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To cite this article: Eleonora E. Nagy (2021): The Making of Mike Kelley's *The Wages of Sin's* Exhibition Copy: Replication as a Means of Preservation, *Studies in Conservation*, DOI: [10.1080/00393630.2021.1911095](https://doi.org/10.1080/00393630.2021.1911095)

To link to this article: <https://doi.org/10.1080/00393630.2021.1911095>



Published online: 19 Jun 2021.



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# The Making of Mike Kelley's *The Wages of Sin's* Exhibition Copy: Replication as a Means of Preservation

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## ABSTRACT

With the arrival of the digital age and technology, creation of art and its replication reached a whole new pinnacle. Increasingly, conservators find themselves dealing with editions, copies, and replicas as part of their job. Indeed, the replication of a work of art, be it paper or a 3D printed sculpture, is becoming one of many conservation measures that may serve as a preventive conservation technique, protecting the art from excess levels of light, travel, or handling, or as a tool to better understand the art. Replication of a digitally existing master for each new display may be the artist's intent, or enable simultaneous multiple displays of the same work as per the artist's directive. This article describes the making of an Exhibition Copy of the American artist Mike Kelley's *The Wages of Sin*, a pile of partly melted wax candles atop a readymade, commercially sourced table. Owned by the Whitney Museum of American Art, New York, the highly complex three-dimensionality and materiality of this iconic work of art posed significant challenges to replicate. The following description illuminates the conceptual aspects considered, why and how the replica was made, and decision-making processes throughout its fabrication, exploring materiality and technical issues. The role of the Whitney's Replication Committee in this project is discussed, including participation of its curators, archivists, and other museum professionals, along with an explanation of the Committee's choice of the term 'Exhibition Copy' to describe the replica. The account of the collaboration and coordination of the project with the Mike Kelley Foundation and external fabricators is central to this comprehensive project. Ramifications for future use of the Exhibition Copy within the museum management, documentation, loans, and wall labels, and its legal and publication consequences conclude this paper.

## ARTICLE HISTORY

Received September 2020  
Accepted March 2021

## KEYWORDS

Mike Kelley; *More Love Hours Than Can Ever be Repaid* and *The Wages of Sin*; replica; exhibition copy; replication committee; decision-making process for replication; thermosetting resins; wax; 3D laser scanning; 3D printing

## Introduction/description

With the arrival of the digital age art making and its replication reached a new pinnacle. Conservators increasingly find themselves dealing with editions, copies, and replicas as part of their job. Replication is becoming one of many conservation measures that serve a wide range of purposes in conservation, such as replacement of a lost or severely compromised original, a preventive measure to protect the art from excess exposure to light, travel, or handling, an aid for educational purposes, or as a research tool to better understand the art and its making. Recent advances in technology, such digitalization, dimensional precision, 3D printing, and repeatability made reproduction highly suitable not only for media and conceptual art, but for the preservation of more traditional forms, such as drawings and sculpture. Be it paper or a 3D printed sculpture, replicating a work of art often leads to uncharted territories conservators must grapple with; from the initial rationale for making a replica to its final status in a museum collection. What is the replica's specific purpose? What is the most appropriate method of making the replica? What are the limits of its use as a replacement? When the

replica is on view, how to be transparent on the label copy? And finally, what exactly is the meaning of the term 'replica'?

This paper narrates the creation of a replica of *More Love Hours Than Can Ever Be Repaid* and *The Wages of Sin* (1987) (Figure 1), a seminal work by the American artist Mike Kelley (1954–2012). It outlines the whole process, exploring the piece's history, the rationale for making a replica, and the terms and recounts its execution. It provides insight into detailed technical considerations and the skills underpinning the project, as well as the complex decision-making processes. It gives a detailed account of the dynamic collaboration between the Whitney Museum of American Art, which owns the work, the Mike Kelley Foundation for the Arts, and outside contractors. Also highlighted is the role of the Whitney's Replication Committee in this project. Made up of curators, archivists, and other museum professionals, the committee provided the theoretical and ethical framework necessary for producing this replica. This paper also addresses the status of the replica and the original work in an institutional setting and places the project into the wider context of replication published in the conservation



**Figure 1.** Installation view of Mike Kelley, *More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, 1987 as installed in the 1989 Biennial Exhibition (18 April –16 July 1989), 4th floor gallery. Whitney Museum of American Art, New York, N.Y. Stuffed fabric toys and afghans on canvas with dried corn; wax candles on wood and metal base. Overall: 306.7 × 385.4 × 80.6 cm. Whitney Museum of American Art, New York; purchased with funds from the Painting and Sculpture Committee 89.13a-d Photograph Sandak, Inc., Stamford, CT. ©The Mike Kelley Foundation for the Arts/Artists Rights Society (ARS), New York.

literature. Written from the point of view of the conservator, and through a specific case study, this article offers pragmatic insight into the impact of technical, theoretical, ethical, and decision-making processes of replica making. It aims to provide guidance to other institutions and provide a valuable contribution to the field of conservation.

### Description

Kelley created one of his iconic works, *More Love Hours Than Can Ever Be Repaid and The Wages of Sin* in 1987 in Los Angeles. The work consists of two parts: *More Love Hours Than Can Ever Be Repaid*, made of stuffed fabric toys, crocheted afghans, and dried corncobs attached to canvas, and *The Wages of Sin*, composed of wax candles piled randomly on top of a round metal table. When displayed, the *More Love Hours Than Can Ever Be Repaid* (later referred to as the afghan) hangs on the wall while the table with the mound of melted wax candles stands left of the afghan (Figure 1). Though physically separate, Kelley intended the two components a singular work of art; therefore, the afghan and the table of wax candles must never be exhibited separately. The two parts form a yin-yang of opposites; the cozy contentment of comfort and love contrasted with the frenzied repentance of sins. This article discusses replication of the latter part of the object, *The Wages of Sin*.

Created in a moment of artistic inspiration, the hastily piled, chunky candles lack structural support.

The core of the heap, hollow by design like a house of cards, permits views through the stack of heavy wax candles. Evoking pious offerings lit in church as penitence for bad deeds, Kelley briefly melted the pile of candles together in the final phase of its creation. These few arbitrary points of partly melted wax provide the sole and inherently poor means of stability to this structurally unsteady object.

### History

Purchased from Metro Pictures, Kelley's major work *More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, entered the Whitney's collection as one of the Whitney Biennial purchases in 1989. Recognized as a pivotal work of the artist, the work travelled on loan extensively. From the onset of its acquisition, frequent travel added to growing conservation concerns, specifically regarding the stability of the wax component of *The Wages of Sin*. During transit for loan in early 2012, the pile of wax tilted, and the whole candle construction shifted out of vertical position, causing an irreparable, permanent tilt in the entire wax mound, and severely compromising the object's stability. Despite concerns, at the end of the same year, the work went out on loan again, this time to Amsterdam for a major Mike Kelley retrospective, a traveling exhibition entitled 'Mike Kelley,' 15 December 2012 to 28 July 2014, with venues at the Stedelijk Museum Amsterdam (15 December–1 April 2013); (Centre de Pompidou, Paris 2 May–5 August 2013); Museum of Modern Art PS 1, New York (13 October–2 February 2014) and The Geffen Contemporary Art at Museum of Contemporary Art, Los Angeles (31 March–28 July 2014).<sup>1</sup> In addition to the significance of this exhibition, the sudden death of the artist in January 2012 added a major impetus to this decision. During travel to the first venue in Amsterdam the sculpture again sustained severe damage. Despite best efforts, *The Wages of Sin* could only be temporarily and partially repaired for the duration of the first venue only, after which it was shipped home in pieces, where a major intervention lasting several months followed. While that particular treatment will not be detailed in this article, the treated work served as the reference for making the replica.

### Rationale to execute a temporary replica

Upon learning the unfortunate news that *The Wages of Sin* had sustained major damage, a few specific inferences became indisputably clear. First, the cause of the damage was *The Wages of Sin's* irremediable permanent tilt, and that the sculpture – even after best repair – would remain too fragile to permit future travel. Second, the original work must be thoroughly repaired to the best condition possible, and third, the

significance of this work in Kelley's *oeuvre* necessitates the production of a replica for the sole purpose of facilitating future loans of the complete work: the hanging afghan together with the table of candles. The Mike Kelley Foundation for the Arts was in strong support of these decisions, and also recollected that Kelley, himself recognizing the inherent instability of the heap of candles, expressed his desire to replicate *The Wages of Sin* in a 'more permanent material.'<sup>2</sup> The Foundation continued to play a major role throughout the entire replication process.

To keep *More Love Hours Than Can Ever Be Repaid* and *The Wages of Sin* on view in the remaining venues in the retrospective, admittedly an extremely important work in the exhibition, a temporary 'stand-in replica' of *The Wages of Sin* was created by Kelley's long-time assistant, Mark Lightcap. Made in 2013, with the approval of the Whitney, the stand-in replica was created between the first and subsequent venues of the show. This stand-in replica reflected the spirit of the original, but showed conspicuous differences in details, and to some degree, dimensions (Figure 2); however, it served its purpose well for the rest of the retrospective venues. Constructed with a durable internal armature, this stand-in replica also consisted of custom cast wax candles and Salvation Army, Goodwill, and eBay sourced candles. Though some of these candles were identical to the original, the Foundation expressed its strong preference to create an entirely new replica, an exact copy of the original, but made of artificial resins, a material they considered more stable than wax. The use of the term 'replica' will be explained in the Replication Committee section below.

### Rationale for execution of an exact replica

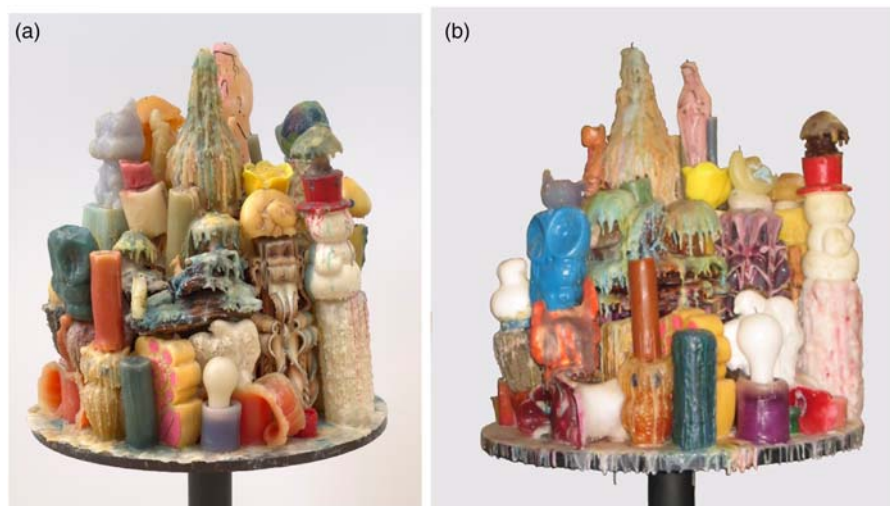
Upon conclusion of the retrospective, and completion of the treatment of the original *The Wages of Sin*, parties with vested interest in the *More Love Hours Than Can Ever Be Repaid* and *The Wages of Sin*, gathered at the Whitney Museum's storage facility to compare and re-evaluate the original *The Wages of Sin* and its stand-in replica. Present at this meeting in June 2016 were two members from the Kelley Foundation, Mary Clare Stevens, Executive Director, and Mark Lightcap, long-time assistant to Kelley and Collections Manager of the Foundation; two curators from the Whitney, Jennie Goldstein and Elisabeth Sussman; and two conservators, the head of conservation Carol Mancusi-Ungaro, and Eleonora Nagy, Research Conservator, who was the project lead. The merits of the stand-in replica were discussed. The stand-in replica was made out of wax like the original; and was an accurate depiction of the ethos of the original. It also permitted moderate adjustments that would better match the precise color and size/

dimensions of the original, should it become a permanent replica. However, given the visual differences and the hasty circumstances under which the stand-in replica was made, and the insistence of the Foundation (based on the artist's stated desire for a precise replica in his lifetime), it was determined to pursue a more permanent solution. This latter, permanent replica would represent the Foundation's understanding of the artist's desire: an *exact* reproduction of the original using *artificial* resins. It was also the Foundation's understanding that Kelley referred to artificial resins when expressing his wish for a precise and more permanent replica.

### Terms of making an exact replica

After substantial logistic, legal, and financial negotiations the following parameters were agreed upon:

- The Whitney Museum of American Art will fund and execute a first rate, exact, and new replica of the original *The Wages of Sin* for the sole purpose of enabling the museum to loan and exhibit Kelley's seminal work of art.
- Based on careful deliberations and honoring Kelley's expressed desire to make a replica in more durable materials other than wax, the replica will be made using various artificial resins that will endure the rigors of travel. Despite the use of dissimilar materials, this replica must be perceived as identical to the original in all other aspects.
- The replica will be based on the repaired original in its 2015 condition, due to lack of sufficient historical documentation from previous years, or its original state.
- The sole purpose of the replica is for travel only. It will be used as a substitute for the original *The Wages of Sin* and allow the work to be loaned to key exhibitions. To reflect its sole purpose, it will be referred to, and enter the Museum's collection as 'Exhibition Copy.'
- The Whitney agreed that the Foundation's preferred fabricator, LifeFormations Inc., will execute the work. The Foundation agreed that the museum will engage directly with all contractors in the replication process, managed and led by the museum's Research Conservator, Eleonora Nagy. The museum may exercise its best judgment to select other contractors and decide on technical aspects of the project.
- The Foundation will remain involved throughout the entire replication process and will approve the final Exhibition Copy.
- The ownership of the Exhibition Copy will be passed to the Whitney, and the museum will be permitted to exhibit, lend, and publish the Exhibition Copy at



**Figure 2.** (a) Candle pile of the original *The Wages of Sin*; and (b) the stand-in replica for *The Wages of Sin*, made in 2013. ©The Mike Kelley Foundation for the Arts/Artists Rights Society (ARS), New York.

its discretion. Exhibition wall labels will clearly indicate the presence of the Exhibition Copy on display.

- Due to its inherent instability, the conserved original work will remain in storage with the sole exception of occasional display at the Whitney Museum. In no instance will the original and the Exhibition Copy be exhibited at the same time.

### Outline of the execution process

LifeFormations, Inc., a Cincinnati, Ohio based firm was chosen to fabricate the Exhibition Copy. The Foundation expressed a strong preference to engage LifeFormations, because the artist had worked with the company during his lifetime. Specializing in creating highly detailed scenic elements and life-like dioramas (such as the figures of the Constitution's Founding Fathers for the Abraham Lincoln Presidential Library and Museum and anatomic figures for the Museum of Discovery and Science) replicating a work of art posed a welcome, but somewhat unusual challenge for the company. Additionally, LifeFormations' location in Ohio (approximately 1,100 km from New York City) posed a significant logistical challenge to the project. With the repaired original unable to travel, two options remained: relocating key members of the company to New York City for the several months' duration of the project, a major expense, or fabricating the replica far from the original in New York City.

The latter option was chosen, and several hundred photographic images of the original were taken by the Research Conservator and sent to LifeFormations. In November 2016, the museum engaged Direct Dimensions, Inc., based in Owing Mills, Maryland, to perform high resolution 3D laser scanning of *The Wages of Sin*. The job was executed on site at the Whitney's storage facility. Photogrammetry, combined with

3D laser scanning was considered, but rejected for the following reasons: First, the procedure would add significant costs. Second, and more importantly, the conservator's previous experience indicated that even the best quality color documentation that photogrammetry could offer, in addition to the gray scale laser imaging, remains inferior to color recognition and reproduction by the human eye. Therefore, side-by-side final color adjustments of a new Exhibition Copy, performed on location, next to the original, was preferred. Completion of the final painting phase of the Exhibition Copy off site in Cincinnati, with no original present, was not considered a viable option. Furthermore, the fact that 3D laser scanning cannot register the multitude of deep, but significant colorful undercuts and voids only re-enforced the decision that the sculpture had to be hand finished on site, attending to all undercuts individually. Photogrammetry, and even the most detailed videos or photographs, remains incapable of properly registering nuanced color schema, a critical feature that capture the ethos of this work.

Additional considerations supported this decision. No precise 3D imaging or casting method is capable of replicating Kelley's capricious gestures. For that the Exhibition Copy needed to be hand finished and painted alongside the original. Though the bulk fabrication of cast and 3D printed candles could be pre-painted with base colors and then assembled, only a hand-finished Exhibition Copy, completed side-by-side with the original would be able to faithfully simulate the randomness of candle drips and accidental effects of Kelley's gestures and represent the work's original intention.

After the 3D laser scanning was completed and sent to LifeFormations along with digital color photography, the head of fabrication from LifeFormations visited the Whitney to examine the original in person



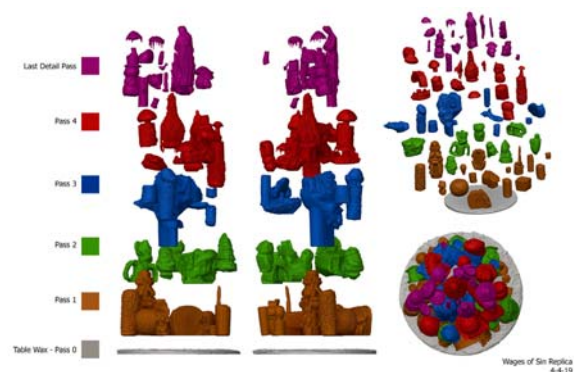
**Figure 3.** Preliminary samples cast in Smooth On Crystal Clear™ 202. Though very promising, replicated candles displayed deviation of color and transparency that could not be accurately emulated based on the photographic images of the original provided to LifeFormations. Though a fundamentally successful step forward, this exercise proved that completion of the replicated candles side-by-side with the original is essential for successful replication.

and discuss conceptual and technical details with the Research Conservator. This step, at the initial stage of fabrication, proved essential to sufficiently impress upon the fabricator the significance of the artistic intent commanding this work, which goes far beyond the distinct physical forms, colors, and dimensions of the object. Without incorporation of these aspects, an otherwise perfectly precise replica would remain false and lifeless. Based on this visit, a number of preliminary samples addressing particular challenges of fabrication were made. These included the translucency of the candles, the casual effects of the dripping wax, the gradually shifting tones from faint to saturated in certain candles, the imitation of wood bits embedded in the work, specific textures, and extreme variations of sheen on certain candles (Figure 3). This exercise also narrowed down the initial range of resins and colorants considered for fabrication. Selection of the materials in order to address these challenging issues was coordinated between the fabricator, the Foundation, and the museum.

The project was conducted through intense correspondence between the Research Conservator and the fabricator, and with several in-person meetings between the fabricator, the museum, and Foundation representatives. All meetings took place on site at the museum's storage facility, with the original work present, serving as reference at each stage of the fabrication process. Samples in process, and later actual parts of the replica, were transported for every meeting for side-by-side evaluation with the original. It is noteworthy to mention that limiting the number of LifeFormations crew members to those solely involved with this project turned out to be ideal for more efficient communication. The six-member team

developed an in-depth understanding of the issues to be resolved in this exceedingly complex and multi-faceted project. The team was made up of two specialists for digital processing and structural design, two specialists for 3D printing, casting, and assembly of the candle sections, and two specialists for coloring and final painting. Thus, despite the remote nature of fabrication, frequent visits to the Whitney by the same individuals afforded their intimate familiarity with the intricacies of the original work.

LifeFormations processed the three-dimensional documentation file, which registered a total of 63 candle clusters and candles, and organized them into potential building sections. Figure 4 shows the groupings divided into six levels. This plan was tweaked based upon comparison on site with the original. The preliminary samples, made to explore the particular challenges of fabrication, were compared alongside the original to perfect various techniques and effects.



**Figure 4.** Wax candle pile of *The Wages of Sin* 3D imaging, broken up to color coded clusters to identify attachment strategy based on how the witnesses interlock.



**Figure 5.** Color-coded digital breakout for molding purposes of a candle with flowers embedded beneath the surface.

A detailed dialogue with the Research Conservator followed, addressing matters of the actual interior support system and resins as well as materials to be employed. Next, LifeFormations incorporated the photographic images into 3D image files, so that individual candles could be digitally separated, turned 360 degrees, and zoomed in and out in color on the screen for use in production (Figure 5).

Opaque candles were generally 3D printed then painted (Figure 6). Semi-transparent candles with a gradual shift in their hues were made in solid thermo-setting resin, producing the color shift in the casts, while transparent candles were reproduced in clear resins. After a selection of candles were 3D printed or

cast in resin and painted with their respective base colors, they were transported to the Whitney for comparison with the original. Occasionally additional microscopic images became obligatory to further understand the texture of specific candles or parts. In addition, colors were registered with color charts and adjusted, and locations of extreme sheen or matte surfaces recorded. Replication of some effects, such as the crackled pattern of the knight, a chess figure, succeeded after two comparisons (Figure 7). Others, like the texture of lodged pieces of wood, required multiple adjustments not only in color and texture, but several trials in various resins (Figure 8). Similarly, recreating the randomness of candle drips finally succeeded using a combination of techniques. Prominent drips were 3D printed or cast, and their surfaces manipulated using various techniques including dripping resins, thickened paint, and even colored hot melt glue. Frequent transportation of candles and sections of the replica to Whitney's storage for comparison with the original continued until each reached about 90% completion.

Once the various components reached a sufficient level of completion, final adjustments to the full replica took one full week of twelve-hour shifts by a six-member crew, consisting of two experts for casting, carving, and assembly, three painters, and the Research Conservator, working on site at the museum's storage facility (Figures 9 and 10). A work area, which included a painting station, was set up adjacent to the original *The Wages of Sin* to permit unlimited access to the original during completion of the replica. The 90% completed replica arrived at the museum's storage facility in parts because the final adjustments of undercuts had to be completed before permanent assembly. Measurements of the 3D printed and cast candles tended to show minor dimensional discrepancies of about one millimeter compared to the originals. The complex spatial relationship of multiple candles positioned in directions ranging through 360-degree angles above, beside, and diagonal to one another, compounded



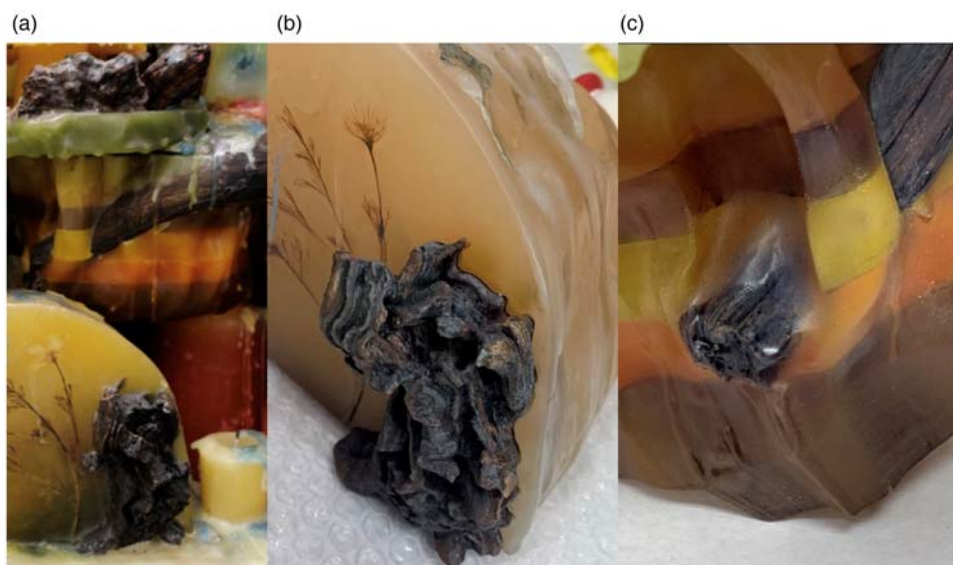
**Figure 6.** 3D printed candles in Polymer Resin® (gray), hollow casts in Smooth-Cast™ 300 Urethane (white) in a test assembly to define angles and points of registration at LifeFormations' studio.



**Figure 7.** (a) Original wax knight candle; and (b) Crystal Clear™ 202 Cast at 80% completion of the replica displaying the cracked area and layering of drips.

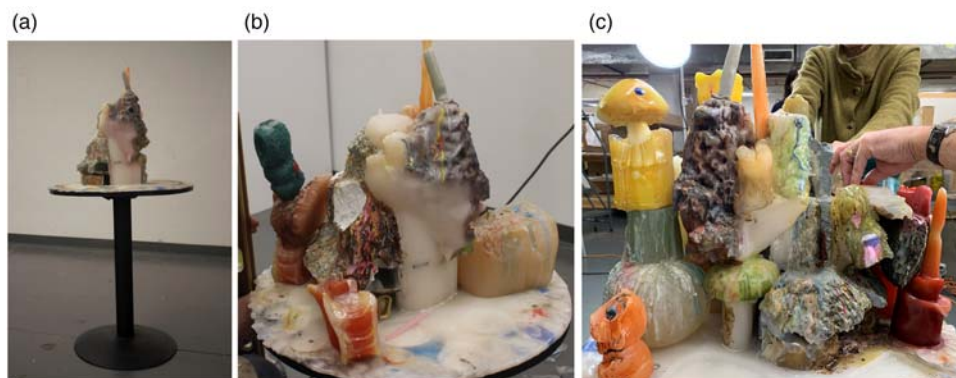
these millimeter discrepancies and added centimeters to the fully assembled replica. Though the replica's entire heap of candles went through several trial assemblies and dimensional corrections, final adjustments to the nearest millimeter was considered a wise re-evaluating measure at this finishing stage. Additionally, because of technical constraints, neither the 3D scanning, nor photography could accurately register details of the multiple undercuts and the hollow core so distinctive to this work. Throughout the project and during the site visits, the team

regularly addressed these issues on sections of the replica. However, re-addressing the final detailing and completion of all undercuts in shape, texture, and particularly in color in the context of the replica as a whole, was a diligent and indispensable undertaking. Moreover, undercuts – some permitting view across the entire object – would become inaccessible once the replica was permanently assembled. Candles and sections, designed with mechanical locks fitting together in the manner of a puzzle, were then permanently secured by a combination of



**Figure 8.** Wooden chunks lodged into the surface of two candles. (a) Original; (b) Replica of the same during process; and (c) In process image of another replica of wooden texture embedded in layered resin imitating wax.





**Figure 9.** (a) Arrival of the Exhibition Copy at the museum storage for final assembly; (b) Painting the undercuts prior to final assembly; and (c) Final assembly of the candles under way.



**Figure 10.** (a) Separate candles 90% complete at arrival for final assembly; (b) Painting studio set up on site in the vicinity of the original; (c) Assortments of water-based paints used for the final color match.

screws, bolts, and adhesives. Lastly, accessible surfaces of the entire replica received final adjustments of texture color and sheen (Figure 11). Several on-site visits by the Foundation and the museum's curatorial team provided guidance during this final week of work. At the concluding meeting attended by all parties involved in the project, the replica was declared finished and unanimously hailed as an overwhelming success, surpassing all previous expectations (Figures 12 and 13). It achieved the goal of a convincing reproduction of *The Wages of Sin*, allowing its legacy to live on, and to travel safely. Approved by all the stakeholders, the newly made Exhibition Copy will tour globally alongside *More Love Hours Than Can Ever Be Repaid* and will replace of the original for future displays at all institutions other than the Whitney.

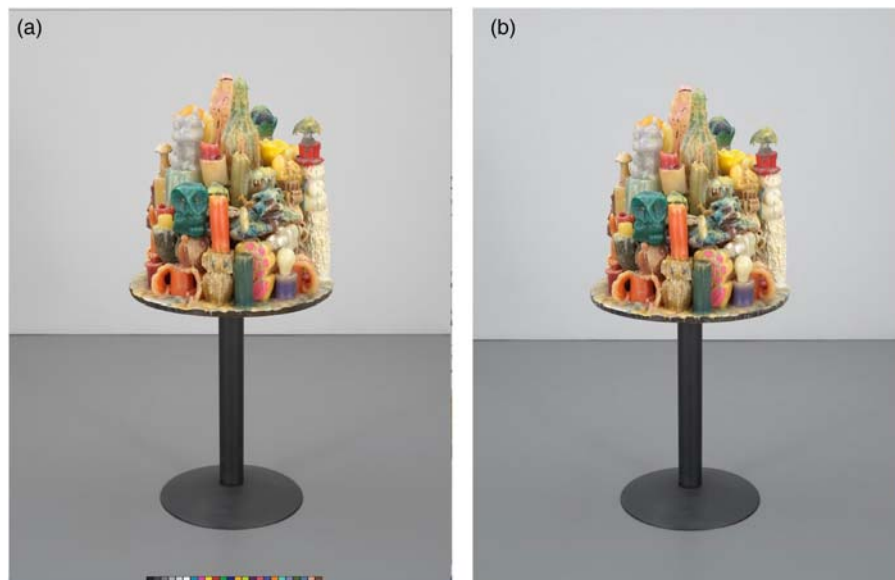
## Production

This replica posed a number of technical challenges. It was to be full scale and 100% custom made, which meant that not all areas could be treated with the same methodology. Further, finding casting materials that could believably represent wax, but be physically resilient, UV stable, accept the surface treatments and various manipulations, and be pigmented to allow shifts in opacity, required weeks of trials and experimentations. Finding a table identical to the one in



**Figure 11.** Final paint adjustments, a few feet from the original. Exhibition copy left, original right on the image.

the original proved impossible, and the table had to be custom fabricated to imitate the mass-produced and intricately painted metal furniture. Casting, forming, and painting each part of the replica had to be done remotely at LifeFormations studio in Cincinnati, with regular visits to the Whitney storage facility that housed the original for comparison. These visits provided the critical, first-hand, empirical experience of touching, seeing, feeling of textures, and colors that allowed for the resolution of numerous technical obstacles. This could not have been accomplished by correspondence and evaluation of digital images alone.



**Figure 12.** (a) *The Wages of Sin* component of Mike Kelley, *More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, 1987. Wax candles on wood and metal base, showing the current state of the work after the 2015 major treatment. Whitney Museum of American Art, New York, N.Y.; Purchase, with funds from the Painting and Sculpture; (b) Mike Kelley, *The Wages of Sin* Exhibition Copy, 2019, from *More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, 1987. Thermosetting resins, paint, and metal. Overall: 51 1/2 × 24 × 24 in. (130.8 × 61 × 61 cm). EXC.89.13d.2. ©The Mike Kelley Foundation for the Arts/Artists Rights Society (ARS), New York.

3D scanning captured about 75% of all surfaces of *The Wages of Sin*, the rest being undercut (Figure 14). Undercuts were then digitally filled to create a comprehensive image file for further processing. Figure 14(c) illustrates these undercuts with dark blue color in the gray-scale digital file delivered by Direct Dimensions. LifeFormations subsequently broke down this 3D scan into individual candles, and digitally sculpted them round, referencing the approximately 500 color images provided by the Whitney conservator. Two challenges arose in the digital phase: the potential loss of the surface drips and the lack of digital data in negative space in the scan, both of which



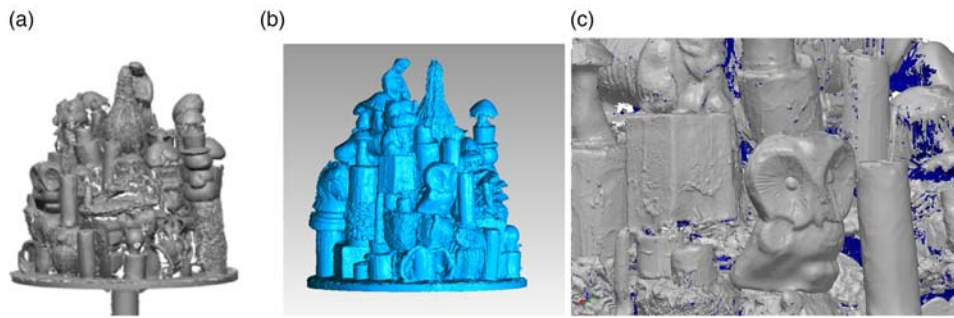
**Figure 13.** The completed project showing the Exhibition Copy on the left, and the original on the right. From left to right: Madison Wade, Project and Production Manager, Technical and Finishing Artist, LifeFormations; Jennie Goldstein, Assistant Curator, Whitney Museum of American Art; Mary Clare Stevens, Executive Director, Mike Kelley Foundation; Eleonora Nagy, Research Conservator, Whitney Museum of American Art.

affected casting and paint layering processes. Special attempts were made to represent details of any drip seen in the scan, so that they remained convincing when transferred in the prints and casts. Rich details of the cavities of negative spaces had to be added later by hand during visits in order to compare these sections with the original.

The candles were digitally rendered and 3D printed with Acrylonitrile Butadiene Styrene Filament® (ABS) filament through fused deposition modeling (FDM) printers and Formlabs brand gray polymer resin on stereolithography (SLA) machines. At this stage, pin locations were modified, wicks the printers could not detect added, and structural holes bored for added stability. The surfaces were then refined to omit visible print-built lines in preparation of molding.

Once molded, the candles were cast in Crystal Clear™ 202, a water clear two-component UV resistant urethane resin. Some intrinsic painting into the mold before injection was required for certain candles to achieve gradual hue change, or provide a layered, in depth feel. For these, the mold was opened before injection and the exterior walls were painted to resemble the gradual color shift that appears in the original. During the casting phase, high sensitivity to opacity levels was required for proper topical paint layering and translucency.

Several candles had to be separated into multiple sub-sections for molding purposes to resolve undercuts, embedded casting, and decorative appendages. Two specifically challenging candles in this regard were a curly tower candle with multicolored layers of wax and ornate extrusions embellishing its sides, and



**Figure 14.** (a) 3D laser scanning on the computer screen with no undercuts recorded; (b) Digital 3D file with undercuts ‘filled in;’ (c) Detail of the same showing typical degree of undercuts marked with dark blue on the gray-scale 3D image.

a transparent light teal colored hexagonal one, with flowers embedded deep in the body of the candle (Figure 15). Prominently positioned at the front of the art, both of these candles required six separate molds to achieve the visual layering needed. Sections of the molds were then glued together, and witness points filled to appear as one piece.

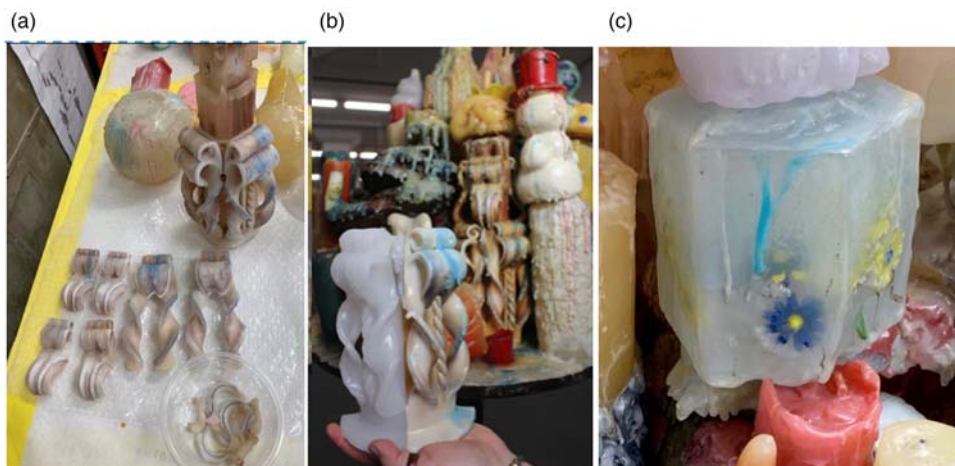
Other candles were cast in base colors that correlated with color registrations from the original candle. Most candles were cast to be transparent, so colors could be built on top of each other creating visual depth. A water-soluble acrylic paint series with the brand name Mod Podge® by Quest Industrial Products, along with water soluble acrylic paints was used to create the surface colors and texture required. Createx™ UV resistant airbrush pigments were used to paint the final details on the candles. Effects of high gloss and matte were achieved by brush or spray applications of Mod Podge® Gloss, Antique and Matte Medium.

### **Method of assembly**

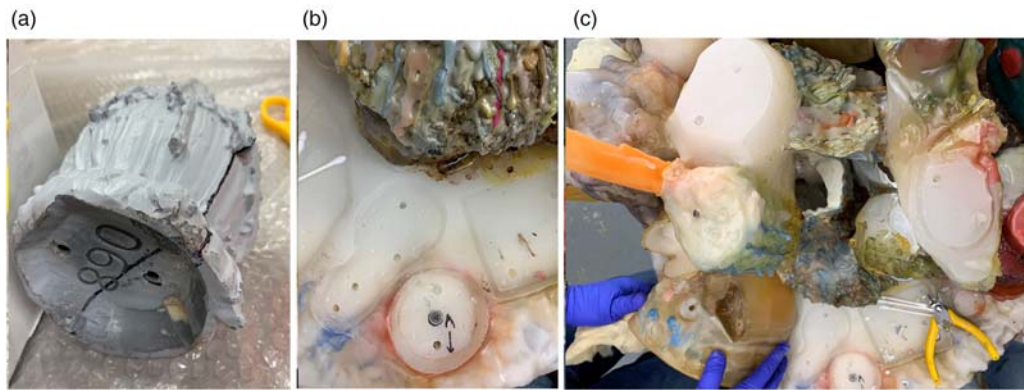
Each candle was painted remotely at the LifeFormations studio in Cincinnati. Before final adhesion each candle was color corrected with as much accuracy as possible while in front of the original. Once colors and surface finish had been pushed to 98% completion,

final gluing of the replica sections followed. Clusters of candles or individual candles were number coded, then printed or cast with built-in mechanical locks functioning like jig-saw puzzles for assembly (Figure 16). Bolts and stainless steel or acrylic pins provided additional fasteners for final assembly. Metal pins were beveled and only used where extreme structural support was required. Clear Plastruct® brand acrylic rods of various sizes were scored or threaded to grip onto the interior mating surface and provide adequate preparation for the adhesive. Hot Glue®, JB Weld™, and Cyberpoxy™ – the latter two are two-part epoxy adhesives for bonding metals and plastics – were used to join the candles together. The process of attaching the pieces together took around four hours, concentrating to ensure that each angle precisely replicates the position of the original. Some color corrections were made once they were directly adjacent, as color relativity was now at play.

It took a great deal of exploration to configure the patina of the original. The winning combination ended up including actual dust foraged from around the LifeFormation studio and manipulated Mod Podge®. The additives were applied in different methodologies. Some candles called for the dust to be sprinkled or flicked topically then stippled with Mod Podge®. On others the dust was mixed into the



**Figure 15.** (a) The curly tower candle broken out before final assembly of parts; (b) The same being compared to the original during fabrication; (c) The hexagonal candle with embedded flowers before final adjustments.



**Figure 16.** (a) 3D printed Chianti bottle printed in two halves, with mechanical locks, code number, and pin holes for assembly; (b) Detail of Chianti bottle pre-painted in base colors with mechanical locks, and bolts and pin holes in the vicinity; (c) Advanced stage of assembly and color adjustments of undercuts.

Mod Podge® and applied with a brush. Some cases required letting the mixture partially dry on the surface and adding more wet media and/or dust to emulate heavy layering of dust. The dust also helped create a porous texture in certain candles. The impression of the candles being haphazardly ‘melted together’ was achieved with a mixture of hot glue and Cyberpoxy™, a two-part epoxy resin.

### Table

The table, integral to the candle pile on top, was made of a three-inch (7.62 cm) stainless-steel tube with 17-inch (43.18 cm) circular steel plates welded to the top and base for stability. The base of the table was generated using the 3D scan which was milled into foam and cast in fiberglass. It was then backfilled with lead gunshot and liquid plastic to create about 18 kg weight at the bottom. This was important to stabilize the top-heavy object. The table top consists of wood, routed out to accommodate the 43.18 cm metal disc. Cyberpoxy™ and JB Weld™ were used to adhere these components together. The overall finish of the table imitates painted cast iron. A highly durable auto body filler was mixed with a flame-retardant polyester resin, then stippled to the surface to create a rigid texture that was painted matte black. The veneer of the wood around the table edge was hand painted, and drips were added to the rim to emulate the appearance on the original. Most of these added drips around the rim of the table were made with colored hot glue, which was further toned as needed.

### Replication Committee

Though the issue of replication garnered the attention of several publications (Malenka and Privitello 2000; Bery 2007; Surma et al. 2012; Brown 2014; Sündermann and Lang 2014; Kennedy, Reiss, and Sanderson 2016; Marchesi 2017; Murata et al. 2018; SFMoMA 2019), to our knowledge the Whitney was the first museum to form

a committee focused on replication in an institutional setting. Established in 2008 and led by the Melva Bucksbaum Associate Director for Conservation and Research, Carol Mancusi-Ungaro, the museum’s Replication Committee addresses issues related to the recreation of works of art in its permanent collection and/or related collections for various purposes associated with the museum’s programming. Meeting monthly, the committee considers requests for replication and discusses associated matters of re-fabrication and exhibition copies. The intent of the committee is to craft a more rigorous and consistent approach to replication policy and practice through critical review of precedents within the institution (Rojas-Sebasta and Delilow 2021) see also [Replication Committee \(n.d.\)](#). The committee is comprised of Curators, Head Registrar, Manager of Rights and Reproductions, General Legal Counsel, Editor for Publications, Director of Research Resources, and Conservators. The makeup of the Committee encourages open discourse from multiple vantage points. The types of projects the Committee considers for replication are limited to the scope of its collection and ranges from conceptual to classical modern art. These include film, performance, and photography, such as Hans Haacke’s photostats, gelatin silver prints, and photocopies (Shapolsky et al. *Manhattan Real Estate Holdings*, 1957) and Bruce Nauman’s chromogenic prints (*Eleven Color Photographs*, 1966-1967, printed 1970); installations by Sol Lewitt (*Wall Drawings*) and Cory Arcangel’s *Super Mario Clouds*; and more traditional objects by Claes Oldenburg (partially remade *Ice Bag – Scale C*, 1971) (Nagy et al. 2011, 2009)<sup>3</sup> or dating issues for Felix Gonzalez-Torres’s *Untitled (America)*. The significance of *More Love Hours Than Can Ever be Repaid* and *The Wages of Sin* in Kelley’s oeuvre, and its prominence in the museum’s collection rendered its replication a priority. While in some respects *The Wages of Sin* was a typical replication project, the presence of multiple stakeholders, the stand-in replica, and the hybrid nature of the later made and estate approved exact replica (‘Exhibition Copy’) led the Committee to uncharted territories,

turning it into one of the more complex projects it had ever undertaken.

### **Issues addressed by the Replication Committee**

The Replication Committee served as a conduit for discussion about the conceptual, ethical, and practical aspects of *The Wages of Sin* project and the debate necessitated the participation of a wide range of Whitney staff. The Committee deliberated numerous points, the first being – having been treated in accordance with best practice before and after the Kelley retrospective, was the original indeed too inherently fragile for travel? The answer was yes. Any further structural reinforcement would be too invasive and would inevitably alter the work's visual impact, distorting its original intent.

Another major issue that the Committee grappled with was the appropriate medium of the replica. Did the already existing stand-in replica, or its 'final' version, satisfy the artist's desire for a 'more permanent' replica, especially since no specific instructions from the artist could be located? Should the museum base a significant replication project solely on memories of Kelley's co-workers' verbal exchange with the artist about the presentation and extension of the life span of *The Wages of Sin*? Furthermore, what are the relative merits of the permanence of wax candles versus thermosetting resins? Candles are more prone to break than durable thermosetting resins. Conversely, wax has been around for thousands of years, with examples of ancient wax objects still surviving today, while artificial resins have a much shorter record of existence, with noted issues of yellowing and degradation. Which aspect of permanence was Kelley referring to and which should have the primacy in a replica created for travel?

The Committee first considered using wax, the original medium, for the replica. The notion of *The Wages of Sin* directly refers to candles lit in church. Keeping this direct correlation between material and its spiritual essence seemed important to preserve. Additionally, the travel history of the wax *Stand in Replica*, which had a built-in metal and plastic armature, proved that safe transportation of such a design was feasible. Based on their understanding of Kelley's wishes however, the Foundation insisted upon using artificial resins. To accommodate the Foundation, the Committee remained open to multiple options such as: improving the stand-in replica; making a new mixed media replica from artificial resins that would include some candles identical to the original (and could be harvested from the stand-in replica); or creating a new replica made solely of artificial resins. Ethically the three options had their pros and cons. The existing stand-in replica was made by the artist's long-time assistant. Therefore, his work represented

the most direct connection with the artist, and his stand-in replica was made in the original medium. A new mixed media replica would be a step more dimensionally accurate to the original, but less faithful in its materials. Making it in a different medium than the original, by someone other than the artist's assistant, would also attest to its being non-art.

Perfect dimensional accuracy of the replica was another priority for the Foundation. Acceptance of this requirement favored artificial resin as the medium. Wax candles can be custom cast to size, but to credibly recreate their random drips they would need to be melted, resulting in minor, but visible discrepancies between the original and the replica. Artificial resins allowed precise replication and delicate tooling of every unique drip existing on the original. One of the Committee's highest priorities was that the replica embodies the spirit of the original. Initially the committee preferred a replica that followed the artist's original methodologies and considered the dimensional discrepancies of secondary importance. This could have been achieved by modifying the stand-in replica rather than making a new one.

Could both of these priorities be merged and still achieve the artists' intent? The concept of a hybrid replica, to comply with both the dimensional precision and the spirit of the piece, i.e. hand-finished 3D print was initiated by the Research Conservator and unanimously welcomed by both the Committee and the Foundation. Thus, the mechanically made replica was completely hand finished to deliver a perfectly accurate visual and dimensional likeness of the original. The Committee approved the artificial resin option after extensive testing and reviewing of successful samples.

Further ethical questions remained unanswered well into the project. First: how precise do color and dimensions need to be to faithfully match Kelley's original? What are the levels of tolerance? By presenting various options with full-size mockups to the Committee and the Foundation, the answers slowly emerged. Candle drips, for example, constituted a crucial aspect of spontaneity that no precise 3D printing could emulate. They required additional attention in 3D printing, followed by complete reworking by hand, then finishing side-by-side with the original. The nuanced hue changes within the semi-translucent candles demanded similar attention. Second: the 3D laser scanning data allowed unprecedented technical freedom for modifications. Should the now permanent, but accidental tilt of the original wax pile be corrected in the replica? Such a correction may render the replica more stable for transport and perhaps make it closer to the historical state of the original. In the end, the Committee and the Foundation agreed that insufficient visual documentation of *The Wages of Sin* left no choice but to replicate its 2015 condition, retaining its 2012 tilt, clearly an accidental damage sustained in the art's lifespan.

Other opportunities for correction surfaced. Numerous wax drips around the table rim were missing. This condition was retained, as it is in the treated original. As one of the more vulnerable areas of the work, the nearly complete loss of these drips remained as one of the most conspicuous historical damages to the original. Since these missing drips were prominent, around 10% of the drips were re-created on the replica. This decision, proposed by the Research Conservator and seconded by the curators on the Replication Committee, felt consistent with the freehand nature of the original, and also pointed to its historical state prior to 2015. The moderate addition of these drips was also supported by the Foundation.

### Result

Other than the change in media, the replica diverged from the original in two minor detectable ways. These were the few added drips around the replica's table rim and the addition of a small plaque stating 'Exhibition Copy, 2019' secured underneath the table top. Since the 'approved' replica was so deceptively identical to the original in all visual aspects, the Replication Committee felt it imperative to mark and date the replica to clearly distinguish it from the original. In the end, the committee concurred with the Kelley Foundation and acknowledged that the completed Exhibition Copy was an exemplary achievement that superseded initial expectations. After a thorough evaluation of the project, the committee then had to wrestle with the wide-ranging implications of integrating this replica into institutional life.

### Terminology used for replication

From its inception, the Replication Committee's mandate included the development of consistent terminology to help clarify communication within the context of museum collection stewardship and museum practice. Additionally, it sought to guide thinking processes on replication and to conduct dialogue among experts. Though not set in stone and constantly evolving, the Committee's current definitions of replica and exhibition copy have been utilized throughout this article. In short, a replica is a recreation of a work of art. Reasons why a replica might be created include: a damaged or lost original, preservation, display restrictions, expense concerns, or artist/estate requests. The first two reasons perfectly fit the purpose of both the stand-in replica and the approved Exhibition Copy. An exhibition copy on the other hand is defined by the Committee as 'an object, either fully or in its component parts, that is made and displayed in lieu of an existing artwork for exhibition' [WMAA website/Replication Committee/

Definitions]. Thus, after some deliberation, the name stand-in replica was designated to the approximate replica, made by the artist's assistant during the Kelley retrospective venues in 2013. This term refers to its temporary purpose, 'standing in' for the original, and not to confuse it with the latter, dimensionally accurate replica. The latter exact replica, virtually identical to the original in appearance, received the title *Exhibition Copy, 2019*.

When placed in the wider context of published definitions, the term replica may be further nuanced. The two best known definitions of replica are published by the *Art & Architecture Thesaurus* (AAT) and in a themed issue of *Tate Papers* in 2008.<sup>4</sup> AAT describes 'replica' as 'Precise reproduction of valued object[s], usually in the same dimensions as the original.' It also uses this term 'when more than one object is produced by the same artists, craftsman, or studio,' thereby focusing on the art-making aspect of replication. It applies to Naum Gabo's habit of making his own exact replicas, but not to *The Wages of Sin* Exhibition Copy (Lodder 2007). The *Tate Papers* definition on the other hand defines 'replica' as an 'Item made by someone other than the artist (though under license) as a public substitute for the original using the same specifications.' Emphasizing the preservation, and its non-art status instead of the art making aspects of replication, it better accommodates the case of *The Wages of Sin* as *Exhibition Copy 2019* (Bery 2007).

Dimensional precision as a requirement for the term replica, so significant for the Whitney's Exhibition Copy, is specified by AAT, but allows the use of the term 'version' for replicas slightly differing from their original. The replica of *The Wages of Sin* presents true accuracy to the original, save small variations. Categorizing *The Wages of Sin* Exhibition Copy as replica instead of 'version,' a term AAT also suggests for replicas with slight variations, points to the Replication Committee's emphasis on the overall visual and dimensional accuracy to the original.

The various definitions for the term replica highlighted above is just one example of a range of similar terms such as: reproduction, copy, exhibition copy, replacement, surrogate, substitute, remake, re-fabrication, and even mock-up. It shows the need for continued refinement of these terms both by the Whitney's Replication Committee and by the profession at large. The terminology the Committee settled on for *The Wages of Sin*'s replicas has proven highly satisfactory in practice because the committee clearly defined the motivation and boundaries of the project from the start. The Replication Committee is currently devising a definitive glossary of terms that will be posted on the Whitney Museum's website.

### **The artist's foundation/museum relationship**

There is a fine line between an artist's foundation and an institutional owner's involvement in making a replica of a work of art. Both are major stakeholders in the enterprise, and their mutual interest is centered around the authenticity of a replica and related legal rights issues. The damage *The Wages of Sin* sustained upon arrival in Amsterdam initiated the dialogue between the Whitney Museum and the Kelley Foundation that continued throughout the entire replication process. During this dialogue, the Whitney's two most difficult decisions were abandoning the stand-in replica, which had proved satisfactory for two remaining venues of the Kelley retrospective, and engaging LifeFormations as the fabricator for the new Exhibition Copy. In both cases authenticity issues compelled the museum to follow the Foundation's lead, as artists' foundations inherit the artist's right to approve a replication for seventy years following the artist's death. The Foundation favored a more restricted interpretation of Kelley's verbal comment for a 'more permanent material' than did the museum. Additionally, since Kelley collaborated directly with LifeFormations during his lifetime, the Foundation strongly felt that using the same company posthumously would enhance the authenticity of the replica. LifeFormations' geographical distance from New York was the main stumbling block. It took several rounds of careful deliberation by both parties to settle upon moving forward with the Foundations' preference.

Ultimately this six-year project turned out to be a true collaboration on many levels. Technical aspects were handled by the Research Conservator, with additional assistance by Kelley's long-time assistant Mark Lightcap. There was also significant legal and curatorial input throughout the project. The Replication Committee and Foundation acted as sounding boards, and the Research Conservator served as the point person, supervising and orchestrating all parties throughout the project. Upon completion of the Exhibition Copy and endorsement by all parties, the museum obtained a formal letter of approval of the Exhibition Copy from the Foundation for its records.

### **Managing the Exhibition Copy**

Once completed and approved by all involved parties, the Exhibition Copy entered the museum's collection and the in-house digital documentation system as a 'component' with an EXH prefix added to the original *The Wages of Sin* catalog number. Also added was the component's material description, dimensions, and formal images. Stored near the original, the Exhibition Copy will be processed for loans, condition

checked, and crated following standard procedures required for a work of art. Wall labels will clearly state the display of the Exhibition Copy as follows:

Mike Kelley:

b. 1954; Detroit, MI

d. 2012; South Pasadena, CA

*More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, 1987

*More Love Hours Than Can Ever Be Repaid*: Stuffed fabric toys and Afghans on canvas with dried corn

*The Wages of Sin*: wax candles on wood and metal base (exhibition copy, 2019: thermosetting resins, paint, metal)

For the purposes of publication, installation photographs that include the Exhibition Copy, will have captions that describe its status. Additionally, images and installation photographs of the original *The Wages of Sin* will be available through the Whitney's Image Rights Department. As a research resource, a Materials Archive was created to document the history and materials used in *The Wages of Sin's* replication project. It contains resins and paints used for the Exhibition Copy, as well as samples representing various stages of production. These are housed along with the crated Exhibition Copy, and can be searched in the museum's documentation system. The museum intends to acquire the stand-in replica from the Foundation to document the decision-making process during the project and to incorporate it in the Materials Archive. Further documentation, including all photographic images taken before, during, and after the project, 3D digital files and their processed versions, videos documenting the process, correspondence throughout the project, and conservation reports, are located in the conservation section of the museum's internal documentation system. All these measures were discussed and approved by the museum's Replication Committee.

### **Discussion**

During the project some issues arose that may be beneficial to revisit in hindsight. These include questions regarding process, authenticity, and authority. They warrant further deliberation by the Replication Committee and may provide guidance to other institutions embarking on similar projects.

### **Process**

The work flow of *The Wages of Sin* project turned out to be very similar to themes addressed by Stephen Hackney at the conclusion of *Inherent Vice: The Replication and its Implications in Modern Sculpture Workshop*, held at Tate Modern on 18–19 October 2007.<sup>5</sup> (Gale 2007). It included the following points:

- Replication is validated if the original is physically degraded, unexhibitable, or too fragile to handle.
- The ownership of the original must be unchallenged.
- All responsibility for the associated documentation falls to the owner of the work of art.
- Record the original condition to best standards possible.
- Creating an objective record of the works current condition.
- Identifying the replica as such and archive properly labelled replication processes and materials.
- Store the original in the best conditions for survival along with the replica.
- Documents relating to the original and replica, including proof of ownership, copyright must be archived.
- The original work of art will remain as long as any part of it remains, after which its status changes to 'lost original'.

The complexities of *The Wages of Sin* project produced a few variations from this list. First, the justification to make this replica 'represent(ed) something that the artist wanted to make and would have done so, but never did,' one of the guiding motivations for making the replica pointed out by Carol Mancusi-Ungaro in *Authority and Ethics* (Mancusi-Ungaro 2007). Second, the deliberation processes, involving multiple parties invested in *The Wages of Sin*'s replication, played a more significant role in the project than hinted at in the proposed guideline in *Tate Papers*. Finally, in addition to its function discussed above, the Committee addressed the future of the replica that included terminology, storage, and terms for loans.

### Authenticity

Before embarking on making the Exhibition Copy, the Committee laid out some specific guidelines agreed upon with the Foundation. Primarily among them was the stipulation that the new replica be overseen by the Research Conservator (and her associates) and that it is not a work of art or new version of it. This was important, as initially the Foundation felt uneasy about the stand-in replica potentially being seen as, or mistaken for, the original work of art. Though the Committee did not share this concern, perhaps the stand-in replica, having been made in the same material as the original and by the artist's assistant, may have provided some grounds for such caution.

This raised some interesting theoretical questions. Is a replica more faithful to the original if made by the artist's direct associates as opposed to by others? Is it more authentic, if made of the same materials as the original versus another medium? Which of these

values are a priority for the best outcome, and are they compatible? What parameters lend authenticity to a replica? Can these parameters be defined in general? Is there a priority among them? How does this apply to the Exhibition Copy of *The Wages of Sin*, where the ethos and material of the piece is so intrinsically connected? Had the Foundation had a broader interpretation of 'more permanent materials' would the Committee have chosen wax or mixed media for the Exhibition Copy? Would then the dimensional precision of the replica compared to the original be more relaxed? Would such changes affect the current terminology of the final product?

### Authority: methods of replication and ethical considerations

The techniques and methods of making prints and photographs are well suited to mechanical reproduction, while this is less true for handmade objects, such as sculpture or paintings. In her article entitled *Resistance to Replication*, Iversen points out that there is notable resistance to replication when it concerns unique, traditional handmade art: 'a painting by Rembrandt will inevitably lose its auratic power because the effect of mechanical reproduction is 'the dissociation of the work from the fabric of tradition'' (Iversen 2007). Because of these traditional values, the *mode* of making a replica of *The Wages of Sin* became a hybrid between technical replication and traditional handmade reproduction.

Heuman and Morgan's account of replicating two of Naum Gabo's works, *Construction in Space 'Crystal'* 1937 and *Spiral Theme* 1941, made of cellulose acetate and Perspex (commonly known as Plexiglas in the USA) indicated that the creation of three-dimensional replicas is more complex and controversial than that of the digitally constructed, 'basic three-dimensional outline model' of the original, citing limits of surface details and, in some places, accurate positions in mechanical data collection and subsequent three-dimensional model production. Though Gabo's objects are not categorized as traditional hand-finished art forms and lend themselves better to mechanical reproduction than handmade ones, the authors' case study concluded that the physical result of such digitally created replicas 'will be considerably altered from [the art's] original appearance' (Heuman and Morgan 2007).

A comparable example to the Exhibition Copy is four of Yves Klein's posthumous works, made by the restorer Jean-Paul Ledeur, who knew Klein, who used the artist's original moulds to create dimensionally correct copies which he then hand-painted as per the originals. Using the original mould was analogous to 3D laser scanning and printing utilized for *The Wages of Sin*. Both retain dimensional accuracy and



objectivity, and both required elaborate hand painting to preserve the essential unique gestures of the originals. Yet, because of the purpose of their making, they ethically differ. Klein's four copies are regarded by his estate as editions as their intention was for sale, while the motivation of making *The Wages of Sin* Exhibition Copy was strictly 'not for sale' (Mancusi-Ungaro 2007). In another case study Barger describes four re-made sections of Eva Hesse's *Sans II* as mock-ups, though they were also made in the original moulds by Hesse's main assistant Doug Jones. The ethical difference between *The Wages of Sin* Exhibition Copy is that these four sections of Hesse's work were created solely for educational purposes (Barger 2007).

Another aspect the Committee contemplated was the historical versus newness-value of the replica, a term coined by Barassi (Barassi 2007). The lack of historical documentary evidence of *The Wages of Sin* forced us to accept the 2015 restored condition as the sole reference point. The intentional and thorough patination of the replica directly refers to the perceived/observed historical value of the original. While making the replica was unconstrained by an actual physical historical wax matrix, it seemed important to recreate signs of dust, dirt, and occasional wear to recreate the perception of the age of the original. Yet, while the replica preserves the documentary integrity of the 2015 condition, the added drips to the replica, lost in the damaged original, bring the replica closer to an undetermined stage of its original condition.

### Comments from the conservator

From the time of *The Wages of Sin's* loan to the advent of its subsequent damage, the conservator's role naturally evolved into the project lead. Being deeply immersed in the material, conceptual, technical, artistic, and ethical aspects of the work, a conservator is best equipped to lead the physical realization of a replica, while meeting ethical and theoretical expectations of the project. Fabricators may be more technologically savvy in specific, limited aspects, but they are less likely to offer solutions outside of their daily practice that would better serve the ethics of the project. Therefore, contracting out the replication of a more traditional handmade object without direct guidance of a conservator may not deliver the desired outcome. Organizational and negotiation skills and endurance are other essential skills the conservator must possess. Constant reevaluation of all aspects of the project, at each step, was the best recipe for the optimal outcome. For that, the conservator found following the guidance of the Decision-Making Model for Contemporary Art Conservation and Presentation proved an excellent tool.<sup>6</sup>

One of the lessons learned in this project is that no matter what high-end technology is used to make a

replica, a hand-made work of art has to be hand-finished to capture the ethos of the original. The subtle tool marks of the technology can give it away as a replica. It is perhaps the most difficult task to capture the original's vulnerable aura in a replica. Lastly, the current consensus is that *The Wages of Sin* Exhibition Copy achieved the fullest representation of the object. This aligns with the conservator's personal reflection after the completion of the project. Yet with time, marks of its making (technology, materials, even the ethical approach) will relegate this Exhibition Copy to the specific period of its making during the lifespan of the art it replicates. As different ages and cultures inevitably possess different sensibilities about the art, the current replica will eventually represent its maker's specific interpretation and time period in the life of the original, and shall be preserved as the documentary evidence of that. A new replica, or replicas, subsequently perceived as more accurate representation(s) of the original, may succeed it.

### Conclusion

The Whitney Museum of American Art owns one of Kelley's seminal works of art, titled *More Love Hours Than Can Ever Be Repaid and The Wages of Sin*, 1987. Consisting of two separate parts, one of these constituents, *The Wages of Sin* sustained irreparable damage prohibiting its future travel. Frequently requested for key exhibitions and barred to loan only one part of the object, the museum embarked upon making an exact replica of *The Wages of Sin* for exhibition purposes only. This study described the entire process of making a successful replica of extraordinary complexity. Starting with the rationale for making a replica to enable future display of the entire work, it guides us through the complex execution, as well as the ethical considerations around using a replica in place of the original. The original work of art was 3D scanned, printed, then cast in thermosetting resins and painted using a wide range of methods and materials. Incredibly challenging visual effects of the original wax candles, such as random candle drips, gradual hue changes, high translucency, extreme texture and sheen variations were successfully resolved by various casting methods in urethane and epoxy resins. Acrylic paints applied in the molds as well as a complex surface coating emulated depth and transparency. Durability for transportation, as the prime purpose of the replica, dictated that its structural stability be resolved by puzzle-like, built in mechanical locks for each candle, combined with acrylic and metal pins, then permanently joined by adhesion. This method permitted prominent views of all undercuts and the inaccessible hollow core, amounting to about 25% of the object, and so characteristic of the

original work. Emulation of Kelley's momentous, accidental gestures so crucial to this work, was achieved by careful hand finishing of the 3D printed and cast candles of the replica. Frequent deliberations with the Museum's Replication Committee concerning all aspects of the replication project ensured a project planned and executed observing best practice. The making of this Exhibition Copy was a true collaboration on so many levels between conservation and the museum's Replication Committee as well as the Kelley Foundation and external contractors. The project thoroughly considered the wide-ranging future implications of owning and using a replica in institutional life. The joint commitment to 'getting it right' resulted in a replica that superseded original expectations and fulfills the goal for its long-term future. This project, with its decision-making processes and deliberations, may also provide useful guidance for replication of comparable works in other institutions.

## Notes

1. This 'Mike Kelley' retrospective 15 December 2012–28 July 2014 was organized by Ann Goldstein, then Director of the Stedelijk Museum. The third venue of the retrospective at MoMA/ PS 1 had a different title from the other venues: *An Homage to Mike Kelley*.
2. Personal discussion of the author with Mary Clare Stevens, Executive Director of the Mike Kelley Foundation. Date 10 December 2012. Kelley never put his explicit verbal desire in writing.
3. <https://whitney.org/media/289>.
4. (<http://vocab.getty.edu/aat/>) (<https://www.tate.org.uk/research/publications/tatepapers/08/terminology-for-further-expansion>).
5. See note 4 for the post-conference publication.
6. [https://www.sbm.nl/source/documents/f02\\_cics\\_gsm\\_fp\\_dmmcacp\\_190513.pdf](https://www.sbm.nl/source/documents/f02_cics_gsm_fp_dmmcacp_190513.pdf).

## Materials

Acrylonitrile Butadiene Styrene Filament® (ABS), Push Plastic, [www.pushplastic.com](http://www.pushplastic.com), (844)-233-4042, Springdale, AR 72764.

Clear Weld, JB™ Weld, [www.jbweld.com](http://www.jbweld.com) (903)-885-7696, P.O. Box 483 Sulpher Springs, TX 75483.

Createx™ Colors, [www.creatextech.com](http://www.creatextech.com), P.O. Box 120 14 Airport Park Rd. East Granby, CT, 06026 (860)-653-5505.

Crystal Clear™ 202, Smooth-Cast 300, Smooth On, <https://www.smooth-on.com>, 6500 Lower Macungie Road, Macungie, PA 18062, (610) 252–5800.

Cyberpoxy™ 5000, Curbell Plastics Inc., [www.curbellplastics.com](http://www.curbellplastics.com) 1500 Distribution Court STE 500, Lithia Springs, GA 30122, (770)-505-1441.

Duraglas®, U.S. Chemical & Plastics, [www.USChem.com](http://www.USChem.com), 600 Nova Dr. SE Massillon, OH 44646.

Glue Sticks, Glue Sticks Direct, [www.gluesticksdirect.com](http://www.gluesticksdirect.com), (972)-484-6177, 12029 Denton Drive, Dallas, TX 75234.

Hetron™ 650, Composites One LLC, 6202 Executive Blvd. Dayton, OH 45424, (937)-236-8180.

Mod Podge®, Plaid, [www.plaidonline.com](http://www.plaidonline.com).

Plastruct®, [www.plastruct.com](http://www.plastruct.com) (626)-912-7016, 1020 Wallace Ave. City of Industry, CA 91748.

Polymer Resin, Formlabs®, <https://formlabs.com>, 1 (617) 702 8476, 35 Medford St #1, Somerville, MA 02143.

Smooth-Cast™ 300, <https://www.smooth-on.com/products/smooth-cast-300>.

## Machines used

F400 Fused Deposition Modeling (FDM) 3D Printer at LifeFormations, Fusion3, [www.fusion3design.com](http://www.fusion3design.com), (855)-301-6654, 4321 S Elm-Eugene St. Greensboro, NC 27406.

KUKA Mill at LifeFormations, [www.kuka.com](http://www.kuka.com), (866)-873-5852.

Outsourced 3D Printing <https://www.stratasysdirect.com>, 27260 Haggerty Rd, Ste A-5 Farmington Hills, MI 48331, 248-280-5905.

Stereolithography (SLA) Machine at LifeFormations, Formlabs, <https://formlabs.com>, 1 (617) 702 8476, 35 Medford St #1, Somerville, MA 02143.

## Acknowledgements

In addition to the contractors, Direct Dimensions and LifeFormations, participants of this replication project included two representatives, Mary Clare Stevens, Executive Director, and Mark Lightcap, long-time assistant to Kelley and Collection Manager of the Kelley Foundation. Curators from the Whitney Museum of American Art included Dana Miller, DeMartini Family Curator and Director of Collection; Jennie Goldstein Assistant Curator; David Breslin, DeMartini Family Curator and Director of Curatorial Initiatives; Elisabeth Sussman Curator and Sondra Gilman Curator of Photography; and Jane Panetta, Curator and Director of the Collection, many of whom participated at certain periods of the project. Carol Mancusi-Ungaro, Melva Bucksbaum Associate Director for Conservation and Research, secured funding and provided overall guidance for conservation and theoretical aspects of replication. Nick Holmes General Legal Counsel, Beth Turk, Editor, Publications, Anita Duquette, Senior Visual Resources Manager, Farris Wahbeh Benjamin and Irma Weiss Director of Research Resources; Barbi Spieler, Head Registrar, Permanent Collection; Heather Cox, Senior Conservation Coordinator, and Melissa Amundsen conservation intern contributed in their respective field to the project. Additional members of the Replication Committee involved in the project were Chrissie Illes, Anne and Joel Ehrenkranz Curator; Clara Rojas-Sebasta, Ellsworth Kelly Conservator of Works on Paper; Kim Donaty, Steven and Ann Ames Curator of Drawings and Prints; Margo Delilow, Assistant Conservator; and Matthew Skopek, Associate Conservator. The author thanks for their participation the following specialists; Madison Wade Project and Production Manager, Technical and Finishing Artist, Bret Woodburry Principal of Sale, Blake Vandussen Lead Digital Artist, Marc Maley Lead Finishing, Molding and Casting Artist, Katelyn Wolary Finishing Artist, Derek Alderfer Finishing Artist, Rob Jefferson Finishing Artist, Caitlin Gilchrist Finishing Artist, Chris Coppoletti Digital and Technical Artist, William Brady Milling, Structural and Technical Artist, Angela Pulvere Surface Refinement of 3D Prints pre-molding, Kane Sargent 3D Printing Technician, Jacob Snyder Molding Artist, of LifeFormations for their dedication to this project, and Harry Abramson, Director of Art and Collections; Jeff Mechlinski, Technical Director; and Dominic Albanese, Director of R&D of Direct Dimensions, who performed the 3D scanning.

## Disclosure statement

No potential conflict of interest was reported by the author.

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