C10   3D Superimposition: A New Technique of Personal Identification

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After attending this presentation, attendees will be informed about a new technique of personal identification.

This presentation will impact the forensic science community by presenting a standardized technique for personal identification based on 3D superimposition.

The goal of this presentation is to show an objective, non-invasive, technique for the subject's personal identification through an analysis of recorded images and 3D avatar superimposition.

Personal identification based on 3D digital stereophotogrammetry presents a natural evolution of previous research in this field, the so-called "Parameterized Superimposition (PS)." Total cooperation of the suspect and the structure where the offense was perpetrated are boundaries of the PS technique. Photogrammetry currently provides the most cost-effective 3D capturing system as it is quick, inexpensive, and non-invasive; the equipment necessary for acquisition is easily transportable and offers high reliability. The technique was suitable for capturing facial morphology for clinical and anthropological usage. This technique involved four steps:

Preparatory Phase: The recorder images of a subject were studied and improved. Frames with a better view of the subject's facial landmarks were then chosen.

3D Acquisition Phase: A 3D stereophotogrammetric avatar of the subject's face was created; this phase only required four photos taken simultaneously with a calibrated camera.

Superimposition Phase: This phase was the preparatory phase for the final step. The 3D avatar of the subject's face was carefully spatially oriented in the same position as in the photos and snapshots that were previously taken. During the morphological analysis, the snapshot of the 3D avatar was superimposed on the frame of the subject's picture by a specific software.

Metric Image Analysis: To perform this step, it was necessary to clearly recognize at least five landmarks on the 3D avatar using appropriate software. A 3D parameterized avatar of the subject was created with a stereophotogrammetric technique and the subject's frame was selected and acquired. In the metric image analysis step, a quantitative comparison between the image of the frame of subject's face and the avatar's snapshot was obtained. Objective anthropometric landmarks, such as exocanthions, glabella, and asubspinal point, were marked on the 3D avatar and on the picture of the frame of the subject's face to calculate the distance of the absolute points discerned on those two images.

Results: The absolute and relative distance between the marked points, the perimeters, and the area of the triangles, obtained by connecting the points, and the compactness indices were automatically calculated with a proper program.

Conclusion: The morphologic phase revealed a full overlap between the 3D avatar and the frame's picture. Metric phase revealed that correlation coefficient values, higher than .998, confirm the identification hypothesis. The technique described is objective, repeatable, and not invasive. Technical skills are required, meaning that improvisation is not allowed.

Personal Identification, 3D Superimposition, Anthropology

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