A7 3D Image Technology in Forensic Anthropology: Assessing the Validity of Biological Profiles Derived From Computed Tomography (CT) 3D Images of the Skeleton

M. Julia Garcia de Leon Valenzuela, MSc, The International Institute of Forensic Sciences, 1670 E River Road, Ste 124, Tucson, AZ 85718*

After attending this presentation, attendees will understand the benefits and limitations the use of 3D technology poses on the creation of biological profiles in forensic anthropology. Attendees will also be informed as to how these issues can be addressed in current and future research.

This presentation will impact the forensic science community by exploring research results that contribute to the growing literature of virtual anthropology, the use of which could theoretically enable forensic anthropologists to derive skeletal collections from living populations and by creating population-specific standards as well as digitizing entire osteological collections, which would enable research to be conducted without the limitations that travel and accommodation costs impose on researchers.

This project explores the reliability of building a biological profile for an unknown individual based on 3D images of the individual's skeleton. 3D imaging technology has been widely researched for medical and engineering applications, and it is increasingly being used as a tool for anthropological inquiry. While the question of whether a biological profile can be derived from 3D images of a skeleton with the same accuracy as achieved when using dry bones has been explored, bigger sample sizes, a standardized scanning protocol, and more inter-observer error data are needed before 3D methods can become widely and confidently used in forensic anthropology.

3D images of CT scans were obtained from 130 innominate bones from Boston University School of Medicine's skeletal collection. For each bone, both 3D images and original bones were assessed using the Phenice and Suchey-Brooks methods. Statistical analysis was used to determine the agreement between 3D image assessment versus traditional assessment. A pool of six individuals with varying experience in the field of forensic anthropology (at the beginner, intermediate, and expert levels) scored a subsample (n=20) and the data obtained were used to explore inter-observer error. The results of the inter-observer portion of this study exhibited mixed results. While a high agreement was found for age and sex estimation for specimens scored by an expert, the inter-observer study shows that observers found it difficult to apply standard methods to 3D images. Higher levels of experience did not result in higher agreement between observers, contrary to what was expected. These results were also contrary to those obtained for the main portion of the study, in which a good correlation was found between scores obtained for dry bones versus those obtained for their 3D counterparts (n=130). Thus, a need for observer training in 3D visualization before applying anthropological methods to 3D bones is suggested. Future research should explore inter-observer error using a larger sample size in order to test the hypothesis that training in 3D visualization will result in a higher agreement between scores. The need for the development of a standard scanning protocol focusing on the optimization of 3D image resolution is highlighted.

Applications for this research include the possibility of digitizing skeletal collections in order to expand their use and for deriving skeletal collections from living populations and creating population-specific standards. Further research for the development of a standard scanning and processing protocol is needed before 3D methods in forensic anthropology are considered as reliable tools for generating biological profiles.

Virtual Anthropology, 3D Technology, Biological Profile