



# Digitizing Archaeological Objects: EinScan SE's Accuracy for Curating Collections

Kiira Jeffers

Department of Sociology & Anthropology

## Introduction

- As virtual anthropology becomes more of an accepted sub-field, 3-D scanners are becoming more of a used tool for anthropology labs, allowing for the retention of information, even when the physical material is not available
- In TCNJ's case, future students won't be able to access material in the Arch Street Project, which provides a key look into the lives of some of the first colonists of Philadelphia
- Many of these 3-D scanners are outside of the price range for institutions
- Can a less expensive 3-D scanner still retain key information?

## Methods and Materials

- Used EinScan SE 3-D scanner
- Scanned 5 different items: a chimpanzee skull, a Native American replica pot, one *Australopithecus sediba* cranium, a handaxe, and a modern human cranium
- 10 rotations were done to create a full 3-D scan of the whole object
- Scans processed to allow for easy sharing of the scans
- Uploaded scans to Fusion 360
- Measured the same features on both the scan and the physical object
- Took the standard deviation for each object

## Results

Object	Measurement taken	Physical Object Measurement (mm)	Scan Measurement* (mm)	Standard Deviation
Replica Pot	Length	172	172.8	0.4
	Diameter	140	139.8	0.1
Chimpanzee skull	Occipital nuchal crest	154	146.6	3.7
	Length of canine (L)	29	27.5	0.75
<i>Australopithecus sediba</i> cranium	Nasal cavity length	21	23.6	1.3
	Nasal Cavity width	22	23.5	0.75
Handaxe	Length	128	125	1.5
	Width	76.1	74.6	0.75
Modern cranium	Mastoid process length	35	29.2	2.9
	Interorbital breadth	20	22.1	1.05

\*Due to unforeseen circumstances, the exact placement of the measurements could not be coordinated, and so some of the discrepancy in measurements can be attributed to that.

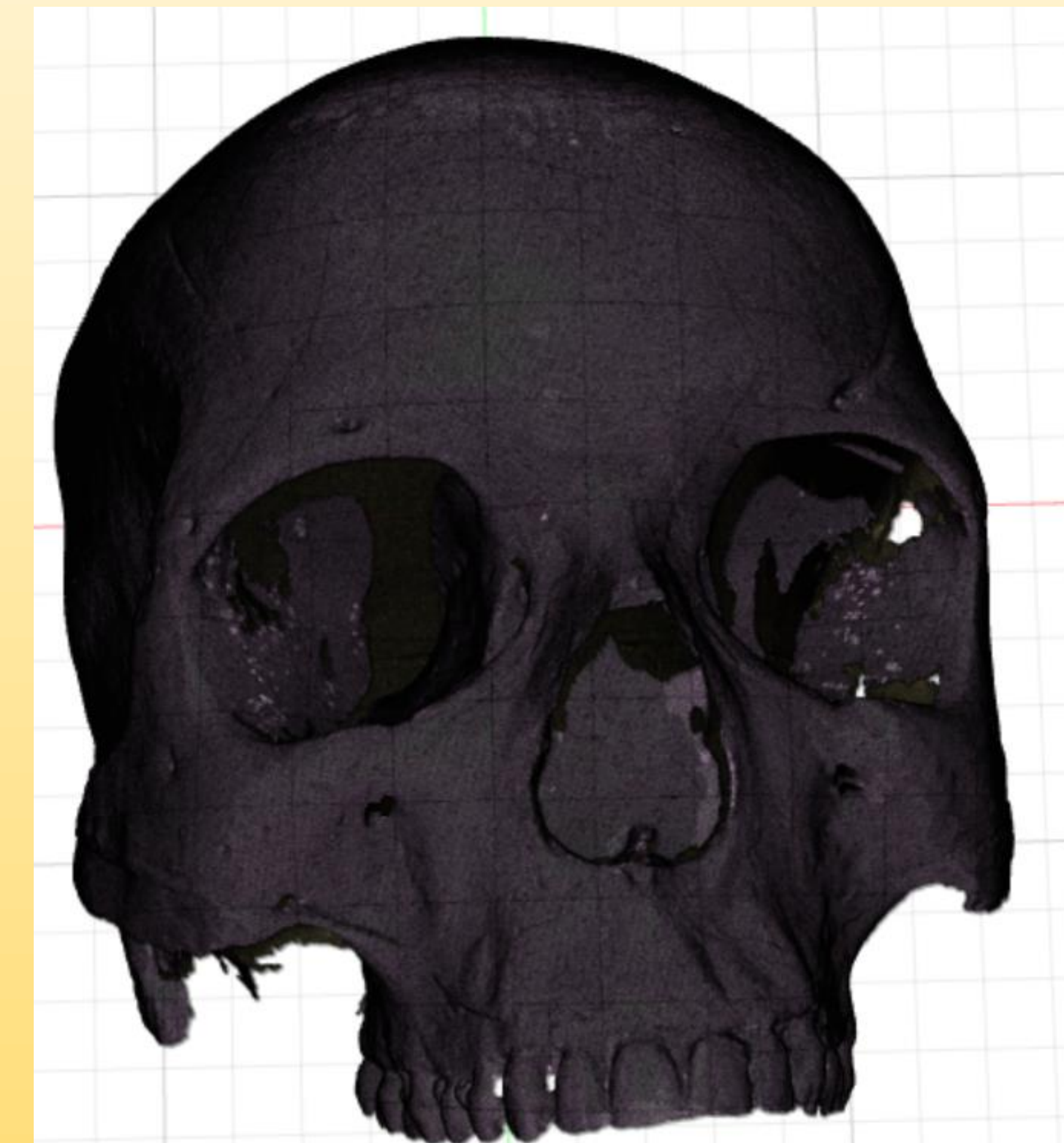


Figure 1: 3-D Scan of modern cranium

## Scanner Comparison

- EinScan S3 Cost - \$1199
- Used gaming laptop cost (for the EinScan software) - \$300
- Fusion 360 - free
- Leading competitors scanners both used for biological anthropology and archaeology: NextEngine and ARTEC (Sholts et al., 2010; Perez et.al, 2019)
- Cost of Next Engine is estimated at \$3000.
- Cost of ARTEC ranges from \$9,800 to \$29,300 for handheld and desktop scanners.



Figure 2: 3-D scan of chimpanzee skull

## Conclusion

- The EinScan SE was accurate within 0.1 mm.
- Due to how the scans were taken, some of the skulls had holes in them where the scans were stitched together, but it rarely interfered with the measurements. Different ways of scanning with more rotations should be looked into to reduce holes.
- The inability of one person to both measure the scan and physical object accounts for some of the discrepancy between the measurements (Covid-19).
- Minimizing interpersonal error will make it accurate to reasonable research error.
- Future research should focus on the scanning of actual crania and other bones that carry important features, such as the *os coxae*.

## References

1. Perez, E., Merchan, M. J., & Salamanca, S. (2019). Fusion of 3D digitization technologies for the virtual exploration of re-covered archaeological remains. In P. O. Calderón, F. P. Puerto, A. J. Prieto, & P. Verhagen (Eds.), *Science and Digital Technology for Cultural Heritage - Interdisciplinary Approach to Diagnosis, Vulnerability, Risk Assessment and Graphic Information Models* (pp. 150–154). CRC Press.
2. Sholts, S. B., Wärmländer, S. K., Flores, L. M., Miller, K. W., & Walker, P. L. (2010). Variation in the Measurement of Cranial Volume and Surface Area Using 3D Laser Scanning Technology. *Journal of Forensic Sciences*, 55(4), 871–876. doi: 10.1111/j.1556-4029.2010.01380.x

## Acknowledgements

Thank you to Dr. Leader and the Department of Sociology and Anthropology.