



## Engineering Sciences Section - 2015

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### D60 The Assessment of Facial Modifications Due to Mimicry: Possible Influences on Personal Identification From Video Surveillance Systems

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After attending this presentation, attendees will better understand the facial modifications due to mimicry and their impact on the reliability of 3D/2D superimposition for personal identification from video surveillance systems.

This presentation will impact the forensic science community by providing clues for facial modification concerns that are due to different facial expressions.

More and more frequently, forensic anthropologists are requested by judicial authorities to assess personal identification from video surveillance systems: 3D/2D superimposition is one of the most commonly used methods which consists of the comparison between a 3D model obtained from the suspect through advanced 3D image acquisition technologies (laser scanner and stereophotogrammetry) and 2D images taken from the video surveillance records. Faces to compare are expected to be neutral, but the culprit may have different facial expressions which may add a bias to the 3D/2D superimposition, therefore resulting in an error in the identification process.

This presentation proposes to expose two pilot studies concerning the assessment of facial modifications due to different expressions.

In the first project, ten male adults, between 30 and 40 years of age, underwent five acquisitions by stereophotogrammetry (VECTRA-3D®) with different expressions (neutral, happy, sad, angry, surprised). On each 3D facial model, nine landmarks (right and left endocanthion; right and left exocanthion; right and left cheilion; on the midline, selion, pronasale, subnasale) were identified using VAM® software; the acquisition of each individual with happy, sad, angry, and surprised expressions was then superimposed onto the neutral one in order to reach the best match between the corresponding landmarks. This procedure allowed the operator to also obtain a chromatic sheet of the face, where increasing zones are colored in blue and the decreasing zones in red. In all the cases, the Root Mean Square (RMS) value between the two models was calculated as well.

In the second project, five photographs with different expressions (neutral, happy, sad, angry, surprised) were taken from five male adults chosen from the previous group; the 3D model in neutral expression was then superimposed to each photo and the distance between 12 facial landmarks (right and left endocanthion, right and left exocanthion, right and left cheilion, right and left alare, right and left gonion; on the midline, selion, pronasale) located on the 3D scan and the 2D images was estimated by Adobe® Photoshop® software.

The first study highlighted that the highest difference in comparison with the neutral standard was shown by the happy expression (mean RMS 4.11mm, SD 1.13mm), followed by the surprised expression (mean RMS 2.74mm, SD 1.02mm), the sad (mean RMS 1.3mm, SD 0.49mm), and angry (mean RMS 1.21mm, SD 0.37mm). The happy and surprised expressions showed a wide modification of the mouth, chin, and cheek regions, whereas the upper third of the face does not show relevant modifications. The sad and angry expressions were affected by slight alterations.

The second study confirmed that the highest mean differences between facial landmarks on 3D scan and 2D image was reached by the happy expression (0.17cm, SD: 0.35cm), followed by the surprised expression (0.08cm, SD: 0.19cm). The sad and angry expressions showed the lowest modifications (respectively, 0.07cm, SD: 0.2cm and 0.05, SD: 0.13cm).

This pilot study shows that mimicry affects facial morphological characteristics and the position of facial landmarks, and therefore may influence the outcome of 3D/2D superimposition procedures for identificative purposes: in addition, the study highlighted the facial regions more stable with mimicry and therefore more usable for a possible identification procedures. Further studies on a larger population are needed in order to provide more details of the phenomenon and possibly add corrective values for assessing personal identification from video surveillance systems.

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#### Facial Mimicry, Stereophotogrammetry, Personal Identification