



Physical Anthropology Section - 2012

H97 REFACE: New Features Addressing the Needs of Forensic Identification Professionals for Objective Facial Approximation

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After attending this presentation, attendees will become aware of REFACE, understand how it generates facial approximations, be informed of new features that have been incorporated, and appreciate the usefulness of those features for forensic identification professionals.

This presentation will impact the forensic science community by illustrating the advantages of statistically-based computerized facial approximation (CFA) as well as the possibilities of a system that can quickly and objectively generate multiple images of an unidentified decedent for eventual presentation to the public.

REFACE was developed during a long collaboration between the Federal Bureau of Investigation's Laboratory Division and General Electric Global Research to complement traditional clay modeling techniques with an objective, repeatable, and less labor-intensive means to generate facial approximations based on large, diverse sample sizes, and whose methods could be fully documented for forensic purposes. Literature assessing traditional facial approximations has repeatedly shown that presenting the same skull to different artists can result in very different approximations. Additionally, many tissue depth studies have been based on small sample sizes.

Modern computed tomography (CT) technology allows three dimensional viewing of facial skin, or the underlying bone, or both together. This technology, which links facial and skeletal data, forms the foundation for REFACE. A CT database of approximately 400 individuals of both sexes and four ancestry groups was collected to form the reference database for a statistically-based CFA program. REFACE applies registration, warping, and principal components analysis to the known relationships between skin and bone of each head in the reference database to approximate the skin for an unknown skull that is scanned and imported into the system.

One of the advantages of REFACE is time. Generation of an approximation using an 8-core processor takes 20 minutes. Because of this speed, users can efficiently generate multiple approximations per day, including the option of estimating the face in alternate groups if ancestral attribution is ambiguous. Users can also address cases of mixed ancestry by specifying a different ancestry group for the nose tip regression if recommended by a forensic anthropologist's analysis of the skull. Export formats for 3D approximations include VTK, STL, OBJ, and DXF, as well as two-dimensional JPEG or PNG formats. Users can also record an AVI video of the rotating 3D approximation. These export options allow the user to perform post-approximation artistic modifications with a software package of their choice or to present multiple images/image formats to the public.

Another advantage of a system such as REFACE is documentation. Users assign unique identifiers for each imported skull and generated approximation, and every aspect of user input, approximation parameters, modifications, etc. is automatically saved and documented. Additionally each unknown skull must be CT- or laser-scanned before import into REFACE, providing agencies with permanent electronic storage of each of their unidentified cases. REFACE also has security features that allow an organization's designated administrator to control user access to specific software features and to specific approximations. These features allow strict control within a facility that may have multiple individuals generating approximations and provide documentation for exactly how each approximation is generated, so that the process can be repeated or presented in court, if either is necessary.

Although nationwide standards for the generation and presentation of facial approximations do not currently exist, features within REFACE allow forensic anthropologists/artists the flexibility to address future developments or changes in the field through the use of multiple export formats and presentation types (3D, 2D, video, multiple images), whether for post-approximation modification, public display, craniofacial superimposition, or for use in facial recognition software aimed at matching unidentified decedents to missing persons. In summation, REFACE provides agencies a way to generate facial approximations objectively and efficiently, the ability to document and secure data for each approximation, and the flexibility to address any changes that may arise within the field of facial approximation.

REFACE, Facial Approximation, Forensic Identification