OSAC 2022-S-0007 Standard Guide for Facial Comparison: Overview and Methodology Guidelines

Facial Identification Subcommittee
Digital/Multimedia Scientific Area Committee
Organization of Scientific Area Committees (OSAC) for Forensic Science

OSAC Proposed Standard

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Standard Guide for Facial Comparison: Overview and Methodology Guidelines

1. Scope

1.1 The purpose of this document is to provide a general overview of facial comparison applications, categories, and methods. It provides guidelines and recommendations for conducting manual facial comparisons, in support of the four identified facial comparison applications.

1.2 This document does not address specific standard operating procedures for conducting facial comparisons, nor does it address specific training, documentation, or reporting requirements.

1.3 This document does not address the use of facial recognition algorithms.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This standard cannot replace knowledge, skill, or ability acquired through appropriate education, training, and experience and should be used in conjunction with sound professional judgment.*

2. Referenced Documents

2.1 *ASTM Standards*:

E2916 Terminology for Digital and Multimedia Evidence Examination
E3149 Standard Guide for Facial Image Comparison Feature List for Morphological Analysis
E3115 Standard Guide for Capturing Facial Images for Use with Facial Recognition Systems
[OSAC Overview of ACE-V Document Placeholder]

3. Terminology

3.1 *Definitions:*

3.1.1 E2916 Standard Terminology for Digital and Multimedia Evidence Examination

3.1.2 Forensic, n— refers to an application of facial comparison in which comparisons are conducted to provide information in the form of testimony in court.

3.1.3 Identity verification, n—The process of assessing whether a person and an image represent the same individual or whether two or more images represent the same individual.

3.1.4 Opinion, n—View, judgement, belief - takes into consideration other information in addition to observations, data, calculations, and interpretations.

3.2 *Acronyms:*

3.2.1 **OSAC**, *n* – Organization of Scientific Area Committees for Forensic Science

3.2.2 **ACE-V**, *n* – Analysis, Comparison, Evaluation, and Verification

4. Summary of Guide

4.1 This guide identifies and defines the four main applications of facial comparison, the three categories of facial comparison, and three methods of conducting facial comparisons. This guide recommends practitioners use morphological analysis as the primary facial comparison method for all applications and categories of manual facial comparison. Morphological analysis is the industry-wide accepted method based on the collective experience of facial comparison practitioners.

5. Significance and Use

5.1 Apart from the methods described below, humans have an innate ability to recognize faces. This ability is more accurate when comparing familiar faces versus unfamiliar faces and is referred to as holistic comparison (Biederman & Kalocsai, 1997; Maurer, Le Grand, & Mondloch, 2002; Rossion, 2008). Holistic comparison is not recognized as a method of facial comparison by the Facial Identification community. People have a wide range of abilities when comparing faces. Some have limited abilities (commonly referred to as "face blind") whereas others have unique innate abilities (sometimes referred to as "super recognizers"). Super-recognizers have superior ability to recognize unfamiliar faces than the general population and are equally as accurate as trained facial examiners or facial reviewers when conducting facial comparisons of unfamiliar faces (Philips et al., 2018).

5.2 Facial comparison is a manual process conducted by a human which entails identifying similarities and differences between two images or an image and a live subject to determine whether they represent the same person. Practitioners conduct facial comparisons to support different applications for the purpose of identity verification. The application, purpose, and

resources available for a facial comparison task determine which category of facial comparison should be conducted.

5.2.1 The following four applications describe functional areas where facial comparisons are conducted to support identity verification. Most facial comparisons fall primarily into one of the following four applications, however crossover may exist.

5.2.1.1 **Intelligence Gathering for Identity Management:** Facial comparisons are conducted to support the compilation of information relating to what is believed to be a single subject, even if the identity of the subject is not known.

5.2.1.2 **Screening and Access Control**: Facial comparisons of both image-to-image and image-to-person are conducted in a high throughput environment and are thus limited in time (e.g., customs and immigration checkpoints).

5.2.1.3 **Investigative and Operational Leads**: Facial comparisons provide information to assist operational personnel with meeting their objective (e.g., comparing an unknown subject featured in one or many images to images of known subjects to provide investigators with a potential name for a crime suspect).

5.2.1.4 **Forensic**: Facial comparisons are conducted to provide information to support testimony in court.

5.3 There are three broad categories of facial comparison: assessment, review, and examination.

5.3.1 Assessment is a quick comparison of image-to-image or image-to-person, typically conducted in screening and access control applications, and often in real time. Due to time and resource constraints, assessment is the least rigorous of all the facial comparison categories and is often not documented.

5.3.2 Review is a comparison of image(s)-to-image(s) often used in either investigative and operational leads or intelligence gathering applications. A broad range of purposes and levels of rigor are involved in review, though it is by nature more rigorous than the assessment process and may require some level of documentation.

5.3.3 Examination is a comparison of image(s)-to-image(s) often used in a forensic application. Examination is the most rigorous category of facial comparison and typically requires more detailed documentation.

5.3.4 Detailed descriptions of, and distinctions between, the three categories of facial comparison are beyond the scope of this standard guide.

6. Comparison Methods and Guidelines

6.1 There are three facial comparison methods currently identified in the facial identification community: morphological analysis, superimposition, and photo-anthropometry.

6.2 Morphological analysis should be the primary approach used for facial comparison in all categories: assessment, review, and examination.

6.2.1 Morphological analysis is the method of facial comparison in which the features and components of the face are compared. Morphological analysis is based on the evaluation of the correspondence among facial features (components), component characteristics, and their respective characteristic descriptors (e.g., presence, shape, appearance, symmetry, location, relative proportion). Features include those corresponding to the overall face, facial components (e.g., nose, ear, mouth), their component characteristics (e.g., nostrils, ear lobes, helix), and discriminating characteristics, such as scars, marks, and tattoos. The E3149 "Standard Guide for Facial Image Comparison Feature List for Morphological Analysis" provides a standard list of facial components and component characteristics to be assessed and evaluated during a morphological analysis. Research shows that morphological analysis is highly accurate and reliable when comparing controlled facial images to non-controlled facial images (Bacci et al., 2021).

6.2.2 The morphological analysis process should not rely on classification schemes (e.g., round face, Roman nose), which result in interobserver differences and are, therefore, not best practice (Iscan, 1993; Penry, 1971; Ritz-Timme et al., 2010; Vanezis et al., 1996).

6.2.3 Documentation of a morphological analysis is best practice, but the amount of detail will vary depending on agency procedures and the application or category of the comparison.

6.2.4 Morphological analysis is highly dependent on the quality and quantity of the facial features and characteristics that can be compared, which is in turn dependent on the capture conditions and quality of the image. Image quality can be affected by several factors, including but not limited to image resolution, lighting, focus, pose, angle, orientation, or obstructions of facial features.

6.2.5 The morphological analysis method requires training consistent with the category of the comparison conducted. Specific training requirements for each facial comparison category will be addressed in a forthcoming standard guide.

6.3 Superimposition should be used only to aid in the facial comparison process and shall never be used as a stand-alone approach within any category: assessment, review, or examination.

6.3.1 Superimposition is the process of creating an overlay of two aligned images and comparing them visually.

6.3.2 Superimposition should be applied only when two images are taken from the same viewpoint (images may be photographs, frames or images from video, or images synthesized from 3D face or head models). Images should be aligned (e.g., scaled, rotated, etc.) with each other. There should be a concordance between images in all aspects of angle and perspective to avoid distortion of the spatial distribution of facial features and characteristics. Practitioners should only use tools which preserve shapes and should not use image processing techniques which may skew the images, facial proportions, or shapes.

6.3.3 Since superimposition is sensitive to image quality, both images should be captured under optimal conditions (as defined by E3115) or the use of this method may be misleading. Loss of image quality through blurring, compression artifacts, reduction in spatial resolution (e.g., number of pixels between the pupils), lens distortion, perspective distortion, etc. reduces the ability to determine the specific location of individual features, which subsequently reduces the ability to generate an accurate overlay/superimposition.

6.3.4 In cases where there are multiple copies of the same original image (e.g., forged identity documents), superimposition may be conducted on images displaying less than optimal quality as the images are proportionally the same.

6.4 Photo-anthropometry shall not be used to support any of the identified applications of facial comparison in any category: assessment, review, or examination. Photo-anthropometry may be used in other applications not covered in this guide, such as research.

6.4.1 Photo-anthropometry is the measurement of dimensions and angles of anthropological landmarks and other facial features visible in an image in order to quantify characteristics and proportions. The measurements taken from one image are compared to the measurements taken from a separate facial image.

6.4.2 As in superimposition, photo-anthropometry is highly sensitive to image capture and quality factors including but not limited to resolution, focus, distortion, obscuration, viewpoint, lighting, and pose. In addition, the following information should be known about the images prior to conducting the comparison: focal length, lens distortion and subject distance. Photo-anthropometry should only be conducted when the image capture and quality factors of the images being compared are controlled and are the same. Given the uncontrolled conditions under which many questioned images (e.g., security camera images) are captured, it is often not possible to conduct a proper photo-anthropometric comparison.

6.4.3 Research on the use of anthropometric comparison has shown that photo-anthropometry does not produce consistent results and may be misleading (Kleinberg, 2007; Moreton and Morley, 2011).

6.5 Analysis, Comparison, Evaluation, and Verification (referred to as ACE-V) is the scientific process implemented by facial comparison practitioners. Depending on the application and category of the comparison, agency procedures may include some or all of the ACE-V steps.

6.5.1 Analysis refers to the assessment of an image to determine suitability for comparison, including the ability to discriminate significant features.

6.5.2 Comparison refers to the examination of two or more samples to establish similarities and dissimilarities. The facial comparison methods recommended above (morphological analysis and superimposition) should be used during the comparison step of ACE-V.

6.5.3 Evaluation refers to the assessment of the value of details observed during the analysis and comparison steps to reach an opinion.

6.5.4 Verification refers to the review or independent analysis of the opinion of another examiner. Verification rarely occurs in facial assessment, may be conducted in facial review, and should be conducted facial examination. The use of the verification step is dependent on agency procedures and time or resource constraints.

7. Summary of Recommendations

7.1 Morphological analysis method is the best practice for facial comparison, based on the collective knowledge and experience of practitioners in the facial comparison community. When

conducting morphological analysis for facial comparison, and the application warrants, the examination and decision-making process should be fully documented.

7.2 Superimposition should only be used in conjunction with morphological analysis.

7.3 Photo-anthropometry shall not be used for facial image comparison.

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