Making Headway
An Investigation of a David Wojnarowicz Flexible Mold

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Abstract

David Wojnarowicz (1954-1992) was an American artist who worked in a wide range of media, including painting, sculpture, printmaking, writing, and film-making from an early age until he died of AIDs-related complications. The artist's archives were acquired in 1997 by NYU's Fales Library and Special Collections and include his papers, films, photography, videos, audio, ephemera, and production materials, including a flexible mold used to create plaster-cast head-forms for his sculpture series, Metamorphosis (1984). A previous attempt at stabilization included the use of an internal support, which suspended the degraded mold over a Plexiglas base. The once-flexible material had become alarmingly brittle and discolored, had fused to the Plexiglas underneath, and exhibited major deformations. A multifaceted project was designed to record the present condition and identify the mold material. This paper presents the results of material analysis using techniques such as, FTIR, and GCMS, as well as evidence from the artist's journals, where he meticulously planned his works and made shopping lists for art materials. The identification of the material will inform ongoing preventive conservation decision making. Additionally, both the hollow cavity and exterior were 3D scanned, with several goals in mind. First, comprehensive documentation was created of the rapidly deteriorating surface. Second, the scan was used as a model for the creation of an external storage support created using a CNC milling machine. Viewers can now see the details inside and understand the mold as what it is: an intermediary process object, rather than an intentional artwork in the artist's outré production. During this project, several exciting applications of 3D scanning were discovered and are described in this paper.

Introduction

Object number 092.0360 was a brown, brittle, head-shaped, hollow artifact presented to the author as the focus of an internship at the Barbara Goldsmith Conservation and Preservation Department at New York University Libraries (figure 1). This object is associated with the creation of David Wojnowicz's sculpture series ***-^mZfhkiahlbl***. ***-^mZfhkiahlbl***, a sculpture series created in 1984, is composed of 23 plaster heads cast from the flexible mold that were subsequently painted and collaged. The mold used to create this series retained signs of the artist's hand. However, the function of the work as an agent in the creation of the plaster heads was obscured by an internal support added in 2006 (figure 2). This research involved the exploration and utilization of University resources to gain insight into the production of this curious object. The goals of this project are presented here in three stages. The first stage describes archival research and scientific analysis conducted to gain insight into the artist's materials and provide context for the mold as a process object. The second stage provides a condition assessment of the flexible mold and the use of 3D scanning as a method to create more suitable housing based on the results of the first stage of research. The third stage describes the additional applications of 3D scanning that were discovered during the duration of this project, using this object as the focal point.

Archival Research

One of the main tasks for archival research involved material identification of the flexible mold. The first place to turn to for information was the David Wojnarowicz Knowledge Base, an Artist Archive Initiative at New York University. This interdisciplinary resource centralizes an array of information gleaned from the artist's archive and makes it accessible through an open-source platform, MediaWiki. The Knowledge Base was invaluable for identifying PPOW Gallery as Wojnarowicz's gallery representation. The director of the gallery was grateful to be informed of the research into this flexible mold, and shared an underground film by the artist's friend Richard Kern. A scene transported the viewer to Wojnarowicz's hellish kitchen-turned-studio. This chaotic experimental film records the artist mixing and pouring plaster into a flexible mold and violently ripping it off to reveal one of the cast head-forms for his work *-^mZfhkiahlbl* (see figure 3). A work of art in its own right, the film also offers unmatched evidence of the mold as an active agent in the making of the series; it is shocking to see the strength and flexibility of the unaged mold material, especially given its current deteriorated state. The documentary video was also examined frame by frame, in hopes that a label would appear bearing the name of the commercial mold-making material. Unfortunately, none was evident.

The next step in material identification was to comb through the David Wojnarowicz Papers, which were acquired in 1997 by Fales Library and Special Collections at New York University Libraries.[1] Fales aims to collect, preserve, and provide access to a wide range of primary research materials in their original formats, to support education and research. The David Wojnarowicz Papers include the artist's writing, film, photography, video, audio, ephemera, and process materials, including the flexible mold used in the making of the *-^mZfhkiahlbl* series. The nearly 175 boxes in the collection held the artists' shopping lists for art materials, undated chaotic to-do lists and sketches, thousands of documents including receipts from art supply and hardware stores and journals where he meticulously planned his works. Although it was a powerful experience sifting through the documented vestiges at the forefront of the artist's creative processes, and photographs were discovered that give insight into the production of the mold, the proprietary name of the mold-making material was never revealed. There was also little to no documentation on record for the mold prior to 2006 which would have strengthened the relationship between the mold and the cast artworks.

Scientific Analysis

Scientific analysis was then conducted to identify the composition and characterize the degradation process of the mold material, evidently an unknown elastomer. Techniques such as Fourier Transform Infrared Spectroscopy (FTIR) and Pyrolysis - Gas Chromatography Mass Spectrometry

[1] This archive, which informed the Knowledge Base, is part of the Downtown Collection, a collection devoted to the documentation of the art scene in the Lower East Side and Soho from the 1970s-1990s.

(Py-GCMS), are common methods of polymer and elastomer analyses, and may require sampling, as was the case here. The flexible mold appeared to be constructed from a single material, so examination in visible and ultraviolet light assisted in the selection of sample sites. Four sample sites were chosen to represent the various stages of deterioration of the homogeneous material, ranging from areas that retained the most elasticity to the discolored and crystallized degradation products. A mold presents a complicated issue of sample retrieval: removing material from the interior would disrupt the surface that actually created the artwork, while removing material from the exterior would create a noticeable loss in the textured surface. Fales' curators granted permission to retrieve samples after discussing these considerations. Samples were taken from the top of the exterior, at the sites of greatest deterioration, as well as the least degraded excess material built up around the interior ring underneath (see figure 4). Sample size was extremely small, each sample measuring approximately 100 microns square, which were removed from the surface of each site with a scalpel under magnification. These sites avoided areas that were once in direct contact with the plaster casts, thus preserving the integrity of the interior surface details.

Attenuated Total Reflectance (ATR) FTIR was conducted on the four samples and their spectra were analyzed to identify the composition of the bulk mold material. Given the function of the mold, it was unsurprising to find traces of calcium sulfate in the spectrum. Subtracting the regions corresponding with calcium sulfate, a spectrum search was run, but the Infrared and Raman User Group (IRUG) database did not yield a convincing match. This is perhaps due to the overall age and degradation of the samples and/or the lack of elastomers in the database. Therefore, functional groups in the spectra allowed some tentative conclusions to be drawn. In the spectrum acquired from least degraded samples there was a strong peak that matches a peak at $835cm^{-1}$ expected of natural rubber.[2] Consistent with the degradation of natural rubbers, this peak disappears in the more degraded samples, suggesting that a component of the original material is rubber. Overall, the peaks become less defined as the degradation advances, with the exception of the peaks in the carbonyl stretch region around $1700cm^{-1}$ that increased, confirming the mechanism of elastomer degradation through oxidation.

Scientific analysis was continued in collaboration with the Department of Scientific Research at the Metropolitan Museum of Art. Research Scientist Dr. Federica Pozzi performed the Py-GC/MS analysis of the mold samples, since other analytical techniques available to us cannot determine the possible fillers, plasticizers, stabilizers or other additives present. The Py-GC/MS chromatogram produced from the least degraded sample suggested the presence of D-limonene, a solvent used to smooth wax molds and other wax-based sculpting mediums, and to clean the leftover wax off the working surface. These results did not appear to be consistent with the archival documentation which did not provide any evidence of wax used in the creation of the sculptures.[3] Further

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[2] Reuss, Margrit, and Thea van Oosten. 1999. ***The Degradation of Objects Made of Rubber: Research Report of an Investigation of Objects at the Legermuseum in Delft***. Amsterdam: Instituut Collectie Nederland.

[3] Archival photos (Contact Sheets, David Wojnarowicz Papers (MSS.092) Fales, Series 9A, Box 37) exhibiting the creation of the mold show that a model for the heads was sculpted in clay. It is possible that

Py-GC/MS would have required a sample taken from the interior of the mold, which was not authorized by the curators.

The proprietary nature of manufacture makes it difficult to identify through analysis alone the compositions of modern materials. It was very clear that the exact mold material would not be identified through either archival research or scientific analysis, but these techniques provided enough information about the object's composition to create more suitable housing.

3D Scanning, CNC Routing and Rehousing

Structural stabilization had been attempted in 2006 with an internal support suspending the mold over a Plexiglas base (figure 3). In the past decade, the mold material has shown signs of rapid deterioration at the areas of contact between the mold and its mount. Documentation photos from 2006 show the localized strain from the internal support at the top of the head, which likely contributed to the advanced degradation observed during this project. Jessica Pace, Preventive Conservator at NYU Libraries, thought this object was the perfect candidate for an experimental rehousing project involving 3D scanning and CNC routing, previously developed by the author for the Metropolitan Museum of Art in 2017.[4]

The first step involved removing the object from its support. The once-flexible mold had become alarmingly brittle, discolored, and in some areas tacky. It sagged, and bonded to the Plexiglas base underneath through contact and gravity over the years. The mount was separated mechanically with a spatula as only a few small points were stuck to the Plexiglas. Once mechanical stress was removed after the mold was separated from the mount, we discussed ideal environmental conditions for storing this sensitive archival object. The primary agents that cause elastomers and plastics to deteriorate are radiation, high humidity, high temperature, oxygen and pollutant gases, stress and other direct physical forces. Optimal conditions such as dark, low-temperature storage[5] and oxygen-free environments contradict accessibility to the object for educational purposes, essential to an object housed in a research library. NYU Libraries could, however, provide reasonable storage conditions for the elastomer in a dark, temperature- and humidity-regulated

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a release-agent containing D-limonene was applied to the model and/or mold surfaces during the production of ***Metamorphosis***.

[4] "3D Scanning to Create Custom Storage Forms for the Charles James Collection in the Costume Institute, Metropolitan Museum of Art" by Taylor Healy, Sarah Scaturro. 191-206. Textile Specialty Group Postprints Volume 27, 2017.

[5] Low-temperature storage environments result in slower chemical reactions. Recommended temperatures reported in conservation literature range from (-20°C to 4°C) Williams, Scott. "Care of Objects Made from Rubber and Plastic." ***CCI Notes 15/1***, Canadian Conservation Institute, 1997, www.canada.ca/en/conservation-institute/services/conservation- preservation-publications/ canadian-conservation-institute-notes/care-rubber-plastic.html. Yvonne Shashoua, ***Conservation of Plastics: Materials Science, Degradation and Preservation*** (Oxford: Butterworth- Heinemann, 2008).

area. The new housing would minimize further degradation and document the deterioration that has already occurred.

Because an internal mount suspending the mold caused rapid deterioration, a housing design that supported the outside of the object seemed more desirable as the shrinkage of the material would likely continue. To create a clamshell-like housing for the object's complex shape, 3D scanning technology was explored. This involved a collaboration with NYU's LaGuardia Studio, a co-op that provides advanced digital media services including 3D scanning to NYU faculty, students, and visiting artists. The studio's scanning technician came to the lab and 3D scanned the exterior surface of the mold with an Artec Space Spider scanner which relies on a structured-light scanning technology. The scanner utilizes blue structured-light scanning which produces a set of data points in space that represented the surface of the object, or ***ihbgm \ehn]È*** These points are connected by vectors into a 3D surface, or ***`^h f ^mkr*** (figure 5) which would be used to create a digital model for rehousing. A decision was made with approval from the curators that an upside-down orientation both distributed the strain on the object as well as exposed the interior cavity for educational purposes. This storage solution would be executed through CNC routing, a computer-controlled cutting machine that can mill various materials including foam. In a commercial, computer-aided design (CAD) program called Rhino, the 3D model was prepared for CNC routing based on the dimensions of the polyethylene foam, or Ethafoam, that performed well in an Oddy test.[6] This entailed slicing the 3D model virtually into several sections, a common processing practice for CNC routing. Each slice was then exported as a stereolithography file format (.stl) that has become the Rapid Prototyping industry's de facto data transmission format required to interact with Partworks 3D, a dedicated toolpath software for CNC machining three-dimensional models. The dimensions of the model and material were defined in this program. Additionally the parameters of the machine were input to calculate the path that the CNC machine takes to cut the foam in three dimensions. The author gained access to Tandon School of Engineering makerspace facilities at NYU which included a 3 axis CNC router, an adequate tool for this rehousing fabrication job. The CNC machine, essentially a drill bit running on an XYZ axis, is controlled through ***` \h]^***, a widely used numerical control programming language, which contains thousands of lines of coordinates and commands as defined in Partworks.

Once the slices were cut, they were assembled into two sections and a sheet of polyethylene was heat-formed to each half of the cavity, as the surface of the ethafoam was too rough for the mold to contact. This provided a smooth-form fitting clamshell form for the mold and adhered the slices of foam without the use of an adhesive. The covered foam was inserted in a box that allows easy access to the interior (figure 6). Details visible from this orientation underscore the value of this mold as a process object (figure 7).

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[6] Oddy Testing was conducted with several samples of polyethylene foam provided by New England Foams in 2019. The protocols and workflows developed for the Barbara Goldsmith Conservation and Preservation lab were adapted from the Department of Scientific Research at the Metropolitan Museum of Art.

3D Scanning Applications

In addition to the digital model used to create the housing, 3D scanning provided further applications. 3D scanning offered detailed documentation of the condition of the interior and exterior surfaces of the object in its current state. Having a 3D scan that documents the entire surface is a huge improvement from the documentation on file which was limited to five photographic views of the exterior and one view of the interior. Also, these scans ideally captured the current state of degradation of the entire surface of the object through texture mapping— a level of detail that photography alone could not achieve. The drawback to using 3D scans as a form of documentation is the lack of accessibility due to the dependency on expensive, proprietary software. Dependencies on proprietary software and non-archival file formats is a common issue faced in the field of time-based media conservation. Following established practices developed in the field, files were created and retained based on the likelihood of future support for proprietary software, and the widespread acceptance and archival quality of the file formats. The raw scans created by the Artec scanner (.sproj), Adobe Photoshop texture mapping (.psd) and the Zbrush project file (.ztl) are analogous to raw and edited video footage. These proprietary formats are not preservation-quality, but are considered “master” material as they are the files that were created by LaGuardia Studio for viewing the model in its full detail. An object (.obj) file was created from the Zbrush project as it one of the most widely supported geometry formats that also retains texture mapping (with associated .mtl and .jpeg files). Additional file formats were considered and created, as standard procedures for the digital preservation of 3D scans are currently being developed in collaboration between technicians, software companies and the digital preservation communities, with the goal of providing access to these models in the near future. The 3D scan has been made available by uploading to a 3D model-sharing platform, Sketchfab.[7]

Conclusion

The wide range of materials used by artists, conflicting or absent information about these materials, and their inherent instability compel conservators to turn to scientific analysis. Due to the proprietary nature of modern material manufacture, material identification with the goal of matching a commercial product becomes nearly impossible. ATR-FTIR was able to able to detect a natural rubber component and calcium sulfate in the bulk mold material and identified oxidation as a degradation mechanism. Because of the limitations of scientific analysis, archival research has become common in modern and contemporary conservation research. Conservators ask questions that can be answered by the object itself as well as materials and networks of people that artists leave behind. This effort yielded valuable documentation of the object, including a video recording its use in the creation of one of David Wojnarowicz’s most significant sculptures. One of the strategies involved re-housing which allowed this object to be accessible for researchers in the future. Rehousing was achieved by utilizing technologies such as 3D scanning and CNC routing to

[7] The 3D model can be viewed here: https://skfb.ly/6MYqQ

create a clamshell polyethylene mount that encapsulated the mold. During the course of this project, additional applications for 3D scanning technologies were discovered that could provide optimal documentation, and more information on the object and the material's deterioration patterns. Subsequent steps include working with a mechanical engineer to identify the areas of risk that the mold is experiencing in its new housing, which can be visualized by false color imaging through the analysis of the 3D model produced. Also this model could be imported to specialized commercial software programs to take virtual cross-sections and compare the relative thickness of the material and see if it correlates to areas of degradation. And finally, one of the most exciting prospects will be an ambitious collaborative effort involving the 3D scanning of one of the finished plaster artworks and comparing that to a 3D scan of the interior of the mold. Deformations and shrinkage that the mold has undergone in the last 35 years can then be evaluated through deviation studies. Collectors who own -^mZfhkiahlbl heads have been identified, and plans to gain access to the works are in progress.

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Figure 1. 2018 Digital photographic documentation (092.2.0360). Image: Taylor Healy

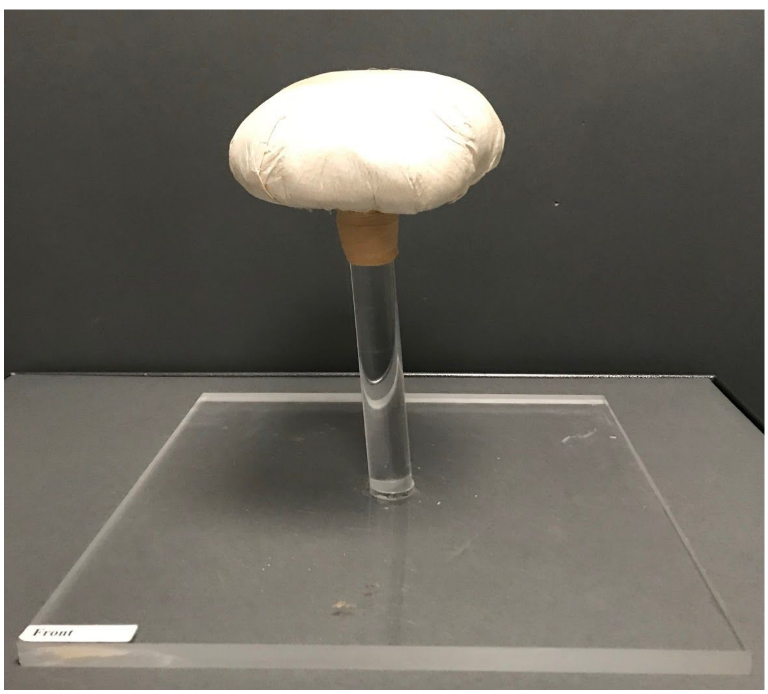

Figure 2. Internal support mount added in 2006. Materials include: Plexiglas base and stand, cast vulcanized silicone rubber, mylar, and Tyvek.[8] Image: Taylor Healy

[8] Materials used for the internals support were listed in a 2006 Treatment Report.

Figure 3. Richard Kern, still from “American ObsessionsÑ 1983. Featuring David Wojnarowicz.
Super 8 color on digital video, silent. 1:21 min.
Image courtesy of the artist, the Estate of David Wojnarowicz and P.P.O.W.

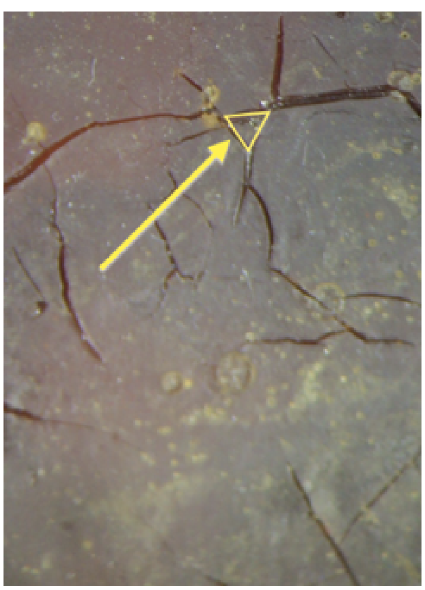

Figure 4: Sample sites. Left: Sample 1 from the top of exterior. Right: Samples 2, 3, 4: Excess material around interior ring. Image: Taylor Healy

Figure 5. Point cloud (top left) geometry (top right),
texture mapping applied to the geometry (bottom). Images: Taylor Healy

Figure 6. Object in its new custom CNC-routed housing. Image: Katherine Parks