3D Scanning at the Athenian Agora and Corinth

During July of 2016, in collaboration with the Athenian Agora Excavations and the Corinth Excavations, my university instituted a pilot project to 3D scan artifacts using non-contact, active scanning technology. The project arose from a larger study on religious materiality in ancient Greece, especially the haptic experience of religion. The final 3D files and artifact images, all religious in nature, will be offered open-source for teaching and research purposes.

This project was the first attempt to laser scan artifacts at the Agora and Corinth. While 3D scanning has gained acceptance as an archaeological technology and a vital heritage management resource, the practicalities and logistics of the technology are still daunting for many. This season's work aimed to explore the scanner's limits, determine best practices, and establish the main challenges to overcome. We hoped to investigate practical field methods for digital imaging in site museums, storerooms, and at excavations. Additionally, because artifact material, texture, and form impact the quality of laser-recorded data (Slizewski 2009), we tested a variety of Greek artifact types.

The project used the newly designed and constructed STEM3D scanner, a triangulation-based laser scanner. We employed two machines, each with a different resolution and scale, the smallest measuring data points approximately every 100 microns. The scanners feature a fully-automated turntable for 360-degree recording. We recorded over 60 artifacts, in a variety of forms: inscriptions, sculptures, reliefs, pottery, and figurines. The materials included marble, limestone, bronze, lead, and ceramics of different fabrics.

The project allowed us to consider technological problems encountered by other researchers as they pertain to Greek archaeology. First, it has been long-recognized that surface reflectivity and color affect the quality of 3D scanned information, either deflecting the laser or absorbing it. With respect to Greek materials, we found that stone objects produced a strong variation in data quality due to stone type. Translucent or crystalline stone such as Parian marble not only deflected the laser at the surface, but also caused sub-surface scattering (Guidi 2009). The traditional 3D scanning method for dealing with reflectivity is to spray items with an anti-glare coating which is inappropriate for use on most heritage artifacts; archaeological materials can be treated with a conservation-grade, removable matte-agent, such as a cyclododecane spray, which sublimates naturally.

Data quality also varied with different ceramic fabrics. Harder red fabrics did well, whereas in many cases the soft yellow clay of Corinth affected the laser detrimentally. This especially seemed to be the case with figurines that had been covered with white slip, some of which required numerous rescans to acquire even tolerable results. When the Corinthian yellow clay was burnished or hardened, as with figurine molds, the laser returned extremely accurate data. In fact, the successful scanning of figurine molds indicates that reproductions of the figures themselves using digital means should be quite effective. Laser scanning highlights the assorted surface morphologies of ceramic fabrics, suggesting a potential research direction for Corinthian pottery experts and coroplastic specialists.

We were also very successful with inscriptions. Scans returned clear, legible text and well-defined tool marks and surface topography. Digital epigraphy is a growing field (Casarosa 2014), but our successful inscription tests indicate the importance that fully three-dimensional scans should hold in future epigraphic publications. More versatile and detailed than squeezes, these scans can be stored and shared online, or rematerialized for libraries and institutes. The technology possesses enormous potential for teaching Latin and Greek in the classroom.

Especially significant, these scans record the entire artifact itself, rather than only the text. 3D scanning can transform inscriptions once more into complete objects.

Incision in general, on both curse tablets and Corinthian pottery, did not show well. The results suggest that, for now, RTI is the more appropriate technology for visualizing incised lines. For those cases in which researchers desire to emphasize the form/shape of curse tablets, however, the scanners were quite effective.

3D scanning has many benefits: saving at-risk cultural heritage, documenting artifacts through an exceedingly accurate measurement system, and the acquisition of new data about archaeological objects. Working with a variety of artifact types has also further illuminated the variable uses of this technology in the Greek context. Indispensable for research, education, and outreach, 3D scanning can also change the way we haptically experience the ancient Greek world.

Bibliography

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