



Physical Anthropology Section - 2013

H35 Craniometric Sex Determination in the Modern Thai Population

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The goal of this presentation is to introduce population-specific discriminant functions for sex determination in the modern Thai population and provide an understanding of patterns of sexual dimorphism within this population.

This presentation will impact the forensic science community by filling a gap in currently existing normative craniometric databases, and providing novel, statistically robust, population-specific discriminant functions for sex determination when analyzing unidentified individuals known or believed to be of Southeast Asian, specifically Thai, ancestry.

Metric approaches to the analysis of human variation are among the oldest scientific traditions in the field of physical anthropology. Despite an ignoble intellectual adolescence, which saw craniometrics applied tacitly and overtly in support of racist sociopolitical and pseudoscientific agendas, these methods have matured into a robust and respected part of modern physical anthropology's analytical engine. Craniometric studies now find application throughout the whole of the discipline. Forensic anthropology is no exception, as craniometric analyses are essential tools for the determination of sex and ancestry in unidentified human skeletal remains. Yet the validity of such analyses depends upon having population-specific reference datasets of sufficient robusticity to adequately characterize the true range of morphological variation within a given population. This is especially true of craniometric discriminant function analyses (the preferred metric method for sex and ancestry determination), in which both the classification of an unknown individual and that classification's statistical certainty (in terms of posterior and typicality probabilities) is driven entirely by patterns of variation within and among the reference populations used to generate the discriminant functions. Reliable sex determination standards that are appropriate for the population(s) under consideration are of particular importance to forensic anthropology, as the determination of all other parameters of the biological profile is predicated on an accurate assessment of an unknown individual's sex. Similarly, reliable standards for ancestry determination are critical to identification efforts, as ancestry is arguably the second-most dominant criterion, after biological sex, by which individuals are classified and identified.

The 2004 Indian Ocean tsunami, which killed nearly 250,000 people in South and Southeast Asia, including approximately 8,200 in Thailand, is but one of a series of natural disasters and human rights violations that have laid bare the need for regionally-based, population-specific forensic anthropology standards and normative datasets. With regards to Southeast Asia, several studies have demonstrated significant patterns of craniometric variation among local populations within the region; however, to date, only a few scientific articles addressing the need for Thai-specific forensic standards have been published in the international forensic literature. Importantly, these studies clearly demonstrate that the available American standards are inaccurate when applied to Thai populations and, in such applications, lead to systematic misclassifications of Thai males as females, due to the relative gracility of the Thai population as compared to American populations. Nevertheless, these studies are an insufficient remedy to the lack of appropriate population-specific standards for the Thai, as they primarily address sex determination from postcranial skeletal elements, which are commonly regarded as less informative and reliable than the more robust craniometric analyses (but cf. Spradley and Jantz 2011).¹

To address these issues, 20 standard cranial measurements were collected on a large sample (n=385; 262 males/123 females) of modern Thai skeletons from three medical school anatomical collections (Chiang Mai, Khon Kaen, and Naresuan Universities). These craniometric data were used to generate two separate linear discriminant function equations for sex determination: (1) using the full set of 20 craniometric variables; and, (2) using eight forward stepwise-selected variables to generate a function potentially applicable to incomplete crania. In both analyses, the discriminant functions were found to be most strongly driven by the larger, more generalized dimensions of the cranial vault and facial skeleton that contribute significantly to the overall size differences between males and females. This mirrors the patterns of variable selection observed in other craniometric studies, and indicates the broad pattern of craniometric sexual dimorphism within the Thai population does not differ significantly from other ancestry groups. Additionally, these functions have cross-validated correct classification rates of 82.6% and 82.9%, respectively. These results are similar to the performance of other population-specific sex determination standards, indicating the validity and broad utility of these functions to forensic anthropology, both in Thailand and the United States.

Reference:

1. Spradley MK, Jantz RL. Sex estimation in forensic anthropology: skull versus postcranial elements. *J Forensic Sci* 2011; 56(2):289-96.

Craniometrics, Sex Determination, Southeast Asia