



In-situ X-radiography of a Monumental Oil Painting: Deconstructing a Giant

Keara Teeter¹, Allison Rabent¹, Kristin deGhetaldi², Anthony Lagalante³, Brad Thorstensen³

1. Conservation Intern, Villanova University
2. Ph.D. Program in Preservation Studies, University of Delaware
3. Chemistry Department, Villanova University



Abstract

In September 2014, *The Triumph of David* (12'x20' oil on canvas traditionally attributed to the workshop of Baroque master Pietro Berrettini da Cortona) underwent X-radiographic examination at Villanova University's Falvey Memorial Library. The analysis is part of a two-year campaign to restore the painting, headed by painting conservator Kristin deGhetaldi. Technicians from General Electric's Inspection Services Department were contracted to work alongside an interdisciplinary team of conservators, interns/volunteers, and members of the Villanova University Chemistry and History departments. The resultant X-radiographic image has now provided scholars with crucial information that may help answer questions about the painting's provenance.

The team was faced with numerous obstacles including the scale of the painting, time restrictions, and the publicly accessible workspace. A novel method of securing the X-radiographic imaging film was devised. This involved two steps: first, the location of each exposure was marked on the verso of the stretcher bars and second, a specialized film holder was designed to facilitate the process over a two-day time span. Thorstensen and Lagalante engineered a 22³/₄"x24¹/₂" film holder using two polycarbonate sheets with rare-earth (neodymium iron boron) magnets mounted in each corner and an insert to accommodate the digital X-radiographic imaging film. This holder provided rapid relocation of the film and did not rely on visual or measurement distances for alignment during both ground and scaffold-based positioning. Each magnet was padded with a soft synthetic rubber to protect the surface of the painting. The verso polycarbonate sheet contained an insert and held the film in close proximity to the backside of the canvas. The recto polycarbonate sheet provided for laser alignment of the X-ray source. While this system worked well for *The Triumph of David* it should be noted the oil painting is without impasto or cupping which afforded safe contact between the film holder and the painted surface. The General Electric technicians used a Spellman LORAD LPX160 tube in conjunction with high resolution 14"x17" Flex XL Blue Digital Imaging Plates. A GE Pegasus CR 50P digital scanner was moved into the space. This allowed for immediate scanning and allowed simultaneous scanning of multiple sheets. The grid template marked on the verso of the stretcher bars ensured individual plates overlapped 1³/₄" on each exposure.

The public nature of the workspace necessitated that the Falvey Memorial Library Reading Room be closed for the two days of X-radiographic imaging. Appropriate signage was placed around the periphery of the site and doors were secured. ND-2000 dosimeters were used to measure radiation levels, and individuals associated with the project vacated the exposure area while the LORAD LPX160 was active. Members of the public were able to observe the entire process through the live web-cam feed that is currently hosted on the project's blog site.

Over 120 X-radiographic captures were collected and compiled for the final image. The composite X-radiograph revealed major artistic changes which will be important to the interpretation of the painting. The creation of the magnetic film holder facilitated accurate, high-throughput positioning, and allowed for global imaging of the painting within approximately 15 hours.

Background

Pietro Berrettini da Cortona is an important artist from the early to mid-17th century known for his frescoes, oil paintings, and architecture. Analysis of other Pietro da Cortona oil paintings, such as *The Rape of the Sabine Women*, reveal *pentimenti* (compositional changes) from different stages of the working process. X-rays penetrate the paint layers to varying degrees, depending on the material's density and composition, and can provide useful information regarding a artwork's condition as well as *pentimenti*.



Figure 1. Detail from *The Rape of the Sabine Women* at the Capitoline Museum (Guarino, Sergio. *Pietro da Cortona, il meccanismo della forma ricerche sulla tecnica pittorica*, 100-101). Repositioning of a woman's arm is visible in the X-radiograph.

Results

X-radiographic imaging of *The Triumph of David* was undertaken to provide additional support for the painting's attribution to the circle of Pietro da Cortona and to gain a better understanding of the original composition. An alphanumeric grid system was organized to facilitate smooth and time-efficient transitions between exposures. This enabled quick relocation of the film holder and easy removal/replacement of the digital X-radiographic imaging film.

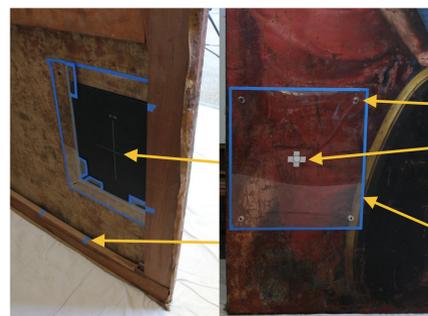


Figure 2. Polycarbonate film holder, verso and recto view, respectively.

- Rare-earth magnets
- X-ray source laser positioning target
- 14"x17" Flex XL Blue Digital Imaging Plate
- 3M ScotchBlue painter's tape covers raw edges of film holder and forms grid lines on verso of stretcher

Upon reviewing the X-radiographic images, sites that appeared overexposed or underexposed (from too much or too little excitation) were recaptured.



Figure 3. Left: *The Triumph of David* during treatment in October 2014 (photograph by Steven Crossot). Right: composite X-radiographic image stitched together using Adobe image processing software.

Results



Figure 4. Detail from *The Triumph of David*. The X-radiograph shows repositioning of Abner's thumb, fingers, and helmet (with original feather plume) as well as repositioning of David's hands and sword (flipped).

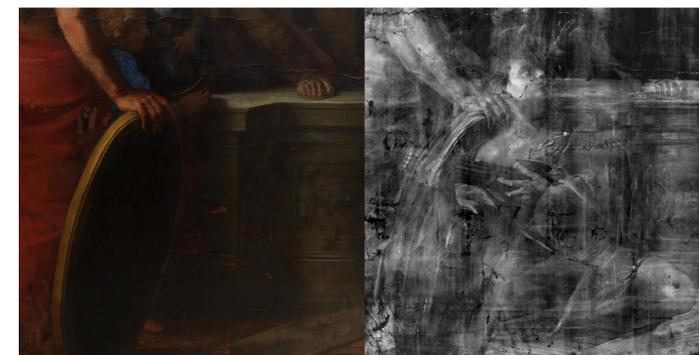


Figure 5. Detail from *The Triumph of David*. The X-radiograph shows a kneeling man holding a *fasces* (bound bundle of wooden rods, sometimes including an axe with its blade emerging). The shield and plinth visible in the completed painting were originally positioned behind this figure.

Conservation Advocacy

Live Feed



Visitors have read web-articles, such as those published on *The Philadelphia Inquirer's* website, or listened to WHYY's radio program "The Pulse". The Falvey Memorial Library blog also provides insight into findings in art history, chemistry, and conservation. Development of a permanent website is currently in progress. Follow us at:

<http://projects.library.villanova.edu/paintingrestoration/>

Acknowledgements

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