A49 3D Web-Based Technologies to Support Interactive Forensic Anthropology Databases

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Learning Overview: After attending this presentation, attendees will understand the available open-source web-based technologies for enabling interaction with 3D bone models to enhance existing and new forensic anthropology reference databases and applications both online and offline.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the implementation of 3D web technologies into forensic databases to encourage interactive references, accessibility to common datasets, and enhancement of quantitative applications.

3D skeletal models provide an opportunity for anthropologists to interact with examples of skeletal variation, pathology, and trauma, to demonstrate data collection procedures, and to develop quantitative methods in place of or in support of visual methods. The availability of medical imaging databases and digitized dry skeletal specimens can improve access to skeletal variation and contribute to common reference datasets. Additionally, the sharing of generated 3D models or de-identified volumetric medical imaging data can provide method training for specific applications, while reducing duplicate digitization/rendering efforts. Despite the availability of free software such as 3D Slicer for generating 3D models from medical imaging data and other free software for interacting with 3D models, the learning curve for 3D software can be steep, and the time required to develop proficiency and to generate large numbers of models may be prohibitive to some anthropologists. Therefore, the ideal sharing mechanism for 3D skeletal models would provide a widely accessible, straightforward interface with simple tools such as multi-model visibility, cross-sectional clipping, transparency, measuring, annotations, and have cross-platform capability and portability with offline viewing options to protect data that cannot be distributed online.

Web-based technologies have progressed to facilitate customizable, open-source 3D interactivity within a browser window utilizing HTML and JavaScript™ to support common 3D model formats. Existing online 3D repositories allow for private/protected viewing, but do not include features such as dynamic clipping, measuring, or multi-model visibility. 3D Heritage Online Presenter (3DHOP) (3dhop.net) was developed to display cultural heritage resources online but also supports offline viewing and has been demonstrated by this study on both tablet and laptop with references for facial approximation, micro-Computed Tomography (CT) skeletal specimens, and full body CTs containing multiple models. Models can be in a PLY format with solid color, color mapping, or in a compressed format optimized for "streaming" large models over the web. Three.js (threejs.org) supports models in various formats as well as de-identified CT volumes or sub-volumes generated with 3D Slicer or Fiji. Although the code for these applications is open-source, 3D HTML pages do not need to live online as they also function offline utilizing a local server or by allowing the browser to read local files. Additionally, customized packages or the models or volumes can be placed online under registration-only access or provided for offline viewing via request or data repository. 3D HTML pages are also supported by R Shiny (shiny.rstudio.com) allowing quantitative applications to include 3D references/examples or for attachment of 3D models to existing applications. The cross-platform capabilities and offline viewing would also support the demonstration of 3D evidentiary models with custom viewers in the courtroom.

This presentation will demonstrate how 3DHOP and three.js can be customized for forensic anthropology applications, 3D HTML integration with R Shiny, and options for online or offline implementation.

3D Modeling, HTML, Virtual Anthropology

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