



Physical Anthropology Section – 2010

H63 Virtual Sex: Phenice and Metrics of the Pelvis From 3D Computed Tomography (CT) Models

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The goals of this presentation are to introduce a new sample of over 70 modern virtual skeletons with known biological profiles, as well as the results of a pilot study using three-dimensional (3D) medical imaging and computer modeling technologies to validate standard sex and novel sex estimation methods of the human pelvis.

This presentation will impact the forensic community by serving to increase scientific knowledge of new technologies and methods available to the forensic community for human identification. It will also attempt to add to the body of knowledge on sex estimation from the pelvis, as well as provide an example for a new source of data.

The University of South Florida College of Medicine has accumulated three-dimensional (3D) data from medical scans (Computed Tomography (CT) and Magnetic Resonance Imaging (MRI)) of donated cadavers and clinical scans into a collection of virtual bodies. Previous studies^{1,2} have demonstrated that three-dimensional (3D) imaging technologies are allowing researchers to create virtual computed models of anatomical structures that go beyond traditional anthropological resources. Virtual models of skeletons from the scanned individuals have been made in order to test anthropological methodologies used in the creation of the biological profile. This study focused on the estimation of sex from the pelvic bones. The most widely accepted technique for sex estimation of the pelvis is based on multivariate evaluation of morphological traits. Sexually diagnostic non-metric traits include the width of the greater sciatic notch, ventral arc, subpubic concavity, and medial aspect of the ischio-pubic ramus. Documented success rates of Phenice³ and Phenice-derived methods^{4,5} consistently report accuracy rates in excess of ninety percent when performed by trained individuals. The goal of this project was to undergo a validation study to determine if sex can be estimated metrically and non-metrically from computed 3D models of the os coxa from a collection of known individuals.

The accuracy of both visual and metric sex traits of the pelvis were statistically evaluated in comparison with antemortem biological profiles. Using a random selection from the 70+ known individuals, os coxa models were extracted from the CT scans and modeled in *Mimics*[®] version 13. The pelvis were then registered against each other and pelvic sex traits were analyzed in 3D space in the software package. Phenice traits³ were compared with metric curvature modeling of the sub-pubic concavity. All measurements were independently verified by two trained anthropologists with the inter- and intra-observer error calculations. Additionally, student data was also used to evaluate the effects of experience on correct classification and measurement techniques.

This project demonstrates the potential for virtual data such as the USF College of Medicine's Virtual Skeleton Collection to increase the resources available to researchers. With the addition of more modern human data, traditional methodologies such as those used to estimate the biological profile can be re-examined and the current knowledge base expanded. The virtual pelvis can provide limitless opportunities for discovery of robust methods applicable to real-world problems in forensic anthropology.

References:

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Sex Estimation, Computer Modeling, Virtual Anthropology