A15 Eye Tracking to Assess Decision-Making in Cranial Macromorphoscopic (MMS) Trait Evaluation: Implications of Education and Training in Method Application

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Learning Overview: After attending this presentation, attendees will better understand the impacts of experience and education on decision-making processes and how eye gaze behavior is associated with MMS trait analyses, method development, and method improvement.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how eye tracking technology can grant further insights into the application of forensic anthropological methods with a focus on ancestry estimation. Research in multiple forensic science disciplines delve into how technology can be used to understand decisions made by experts in their respective fields. Investigating anthropological methods from this cross-disciplinary approach can help researchers understand human decision-making, specifically how and when variance occur in method application and thus support the improvement of method development and training.

In this study, ten individuals with various education and experience levels assessed two skulls using the MMS scoring procedure while wearing Tobii Pro eye tracking glasses. Data from the glasses allowed the creation and analysis of eye fixation patterns. This includes time recorded for each of the 17 MMS traits, time spent on each individual skull, and the overall time of analysis. Individuals were assigned distinct groups based on a preliminary questionnaire. These groups are separated into the following categories: (1) education level, (2) MMS experience, and (3) a combination of both education and experience.

For this study, time was used as a proxy for confidence in decision making for the MMS method. A Kruskal-Wallis test was used to compare the times between the three groups. Kruskal-Wallis and pairwise Wilcoxon rank sum tests were applied comparing the times for each individual MMS trait between the groups. A two-way mixed-effects model for Intraclass Correlations Coefficients (ICC) was used to measure inter-observer reliability of the MMS scores on each skull.

When looking at the median times for each trait, the Nasal Aperture Width (NAW) was the quickest scored trait, with an overall median time of 14.59 seconds. The results also show that Nasal Bone Contour (NBC) took the longest to score, nearly 16 seconds slower than the next longest trait to score, the Transverse Palatine Suture (TPS).

When analyzing the median overall time to score both skulls, a Kruskal-Wallis rank sum test indicates individuals with <2 years of MMS experience and individuals with >2 years of MMS experience differed significantly (p=0.01052). The results from the Kruskal-Wallis and Wilcoxon rank sum tests for individual MMS traits show that time differences between experience, education, or a combination of both are not significant. While none of these differences are significant, individuals with more than two years of experience were consistently quicker than individuals with less than two years of experience, with the exception of: (1) nasal overgrowth, (2) orbital shape, and (3) postbregmatic depression.

The results of inter-observer error using the single fixed rater ICC indicate reliability between the ten individuals is moderate (*ICC*=0.72–0.74). When grouped by education level, the ICC results indicate good agreement between groups (*ICC*=0.86). ICC results based on the experienced groups show good to excellent agreement (*ICC*=0.86–0.92). Overall, when splitting the assessors into the four groups based on experience and education level, the ICC results indicate good agreement (*ICC*=0.82–0.88), demonstrating that experience is the key to higher reliability between assessors. The ICC results indicate that the inter-observer reliability is high for the MMS method, with experience only slightly improving the agreement between groups.

Using the time data, ICC results, and heat maps created from the eye gaze patterns, eye tracking technologies allow researchers to visualize where variance may be occurring between assessors to identify critical parts of decision-making process. Through empirical decision-making studies, forensic anthropologists can move forward and improve practice by decreasing observer differences by targeting confusing or problematic aspects of a method. This allows training to focus on problematic traits when training forensic anthropologists.

Forensic Anthropology, Macromorphoscopic, Decision-Making

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