A44 Applications of 3D Technology in Forensic Anthropology

Helen Cho, PhD, Davidson College, PO Box 6934, Davidson, NC 28035; Eun Jin Woo, PhD*, Seoul National University, Dept of Anthropology, San 56-1, Silim-dong, Kwanak-gu, Seoul, SOUTH KOREA; Hae Joung Cho*, MAKRI in Hyunchungwon, Dongjack-gu, Seoul, SOUTH KOREA; Yu Ryang Jang, PhD*, 65 Hyeonchung-ro Donggak-dong, Donggak-gu, Seoul 156-080, SOUTH KOREA; and Nahyok Im, PhD*, 65 Hyeon Chung-Ro, Dong Jak - Gu, Seoul 156-080, SOUTH KOREA*

After attending this presentation, attendees will better understand the different types of 3D technology and their applications in forensic anthropology and related forensic disciplines.

This presentation will impact the forensic science community by providing results that compare various 3D scanning systems and the quality of the models produced. This presentation encompasses a relatively new type of technology and novel applications in forensic anthropology and related disciplines such as forensic art.

With the advent of 3D technology, the potential applications are numerous in the forensic sciences. Forensic anthropology and related disciplines, such as forensic art, can benefit from 3D imaging technology and 3D printing of skeletal remains. One of the main objectives of forensic anthropology is to reconstruct the biological profile of the unknown skeletonized individual. Whether the remains are positively identified and should be returned to the next of kin, or unidentified and kept in custody, the bony remains may be needed for anthropometric analyses and facial reconstruction. Both 2D photography and scanned images may be insufficient for further anthropometric analyses if the original remains are unavailable for pragmatic reasons. Performing facial reconstruction on the actual skull may be impermissible, and utilizing the real human remains as physical models in court while serving as an expert witness may be deemed unethical and disturbing to the audience. Furthermore, rare anatomical and anthropological specimens can be reproduced for educational purposes. Thus, 3D technology can be a necessary tool for forensic anthropologists to create replicas of the skeletal remains.

In this regard, the most important issue is the quality of the 3D model. Anthropometry requires precise measurements of standardized osteological landmarks, and these quantified data are then employed to derive the biological profile of the unknown individual. The quality of 3D replicas is dependent on image resolution and digitizing systems. Although digitizing natural bone at a high resolution will result in a more precise model, access and availability of the best digitizing system and the 3D printer may be limited to organizations such as law enforcement and universities. In this study, the quality of the anatomical models created from a single 3D printer using various digitizing systems was compared.

Three different techniques were employed to digitize a skull at the Central Identification Laboratory in the Ministry of National Defense in Seoul, Korea. Three separate systems were printed with the Zprinter® 650 powder-based 3D printing technique utilizing a powder composed of plaster and a starch/cellulose mixture at the speed of 28mm per hour. The digitizing systems were as follows: (1) Computed Tomography (CT); (2) an ATOS 1 (0.8M) 3D scanner with software that captures the image in an 800,000-pixel triangle mesh; and, (3) a PHT-6500 panorama X-ray with a rotating X-ray tube that captures a panoramic image of the object. To test the quality of the replicas, 34 standard cranial measurements (e.g., nasal height, bigonial width, mandibular angle) were collected from the original skull and the CT, ATOS 1, and PHT-6500 models for comparison.

Based on the results of this study, although CT scans produce the highest resolution images in general, it may be unnecessary to rely only on CTs when comparable technology is available and more accessible.

3D Printing, 3D Scanning, Anthropometry