H29 Reassessment of Cranial Trait Scores: Effects of Sex, Population, Age, and Body Size

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After attending this presentation, attendees will understand the effects of sex, population, age, and body size on cranial trait scores, and how these effects are relevant to sex determination methods.

This presentation will impact the forensic science community by providing knowledge regarding the reliability of cranial sex traits, the factors influencing cranial trait scores, and suggestions regarding which of these factors should be considered during sex determination methods.

Forensic anthropologists continue to rely on morphological cranial traits as key variables in sex determination methods. Typically, forensic anthropologists score the morphological expression of the glabella/supraorbital ridge, orbital margins, mastoid process, mental eminence, and nuchal crest using ordinal scales, such as those presented in Buikstra and Ubelaker (1994).[1] While numerous studies evaluate the diagnostic significance of these trait scores, investigations of the factors influencing these trait morphologies remain much more limited. These factors can be vital when applying sex determination methods using these traits. Traits may be highly variable in their expressions or patterns between populations, which would support the need for population-specific standards of assessment. For example, some populations may display relatively more "masculine" or "feminine" traits, and would therefore be more likely to be misclassified by a set of universal standards. The reliability of specific cranial traits may also vary between populations with differing levels of sexual dimorphism. Furthermore, if age-at-death or body size is highly correlated with cranial trait scores, these factors should be taken into consideration during sex determination methods to obtain accurate results.

In order to address these problems, cranial trait scores and postcranial size measurements were obtained from males and females across six different samples: (1) Bass Donated Collection European-Americans; (2) Terry Collection European-Americans; (3) Terry Collection African-Americans; (4) Hamann-Todd Collection African-Americans; (5) Kulubnarti medieval Nubians; and, (6) Arikara Native-Americans. Data were obtained from at least 30 males and 30 females of each sample (total n = 498). Age-at-death and sex were known for the documented samples, and were estimated in the archaeological samples using traditional aging techniques and pelvic morphology. Pooled and sample-specific statistical analyzes were conducted to evaluate how cranial trait scores vary with each other, as well as with sex, population, age, and postcranial size.

Across- and within-sample analyzes revealed significant sex differences in all five cranial traits (p-*value* < 0.05). Discriminant Function Analysis (DFA) results revealed that glabella and the mastoid process were the best cranial trait sex indicators, whereas nuchal crest scores were the least reliable. Sample-specific correct DFA classification rates ranged between 86 and 94%. Kruskal-Wallis tests confirm significant sample differences in all cranial traits, including significant differences between Terry European-Americans and Bass European-Americans (e.g., p-*value* < 0.01 for nuchal crest, mastoid, and orbital margin differences in both sexes), and between Terry African-Americans and Hamann-Todd African-Americans (e.g., p-*value* < 0.05 for nuchal crest, orbital margin, and mental eminence differences in both sexes). These results suggest not only ancestral differences, but also more specific sub-population differences or possible secular trends. On average the Bass European-Americans exhibited greater (more "masculine") scores in all traits, except the mental eminence. However, no other consistent patterns in sample differences could be discerned. For example, a greater average score in one trait did not coincide with greater scores in other traits. Furthermore, samples of similar ancestries did not necessarily display similar trait scores. Jonchkeere-Terpste test results support an overall increase in trait scores with femoral head diameter when males and females are pooled separately (p-*value* < 0.05 for all traits except mental eminence in males and orbital margin in females), but these relationships are mostly lost when samples are analyzed independently. Similarly, pooled sample results indicate a significant trend in nuchal and glabella scores with age (p-*value* = 0.000 for both traits in both sexes), but in many of the sample-specific analyzes these relationships do not reach statistical significance.

In summary, regardless of the sample, glabella and mastoid process were found to be the most reliable cranial sex indicators. Significant sample differences in trait expressions, even between samples of the same ancestral group, suggest that sample-specific standards would likely increase the accuracy of sex determination methods. When all samples were pooled, however, discriminant function analyzes were still capable of correctly sexing 86.5% of individuals, indicating that in the absence of sample-specific standards, a universal set of sex standards will still provide accurate results. Although the results of this study support a general increase in trait scores with body size and age, these relationships are weak (r^2 < 0.14) and not likely of significance during sex determination methods.

Reference:

[1] Buikstra JE, Ubelaker DH. Standards for data collection from human skeletal remains. Fayetteville: Arkansas Archeological Survey, 1994

Sex Determination, Cranial Traits, Population Variation

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