

National Institute of Justice

Award Title: MODELING SURFACE MORPHOLOGY OF THE PUBIC SYMPHYSIS: Quantitative Methods and Computational Tools for the Objective Estimation of Age-at-Death for Modern Populations

Award Description:

As submitted by the proposer:

The pubic symphysis is widely used to estimate age from the adult skeleton. Standard practice requires the visual comparison of its surface morphology against a set of population-specific criteria representing pre-defined phases. The case-specific age-at-death is estimated from the age-range previously associated with the assigned phase. While this approach is appealing for its simplicity, the process of bone-to-phase-matching is conditional upon the variation in the comparative samples and driven by the user; as such it is methodologically subjective. The efficacy of this kind of approach is, therefore, dependent upon the experience of the practitioner and the typicality of the skeletal element under analysis. The problems of method and observer error suggest that there is an immediate need to develop alternative tools for the rigorous quantification of age-related change in skeletal morphology that better approximate true chronological age, regardless of sample source and level of training, and better meet medico-legal standards of scientific evidence.

This project seeks to improve age-estimation in forensic anthropology by developing objective, quantitative methods that merge skeletal analysis and scientific computing. Preliminary work has involved the use of a variance-based and thin-plate splines scores of surface complexity computed from vertices obtained from a scanner sampling the pubic symphyseal surface. Both scores are significantly associated with known age-at-death. For further method refinement, laser scan data on multiple, established age indicators from approximately 3200 available modern American, Japanese and Thai skeletons will be collected. The new data will be used to assess the role of grid density and surface sample resolution. Improvements will also be sought by developing partitioning schemes to objectively identify which, if any, geometrically defined subregions of the indicator are most useful ζ a point of interest for fragmentary remains. Extension of methods will also involve outline analysis, two-dimensional Fourier analysis, wavelet parameterization, regression models and Bayesian analysis.

Using the additional data, this project will also determine the effects of sample diversity and asymmetry on estimation, test the applicability of the proposed methods to multiple skeletal age indicators (pubic symphysis, auricular surface, sternal rib ends, medial clavicle) when treated independently and combined, and compare our approach against traditional skeletal aging methods. Project results will be disseminated at forensic science meetings and in high-visibility journals. Free access software, a reference sample data base, and training workshops will be delivered to ensure the easy and consistent implementation of our methods by a wide variety of forensic caseworkers.

This project contains a research and/or development component, as defined in applicable law.

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Awardee Name: Florida State University	Award Number: 2015-DN-BX-K010
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