



A Comparison of Three-Dimensional Scanning Methodologies in Digital Reconstruction of Lithics

Marcelina Nagales

Supervisor: Dr. Bryan Quaife

Department of Scientific Computing, Florida State University

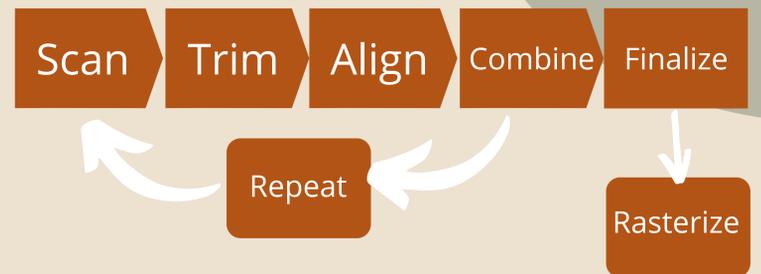


Abstract

We compare different methodologies to digitize lithics projectile points/knives. North American projectile point/knife (PPK) typology and classification varies widely across cultural groups, time period, geographic locale, and archaeological interpretation. The Florida Bureau of Archaeological Research is compiling a digital archive of 3D PPKs to facilitate virtual research that is confined to the curatorial facility. Comprising of different types of PPKs from the Southeastern United States, high-resolution 3D scanners and photogrammetry were used to create highly accurate 3D renderings. The HDI LMI 109A scanner with FlexScan software uses blue light scanning to create black and white 3D models that were rasterized with images taken of the physical object using Meshlab. The NextEngine Ultra HD scanner with ScanStudio Software uses stereographic cameras and LED light to create 3D color models. Photogrammetry—using a DSLR camera, Agisoft software, and photograph editing software—allows for model modification in response to environmental and light exposure factors. These 3D renderings from different 3D creation methods were compared using Cloud Compare software and Ben Pomidor's Generalized Procrustes Surface Analysis (GPSA) software. Cloud Compare uses the meshes of the same object from each methodology and compares them by calculating the distance between landmarks. GPSA software also compares the meshes of the same object from each methodology by calculating distances but without using landmarks. The two methods of comparison can reinforce and improve our understanding of the difference between 3D scanners and photogrammetry. This research project discusses the differences between methods specifically for scanning a variety of PPKs and provides a set of instructions for researchers who will digitize PPKs in the future. Additionally, we continue to build the archive to include a broader representation of Southeastern lithic technology and apply this methodology to other artifact types and typologies.

Processes

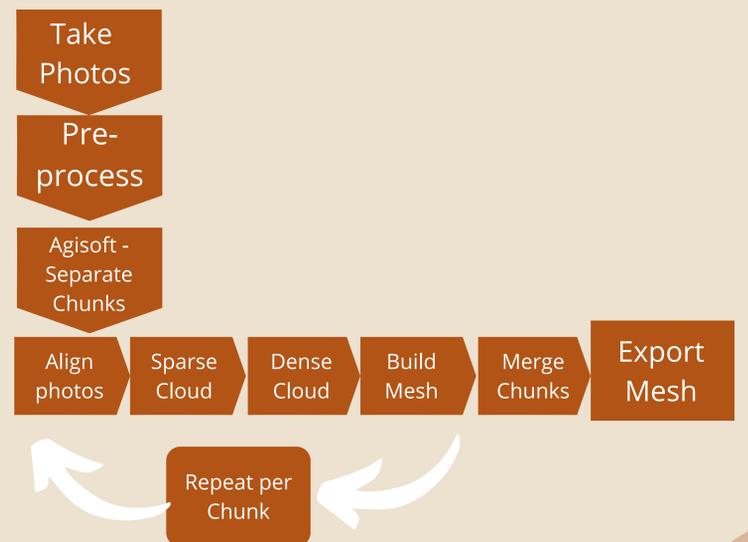
LMI HDI 109A



Nextengine Ultra HD



Photogrammetry



Methods



Figure 1

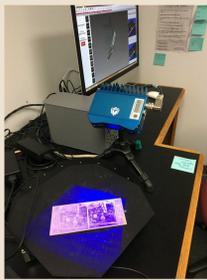


Figure 2



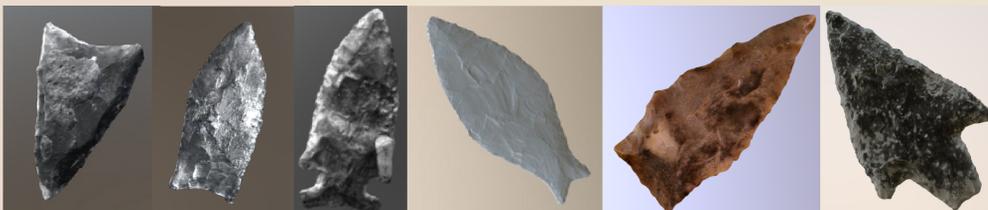
Figure 3

Figure 1: Photogrammetry set up at the FBAR with green fleece background and styrofoam markers

Figure 2: LMI HDI 109A 3D scanner set up with rotary table and FlexScan software

Figure 3: Nextengine Ultra HD 3D scanner set up with accompanying rotary table and stand

Materials



Dalton

Suwannee

Bolen Beveled

Simpson

Jackson

Newnan

Results

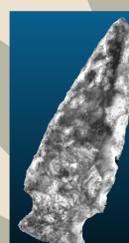


Figure 4



Figure 5

Comparing the same Jackson type ppk from two different 3D creation methods: LMI HDI 109A (Fig. 4) and photogrammetry (Fig. 5)

Cloud Compare visualization of the distance between the two models: the mean relative distance is calculated to be 0.39

Fig. 6 and 7 show that the two models differ mainly in the basal ears and the tip of the Jackson ppk.

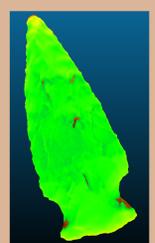


Figure 6

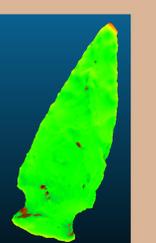


Figure 7

Acknowledgements

Florida State University, Dept. of Scientific Computing, Dr. Dennis Slice, Dr. James K Soda, Dr. Ben Pomidor, and Stephen Townsend;

Florida Division of Historical Resources, Florida Bureau of Archaeological Research. Dr. Kathryn Miyar, Dr. Sam Wilford, Marie Prentice, and Jeremy Vause;

This research was supported, in part, by a 2015 FSU EIEG Award: 3D Surface Scanning Systems for Morphometric Data Acquisition