H3 3-Dimensional Morphometric Analysis of the Zygomatic as Used in Ancestral Identification

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This poster will demonstrate a technique which in capturing the form of a craniofacial trait, lends increased accuracy to ancestry assessment.

This presentation will impact the forensic community and/or humanity by serving to increase scientific knowledge of new technologies and methods available to the forensic community that augment traditional methods and may ultimately increase precision in human identification. Ancestral identification, although often shrouded in controversy, continues to be an integral component of the biological profile. By adopting new technologies and methods, forensic scientists enhance their likelihood of successfully identifying unknown individuals.

The purpose of this poster is to investigate the potential of 3-D geometric morphometric landmark data to determine ancestry using the zygomatic region of the skull.

The determination of ancestry is often a critical component in the forensic identification of human skeletal remains. Ancestral classification is usually measured by examining a suite of metric and nonmetric traits whose grouping tendencies have been extensively researched. For example, traditional metric morphological measurements have shown that ancestry can be determined from the skull 85-90 percent of the time (Krogman & Iscan 1986:296; Sauer 1992). However, an overwhelming number of these traits are non-metric in nature and cannot be measured with traditional osteological tools (Rhine 1990). The ability to predict the ancestral group or groups with which an individual is associated is based solely on the observer's experience. While many non-metric traits are recorded as present or absent (e.g., inion hook, metopic suture, wormian bones, etc.), others leave a tremendous amount of room for interpretation and, consequently, observer error. While traditional methods of ancestral analysis have proven their usefulness in forensic identification, new technologies are providing the opportunity to reevaluate current methods and create new techniques for analysis, like geometric morphometrics, which should help forensic and physical anthropologists to increase the accuracy of their results.

Over the past 20 years, the frequency of geometric morphometric studies has increased in physical anthropology. The applicability of such studies is now being explored by individuals in the field of forensics (e.g., Ousley 2003). Geometric morphometrics, the study of biological size and shape variation, is based on the analysis of 3-D coordinate data of anatomical landmarks (Bookstein 1991). These studies have increased precision and control error in the interpretation of biological data over those using traditional metric measurements. The coordinate data of geometric morphometric analyses, in particular, use the relationships between the landmarks to give a more comprehensive depiction of an object. Landmarks must be clearly defined and be able to be reproduced with certain accuracy by different observers. While many of these correspond with accepted anatomical landmarks like ectoconchion, zygion, and jugale, they often do not give the most complete picture of the object being studied. However, additional craniometric landmarks can be designed to complete this gap and better represent the form of the trait being studied.

This study examines the geometric morphological form of the zygomatic since it is a bone of particular interest to those attempting to identify ancestry of an individual. According to Rhine (1990), the angle of the zygomatic, in relation to the entire craniofacial region, can vary between Caucasoid (retreating), Mongoloid (projecting), and Negroid (vertical) skulls. The distinction between these populations is often made by placing a pencil across the nasal aperture and by attempting to insert a finger between the zygomatic and pencil in order to determine the angle (Bass 1995). While "eye balling" methods are beneficial in the field or for a quick assessment, there are times when more accurate methods are needed, especially in today's often hostile judicial climate.

The purpose of this pilot study was to transform a non-metric ancestral trait into a metric one by quantifying or 'metricizing' it. A Microscribe G2X 3-D digitizer was used to collect data from a variety of landmarks to help capture the size and shape of the zygomatic. The software package *Morphologika* (O'Higgins) helped with the visualization of form and the statistical analyses used to assess the variation of form within and between populations to isolate discriminating factors. The sample was comprised of individuals of known origin, both male and female, representing each traditional ancestral group, Caucasoid, Mongoloid, and Negroid. The preliminary results confirm the distinctiveness of the zygomatic region yet also reveal interesting patterns of variation within each of these traditional ancestral groups.

This study serves to increase scientific knowledge of new technologies and methods available to forensic anthropology that augment traditional osteological methods and may ultimately increase precision in human identification. Ancestral identification, although often shrouded in controversy, continues to be an integral component of the biological profile. By adopting new technologies and methods, forensic anthropologists enhance their likelihood of successfully identifying unknown individuals.

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Ancestry, 3D Geometric Morphometrics, Human Identification

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