Nineteenth-Century Art Worldwide
a journal of nineteenth-century visual culture

L. H. (Hugh) Shockey Jr.

Technical Evidence from a *Greek Slave* Intermediary

Nineteenth-Century Art Worldwide 15, no. 2 (Summer 2016)

Abstract:
This article focuses on the evidence revealed during the technical examination and conservation treatment of a plaster model of *The Greek Slave* used by stone carvers in Hiram Powers's studio to produce finished marble copies. Observations focus on what both the internal "skeleton" and the exterior "skin" revealed during the conservation process that supports a history of the plaster model's repeated use, as well as offers details about the role of intermediates in historical studio technique. Also presented is the use of 3-D scanning as a digital tool for art historical research in addition to its enabling the making of a 3-D "print" of the plaster model suitable for gallery display.

Technical Evidence from a *Greek Slave* Intermediary

by L. H. (Hugh) Shockey Jr.

Note: For Smithsonian X 3D Explorer system prerequisites, see: http://3d.si.edu/article/prerequisites. To access a 3-D model of the pointed plaster of *The Greek Slave*, click here: http://3d.si.edu/explorer?modelid=1392. To download a 3-D model of the pointed plaster of *The Greek Slave*, click here and follow the instructions: http://3d.si.edu/downloads/1392.

The plaster cast of Hiram Powers's *Greek Slave* was made from the artist's clay model and from 1843 served as an intermediary step in the production of marble replicas. In preparation for its display in the exhibition *Measured Perfection: Hiram Powers'* Greek Slave (July 3, 2015–February 19, 2017, Smithsonian American Art Museum), the cast was closely examined beginning in 2013 at SAAM's Lunder Conservation Center, where researchers assessed the sculpture's structural integrity and critically evaluated its surface to determine if making aesthetic improvements was desirable, or even possible, in advance of the public showing. The cast's internal structure was studied with the help of digital X-radiography, and its surface was characterized through combining observations made under UV and visible light with those from solvent and aqueous solubility tests. The 3-D scan of Powers's working model, produced in collaboration with the Smithsonian Institution's Digitization Program Office, provided a textured and accurate framework on which to hang these observations, while also serving as the basis by which modern "replicas" might be constructed. This in turn gives scholars access to working models for deeper study and analysis. What we learned from traditional examination techniques in addition to X-radiography and 3-D scanning both opens a window into traditional sculpture processes in general and raises questions about iterations of *The Greek Slave* specifically, begging further examination and evaluation using comparative 3-D scan modeling.

The Skeleton

We were anxious to know more about the overall integrity of the plaster cast and its internal armature, especially since there was a concern that the bronze and iron rods and fittings inserted into and rising out of the plaster body created potential points of fracture propagation and may have introduced weaknesses or voids in the plaster. The goal in studying the internal structure was to identify any areas that were thinly poured, note any signs of interior fractures, and check for sections that may be unsupported by an armature. We wanted to determine how extensive and interwoven the metal armature was, how firmly imbedded in the plaster it remained, and if the material of the armature itself was stable and free of signs of deterioration. The digitally captured X-radiographs revealed a solid cast-plaster sculpture with a carefully placed and tied-in metal armature. We also noted that the model had been created to withstand movement (i.e., the repeated vibrations created by the loading and unloading of the loop with the pointing device), making it able to endure constant daily use as a tool for a stone carver.

Digital X-radiography has increased our ability to examine sculptures in detail, but the technology still has its limitations. As with traditional X-radiographs, each digital X-ray is limited in size and requires that a mosaic of smaller images be assembled to provide a complete look at a subject the size of *The Greek Slave* (fig. 1). Also, whether digital or film based, X-radiographs can provide only partial sectional views of three-dimensional objects and must be carefully analyzed with that in mind. Our flattened, near one-to-one-scaled image presents a spatial challenge to the examiner since multiple planes—in this case the left arm and hip region—are superimposed in the same view. Comparing additional X-radiographs shot from other points of view helps clarify some spatial questions, but even those images offer only a flattened view of a highly dimensional object. Given this restriction, using X-radiographs to make comparative measurements of internal features will always be of questionable accuracy, since the image is necessarily subject to distortion from the cone-shaped X-ray beam and bound by other practical limitations of the technology.

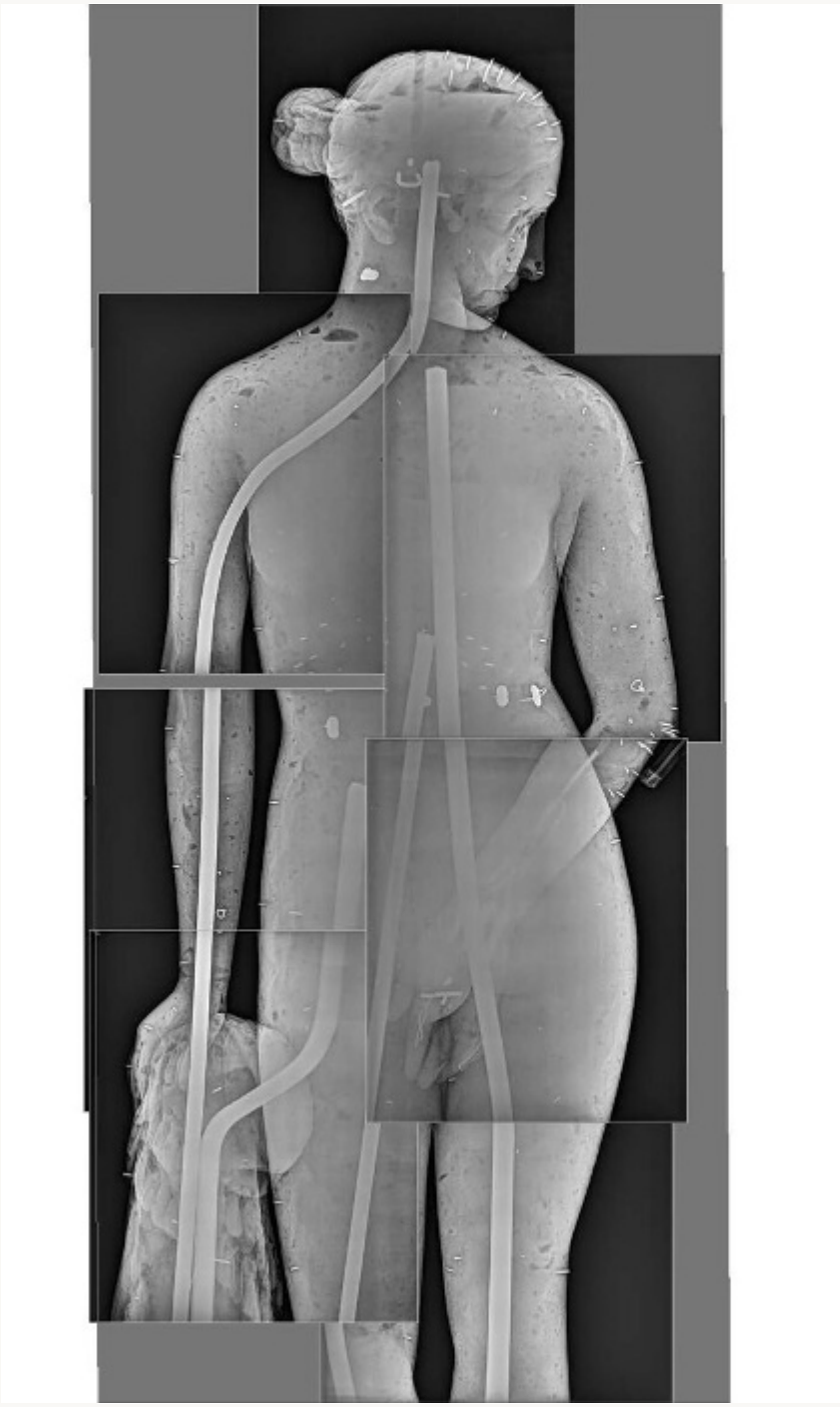

Fig. 1, Samantha Grassi, composite of sectional X-radiographs of the plaster model of *The Greek Slave*, 2015. X-radiographs courtesy of Susan Edwards and L. H. (Hugh) Shockey Jr., Lunder Conservation Center, Smithsonian American Art Museum, Washington, DC.

This assembled mosaic of individual X-radiographs shows the internal armature and other opaque elements captured by the digital X-radiograph film. Denser materials, such as metals, read as lighter gray to white, while darker gray to black areas indicate low-density material and voids. In this image, the figure is facing the viewer.

The X-radiographs of this *Greek Slave* cast showed the unmistakable presence of an internal metal armature, a robust structure made with ribbons of metal passing from one section to another, forming the durable bones for the plaster matrix. Among the number of other opaque shapes visible in the X-radiographs were several winged objects surrounding the waist of the figure just beneath the inverted heart-shaped constellation of pins defining the lower ribcage. Their specific purpose cannot be definitively determined from the X-radiographs, although one conjecture is that perhaps the objects were used to connect a "hollow cast" (that is, an unfilled shell cast) of the torso to the solid-cast pelvic area before the torso shell was filled in with liquid plaster to solidify the body as a single unit.

The X-radiographs also reveal that beneath the surface of the sculpture's delicate left wrist is the localized inclusion of three metal bars tied together with wires that run up the left forearm nearly to the elbow (fig. 2). This treatment, which appears excessive to support the subject's small hand and is not consistent with other parts of the sculpture, seems to suggest a calculated measure to provide support for more weight. We hypothesize that it must have been the free-hanging weight of a metal shackle and chains, a load that eventually would have caused unreinforced plaster to fracture and fail. By contrast, if similar weight were added to the subject's right side, it would not need extra support, since a thick, solid metal bar runs from the base of the cast, through the pillar, up the arm into the shoulder, and on through the neck, finally terminating in the head of the figure.

Fig. 2, Detail of the left forearm, Samantha Grassi, composite of sectional X-radiographs of the plaster model of *The Greek Slave*, 2015. X-radiographs courtesy of Susan Edwards and L. H. (Hugh) Shockey, Jr., Lunder Conservation Center, Smithsonian American Art Museum, Washington, DC.

This single X-radiograph of the left forearm shows higher-density reinforcements extending from the wrist up to the elbow. The higher-density material is believed to be metal.

X-radiography also showed us much about the interior condition of the sculpture, including the unexpected revelation of an area of particularly low porosity and uniform density in the head. Digital X-radiographs allow for researchers to review their contents at a variety of settings—different combinations of which can reveal details not always visible at a single fixed exposure, as with film—and in this case our examination of the X-radiographs led us to propose that this part of the figure's head might contain something other than plaster. One idea is that this more uniform area might be a type of wood. The inclusion of a less porous, more uniform mass in the head connects directly (and perhaps even relates by design) to the termination of the long vertical armature bar, as well as to the placement of small-diameter iron rods (whose purpose is as yet unknown) and the iron loop from which the pointing device hangs when the cast is being used for replication. If our theory is correct, this more uniformly dense material is more durable than cast plaster and possibly provided a degree of shock absorption to mitigate the constant movement of the pointing device attached to the loop.

The Skin

As we began this study, the stained and soiled surface of the sculpture gave off the immediate impression of an object with a long history of studio use and warehouse storage—not unexpected for a plaster model of this kind. The moderate to heavy surface soiling had distinct characteristics in two different areas: the upper two-thirds of the sculpture had a soiling layer dominated by hydrocarbon combustion soot and fine-grain particulate material, while the lower third was characterized by a dense and finely divided particulate accumulation reminiscent of brick or concrete dust. (The possible origins of the soiling have yet to be fully studied.) These accumulated layers of soiling obscured details of the original surface and hindered initial UV examination of surface coatings.

The process of revealing additional details about the surface of the model began after a considered discussion between the curator and conservator about the nature of the soiling, the potential information to be gained from cleaning the cast, and the risk of damage to the surface during such an intervention. Previous success using a modified aqueous gel cleaning system on thinly coated plasters informed the agreed-upon treatment plan, which also required consideration of the total surface area to be cleaned. The process progressed slowly as conservation technician Susan Edwards painstakingly began cleaning the thickest areas of soiling while being mindful of the possibility of uncovering, and potentially accidentally removing, annotations written on the surface of the model.

The surface beneath the soiling revealed a number of interesting finds (fig. 3). In particular, the extent of the annotations on the surface was unexpected. Hand-applied graphite "X"s, originally noted in only a few areas before cleaning, could now be seen covering the surface in both regular and slightly variable patterns. Additional unexplained annotations also became evident, notably numbers located on the head, left arm, and base. Following the cleaning, examination under UV light assisted in characterizing the surface coating, which appeared to be mostly continuous. Overall, the surface did not display strong fluorescence, however, faint yellowish-green areas suggested the plaster might have been locally coated with a natural resin varnish rather than an oil- or protein-based paint binder. Subsequent solvent testing of these areas indicated no apparent solubility to polar solvents, as would be expected of a natural resin varnish. These results rule out an aged and discolored resin varnish as the cause of the mottled surface, suggesting instead that it is coated with paint of an unidentified medium. Further analysis of select areas of uniform discoloration, such as the face, may eventually reveal that traces of other materials, such as period mold-release agents, were applied to the surface.

Fig. 3, Hiram Powers, *The Greek Slave*, 1843. Plaster. Smithsonian American Art Museum, Washington, DC. Photograph by Susan Edwards.

The cleaning treatment revealed a brighter surface with a much higher degree of color variability and detail than was previously observed.

Additionally, the right and left wrists show a buildup of several layers of paint and plaster at what appears to have been the spaces between shackles and the surface of the figure. This pattern of periodic repair and "refreshment," in addition to the presence of graphite "X" marks that are both under and on top of surface coatings, strongly suggest that the plaster cast was used over a long period, may have been used by multiple carvers, and is likely to have been used to produce multiple finished marble copies of *The Greek Slave*.

Less frequently, we see more starkly contrasting surface areas—such as on the face, left forearm, ankles, column, and base—that suggest secondary coatings and more invasive repairs or alterations made to the model over time. The distinct pink-colored area of the left forearm is a readily visible example, as it clearly shows a coating applied over several graphite "X"s (while others were intentionally spared), with a legibly inscribed "7" on the surface of the more recently applied pink coating (fig. 4). These observations raise numerous unanswered questions, including: Why was the area over-painted? What is the significance of the number "7"? Is there a previous "7" under the pink coating that we cannot see? Do these markings relate in some way to the life cast forearm that Karen Lemmey describes in her article "From Skeleton to Skin"; a life cast we suspect Powers used in the modeling process, and for which the comparative analysis of the 3-D scans have indicated minimal deviation?

Note: high-resolution zoomable image available online here.

Fig. 4, Detail of left forearm, Hiram Powers, *The Greek Slave*, 1843. Plaster. Smithsonian American Art Museum, Washington, DC. Photograph by Susan Edwards.

This detail image of the left forearm and hip shows where the number "7" can be seen on top of the pinkish-colored over-paint. Small "X"s can be seen faintly peeking through the coating on the forearm, while the pattern of "X"s is clearly visible on the hip.

Digital Duplication

The 3-D scan of this *Greek Slave* model conducted by the Smithsonian's Digitization Program Office followed a proven workflow developed for the preservation of objects through digitization. The 3-D scan of the model is, in fact, a point cloud data set created through laser acquisition scans and photography of the sculpture. The scanning process relies on scans of multiple resolutions, where the low-resolution, broad-acquisition scan locates the object in the environment and the high-resolution, narrow-acquisition scan captures the finer details of the sculpture's surface topography. The virtual model created from these scans is free of surface coloration until accurately scaled photographs are overlaid on the virtual model. The result is a computer data file that offers us the opportunity to create our own 3-D print (fig. 5), which then opens the possibility for closer examination of the surface details and sculpture's dimensions at the locations and durations of a researcher's choice, unrestricted by the limits of studying the original in a museum setting. Should high-quality 3-D scans of the marble replicas become available, scholars will have the opportunity to compare the point cloud data generated from each of those scans with those of the plaster cast. The simultaneous evaluation of a group of scans will allow for the more-accurate identification of similarities, deviations, and alterations between the marble iterations and the plaster model.

Fig. 5, 3-D print generated from data captured through the Smithsonian Digitization Program's 3-D scan of the pointed plaster model of *The Greek Slave*, 2015. Glass-infused polymer. Photograph by Gene Young, Smithsonian American Art Museum, Washington, DC.

Digital Humanities Project Narrative

The use of digital tools to further scholarship in the humanities offers an opportunity to expand collaboration and research and to reach beyond traditional publication paths. For my essay, "Technical Evidence from a *Greek Slave* Intermediary," the incorporation of a zoom feature that allows for the exploration of details in the accompanying image enhances the reader's ability to understand the nuances of the observations presented in the text. As an author, this allowed me to allot more words to explaining relationships between pieces of observed evidence and their correlation to studio practices documented in the historical record rather than spend time describing inherently visual objects. As a conservator, such digital tools have become a regular part of my examination and documentation practice. The adoption of digital tools by art conservators is not simply the inevitable evolution away from obsolete technology, it is also the addition of new tools made possible by the advancement, refinement, and miniaturization of digital technology.

The expansion of the data generated by merging old techniques with new, as with digitally captured and processed X-radiographs, and the opportunities offered by new tools, such as 3-D scanning and printing, represent only the cusp of the possibilities offered by digital tools. Recent advances in machine vision coupled with computer analysis, for example, now allow for the scanning of object surfaces at resolutions and in spectral ranges beyond human vision, while also offering the opportunity for data analysis including the accurate characterization of color, spectral response, and surface topography, and the ability to detect subtle change (Δ in scientific notation) in a single object over time or in comparison to other examples. This data is easily shared with colleagues for review via peer-to-peer file sharing, open source data and image processing software, annotated screenshots, and emails, taking advantage of "crowdsourced" expertise while adding to the existing knowledge base. Numerous additional examples of the application of digital technologies, such as augmented reality (AR), virtual reality (VR), reflectance transformation imaging (RTI), optical coherence tomography (OCT), and geographic information systems (GIS) are currently being applied to technical examinations of art to help us better understand and experience the work on a physical level, to view its history in a larger context, and to provide for its preservation by offering a detailed digital surrogate for study while reducing the risk inherent in the handling and display of an original object.

Nineteenth-Century Art Worldwide's use of digital tools and the support it provides to scholars (I give my sincere thanks to those who assisted with my submission) is knocking on the door of the future of humanities scholarship. Numerous museums have embarked on digital strategies and, as part of those strategies, the digitization of collection holdings offers an ever growing resource of digital assets from diverse collections. For example, the Smithsonian's X 3D initiative provides a global resource for experiencing an object in virtual or real space from any location; the Museum of Modern Art's Inside/Out blog offers the visitor a dynamic look at objects, exhibitions, and behind-the-scenes activities at the museum; and the Rijksmuseum's

Rijks Studio presents a space for the exploration of institutional and visitor curated "studios" on a variety of themes related to its collection. In theory, a museum's digital database is limited only by the availability of technology and the creativity of the user's application. With that in mind, imagine opening an object's pool of digital documents to art historians, who could then dig through piles of registration, curatorial, and conservation records, or watch videos of artists' interviews, conservators' treatments, or curators' installations, etc., from a laptop in a remote location while preparing for the digital publication of his or her latest research.

These dynamic platforms for sharing resources that support scholarly dialogue and publication in the humanities are still in their infancy. The future platforms and resources that will support and further humanities collaboration and scholarship remain to be built, and *NCAW* offers but one example of how high-quality scholarship, of the type normally seen in peer-reviewed print journals, can be enhanced by digital tools. As a museum professional who deals with facts and evidence from primary sources and publishes across a variety of professional outlets, I believe in the editorial and peer-review process and think *NCAW* demonstrates that it is possible to maintain scholarly integrity when publishing in the digital realm. In my view, it does so by publishing rigorously edited articles that are freely accessible online without requiring institutional subscription or individual payment. Moreover, a dynamic editing process for these digital articles amounted to frequent conversation and collaboration among myself as the author and the *NCAW* editors, guest editors, and technology specialists, enabling a richer and more balanced outcome. As platforms for sharing scholarly research and collection resources take hold and proliferate, it is possible to envision more such "publications" that are completely digital, building on the example of *NCAW*'s special issue and its focused examination of *The Greek Slave*, acting as the hub for topics that draw on the resources of collections scattered around the world, narrated by established and emerging scholars, and quality ensured by a panel of editors and experts.

L. H. (Hugh) Shockey Jr. is head of conservation at the Saint Louis Art Museum. Previously, he was an objects conservator at the Smithsonian American Art Museum and Renwick Gallery from 2005 to 2015. During his Smithsonian tenure he participated in the Smithsonian's Haiti Cultural Recovery Project in 2010 and worked in the Smithsonian's collections of the National Museum of American History and the National Museum of the American Indian from 2002 to 2005. He has also worked in the collections of the National Park Service, the Los Angeles County Museum of Art, the Fine Arts Museums of San Francisco, Elvis Presley's Graceland, and the collections served by the Balboa Art Conservation Center. Shockey holds an MS degree in art conservation from the Winterthur/University of Delaware Program and has been an individual recipient of funding from the Andrew W. Mellon Foundation and the Foundation of the American Institute for Conservation.

Email the author: hugh.shockey[at]slam.org