B18 Postmortem Identification From Physiological Biometrics: A Study of Fingerprints, Irises, and Facial Images

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After attending this presentation, attendees will understand the use of postmortem fingerprint, iris, and facial biometrics for positive identification of unknown individuals, including the maximum number of days each biometric type can be successfully used for identification and how the decomposition processes of human remains affect the utility of biometrics over time.

This presentation will impact the forensic science community by describing the advantages and limitations of these biometrics based upon the points of similarity and match scores for each identifier type.

Biometrics are measurable unique characteristics that are used to classify both living and deceased individuals. This study examines the effects of decomposition on the ability to correctly identify, or match, individuals over time using three physiological characteristics: fingerprints, facial photographs, and iris scans. This study examines the maximum number of days in which usable biometric data can be successfully matched to an individual using digital technologies and how the image quality and ability to obtain sufficient match scores to make a positive identification decreases over time. For the purposes of this study, *usable data* refers to images that are able to correctly identify the individual through a digital biometric program that uses statistical algorithms to match the captured images with those images taken on the initial receipt of the donated individual. This study was conducted in conjunction with Oak Ridge National Laboratory and the University of Tennessee Anthropological Research Facility between April 2014 and January 2015. Digital facial photographs (n=172), iris scans (n=123), and fingerprints (n=480) from the donated remains of thirteen (n=13) individuals were obtained daily until usable data could no longer be captured. The individuals were placed supine and mostly uncovered with the exception of wire or plastic mesh placed over the hands to prevent scavenger activity. The left iris of all individuals was hydrated with 0.4mL of sterile saline solution ten minutes prior to iris scanning to determine if this would increase the quality of images compared to the untreated right iris. No other preparations were made to the remains prior to data collection.

With daily high temperatures ranging between 59°F (15°C) and 84°F (28.89°C) during the spring trial (n=4), usable data was obtained for an average of four days; however, the early summer trial (n=5) included high temperatures between 81°F (27.22°C) and 91°F (32.77°C) and the number of days usable data could be captured was reduced to two. The winter trial (n=4) only had high temperatures between 18°F (-7.78°C) and 55°F (12.78°C) and demonstrated that useable data was available, on average, for 28 days with both facial images and fingerprints persisting over the longest period at 40.75 days and 24.5 days on average, respectively. Overall, fingerprints produced the most reliable biometric data, with more usable data and higher match scores over longer periods of time than iris scans or facial images. Color change, structural changes to facial features due to bloating, and insect activity prohibited the capture of usable facial images after an average of two days in the spring and summer, while dehydration, clouding, and collapse of the cornea prevented capture of usable iris scans after an average of two days in the spring and only one day in the summer. While the winter trial produced more usable images and significantly higher match scores over a longer period of time, scavenging and freezing temperatures limited the quality and quantity of available data.

This study demonstrated that digitally captured fingerprint biometric data can be used up to 25 days postmortem to identify individuals. The results of this study show that biometrics do remain viable over time, depending upon seasonality and environmental conditions. When scavenger activity is inhibited, fingerprints persist longer than facial and iris identifiers; however, temperature, precipitation, and insect activity were the primary factors affecting the retention of biometric information in decomposing human remains. This study builds upon previous work and continues to support the utility of physiological biometric identifiers during the decomposition process. Postmortem biometric research has the potential to make important contributions to forensic anthropology and the law enforcement, military, and medicolegal communities.

Biometrics, Human Decomposition, Positive Identification

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