



Physical Anthropology Section – 2004

H50 Skull-Photo Superimposition and Border Deaths: Identification Through Exclusion and the Failure to Exclude

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After attending this presentation, attendees will understand the methodology and application of skull-photo superimposition.

This presentation will impact the forensic community and/or humanity by demonstrating an improvement on the application of skull-photo superimposition as a technique for identification.

This paper has four objectives: 1) to present a case in which five individuals (undocumented aliens) died after crossing over the southern Arizona border with Mexico; 2) to discuss the role of video skull-photo superimposition in the identification of two individuals in this "closed disaster;" 3) to describe the methods employed which resulted in identifications through exclusion and the failure to exclude; and 4) to explore the application of the logic of science to this cranio-facial technique of human identification.

Many of the individuals who die trying to illegally cross into at the United States along the Mexican border do not leave behind existing antemortem x-rays or fingerprints on file. As a result, skull-photo superimposition presents a very useful technique in the investigation of border deaths, particularly in the identification of undocumented aliens. Identification in these cases can be the result of either the exclusion of, or the failure to exclude, the skull as a match to the photo.

On February 11, 2003, a hiker discovered human remains in a remote desert area of southern Arizona near the town of Ajo. The Pima County Sheriff's Department responded and led a search team which also included rangers from the Bureau of Land Management. The scene, located on the lower slope of a mountain, was rocky with low, sparse desert vegetation consisting mainly of mesquite trees, palo verde trees, ocotillo, and various forms of cacti. The search took place over the course of two days and resulted in the recovery of five skulls, five backpacks, four personal identification cards, clothing, and a large number of skeletonized postcranial remains scattered over a 50 to 100 yard radius.

With this evidence, investigators at the Forensic Science Center in Tucson, Arizona and the Pima County Sheriff's Department began working with the Consulate of the Republic of Mexico to identify the deceased. Through these cooperative efforts, the names of all five of the individuals traveling in this group were presumably known. As a result, this case of multiple border deaths is analogous to a "closed disaster" (such as a small aircraft crash in which there is a passenger roster).

The anthropological analyses conducted at the Forensic Science Center determined that the disarticulated skeletal remains represented two adult Hispanic males and three adult Hispanic females. The two males and one of the females could be segregated and tentatively identified and assigned names. The other two females reputed to be traveling in this group, however, were close in age and height, which made skeletal separation extremely difficult. It was at this point that the authors were asked to assist the identification efforts by performing skull-photo superimpositions at the Michigan State University Forensic Anthropology Laboratory.

The system at Michigan State utilizes two video cameras, a video mixer, a monitor, two VCRs, a computer, and image capturing software. The superimposition process begins by placing tissue depth markers on the skull and then generally sizing and orienting the skull with the photo. The "dynamic orientation process" follows, which is the most difficult and time-consuming part of the methodology. The goal of this process is to arrive at the "best fit" possible in the alignment of the skull with the antemortem photo. This is achieved by superimposing specific anthropometric landmarks on the facial soft tissues over the corresponding landmarks on the bones of the skull.

In the ideal situation, the first step in the dynamic orientation process is to align the skull and photo at porion. In the second step, the left and right Whitnall's tubercle of the skull is aligned with the left and right ectocanthion points of the face. These first two steps are critical in establishing the correct angle of inclination and declination in the superimposition. In the third step, the subnasal point of the skull is adjusted to align with the subnasal point of the face. In the fourth step, gnathion on the skull should align with gnathion on the face in the photo.

Allowing for slight variations which may be present due to photographic variables (lens, distance, angle, etc.), if all of the landmarks align the next step is to systematically evaluate a list of morphological points of correlation between the face and skull. This list includes the contour of the head and jaw line, the eyebrow and brow ridge area, and the eye orbit and cheekbone region. The evaluation of these areas is greatly enhanced by the placement of tissue depth markers on the skull. The last step in this superimposition methodology is a metric analysis of the facial proportionality of both the aligned skull and the photo.

The approach to image identification utilized at Michigan State is an adaptation of Popperian scientific method. Rather than prove hypotheses, the proper role of science is to construct hypotheses that are capable of falsification. In other words, it is improper to attempt to prove



Physical Anthropology Section – 2004

that two data sets (a skull and a photograph, for example) represent the same phenomenon.

This approach begins with the assumption that the known and unknown images represent the same individual. Repeated attempts are made to reject (or falsify) the assumption. If there are any inexplicable differences between the skull and the photo during the “dynamic orientation process,” the evaluation of morphological correlation, or the metric analysis, then the individual is excluded from a match. The strength of the falsification or identification in a skull-photo case depends on the quality of the images, the experience of the experts, the thoroughness of the analyses, and the equipment. The process of comparing and matching features is essentially the same as traditional approaches to identification, however the logic of falsification frees the investigator from generating statements about probable or highly probably identification.

In this case of multiple border deaths, two adult female skulls and a photograph reported to be one of the missing women were submitted. Using video skull-photo superimposition, one skull was excluded and the other was not excluded as a match. The ability and the failure to exclude were both the result of extensive comparisons and metric evaluation of facial proportionality, as well as the comparison of a number of morphological features of the face and skull. Due to the presumed closed nature of this case, the exclusion of one skull and the failure to exclude the other skull represented identifications.

Finally, it is the opinion of the authors that in the absence of clear images of unique dental features, skull-photo superimposition does not yield a positive identification. Exclusion or the failure to exclude, on the other hand, are more typical outcomes of the method.

Forensic Anthropology, Identification, Skull-Photo Superimposition