Did intended firing method condition the morphology of Caddo bottles?

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Color is afforded primacy in ceramic production inquiries, as it provides evidence linked with use, raw material variability, and method of firing. This study is focused on the latter, and asks whether Caddo potters conditioned the morphology of bottles based on the method in which they intended to fire them. Thirty three-dimensional (3-D) scans of Hickory Engraved and Smithport Plain bottles were collected from five museums and repositories, and provide 360-degree coverage of exterior colors associated with each vessel. Texture (color) files were used in a quantitative analysis of color where vessels were subsequently binned into two groups based upon firing method; oxidized and reduced. The 3-D meshes were then analyzed using the tools of geometric morphometrics to assess whether bottle shape and size differ by method of firing. Results demonstrate significant differences in both color and bottle shape—but not size—by firing method. Thus, Formative/Early Caddo potters conditioned the shape of Hickory Engraved and Smithport Plain bottles based upon their intended firing method. This finding provides evidence for two discrete, contemporary, and sympatric Caddo potting communities delimited by macroscopic production attributes, advancing our understanding of Caddo decision-making behaviors related to Formative/Early bottle production.

***Keywords: NAGPRA; American Southeast; Caddo; ceramic; pottery; 3D; computational archaeology; museum studies; digital humanities; non-Western art history; STEM; STEAM***

METHODS

Each of the 30 vessels was scanned (3D) using a Creaform GoSCAN20 to capture color and geometry. Following data collection, each scan was exported as an .obj file, which includes a bitmap image of the surface color for the entire vessel. Images were then transferred to a transparent background in Photoshop in preparation for analysis using the *colordistance* package in R ([R Core Development Team 2023](#_ENREF_1)). Upper and lower limits of the color range were determined based on colors present in the sample. Ten thousand randomly selected pixels were plotted from each image, a histogram binning method was used to group similar colors for each specimen, and pairwise distances between histograms were computed using earth mover’s distance.

Bottles were coded as ColorGroup A (reduced) and ColorGroup B (oxidized) using the output from a neighbor-joining tree, calculated using the color distance matrix. To test whether vessels differ in color according to ColorGroup assignment, the color distance matrix was exported and joined with categorical data. Those data were used in a permutational multivariate analysis of variance in the *vegan* package to evaluate whether vessel color differs by firing method (*permutations: 10,000; Rsq: 0.4342;* ***Pr(>F): 9.999e-05***).

REFERENCES CITED

R Core Development Team

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