



Anthropology Section - 2015

A61 Testing Inter-Observer Reliability of the Transition Analysis Aging Method on the William M. Bass Forensic Skeletal Collection

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After attending this presentation, attendees will gain an understanding of the Transition Analysis (TA) component-scoring and age-estimation method and its applicability in a modern, forensic skeletal collection.

This presentation will impact the forensic science community by providing method-validation information for the repeatability and teachability of the TA method by assessing the degree of variation in age estimates produced from differently assigned scores.

Age estimation is an integral part of the biological profile generated by forensic anthropologists presented with a set of unidentified skeletal remains. For nearly a century, scholars have investigated age-related changes to the adult skeleton with varying degrees of success. It is generally understood that accurate and precise age-at-death estimates derive from the evaluation of multiple anatomical elements and skeletal traits (or components) within an anatomical element rather than isolated, single-age indicators. Multiple-trait approaches better capture the sequential aging process that occurs at different rates among individuals and, therefore, provide a more reliable age estimate. The TA age-estimation method of Boldsen and colleagues is one such component scoring system.¹ This method utilizes skeletal observations of the pubic symphysis, auricular surface, and cranial sutures to make inferences about the timing of transitions of specific osteological traits from one stage to the next. The transitional ages derived from skeletal traits are then inverted using Bayes theorem in combination with prior knowledge on the age-at-death distribution of the target in order to calculate maximum likelihood estimates and 95% confidence intervals. Boldsen et al. urged others to validate the TA method and, in the last decade, several studies have responded to this call.²⁻⁵ The current study seeks to contribute to this discourse and is the first inter-observer error study using TA with more than two observers. Specifically, inter-observer error tests among practitioners representing varying levels of TA scoring experience have been carried out in an effort to assess its applicability to achieve accurate age-at-death estimates.

The sample data consist of 58 positively identified cases from the William M. Bass Forensic Skeletal Collection curated at the University of Tennessee, Knoxville. The Bass Forensic Collection is a skeletal collection of 20th- and 21st-century Americans. Five researchers independently applied the TA method as described by Boldsen et al. to the available elements with no prior knowledge of chronological age. These scores were input into the software and maximum likelihood estimates and 95% confidence intervals attained using the United States homicide prior distribution. To evaluate inter-rater reliability and agreement of the raw scores, Krippendorff's alpha values were calculated for each trait using R. Unlike other specialized coefficients such as Cohen's or Fleiss's Kappa, Krippendorff's alpha is a generalization of a number of reliability indices and allows for more than two observers, any measurement level, small sample sizes, and incomplete or missing data.⁶ Alpha values close to one denote increased reliability while values nearing zero signify less reliable measures.

Krippendorff's alpha values indicate that the majority of traits had a moderate to excellent agreement among observers with a 0.6 or better level of agreement. For a single trait, superior surface morphology had the least amount of congruence (0.355) and the ventral symphyseal margin had the most congruence among scores (0.903). A repeated measure Analysis of Variance (ANOVA) demonstrates that, despite differences among the five raters with regard to knowledge of the TA method, there are no statistical differences between the maximum likelihood ages estimated by each observer and the true ages. These results indicate that the TA method can be reliably used by researchers of varying experience levels to estimate the age of an unknown individual.



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References:

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