

# 3D Scanning and Mapping Heritage

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## Project Goals

1. Explore applications of 3D scanning technology as a method to contribute to the curation and heritage management of archaeological material.
2. Develop a simplified, yet comprehensive manual for use by academic and public communities.
3. Create digital 3D models of artifacts that can be used for education and outreach.

## Background

3D scanning and imaging software can be used in archaeological contexts to produce reproductions of both small artifacts and full sites. Blue light 3D scanning is a non-contact method to produce highly accurate measurements which can then be used to create a digital 3D Model.

The Revo Pop Mini 3D Scanner is based on structured blue light, which generates a cloud of data-points on an object with .02 mm precision at a rate of 10 frames per second.

## Methodology

The 3D scanner and observation platform are positioned so the object being scanned is within optimal range. Depth and color data are used to produce a digital reproduction. Some objects can be scanned from multiple angles within the same session, while others require manual alignment of separate scanned sections using post-imaging software. Flatter objects with higher structural symmetry tend to require manual alignment more than objects with more discernable sides.

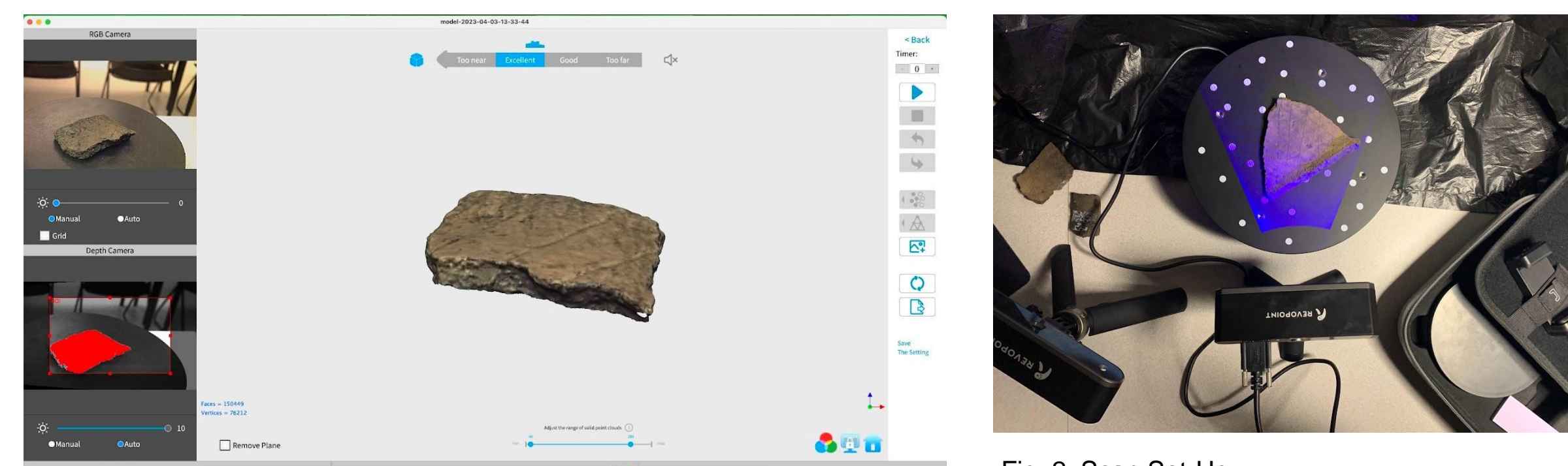


Fig. 1: RevoScan User Interface in use

Fig. 2: Scan Set-Up

After the initial 3D imaging, we used 3D post-imaging software, which allowed us to remove undesirable parts of the scans, such as noise, overlap, duplicate sections, and shadows from free standing pieces. These programs further allow for the alignment of multiple scans, which was useful when we combined surfaces of flat artifacts or removed a stand that was used to position an artifact but was not meant to be in the completed scan.

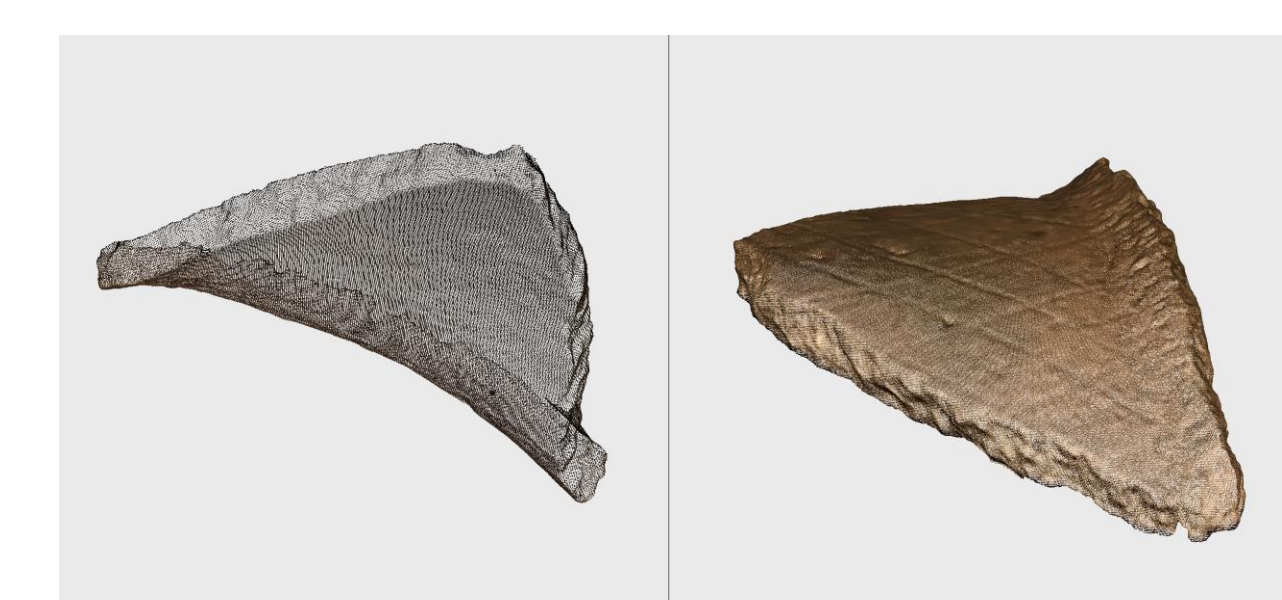


Fig. 3: Point cloud and meshed reconstruction

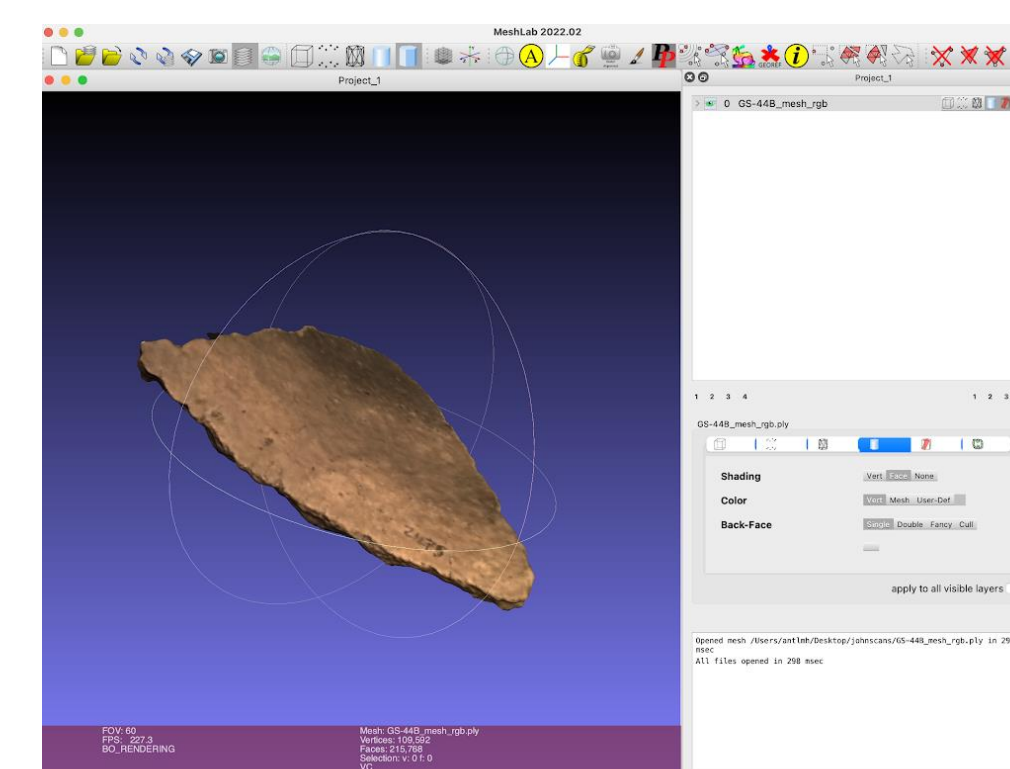
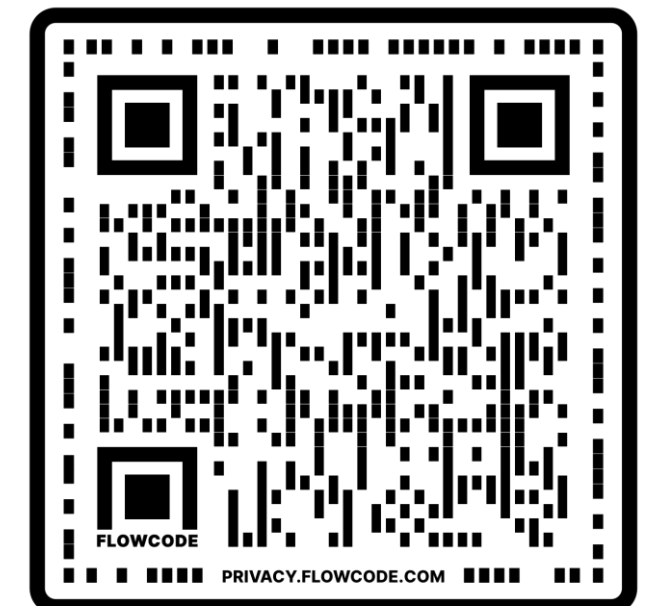


Fig. 4: MeshLab Post-Imaging Software user interface

## Results

The software used for scanning and post-imaging, RevoStudio and MeshLab, are not user-friendly for a broad audience, specifically for materials related to heritage management. To remedy this, we have created a simplified manual for use by public and academic users.



## Discussion

3D scanning is becoming instrumental in industries related to heritage and conservation. 3D scanners are different from other forms of archaeological data collection because it not only provides information about an object's surface, but also creates a digital version of the object. This version can then be used to document and communicate archaeological results to students and broader public audiences and to create physical 3D replicas of artifacts for teaching and display.

With digital 3D models, artifacts can be published to online sources, such as SketchFab, and accessed by all audiences. These sources allow for Indigenous community members, private stakeholders, and other unaffiliated researchers to see materials remotely. Additionally, digital modeling used in conjunction with 3D printing opens the door for highly accurate replicas to be used in public education programs without the fear of damaging or breaking irreplaceable materials.

Replicas can have limitations as teaching tools. We found that there are traits related to pottery decoration and spatial dimensions that can be copied with relative accuracy and precision. 3D printers can produce good replicas, but many are limited in producing quality models. Certain traits like vessel texture and artifact size require a higher quality printer to effectively produce an accurate model. Nevertheless, if you are aware of these limitations, a digital scan or printer copy can provide unique learning opportunities to interact with materials without fear of damaging the original artifacts.

The next step for research in the application of 3D Scanning in archaeology is the ethical concern of potentially altering digital reproductions and misrepresenting artifacts.

## Selected Reference

McPherron, S., Gernat, T., & Hublin, J. (2008). Structured light scanning for high-resolution documentation of in situ archaeological finds. *Journal of Archaeological Science*, 36, 19-24. <https://doi.org/10.1016/j.jas.2008.06.028>

## Acknowledgements

Drew Rausch, GVSU alum, for his involvement in the authorship of our manual.