly tarnished due to natural oxidation to a matte finish without a surface coating (there was no sign of one). A commission undertaken by the artist in Darlington, England (which yielded the sculpture *Resurgence* in 1969), employed stainless steel rather than aluminum. It is likely Hoskin used stainless steel—a more expensive material—because this was a commissioned work and because the material would achieve a more durable polished finish. The use of aluminum on *One for Bristol* may well have been an economic decision, and Hoskin may not have anticipated the tarnishing effect but decided not to attempt to recover a shiny surface. In addition, refinishing the aluminum would result in removal of the stenciled numbers so that they would need to be re-created. There was general agreement among all the stakeholders—including the artist's estate—that the original stenciling should be retained, as it was a quirky but important feature that would significantly alter the sculpture if it were reapplied anew.

It was decided to proceed with a less interventive aqueous cleaning using Orvus detergent and water, then review again the use of more abrasive techniques. Even though the surface was left slightly etched and weathered, aqueous cleaning obtained good results and the problematic issue of replicating the stencil was avoided. The aim throughout was to retain the artist's vision but accept that the sculpture was no longer a contemporary work of art and had acquired a history of its own.

The question of whether the refinished painted steel would be harmonious with the aluminum was answered by the specialists at Pegg and Son who proposed that shot blasting of the painted steel could be carefully controlled so that the remains of old paint and corrosion were removed without also removing signs of wear such as pitting. When the new paint system was applied, the true age of the metal would remain self-evident. Due to the level of corrosion, no other method was less interventive—for example, the use of a solvent such as dichloromethane. A system of air abrasives with grit aluminum oxide was used to remove the corrosive products and provide a clean surface for the new paint system. It was determined that the finished result would therefore be harmonious with refinished painted steel but would show signs of age and surface cleaning of the aluminum rather than complete refinishing of these components.

Color Matching

The discovery of unweathered original paint on the underside of one of the fixing brackets connecting the various elements of the sculpture was vital to the process of matching the color. In fact, of a number of areas of original paint that were located, one larger section was surface cleaned and photographed as a reference. Working under the microscope, a discreet scratch test revealed this to be the original finish (fig. 3). A light blue paint applied underneath to the bare metal presumably acted as an undercoat or perhaps a first tryout.

To identify the actual color, conservators turned to Hoskin's notebook. Entries from 1967 to 1968 contained detailed notes on sculptures of the period, sometimes indicating a specific automobile paint color (fig. 4). The page for *One for Bristol* does not state a color, and the only blue referred to from the period is BMC Basilica Blue, noted on another page and dated 1968. This color at first appeared to match and was available between 1966 and 1968. Armed with this information, conservators took the bracket with the original paint (fig. 5) to AGS Coatings / Pegg and Son for analysis. The company used a commercial spectrophotometer that matches colors to known spectra—a database that includes RAL and BS standard colors and a database of listed commercial mixed colors. The aim was to search for a match with the sample anticipated to be Basilica Blue.

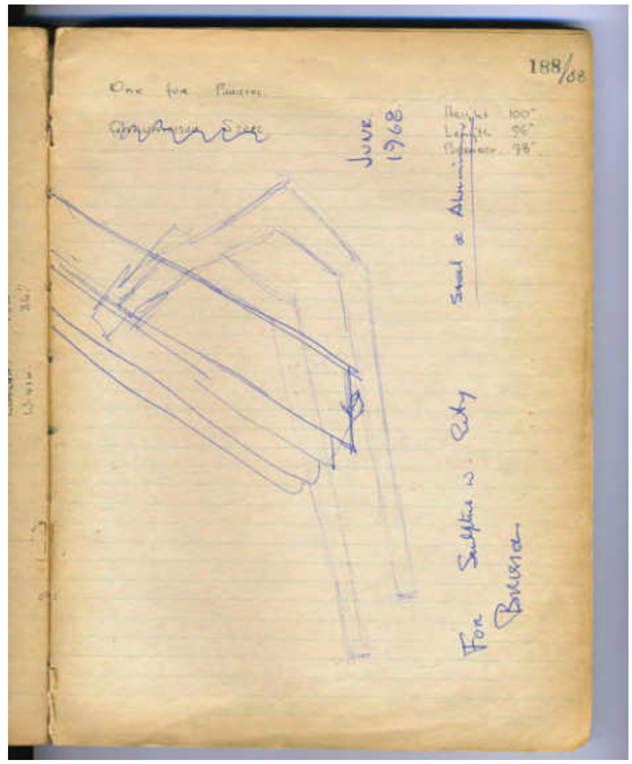

Figure 4 Page from John Hoskin's sketchbook, 1967–68, referring to *One for Bristol*.

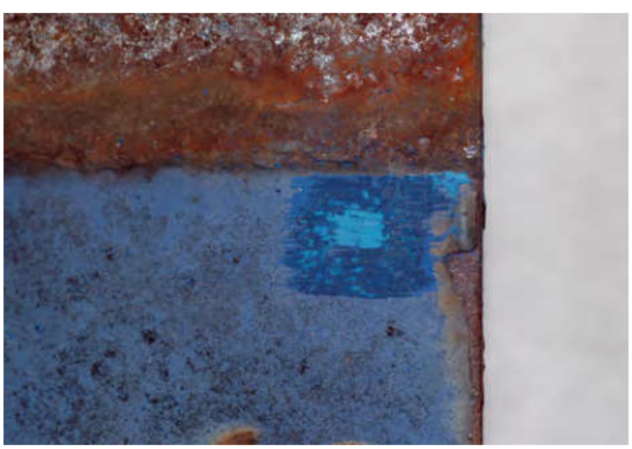

Figure 3 Detail of *One for Bristol*. A scratch test revealed the original paint finish underneath.

Figure 5 Bracket from *One for Bristol* with the original paint finish.

The results proved interesting. The fabricator mixed a sample of Basilica Blue but in fact confirmed this was not the original color. The original sample was matched and subjectively came very close to a standard RAL color, 5013 Cobalt Blue (fig. 6). After some hesitation as to whether to try and refine the mix still further, a sample was mixed essentially by hand and eye. The two samples were closely compared and were only perceptively different under controlled lighting conditions, possibly explained with the acceptance that the original color may well have darkened over time, not least with accumulated surface dirt. In communication with the artist's estate, it was decided that an RAL color gave a very concise instruction in terms of any future refinishing work that would undoubtedly happen again in the future. The avoidance of a complex paint mix is also valid concerning the routine repair of minor scuffs or chips. This was a key point: because an outdoor sculpture was likely to require routine refinishing, the project should set down clear parameters not only for this occasion but also for the future.

The complete refinishing of the painted steel ruled out the possibility of preserving an area of original blue for posterity. The fabricator advised that saving an area of original paint by masking it out during shot blasting may be difficult to achieve without affecting the new finish. The painted swatch samples have been retained on file for future reference, and it remains an enigma that no exact match has yet been made to a known commercial automobile paint color of the period. Although not a comprehensive list, a series of popular UK automobile blue paints from the period was considered, including Aqua Blue, Bermuda Blue, Blue Royal, Iris Blue, Midnight Blue, Clipper Blue, Ice Blue, Mineral Blue, Mirage Blue, Pageant Blue, Riviera Blue, and Teal Blue. None of these period colors provided a precise match.

Figure 6 Comparison of a prepared test swatch with the original paint finish.

As a footnote, the artist's estate reacted with bewilderment to the color matching process, stating that Hoskin "was not a colourist and he would have found the fussing over very slight variations in colour highly amusing."[1] However, the family was well aware of the ethical dimension facing conservators and the need to retain authenticity, one of the fundamental aspects of art.

Choosing and Applying a New Paint System

The original paint system was a nitrocellulose paint, which was the principal resin for car paint during the 1960s—this has been confirmed by FTIR analysis, and cross sections were taken for future analysis. The process of selecting a new system started with the idea of using nitrocellulose. It soon became apparent, though, that this technique has been all but phased out due to health and safety legislation. The choice of other, more available systems included polyurethane or, rather, the acrylic-urethane paint system, powder-coat system, and epoxy system. The fabricator, Pegg and Son, recommended using an acrylic urethane paint system based on its durability and longevity and the fact that it could provide a sympathetic gloss finish equivalent to the nitrocellulose automobile paint of the 1960s.

The new system included a specialist primer to be followed by a two-pack coating. The primer was Cromadex 395, a specialist primer containing zinc phosphate that provides corrosion protection and a sound base for the topcoat—critically important in a durable paint system. This was followed by Interthane 990, a two-pack acrylic polyurethane finish providing durability and long-term recoatability. Working with the fabricator and, more specifically, a specialist paint-finisher proved critical in the selection and application of a durable system. The new system should be durable for ten to twenty years, depending on factors such as severity of weathering and risk of vandalism. A key aim of the project was to provide a durable paint system that was sympathetic to the artist's original system. In fact, the new system is undoubtedly more durable than Hoskin could have hoped for when he made his first color sculptures in his studio in the late 1960s.

Figure 7 *One for Bristol*, displayed inside the Sainsbury Centre at the UEA after conservation was completed, 2011. © The Artist's estate.

Once the conservation project was completed, *One for Bristol* was exhibited indoors at the UEA's Sainsbury Centre for Visual Arts for a short period of time to showcase the sculpture and the conservation project (fig. 7). Reaction was positive, and the sculpture's transformation validated the decision to "save" the work from further neglect and possible destruction. There had been a real risk that the condition of the sculpture had so deteriorated that it was not economically feasible to repair, which may well be a fate facing public sculpture beyond the confines of a museum.

The sculpture was returned to its outdoor location in the summer of 2011 (fig. 8). The addition of a protective wax coating should help promote longevity and protect against graffiti. To address the issue of galvanic corrosion produced by electrolytic reaction between the steel and the aluminum, polythene spaces were inserted to prevent this damage in the future.

Figure 8 *One for Bristol*, re-sited on the parkland of the UEA campus, 2011. © The Artist's estate.

Conclusion

The decision to refinish the painted steel sculpture *One for Bristol* could be carried out only after extensive consideration of all factors as part of the conservation project. Given the set of circumstances, refinishing was the most appropriate option for this outdoor sculpture based on its deteriorated state and drift from its intended color. The project raised the important point that sculptures displayed outdoors may require more interventive methods of conservation than those accepted for works in a gallery. If they are to be preserved, however, one must accept the realities of the outdoor environment while at the same time retaining the artist's original intent.

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"Not for Eternity maybe…":[1] Franz West's *Flause* and Considerations on Outdoor Painted Sculpture

Florian Szibor

Abstract: *Outdoor painted sculpture pushes conservation ethics to its limits. Harsh climate conditions, vandalism, and biological infestation all are factors that dramatically shorten the life span of paints. Repainting seems to be the only solution to maintain the intended look of an artwork. But some works simply are not reproducible. What options does a conservator have before deciding to repaint? Are there ways to extend the lifetime of paints? Which carries more weight: the artist's intention or the material of an artwork? This short guideline will consider these questions using Franz West's* Flause *(1998), from the collection of the Museum Abteiberg Mönchengladbach, Germany, as an example.*

Introduction

Art in public spaces is always more vulnerable than artwork within a museum. Artwork in a museum is usually presented under stable environmental conditions, with measures in place to prevent damage; outdoor art is often used in any way a person can think of. It may be used as a chair or writing desk or, if disliked, may be subjected to vandalism. This places significant stress on the artwork. On top of that, climate conditions are much harsher; rain, frost, and radiation are real challenges to every material. Though materials such as stone or metal may withstand these conditions for quite some time, more delicate surfaces—especially outdoor painted surfaces—will suffer. We have to accept the limited life span of some materials.

Outdoor painted surfaces therefore require a different approach when it comes to conservation. Due to circumstances, it is impossible to treat them with the same ethical considerations that are used for artworks presented indoors. A complete repainting is often inevitable. Nevertheless, the conservator should not make this decision lightly. All options should be carefully considered before taking action.

Some of the considerations that would influence a conservator's decision include the following:

- **About the artwork:** Is the paint unique or reproducible? What materials are used in the artwork? How do they interact? What is the artwork's current condition? How stable is the construction? What is the expected life span of the work? Is the artist's intention still readable?
- **About the surrounding area:** Where is the artwork standing? What kind of damage is caused by its location? Do a large number of people pass by? Have there been incidents of vandalism? Is the artwork standing under or close to a tree? Do birds or other animals often come to rest on it? Are there biological remains? Can the surrounding influences on the work be avoided or reduced?
- **About the artist:** What should the work look like? What is the artist's intention? Should the surface look undamaged or like new, or can the aging become part of the work? Can the work be repositioned, or is the artist's intention linked to the current location? If the artist is no longer living, is literature available to answer

these questions? Are recordings available of interviews with the artist? Can the artist's assistants be contacted to provide information? Do other museums have similar works by this artist with comparable problems?

As every work of art is individual, the conservator always has questions about any further considerations before making an assessment for treatment. A recent investigation into the condition of the painted aluminum sculpture *Flause* (1998) gives insight into the dilemmas involved.

About the Artwork

Flause, by the Austrian artist Franz West (1947–2012), is composed of several aluminum sheets that are shaped, bent, and welded together into a long, organic, pink-colored form that stands vertically (fig. 1). Similar to the artist's other metal sculptures, *Flause* has a simple, informal form. Intentional dents in the surface make the work appear handmade, and the viewer's eye is drawn to the irregularly welded seams. Overall dimensions are 360 × 65 × 65 centimeters. The color has been applied by hand rather untidily, judging by the drips on the paint surface (fig. 2). From a distance the pink color looks monochrome, but upon closer examination various shades and structure in the paint can be detected. These factors together give the impression of a "sloppy" working technique.

In terms of its condition, the work needs conservation. Although the aluminum support is stable and does not show any deterioration caused by outdoor conditions, the paint does indicate deterioration. Investigation made it clear that due to sunlight, the red in the pink color has bleached out significantly compared to its original tone (fig. 3). Because of the sculpture's provocative form, vandalism has taken place.

An FTIR (Fourier Transform Infrared Spectroscopy) analysis confirmed that the paint used on the artwork was a long-oil alkyd resin, and titanium dioxide was identified as the white pigment/filler. This was cor-

Figure 1 Franz West, *Flause*, 1998. Painted aluminum, 360 × 65 × 65 cm (16.2.1947–25.7.2012). Installed on the grounds of the Museum Abteiberg Mönchengladbach in Germany. Used with permission of Franz West Archive © legal successor of Franz West.

Figure 2 Detail of *Flause*. Drips visible in the surface structure of the paint indicate a lack of careful paint application.

Figure 3 Detail of *Flause*, showing the effects of sunlight on the paint. The red in the pink color has been bleached out significantly.

Figure 4 Detail of *Flause*, showing flaking paint caused by expansion of the aluminum underneath.

Figure 5 Detail of *Flause* after the top layer of paint was removed, revealing the sculpture's original, much brighter pink color.

roborated by Franz West's former assistant Peter Holl, who recalled that the artist used these paints in 1998, even though he turned to polyurethane (PUR)-based paints later in his career.

Alkyd resins were widely used and offer reasonable resistance to oxidation and other forms of aging. However, they cross-link on aging and tend to become stiff and brittle and therefore prone to flaking. On *Flause*, this was most apparent at the welding seams, where the ground material aluminum has a different expansion coefficient. The aged, stiff paint is not flexible enough to follow that movement and flakes off (fig. 4).

The original pink paint was originally much stronger in color. This was confirmed after local mechanical removal of the top layer of paint: a much brighter, more intense color appears underneath (fig. 5). Other damages also existed. The overall condition of the paint is mapped in figure 6.

Figure 6 Condition map of the sculpture's north-, east-, south-, and west-facing sides. The red areas indicate paint that has flaked off along welding seams. Green indicates areas where the upper layer of color is missing down to the primer. The blue areas indicate scratches in the paint.

About the Surrounding Area

Flause is located on the grounds of the Museum Abteiberg Mönchengladbach, in the former garden of the abbey. The historical church is within sight of the sculpture; West intended this close proximity as a provocation to regard the church as an institution. As a shortcut to the city, people pass through the grounds during the daytime. The park is closed at night. During opening hours guards keep watch over the artworks. At nighttime, however, people have entered the park and scratched, kicked, or left graffiti on the sculptures. As the park also has plants and animals, there are biological remains on the surface of the sculptures, such as moss, leaves, and blades of grass cut by a lawnmower.

About the Artist

Franz West had a lifelong interest in the interaction between spectator and art. He once said: "Das ist meine Arbeitsmethode: nicht konstruktiv, sondern responsiv" (This is my working method; not constructive, but responsive).[2]

This interaction with the spectator is important. *Flause* is both a sculptural object and, with its longitudinal, upright shape, a rather symbolic statement. During the two years of maintenance work on *Flause*, every visitor to whom I spoke had the same idea about what the sculpture looks like. It seems the artist's intention is still effective. The place where the artwork now stands was chosen by West himself. *Flause* had first been exhibited indoors at the Museum Ludwig in Cologne, so it is not exactly a site-specific work of art. However, the current location, close to the church, was intentional. Following the path in the sculpture garden, visitors are inevitably confronted with the pink object as they look toward the old church. The form, the color, the location of *Flause*—all are pure provocation.

Most likely the paint on *Flause* was applied not by West but by one of his assistants. Does this make it less "original"? West loved to work in collaboration with other artists. In group exhibitions, it was difficult to tell who did which artwork. He collaborated on exhibitions with his assistants and always encouraged them to work in an artistic way. Perhaps for West the term *authentic* is hard to define when it concerns his own work.

Considering a Conservation Approach

Taking into account the previous considerations, the conservator may evaluate several treatment options, as described below.

Moving the Work Indoors

Moving any artwork indoors instantly improves the conditions to which the work is exposed and would prolong the life span of the (original) material of *Flause* considerably. This idea actually has some validity, since one of the first places where *Flause* was shown was at the restaurant "Kantine" at the Museum Ludwig in Cologne. Later West himself decided that it should be positioned outdoors, within sight of the church; its location is thus part of the artist's intention.

Protecting the Sculpture with a Shelter

One way to keep the work outdoors and protected from rain and radiation would involve erecting a shelter. In this manner, the artwork could remain in its location while the environmental circumstances would be rendered less challenging to the paint. Such a shelter would, however, block the view to and from the church and differentiate the artwork from the rest of the garden. Furthermore, it would be quite difficult to convey that the shelter is not part of the artwork, and there is no record of West ever suggesting this as an option.

Restoring the Existing Paint Film

Because the bleached color of the existing paint film is a surface phenomenon, it may be possible to regain a color that is closer to the original. A number of methods for removing a thin paint layer were investigated, and one test using water applied with a cotton cloth and an abrasive material proved successful. This method appeared to produce minimal erosion, allowing the possibility of respecting surface irregularities and producing an acceptable surface gloss.

Would it be feasible to treat the entire irregular surface of *Flause* in this manner and reach a homogeneous impression? The irregular surface and the paint drips give reasons for doubt. The paint layer on *Flause* is also very thin, making it hard to reduce it in thickness any further without exposing the underlying primer. This approach of "buffing up" the worn surface would have only a temporary positive aesthetic impact for just a few more years; the newly exposed paint film would of course bleach out again as before. Currently there are no known protective layers that could be used to prolong the color intensity much further; at any rate, several other measures would need to be carried out first. One temporary intervention would involve local fillings and retouching areas of paint loss. Even though this is a proven method for artworks in a museum context, for outdoor painted surfaces filling and retouching provides a very limited solution, both in aesthetics and over time.

Repainting the Sculpture

Regarding the limited life span of *Flause*'s existing paint film, another approach is to consider repainting the artwork completely. Contemporary paint systems are far more durable. A complete repainting would be a costly but reasonable investment, as the industry provides warranties of ten years or more for new paint systems. If maintained properly, the life span could be extended even further.

Although it is difficult to determine exactly what color the surface had when the paint was first applied, a reasonable approximation could be made—certainly one that was fresh and provocative, as the artist intended. A good paint needs a good priming. Therefore it may be necessary to remove both the original paint and primer completely. Older paints are often removed effectively by sandblasting if the base material is hard enough, but a range of other techniques are available for more sensitive substrates, including softer blasting materials and abrasive and solvent-based methods (i.e., chemical strippers). Whatever method is implemented may well result in a total loss of the current—original—paint. The specific surface structure in the top paint layer, the drippings, and the brushstroke direction also will be lost. This option will alter the sculpture and should perhaps be avoided as long as possible.

Weighing the Options

After some fifteen years outdoors, the overall condition of *Flause* can still be considered good. But as more paint flakes off, as the paint surface becomes duller and the pink color fades further, intervention will become inevitable. In anticipation, a conservation concept for the sculpture has been set up. First, the current situation of the work is to be monitored as long as possible. Next, local repairs may be preferred, perhaps in combination with buffing up the surface. This way, the decision of complete overpainting can be postponed but not avoided. Filling will react in a different way to strain, sun, and differences in temperature. Inpainted areas will soon stand out as the paint used in touch-up ages differently from that used on the surrounding, already aged and bleached surface.

When the final decision to apply a completely new paint layer must be made, can the original artistic properties of the pink paint layer be taken into account? Is it appropriate to mimic various shades in the pink color, add drippings at the same locations as before, and invent a brushstroke on the surface? Making reconstruction samples for this on larger dummy plates to be compared outdoors with the original painted surface of *Flause* can be of help in making these aesthetic decisions.

The aim of the actions taken is to keep the work in a “vital” state. The artwork manifests itself in its position, form, and color. Its position will not be altered since it was chosen by the artist. The form is stable due to its basic material, aluminum; the paint layer, however, is not. Treatments will thus need to concentrate on the paint. In the long term, conservation of the existing coatings is as challenging as it is futile. In the medium term, the present coating can still transport the artist’s intention. Conserving the unique paint and slowing down further degradation has a high value. The decision to protect the surface with a reversible waxy layer or a more durable but invasive layer is pending.

Against all odds, the “vital” state of the paint will vanish and repainting will be imperative. Having it done by Franz West’s former assistants is the closest we can get to the original, which it will never be.

Conclusion

Outdoor painted sculpture needs a conservation approach that is different than for indoor sculpture, and often even different than for nonpainted outdoor artworks. The paints that have been produced thus far are not stable enough to withstand outdoor circumstances for extended periods. Sunlight, UV radiation, humidity, and fluctuations in temperature all shorten life span dramatically, as do human acts such as vandalism.

Conservators of outdoor painted sculpture often need to consider the option of repainting in addition to other, less invasive options, in order to return the look of a work to the way it was intended by the artist, especially if there is insufficient original material to save. For industrially applied paint films, it is possible to re-create a surface similar to the original, but when the surface is unique and hand-painted, it is not as reproducible. In this case, the aim must be to conserve the artwork as effectively as possible, either by replacing or covering it or by covering it with a protection layer. Whatever approach is chosen will not last forever. Continuous maintenance is a vital part of any conservation strategy that minimizes damage and deterioration in the long term. Outdoor painted sculpture is too complex to yield simple and universal answers.

Notes

1. Franz West, *Gelegentliches zu einer anderen Rezeption*, exh. cat. (Mönchengladbach: Städtisches Museum Abteiberg, 1995).
2. Quoted in Peter Gorsen, “Befindlichkeit in lebende Skulpturen gefasst, Partizipation und Autonomie im Werk von Franz West,” in Eva Badura-Triska, ed., *Proforma* (pp. 13–36), exh. cat. (Vienna: Museum of Modern Art, Ludwig Foundation, 1996).

Alexander Calder's *Le Hallebardier*: Recommendations for Care and Maintenance

Angelika Gervais

Abstract: *Since 1978, the stabile* Le Hallebardier *(1971) by Alexander Calder has been situated on the banks of the Maschsee in Hannover, Germany, where it is particularly exposed to the elements. To assess the damage phenomena, digital mapping was carried out. This, together with visible (VIS) and fluorescence spectroscopy examinations and other material analyses, provided the basis for the development of a restoration and preservation plan with recommendations for maintenance and care.*

Introduction

At 8 meters tall, Alexander Calder's *Le Hallebardier* (1971) is an impressive, freestanding outdoor painted sculpture positioned in front of the Sprengel Museum Hannover, overlooking the lake Maschsee from the north side. The artwork is constructed from soft sheet iron, has a total painted surface of 6–7 square meters, and weighs 6 tons. Approximately three hundred screws and square nuts in the iron construction exist partly for aesthetic reasons and bear witness to Calder's fondness for screws. In 2003 the sculpture's condition was assessed and the damaged areas in the paint layers and the metal construction in need of restoration were mapped. The bolts and screws required special attention. Research revealed the existence of a total of seven different layers of paint.

This article discusses the complex history of the sculpture from 1971 until 2013, including its geographic positions, variable environmental conditions, and past restorations.

Le Hallebardier's Journey from France to Hannover

Dr. Bernhard Sprengel, the chocolate manufacturer and art collector, first saw *Le Hallebardier* when he visited Alexander Calder in 1971 in the French town of Tours. In Calder's oeuvre *Le Hallebardier* is a so-called stabile, a fixed standing sculpture as opposed to the artist's famous mobiles. Sprengel enthusiastically expressed interest in purchasing the work and donating it to his hometown of Hannover, inspired by towns such as Grenoble, France, and Grand Rapids, Michigan, where stabiles and other sculptures by Calder had been erected in central town squares.

Sprengel's personal relationship with the artist and their mutual respect played a role in choosing this sculpture. The work acquired its current title in 1971. An early photo shows the statue in its first stage as an unpainted, welded, and screwed shipbuilding construction made from soft iron (fig. 1).

For transport from France to Germany, the stabile was separated into its component pieces. On July 13, 1972, it was installed temporarily in front of the opera house in Hannover (see timeline, p. 124), an operation that took three days. Sprengel planned to give the sculpture a prominent location near the future Sprengel Museum, having donated his art collection to the city of Hannover in 1969.

In September 1976, as plans were under way for the museum's opening in 1979, the museum's director, Dr. Joachim Büchner, made it clear that as far as attractiveness and promotional effectiveness were concerned, erecting *Le Hallebardier* was not only desirable but absolutely essential: “The huge statue with symbolic importance should provide a colossal pointer or signpost to the new museum. The signal colour red contrasts effectively with the light colours of the museum’s facade. It is essential for both being able to work through the site where the artwork will be erected and that adequate unobstructed views are ensured.”[1] It was decided that these requirements would be met by installing the work on the north bank of the Maschsee.

However, on October 20, 1976, city building authorities raised the following objections to the proposed site: no backdrop, rolling terrain, inadequate space, and obstruction by trees. Despite this, on April 14, 1978, the order was given to move *Le Hallebardier* from the opera house to its final location near the Maschsee, in front of the Sprengel Museum (fig. 2). A month later, on May 10, 1978, the sculpture was moved again and erected on frost-free concrete foundations, without addressing geographic positioning or other requirements of its surroundings. Today large trees stand in close proximity to the statue (fig. 3).

Figure 1 Early photo (ca. 1971) from France, showing Calder’s work in its first stage as an unpainted, welded, and screwed shipbuilding construction made from soft iron. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. Photographer unknown.

			 	
The artwork in Tours, France, 1971. For credit see fig. 1.	In 1972 the stabile was installed temporarily in front of the opera house in Hannover, Germany. Between 1972 and 1978 several repaintings took place. Photo: Wilhelm Hauschild, courtesy Hannover Allgemeine HAZ.	Since 1978 *Le Hallebardier* has been situated in front of the Sprengel Museum, on the north bank of the Maschsee. For credit see fig. 2.	Examples of corrosion in the pockets of the sculpture where water can collect. © ZMK, Hannover 2003.	*Le Hallebardier* today. Restoration was completed in 2003. © 2014 Calder Foundation, New York/ Artists Rights Society (ARS), New York © ZMK, Hannover 2013.

Timeline: Alexander Calder, *Le Hallebardier*, 1971–2013.

Figure 2 *Le Hallebardier*, installed in front of the Sprengel Museum, 2003. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Figure 3 *Le Hallebardier* on the banks of the Maschsee, 2003. In this geographic position, the sculpture is heavily frequented by crowds of people, except during the early mornings. Note the little white posters on the right leg. Layers of paper and adhesive, illicitly placed over the years, cause damage to the paint. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Conservation History

It has proved difficult to reconstruct the material history of *Le Hallebardier*, which is now more than forty years old. The first reported treatment took place in 1975 while the sculpture was still at the opera house. Illicitly pasted advertising posters had to be removed, as layers of paper and adhesive had damaged the red paint. The statue was then repainted only up to a height of 2 meters. In addition, it was treated with an adhesion reducer, making it harder for adhesives to stick. The result of this local new coat of paint was unsatisfactory: the coating looked patchy and the joints soon became clearly visible.

A specialist paint company recommended that the sculpture be painted twice a year and coated with an adhesion reducer. In 1978 it was decided to paint the whole sculpture anew after it was transported to the Sprengel Museum. The so-called Calder red, a paint the artist explicitly requested, was used; this paint was produced by a French firm in Tours.[2] Another repainting was carried out by Hannover building authorities in 1979.

More than a decade later, in 1992, Calder's stabile was cleaned again. Apparently the rust was removed and the statue painted again, just in time for the reopening of the expanded Sprengel Museum. In 2003 ZMK in Hannover performed a preliminary condition check of the sculpture.[3] This was followed by a full inspection of the entire sculpture using mobile scaffolding. At the end of the year ZMK made treatment recommendations, and a restoration and conservation plan was worked out.

The aim of the ZMK investigation project was to perform an inventory of all known information about Calder's materials and technique, the identification of the subsequent paint layers, the current condition of the sculpture, any signs of deterioration from the environment and other causes, and the outlook for the future. The processing of this information gives insight into past repairs and any other changes made, which in turn will help in the planning of future care and maintenance.

Environmental Factors

The most important matter of concern was the combination of large-scale steel construction and outdoor circumstances. Steel has been favored by sculptors for large constructions ever since industrialization, as it has the desired properties in hardness, strength, and stiffness. Paint layers over steel function primarily as a protective system for the metal. Calder applied steel plates, bolts, and nuts on his large constructions, and the color red was his artistic and aesthetic choice.

Corrosion is the main risk to the work, as it can cause paint to flake off and ultimately threaten the strength of the construction. Being situated on the north bank of the Maschsee, the mechanical strain is considerable. The Calder sculpture had suffered from the formation of corrosion to a stage that the metal itself must be considered endangered. Interventions in the past, such as complete overpainting, did not always meet the technical standards, nor were they compatible with the aesthetical choice of Calder red.

Comparison with Other Calder Sculptures

In order to assess and qualify the damage phenomena of *Le Hallebardier* in the larger context of Calder's work, two other works by the artist, which also have been exposed to outdoor weathering, were examined. In 2003 the grounds of the former US General Consulate in Frankfurt am Main housed the early Calder work *L'Hexopod* (1955). When the sculpture was loaned out for a special event, it had to be sawn in half so that it would fit through the gate. After the sculpture was returned, the two halves were welded together again; the sculpture is now marred by a welding seam.

On the grounds of the New National Gallery (SMPK) in Berlin stands the sculpture *Heads and Tail* (1965). It was viewed on August 23, 2003. The sculpture, which is metallic black, shows signs of rust on its vertical "joints" and "runs" and has been damaged to varying degrees by exposure to light and climate conditions. The surface now shows different gray tones. Mounted on steel plates, the work has no direct contact with the natural stone or with the ground, providing better protection from corrosion than in the case of *Le Hallebardier*, where corrosion of the steel is induced by the sculpture's close contact with the ground.[4]

Material Analysis

Sampling points of carefully chosen locations in the paint, on welding lines, and on nuts and bolts were carefully mapped in the documentation to assess the specific condition and damage in every small area. By analyzing old and new material, incorrect restorations (and consequently considerable costs resulting from unsuitable use of material) became apparent, as seen in incompatibilities between older and more recently applied materials and in materials with unsatisfactory results. The investigations revealed which materials were used originally, results that should be considered when selecting suitable restoration materials and methods.

Color Analysis

The oldest photograph of *Le Hallebardier* shows the work unpainted but with some ocher-colored lines on the metal (see fig. 1). These lines are the reverse sides of the welding joints that had been heated to counteract the buckling of the metal during the welding process. In a later stage, the welding lines were smoothed and covered by the layers of paint. From 1972 on, the sculpture was painted red several times. Paint samples were prepared into cross sections and the stratigraphic sequence of the paint layers was examined in visible (VIS) and fluorescence spectroscopy. Seven different layers of paint were found, although it is not certain whether each layer belonged to a single campaign of painting. All the layers of paint are orange-yellow or red with varying pigmentation.

Analysis of the oldest layer relevant to the question of new painting was carried out with the aid of polarization microscopy. Evidence of a mixture of ferric oxide, ferric hydroxide, calcite, and quartz was found. The presence of iron (III) was confirmed through microchemical tests. When the sample was dissolved in acid, CO_2 was released, which was attributable to the presence of calcite. Individual analyses of further paint layers were not carried out.

Visual Observation and Documentation: Digital Mapping

On the basis of the preliminary research, systematic documentation of the object's condition began with registering the specific environmental factors (location on the banks of the Maschsee, usage conditions, and so forth). When the object was studied closely without optical aids, traces of mechanical impacts, and older or more recent repairs, alterations and other interferences were revealed. Examining the sculpture under different weather conditions (sunshine, rain) supplemented this information (fig. 4). Findings were recorded in the following formats:

- Sketches (Angelika Gervais, July 10–11, 2003)
- Photos (Michael Herlig, March 28, 2003)
- An orientation system based on a simplified sketch from Hannover building authorities (Ursula Reuther, March–April 2003), placed over two-dimensional diagrams of the object

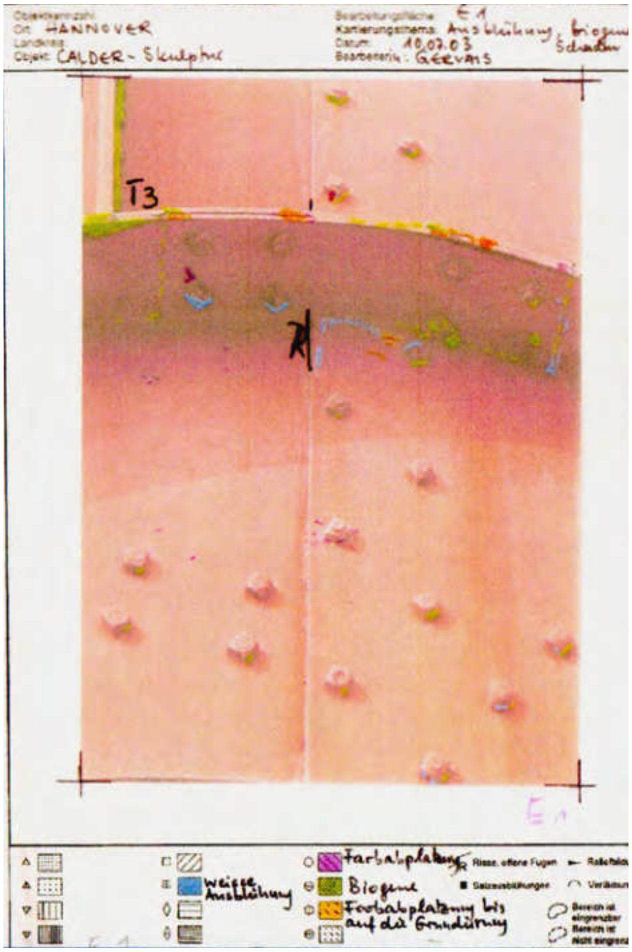

Figure 4 Digital map of *Le Hallebardier*, showing traces of mechanical impact, older and more recent repairs, and alterations and other interferences. Data gathered under different weather conditions (sunshine, rain) were added. This information was recorded in sketches and later digitized. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

The digital mapping process was found to help considerably in visualizing the occurrence of condition phenomena such as aging, previous treatments, and damage. It was carried out on the object in close cooperation by the author, Stefan Lasch-Abendroth, and Ursula Reuther on the basis of the VDI (Association of German Engineers) guideline 3798 (digital mapping), which was further developed and adapted by the Lower Saxony State Office for Monument Preservation.

The system is grouped into twelve mapping units, each with interlinked aspects. The biogenic infestation—specifically, algae growth—had to be determined. Open joints were discovered in places where screws probably were not tightened enough or where bolts and nuts were positioned the wrong way, and there are areas where the original material had been exchanged. Mapping was carried out to show rust, white efflorescence, and runs. It was also possible to differentiate several kinds of paint loss: flaking of the top layer or several layers, down to the primer (figs. 5–7). In some places, black dust, rubber marks from shoes, and remnants of graffiti and poster glue were found.

Figure 5 Photo of the west-facing side of *Le Hallebardier*, showing algae growth. © 2014 Calder Foundation, New York/Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Figure 6 Photo of the west-facing side, showing gaping or open joints where a nut had not been tightly fixed. Loss of paint included flaking of the top layer or several layers, down to the primer. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Figure 7 Photo of the west-facing side, showing rust and runs. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Figure 8 Corrosion damage is evident on the feet of the sculpture, caused by gravel with grass growing over the base plates. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

Results and Recommendations

The intensive preliminary work (research, mapping, material analysis) serves as the basis for developing a restoration and preservation concept. Certain factors need to be taken into consideration:

- The original materials that Calder used and their properties
- The repairs carried out over the years and the materials used
- The current condition with environmental factors

A restoration treatment must be performed respecting the indications of the Calder Foundation.

Feet of the Sculpture (Mounting)

Corrosion damage was evident on the five feet of the sculpture. This was caused by base plates covered with gravel and grass that had grown over the plates (fig. 8). When reassembled, it was recommended that the base plates be placed on the foundation heads with a layer of tarred sheathing felt in between.

Legs and Mounting

Paint is flaking in patches over the area around the legs or the mounting. These patches are numerous at a height of up to 1.5 meters above the ground and less so up to a maximum of 2 meters. They are characterized by flaking right down to the priming coat and with rusty parts underneath. The damage is caused by vandalism, by leaning bicycles against or locking them to the sculpture with chains, and by metal fittings on shoes worn by visitors trying to climb the sculpture. Where the protective coating is damaged, corrosion can more easily occur.

After removing what is not part of the original paint, a new protective layer of paint should be applied. Better corrosion protection is recommended. Furthermore, as far as protecting the sculpture is concerned, suitability of the current location should be reconsidered.

Transverse Metals and Joints

In some areas of the artwork, on both the vertical and horizontal joints, paint has blistered and flaked off; rust spots as well as moss and algae growth can be detected. At some of the intersection faces of the metal, there is no paint left. During reassembling of the sculpture in 1978, after it was moved to the Maschsee, some parts were not fitted tightly enough and nuts were not completely tightened. Drainage is not 100 percent functional.

The sculpture ought to be taken down and the individual parts cleaned and reassembled, checking that all fittings have been tightened securely. After that it should be painted again in Calder red.[5]

Transverse Metals/Corners

In the corners of the stabile, so-called pockets have formed where water can collect and lead to corrosion damage (fig. 9). For example, in pocket 1 the steel has corroded by about two-thirds (sample probe: 6 mm corrosion, 0.9 mm loss of material). One nut is so badly rusted that it cannot be loosened, and its functionality must be tested. Due to the blocked drainage, standing water has collected with corrosive residual moisture. Here as well, a takedown of the entire structure is recommended. The alternative would be cleaning and rebuilding it with anticorrosive coating, installing drainage, and adding tar covering on the horizontal elements. Continual maintenance and care are indispensable prerequisites for long-term prevention of damage.

Head and Halberd

Various problems occurred in the head and halberd sections of *Le Hallebardier*. Several layers of paint flaked off, biogenic growth was found on the vertical elements (intersections and joints), and pockets of water were discovered on the transverse elements. Stagnant water on the transverse elements provides the humidity necessary for biogenic growth and in the long run leads to corrosion damage. An alternative to taking down the entire sculpture would involve cleaning, reconstruction, applying an anticorrosive coating, installing drainage, and adding tar covering on the horizontal elements. Similarly, maintenance and care must be carried out continuously in order to minimize damage in the future.

Figure 9 In the corners of the sculpture, pockets form where water can collect, leading to corrosion. © 2014 Calder Foundation, New York / Artists Rights Society (ARS), New York. © ZMK, Hannover 2003.

2013: Ten Years Later

Today *Le Hallebardier* is in good condition. The Calder red has lost some of its luster, but it is still Calder red. The result of the restoration work carried out by the firm Arnold AG, Steinbach-Hallenberg, Germany, in 2006 in accordance with the wishes of the Calder Foundation is still acceptable.

For the future, one can take into consideration the current results of relevant projects to prevent the corrosion of freestanding painted and unpainted steel and iron objects exposed to weathering.[6] Furthermore, setting out a trial area is recommended in order to provide examples of the following aspects: exposing the metal surface, checking the tightness of connecting parts, reviewing the necessity of partial dismantling, reducing corrosion products, and applying corrosion protection with particular regard to preservation aspects (originality of the object, reversibility of protection), the new coating, and further conservation measures.

On this basis, rational decisions can be made as to the treatment of the corroded, coated steel object, and the total cost of repair can be calculated reliably. Finally, it would be useful to discuss changes in the way the sculpture is displayed (as with *Heads and Tail*, which was erected without direct contact with the ground) or moving it to a less polluted location.

Acknowledgments

The work was carried out jointly by geologist Angelika Gervais and librarian Angelika Kracht, both of the North German Centre for Material Science of Cultural Artifacts (ZMK); restorer Ursula Reuther and

photographer Michael Herling, both from the Sprengel Museum; and freelance restorer Stefan Lasch-Abendroth of Hamburg. Art historical classification and support in producing the report were provided by Dr. Peter Königfeld of Hannover. The investigations relating to polychrome were conducted by Andreas Buder, Hochschule der Künste Bern, Konservierung und Restaurierung, Bern, Switzerland. The translation was done by Pamela Seidel, Laatzen.

Notes

1. Dr. Joachim Büchner, director of the museum of art, Sprengel Collection, letter to the authorities of the city of Hannover, September 9, 1976.
2. Philocolor, Z.l. Thuisseau – BP 1, 37270 Montlouis-sur-Loire, France. Color: rouge Calder (order no. 2 S. 322).
3. Norddeutsches Zentrum für Materialkunde von Kulturgut e.V. / North German Centre for Material Science of Cultural Artifacts.
4. For images of these sculptures, see Wikimedia commons: File: Berlin, Tiergarten, Potsdamer Strasse 50, Neue Nationalgalerie, Skulptur 'Tetes et Queue' von Alexander Calder.jpg. Taking photographs of *L'Hexopod* at the former US consulate in Frankfurt was prohibited for security reasons.
5. General guidelines on conservation are to be found on the Calder Foundation website: http://www.calder.org/contact/conservation.
6. These projects involved research conducted by the Deutsches Bergbau-Museum Bochum (German Museum of Mining), Monument Protection / Materials Science Department in the pilot projects "Transparent Corrosion Protection for Industrial Monuments Out of Iron and Steel" and "Model Application and Further Development of Protective Coatings and Corrosion Inhibitors to Preserve the Baroque Choir Railing, Damaged by Environmental Influences, in Osnabruck Cathedral," both sponsored by the DBU (German Environmental Foundation). The findings should serve as a basis for the formulation of the necessary new coating.

Preservation of Outdoor Painted Sculpture in Quebec

Stéphanie Gagné and Monique Benoît

Abstract: *Since the 1960s, more than thirteen hundred sculptures have been installed in public spaces throughout the province of Quebec. A significant number are painted. In order to meet the growing demand for information and services, the Centre de conservation du Québec has made a variety of helpful tools available to the public. Artists, caretakers, and collections managers have access to a downloadable guide to public art and free consultations with conservators. Pilot programs have been created for municipalities, and training programs on the maintenance of public art are available. Case studies will present successes and the risks associated with these initiatives.*

Introduction

This article focuses on the preservation of outdoor painted sculptures within the context of the province of Quebec. First, a brief overview of the Centre de conservation du Québec (CCQ) and its mission is provided, followed by an explanation of the public art program in Quebec, which is partly responsible for the large quantity of outdoor sculpture. Because of the widespread installation of public art in the province, the CCQ has developed a series of preventive conservation tools and strategies in response to the overwhelming demand for technical information. Several case studies demonstrating the use of these tools, as well as the risks associated with providing technical advice to nonconservators, are also presented.

The CCQ and Its Mission

Founded in 1979, the Centre de conservation du Québec is a provincially funded conservation center attached to the Quebec Ministry of Culture and Communications. Its mission is to contribute to the preservation and conservation of Quebec's cultural heritage, including artifacts, artworks, public art, and architectural elements.

The CCQ represents the largest team of conservators working under one roof in Quebec. Approximately thirty-eight conservators are employed in seven specialized labs: sculpture, paintings, furniture and wood, paper, metal and stone, textiles, and archaeology and ethnology. Three professional photographers work alongside the conservators, providing photo documentation and specialized imaging support. As a result, the CCQ is able to offer a variety of professional services to a diverse clientele. These services include, but are not limited to, condition reports, conservation treatments, consultation and expertise, collection surveys, disaster preparedness and recovery, and education and outreach programs. The CCQ does not have its own collection, but its clientele includes museums and archives, corporations, religious communities, municipalities, and private citizens.

Public Art in Quebec

In the CCQ's sculpture and metal and stone labs, preservation and treatment of outdoor painted sculpture constitutes up to 40 percent of the institution's work in any given year. Most of these sculptures are part of public collections and are located near government buildings, on university campuses, or in public parks.

In 1961 the provincial government of Quebec implemented a policy of integrating art into architecture and the environment, commonly referred to as the Politique du 1%. Under this policy, each time a public building is constructed or undergoes significant renovation, 1 percent of the total construction budget is to be spent on artwork.

At the time of this writing, more than thirteen hundred sculptures have been installed province-wide under this program alone (fig. 1). While the sculptures can be created from many different and mixed media, the most commonly used materials are metal, concrete, wood, or other composite materials such as glass fiber–reinforced polyester. The majority include a painted finish.

From 1964 to 1997, thirty-three outdoor sculpture symposia were held in the province of Quebec (Fisette 1997). In total more than two hundred artists participated. The 1967 International and Universal Exposition (Expo 67), held in Montreal, exhibited sculptures by artists of national and international acclaim such as Naum Gabo and Alexander Calder. Together these events brought attention to outdoor sculpture and helped inspire a new generation of artists.

Because all materials deteriorate due to natural causes, vandalism, accidental damage, or improper maintenance, regular and repeated treatments are required for preservation (figs. 2, 3). It is physically impossible for conservators to treat each and every sculpture in the province; budgets are limited and the outdoor work period in Quebec is short due to the harsh winter climate. These factors further complicate the already challenging reality that is the conservation of outdoor sculpture. For these reasons, it is imperative that the public be involved in preventive conservation.

Preventive Conservation Tools and Strategies

Over several years, the CCQ has developed a series of tools in order to raise public awareness of preventive conservation. Feedback from collections managers gathered through surveys, evaluation forms, and informal communication confirms that they have seen an increase in the life span of outdoor sculpture in their collections once they have implemented preventive conservation strategies. They also note that conservation treatments are less costly when eventually required.

Figure 1 Example of an outdoor painted sculpture installed under Quebec's program Politique du 1%. Raymond Mitchell, *Égalité?*, 1976. Painted aluminum. City of Amos; installed in front of the city courthouse. © Raymond Mitchell. Photo: Catherine Lebel Ouellet, 2011 © MCCCF.

Figure 2 Example of deterioration due to improper maintenance, showing grass projections and scratches from maintenance equipment. Photo: Nathalie Richard, 2012 © CCQ.

Figure 3 Example of deterioration due to improper maintenance, showing paint lifting and corrosion of steel behind the weeds. Photo: Marie-Chantale Poisson, 2012 © CCQ.

Web-Based Tools

One web-based tool developed by the CCQ is the free, downloadable guide on public art, *Guide pour la conservation des oeuvres d'art public*, available at http://www.ccq.gouv.qc.ca/fileadmin/images/guide_artpublic/guide_2013.pdf (fig. 4). This guide is geared toward artists and collections managers and touches on all aspects of public art, from conception and realization to installation and maintenance. Its information and recommendations are directly applicable to the preservation of outdoor painted sculpture. For instance, there are sections on different coloration techniques of concrete sculptures, on protective coatings such as anti-graffiti coatings, and on the potential danger of bird droppings to sculptures and to public health. The guide also offers advice on choosing locations and materials for sculptural installations, as well as information about fabrication and joining techniques and the different factors of degradation for concrete and metal sculptures.

Pilot Programs

In addition to online preventive conservation tools, the provincial government has funded initiatives wherein CCQ professionals are made available free of charge to certain clients. Within this framework, conservators are able to provide consultations to artists and collections managers, usually by phone or e-mail.

One of the CCQ's objectives in working with artists is to be involved with new public sculpture projects from their inception. The goal is to encourage relationships between conservators and artists, make them aware of the conservation services available to them, and assist in the decision-making process, free of charge. Some of the most sought-after information relates to materials stability and compatibility, fabrication techniques, surface preparation, and paint systems. This artist–conservator collaboration has reduced long-term conservation problems and addressed public safety concerns. It has generated a positive response from the artists involved, who are thrilled to have input on best practices to ensure the longevity of their works.

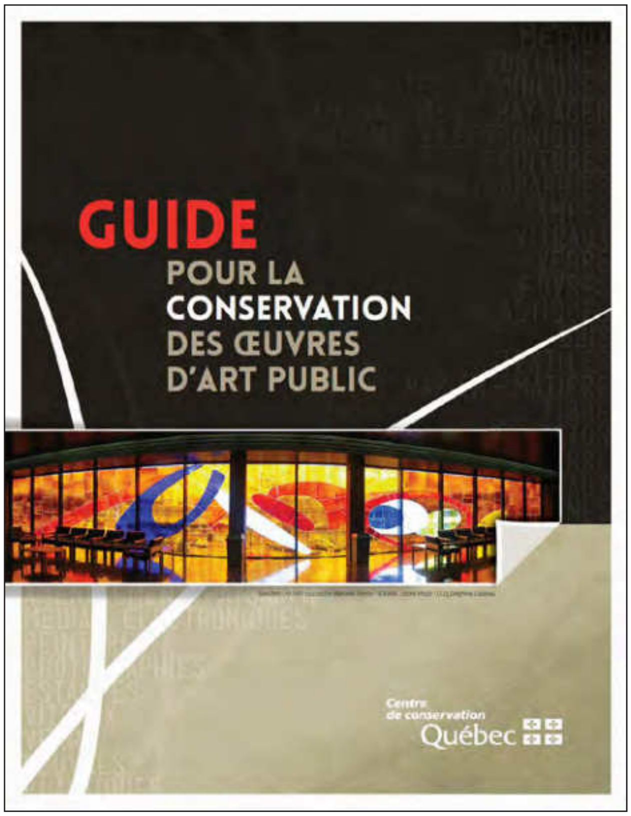

Figure 4 Downloadable guide on public art, developed by the CCQ. 2013 © CCQ.
Available at: http://www.ccq.gouv.qc.ca/fileadmin/images/guide_artpublic/guide_2013.pdf

Figure 5 A CCQ conservator prepares a condition report on a sculpture as part of a collection survey. Artist and title unknown, 1971. Painted steel. Parc Roussillon, City of Longueuil. Reproduced by permission of the city of Longueuil. Photo: Stéphanie Gagné, 2012 © CCQ.

Another challenge for the CCQ is to develop specific collaborations with municipalities owning significant outdoor painted sculpture collections. The first objective is to encourage CCQ's municipal partners to invest in the preservation and conservation of their collections. The second objective is to implement preventive conservation strategies into existing public maintenance programs.

Since 2009, seven successful collaborations have been established thanks to these pilot programs. The municipalities involved are Trois-Rivières, Sherbrooke, Saguenay, Gatineau, Victoriaville, and the Chaudière-Appalaches and Abitibi-Témiscamingue regions (Cree First Nation communities). Each pilot project includes 100 hours of conservation services and training seminars for municipal employees.

Conservation services include a collection survey containing a detailed condition report for each sculpture examined (fig. 5), a list of global treatment priorities for the collection, a maintenance schedule, a handout describing simple tasks that can be carried out by municipal employees, and a sample maintenance log sheet. Where necessary, employees are trained to carry out condition checks and records on-site with their own collections as reference material. For each municipality, the CCQ provides a list of local suppliers for materials.

Maintenance recommendations routinely include rinsing sculptures with water, cutting grass carefully, installing barriers between the grass and the sculptures, pruning trees, installing gravel at the sculpture base to improve drainage, and installing winter protection and snow fences to reduce damage from snowblowers, deicing salts, and snowplows. In addition, the CCQ advises on the delocalization of artworks and on the supervision of new installations (fig. 6).

Figure 6 The CCQ supervises installation of sculptures after treatment. Lewis Pagé, *Dispute philosophique*, 1972. Painted ferro-cement (after treatment). Grand Théâtre de Québec, Quebec City. © Lewis Pagé estate. Photo: Claude Payer, 2002 © CCQ.

As an added benefit, conservators may interview artists in order to understand their sculpture and their intent or vision. All CCQ conservation recommendations respect artists' intent when known, and are reasonable within the means available to the respective municipality.

In addition to the cities selected for the pilot projects, Montreal, Longueuil, and Trois-Rivières have taken the initiative to engage the CCQ to carry out similar conservation projects for their own collections.

Case Study 1: City of Longueuil Collection Survey

Longueuil, Quebec, is an example of a municipality that has taken an interest in the conservation of its outdoor painted sculpture collection. In 2012 the city hired the CCQ to carry out a pilot project. City authorities selected nineteen works from Longueuil's vast collection for this project.

Although the sculptures selected were generally in good condition with sound structure, most had been repainted over the years with little to no concern as to the original color scheme (see, for example, the artwork shown in figs. 7 and 8). In these cases, the CCQ recommended repainting the sculptures with the original colors based on archival documentation, artist interviews, photographs, and cross-section paint analyses. The Sico 6000 color chart was consulted to approximate the original paint color as closely as possible. Paint color reference numbers were included in each condition report.

The city of Longueuil is actively making efforts to implement preventive conservation strategies and changing its maintenance procedures as a result of its collaboration with the CCQ.

Case Study 2: Examining Painted Aluminum

An example of preventive conservation from the Longueuil project is the painted aluminum sculpture *Miroirs, ronds de lumière et rideau de scène* (1996) by Lise Boisseau (fig. 9), located at Collège Édouard-Montpetit, Longueuil. Upon examining the sculpture in 2012, CCQ conservators were surprised by its advanced state of deterioration.

Owing to the work's location in a public area frequented by students, the painted surface was marred by scratches and graffiti (fig. 10). Furthermore, the paint layer was bubbled and the subsequent varnish layer was delaminating (fig. 11). This phenomenon was primarily observed along the edges of the panels and in areas that were scratched or where the paint had been disturbed. Investigation revealed that these bubbles had formed over pockets of local corrosion, where white powder—a typical aluminum corrosion product—was observed (fig. 12).

Figure 7 Example of an outdoor sculpture repainted over the years with little to no concern for the original color scheme, shown in its original location at Fernand-Bouffard Parc, Longueuil. Régis Pelletier, *Concerto pour poutres et chaînes*, 1972. Painted steel. © Régis Pelletier. Photo: 1972 © Johanne Viens.

Figure 8 The Pelletier sculpture from fig. 7, in its current state and location at Lecavalier Parc, Longueuil. Régis Pelletier, *Concerto pour poutres et chaînes*, 1972. Painted steel. © Régis Pelletier. Photo: Nathalie Richard, 2012 © CCQ.

Figure 9 Lise Boisseau, *Miroirs, ronds de lumière et rideau de scène*, 1996. Aluminum, polyurethane enamel. City of Longueuil. During an examination in 2012, CCQ conservators noted the sculpture's advanced state of deterioration. © Lise Boisseau. Photo: Stéphanie Gagné, 2012 © CCQ.

Figure 10 Drawn and engraved graffiti on the Boisseau sculpture. Lise Boisseau, *Miroirs, ronds de lumière et rideau de scène*, 1996 (detail). © Lise Boisseau. Photo: Stéphanie Gagné, 2012 © CCQ.

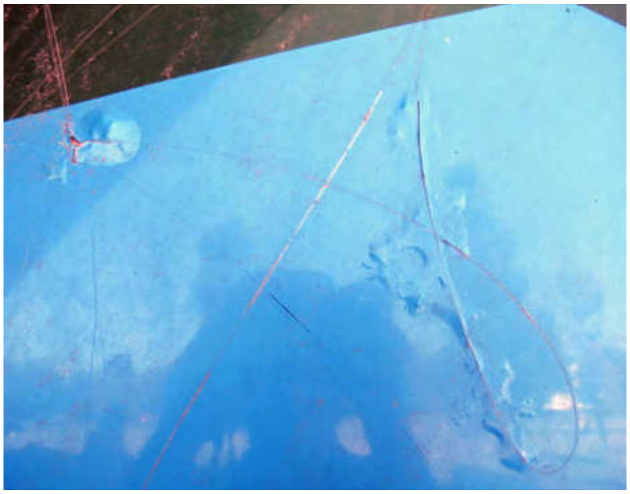

Figure 11 Paint bubbles and engraved graffiti with water infiltration on the Boisseau sculpture. Lise Boisseau, *Miroirs, ronds de lumière et rideau de scène*, 1996 (detail). © Lise Boisseau. Photo: Stéphanie Gagné, 2012 © CCQ.

Figure 12 Pulverulent corrosion under the paint bubbles on the Boisseau sculpture. Lise Boisseau, *Miroirs, ronds de lumière et rideau de scène*, 1996 (detail). © Lise Boisseau. Photo: Nathalie Richard, 2012 © CCQ.

In order to understand why this premature degradation was present, CCQ conservators interviewed the artist and the professional auto-body painter who had done the work. Microscopic analysis of paint fragments revealed that the aluminum had not been properly prepared or primed before the paint finish was applied, hence the corrosion and the flaking paint. Improperly prepared surfaces are one of the key reasons that paint finishes fail prematurely.

Conservators were able to assist the artist and the owner in understanding the needs of this particular work. In the condition report, it was recommended that the sculpture be repainted, respecting the appropriate surface preparation protocols for aluminum. Given the lack of surface preparation, localized retouching was not an appropriate treatment. It was also recommended that all tools used in the surface preparation be reserved for aluminum in order to avoid cross-contamination of materials (for example, rust stains from steel dust).

Moreover, conservators advised the application of a glossy protective coating to protect the surface from both environmental degradation and graffiti, and the installation of a lighting system to discourage vandals. Also stressed was the importance of having a professional validate all products prior to their application. At the time of this writing, no conservation treatment has been undertaken.

Addressing the Risks of Conservation Treatment

Although the CCQ has successfully collaborated with municipal employees for several years, conservators remain aware that there is still an issue that bears consideration. Part of these pilot projects involves training nonspecialists to treat works of art. On the one hand, a key benefit of these programs is that they provide at least a minimum of training to those who are likely to treat the sculptures regardless of their previous training, whether it is in cleaning, repairs, painting, and so forth. Many municipalities or public institutions do not have dedicated staff for the maintenance of their sculptures. It is common to find inadequate or inappropriate treatments carried out by well-meaning individuals who lack specialized training. For those places that do have a maintenance team, the CCQ has observed that there is a high employee turnover. In these situations, collections maintenance knowledge is rarely transferred from one employee to another. The importance of planning regular training sessions and record keeping should be stressed.

On the other hand, this brings up a certain ethical dilemma. There are always risks associated with conservation treatment, but even more so when conservators provide advice to nonconservators. Some tasks are delicate, and well-intentioned individuals can damage a painted surface simply by, for example, overcleaning the sculpture with high-pressure water. However, when there are not enough professional conservators to handle the high volume of artworks, choices have to be made. The philosophy adopted by the CCQ for outdoor painted sculpture is that knowledge empowers owners. By providing preventive conservation tools and safe, easy-to-follow maintenance protocols, it has been possible to minimize the damage caused by improper treatment and ultimately to prolong the life span of outdoor sculpture.

Also, through presentations and training provided by the CCQ, participating municipal employees have become more conscious of the importance of preserving sculpture. They develop a feeling of ownership after investing their time and effort in the conservation of sculpture. Conservators have found that when maintenance plans are simple and straightforward, there is a better chance that they will be followed.

Conclusion

In Quebec, outdoor painted sculpture collections benefit when their caretakers have access to online tools, when artists take advantage of free consultation, and when municipal employees take advantage of the free consultation and training provided by the CCQ.

By making preventive conservation tools and strategies available to a wide audience, there is a better chance that outdoor sculptures will be maintained without being damaged. A secondary benefit is that relationships based on a respectful exchange of knowledge will develop between artists, collections managers, and conservators. Concrete results have been seen in the form of successful partnerships between the CCQ and the ten municipalities named above that are actively making an effort to implement preventive conservation strategies and improve maintenance procedures. In addition, the number of artists who contact the CCQ for technical advice has increased as our programs gain visibility.

Since the production and installation of outdoor painted sculpture shows no signs of slowing down, the CCQ continues to be called upon as the primary source for technical information in Quebec. The dissemination of preventive conservation information enables collections managers, owners, artists, and others to make informed decisions about their works and to know when to contact appropriate professionals, including conservators.

Acknowledgments

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References

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List of Meeting Participants

Conserving Outdoor Painted Sculpture Meeting, 4 and 5 June, 2013

First name	Last name	Organization	Job title/student	Country
Amy	Anderson	Plowden and Smith	Conservator, Head of Decorative Arts	United Kingdom
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Gilles	Barabant	C2RMF	Chef filière XXe siècle, art contemporain	France
Lucie	Bausart	Middelheimmuseum/Stad Antwerp	Collection Manager	Belgium
Julia	Becker		Conservator	France
Tonny	Beentjes	University of Amsterdam	Program Leader, Metals Conservation	Netherlands
Lydia	Beerkens	Stichting Restauratie Atelier Limburg (SRAL)	Senior Conservator of Modern Art	Netherlands
Paul	Benson	Nelson-Atkins Museum of Art	Conservator of Objects	USA
Frederike	Breder	Museum Folkwang	Conservator	Germany
Cleo	Cafmeyer		Conservator of Modern and Contemporary Sculptures	Belgium
Zeeyoung	Chin	Leeum, Samsung Museum of Art	Conservator	Korea
Céline	Chrétien		Sculpture Conservator	France
Sara	Creange	Rijksmuseum	Conservator of Metals	Netherlands
Laura	Davies		Freelance sculpture conservator	United Kingdom
Nora	de Smet	Middelheimmuseum/Stad Antwerp	Consultant	Belgium
Alberto	de Tagle	Cultural Heritage Agency of the Netherlands (RCE)	Chief Scientist	Netherlands
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Thomas	Dempwolf	Dempwolf-Restaurierung		Germany

First name	Last name	Organization	Job title/student	Country
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Michaela	Florescu	Institut national du patrimoine (INP)	Student of Metals Conservation	France
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Sami	Supply	Finnish National Gallery	Conservator	Finland
Valeria	Suruceanu	National Art Museum of Moldova	Conservator and Curator	Moldova
Florian	Szibor	Museum Abteiberg Mönchengladbach		Germany
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First name	Last name	Organization	Job title/student	Country
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Sjoukje	van der Laan	University of Amsterdam	Master's student, conservation of contemporary art	Netherlands
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About the Contributors

Peter von Bartheld studied fine art and design in education at Artez Institute of the Arts, Arnhem, and conservation at Bern University of the Arts. He currently teaches metal processing in Zurich and works as conservator at the Kunstgiesserei St. Gallen AG.

Nikki van Basten studied fine arts at the University of the Arts in Utrecht, graduating in 2009 as a certified autonomous artist. In 2013 she obtained her MA in conservation and restoration of cultural heritage at the University of Amsterdam with a specialization in contemporary art. Currently she follows the postgraduate conservator-in-training program at the University of Amsterdam.

Lydia Beerkens is a freelance conservator of modern and contemporary art and senior conservator at Stichting Restauratie Atelier Limburg (SRAL), Maastricht. Involved in Dutch research projects including "Modern Art: Who Cares?" and "The Artist Interview" and in the development of specialized training programs, she also lectures and publishes on case studies and decision making in modern art conservation. She earned a PhD at Radboud University Nijmegen in 2012.

Monique Benoît graduated with a master's degree in objects conservation from Queen's University, Kingston, Canada, in 2007. In 2009, after participating in various projects and contracts in Canada and Europe, she began working with the Centre de conservation du Québec (CCQ) in Quebec City. Specializing in the conservation of metals, she is engaged in the treatment of a wide variety of objects, ranging from small decorative pieces to outdoor installations, monuments, and architectural elements.

Paul L. Benson received a BS in geology in 1972 from Kent State University, Ohio. He worked in geophysical exploration for the oil industry in the US, in South America, and in the South Pacific. He received a BSc in archaeological conservation and material science in 1991 from the Institute of Archaeology, University of London. He joined the Nelson-Atkins Museum of Art, Kansas City, Missouri, in 1992 and is currently a conservator of objects.

Frederike Breder is a conservator at Museum Folkwang in Essen, where she cares for the collection and advises the city council on matters pertaining to preservation of public art. From 2006 to 2011 she worked at the private studio Restaurierungsatelier "Die Schmiede" GmbH in Duisburg as conservator for modern sculptures, directing numerous projects of large-scale artworks in public spaces. She studied at the Cologne Institute for Conservation Sciences in the Department of Paintings, Sculptures, and Modern Objects and in 2006, completed her diploma thesis on outdoor painted sculptures.

Zeeyoung Chin is a conservator of modern and contemporary art at Leeum, Samsung Museum of Art, located in Seoul, Korea. She obtained her European master's degree in conservation of paintings at L'Ecole Supérieure d'Art d'Avignon, France, in 2005. Since then she has worked with different forms of art and with a variety of materials found in the museum's collection.

Thomas Dempwolf is a freelance conservator based in Berlin. He received a diploma in the conservation of modern materials and technical heritage in 2004, was skilled in 1998 as a restorer in metal crafts, and was certified as a master of metalworks in 1996. His studio specializes in the conservation of works of art made of metals and modern materials.

Hans Springvloet Dubbeld started his career working for his uncle in the paint wholesale business. When he became manager, he grew more and more interested in the conservation business. His next job was as general manager of a small paint wholesale business near The Hague. Currently he is sales engineer at De IJssel Coatings, Moordrecht, a Dutch producer of paintings and gelcoats, where he has worked for the past fourteen years specializing in the field of outdoor conservation. He has a bachelor's degree in sales management and economics and will complete his MBA (with a specialization in strategic sales management) at the end of 2014.

Stéphanie Gagné graduated with a master's degree in art conservation from Queen's University, Kingston, Canada, in 2007. Specializing in modern and contemporary art, she joined the sculpture lab at the Centre de conservation du Québec (CCQ) in Quebec City in 2008. Her projects have included coordinating the conservation of public artworks installed throughout Montreal's vast subway system, and conserving indoor and outdoor sculpture across the province of Quebec.

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Liz Kreijn studied art history and archaeology at the University of Amsterdam. After graduating in 1989 with a specialization in modern art history, she worked for the Ministry of Culture, where she was involved with the so-called Deltaplan for Cultural Heritage, a national Dutch project to eliminate backlash in conservation of cultural collections. Later she started up a department at the State Training School of Conservators, developing courses for museum staff on preventive conservation and art handling. Since 1998 she has served as a consultant for several Dutch museums, managing exhibition projects and writing organization and policy plans. In 2005 she became assistant director, collection and presentation, of the Kröller-Müller Museum in Otterlo.

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René Peschar studied chemistry and earned a PhD in the field of crystallography and X-ray diffraction at the University of Amsterdam. After serving as assistant professor and group leader in this field at the university's Faculty of Sciences, he joined the Department of Conservation and Restoration of Cultural Heritage (Faculty of Humanities) as a science lecturer in 2012. He has an interest in a wide range of research areas, in particular processes that modify properties of materials.

Rachel Rivenc is an associate scientist at the Getty Conservation Institute, where she manages the Outdoor Sculpture project as well as Art in LA, a project investigating the innovative materials and processes used by LA artists since the 1950s and associated conservation issues. She holds a Master in Paintings Conservation from Paris I Sorbonne and a PhD in cultural history of contemporary societies from the Université de Versailles-Saint-Quentin-en-Yvelines (UVSQ). She is currently assistant coordinator for the Modern Materials and Contemporary Art working group of ICOM-CC.

Gwynne Ryan is sculpture conservator at the Hirshhorn Museum and Sculpture Garden at the Smithsonian Institution in Washington, DC, where her responsibilities span the conservation of the outdoor sculpture garden, contemporary sculpture and installations, and time-based media. She is also a principal investigator for the Smithsonian Pan-Institutional Time-Based Media Working Group and serves on the board of the International Network for the Conservation of Contemporary Art—North America (INCCA–NA).

Florian Szibor is a conservator for modern materials and technical heritage. Since 2012 he has worked at the Museum Abteiberg Mönchengladbach, where he is responsible for art in public spaces and for the museum garden. He was a participant in the course "Masterclass Plastics: Identification, Degradation and Conservation of Plastics" led by Thea van Oosten and Anna Laganà at the University of Amsterdam. In 2012 he graduated from the University for Applied Sciences (HTW) in Berlin. Before turning to conservation and modern materials, he achieved in 2006 a Magister Atrium in the history of art and modern history at Westfälische Wilhelms-Universität Münster. During these studies he spent one year as an Erasmus exchange student in Rome. He also worked for several archaeological excavations and archives in the city of Münster.

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