H94 Craniometric Variation Within Southeast Asia

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After attending this presentation, attendees will understand the utility of discriminant function analysis, Mahalanobis' Generalized Distance, and cluster analysis as a means of observing regional differences in supposedly homogenous "Asian" populations.

This presentation will impact the forensic science community by proving that intra-regional differences can be seen in Southeast Asian populations, thus allowing anthropologists to create a more accurate biological profile which can aid in narrowing a missing persons list.

Craniometrics are frequently used to investigate human variation within and among populations. Work by W. W. Howells (1973, 1993, 1995) investigated craniometric variation among geographic areas worldwide. More recently, Pietrusewsky (1992) investigated craniometric differences in modern Southeast Asian populations. While his focus was population history, this study focuses specifically on regional differences in Southeast Asia.

The ability to accurately discriminate between populations is beneficial in aiding in a more accurate biological profile which could potentially narrow down a missing persons list. In forensic anthropology, Ancestry is largely based on geographic origins, and Southeast Asian populations are generally considered "East Asian," though population differences are found among them (Ousley et al. 2009). Forensic anthropologists should bear in mind the arbitrary nature of sample labels. For instance, a single sample from Laos, Cambodia, or Vietnam may be labeled "Southeast Asian," though it may not represent the variation present throughout the region. Further, samples may be labeled using nationality, language, tribe, or religion, with similar assumptions. FORDISC, for example, uses reference samples that are categorized by nationality or language. Southeast Asia's recent, as well as past, population history has been dominated by wars and political unrest that may have modified earlier patterns of variation. This study explores craniometric variation in Southeast Asian populations to examine intra-regional differences.

Craniometrics from 110 male skulls were collected by Pietrusewsky and samples are as follows: 15 from Hanoi, 34 from Ho Chi Minh City, and 51 from Ba Chuc, Vietnam, 10 from Cambodia, 29 from Laos, 50 from Bangkok, Thailand, and 16 from Mandalay, Burma. All samples are from the nineteenth and twentieth centuries and from dissecting rooms or cemeteries. The Ba Chuc sample is from a village located near the border with Cambodia that was part of the "Killing Fields" massacre. Its location was part of a frequently disputed border area between Vietnam and Cambodia. At the time of the massacre, its residents were citizens of Vietnam, though many were probably ethnic Khmer they were culturally and linguistically Cambodian. The Vietnamese sample in FORDISC 3 comes from Ba Chuc. It was hypothesized that North and South Vietnamese crania would be more morphologically similar to one another, while the crania from Ba Chuc would be more similar to Cambodia, which it was historically a part of until recent history. As these relationships were observed, data from surrounding countries was introduced and examined.

Data were analyzed using FORDISC 3.0 (Jantz and Ousley 2005) and statistical program R (R Development Core Team 2008). The data were checked for normality and any outliers were removed. Discriminant Function Analysis (DFA) was employed using FORDISC, and R was used for cluster analysis. Analyses were conducted using variable numbers that were limited to one-third of the smallest sample size. This ensured that the data were not being over-fitted. Groups that did not prove to be significantly different using DFA were pooled and the analyses continued. As groups were pooled and sample sizes increased, the number of variables used in the discriminant function were increased in conjunction with the one-third rule.

Results show the emergence of three distinct clusters, though with overlap, using 15 variables. The North and South Vietnam crania clustered together, as did Laos and Burma, while Ba Chuc, Cambodia, and Thailand formed a third cluster. Generally, the Vietnamese cluster showed longer crania with narrower palates, while the Ba Chuc, Cambodia, Thailand cluster and Burma and Laos cluster had crania with wider palates and shorter crania. The Ba Chuc sample was craniometrically more similar to the Cambodian and Laos samples. With three clusters, a random determination of geographic affinity would be 33.3%, and these three clusters were classified with 69% accuracy when cross-validated. This function, then, proves to be more accurate in group assignment. This initial study has shown that it is possible to regionally differentiate Southeast Asian populations into more specific geographic entities. These results act as a reminder to not take DFA classifications too literally, because biological samples are always assigned labels that are considered meaningful, though they are often arbitrary. Additionally, the labels are most often based on cultural criteria, independent of the groups' biological affinities.

Discriminant Function Analysis, Craniometric Variation, Southeast Asia

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