A71   Texture Mapped Average Skulls Created From Standardized Photographs Using the Perception Lab's Psychomorph

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After attending this presentation, attendees will be aware of highly realistic, sex-specific, mathematically average photographs of skulls for South African Black and White, American Black and White, and Japanese population groups.

This presentation will impact the forensic science community by providing, for the first time, photographic-quality average skulls to objectively illustrate skull morphotypes.

To date, "typical" skulls for each group have been represented either by average linear measurements or Cartesian coordinates, descriptions of morphoscopic trait frequency, or diagrams (drawings or photographs) of single skulls thought to represent the morphotype well. While these methods are important for determining sex and ancestry to aid in identification, they do not allow accurate visualization of what the average skull for each group would look like. Current depictions of each group rely either on diagrams that caricaturize typically observed morphoscopic traits or on a single individual as representative of an entire population. The central tendency, being the most widely used measure for normally distributed data, is a natural choice to more accurately visualize depictions of skulls classified according to particular groups. This was undertaken for this study by: (1) taking standardized photographs of skulls in anterior and left lateral views; (2) outlining the skull shape; (3) calculating the average shape; (4) warping individual photographs to the average shape; and, (5) averaging the color information of the warped photographs to obtain the final average shape and color result.[1] This method has previously been successfully applied to face photographs, producing average faces for individuals (males and females) of self-reported European and Central/Southeast Asian origins.[2]

Standardized photographs were taken of skulls in an anterior view and left lateral view, sourced from the Pretoria Bone Collection, the Hamann-Todd Collection, and the Chiba Bone Collection. Photographs were taken using a full-frame Digital Single-Lens Reflex (DSLR) camera fitted with a 100mm lens, and a camera-to-object distance of 1.2m. Each image was manually delineated by positioning landmarks that were then joined with contour lines to form the outline delineation map. This map was created for each and every skull photograph in this study, and the map was specific to the photographic view. The average x and y coordinate position of each landmark was then used to form the average delineation map, which was used to warp each individual image to the average shape. The average color information for each pixel was then applied for each group to produce the final images.

These average images provide the first quantified basis for depicting skulls grouped by sex and ancestry. They can serve as exemplar images for sex and ancestry, eliminating the need for caricaturized diagrams or isolated single examples drawn out of the sample distribution.

Reference(s):

1. Tiddeman B., Burt D.M., Perrett D. Computer graphics in facial perception research. *IEEE Computer Graphics and Applications*. 2001;21(5):42-50.
2. Stephan C., Penton-Voak I., Perrett D., Tiddeman B., Clement J., Henneberg M. Two-dimensional computer-generated average human face morphology and facial approximation. In: Clement J., Marks M., editors. *Computer-graphic facial reconstructio*n. Burlington: Elsevier Academic Press, 2005;105-27.

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