



## **Disclaimer:**

As a condition to the use of this document and the information contained herein, the Facial Identification Scientific Working Group (FISWG) requests notification by e-mail before or contemporaneously to the introduction of this document, or any portion thereof, as a marked exhibit offered for or moved into evidence in any judicial, administrative, legislative, or adjudicatory hearing or other proceeding (including discovery proceedings) in the United States or any foreign country. Such notification shall include: 1) the formal name of the proceeding, including docket number or similar identifier; 2) the name and location of the body conducting the hearing or proceeding; and 3) the name, mailing address (if available) and contact information of the party offering or moving the document into evidence. Subsequent to the use of this document in a formal proceeding, it is requested that FISWG be notified as to its use and the outcome of the proceeding. Notifications should be sent to: [chair@fiswg.org](mailto:chair@fiswg.org)

## **Redistribution Policy:**

FISWG grants permission for redistribution and use of all publicly posted documents created by FISWG, provided that the following conditions are met:

Redistributions of documents, or parts of documents, must retain the FISWG cover page containing the disclaimer.

Neither the name of FISWG, nor the names of its contributors, may be used to endorse or promote products derived from its documents.

Any reference or quote from a FISWG document must include the version number (or creation date) of the document and mention if the document is in a draft status.



# Facial Comparison Overview and Methodology Guidelines

## 1. Scope

1.1 The purpose of this document is to provide guidelines and recommendations to the practitioner for conducting facial comparisons.

1.2 This standard does not purport to address all 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.

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>1</sup>

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

### 2.2 Other Standard Documents:<sup>2,3</sup>

FISWG Recommendations for a Training Program in Facial Comparison

FISWG Guidelines and Recommendations for Facial Comparison Training to Competency

SWGDE Technical Overview for Forensic Image Comparison

<sup>1</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@asstm.org](mailto:service@asstm.org). For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>2</sup> For referenced FISWG documents, visit [www.fiswg.org](http://www.fiswg.org).

<sup>3</sup> Available from Scientific Working Group on Digital Evidence (SWGDE), [www.swgde.org](http://www.swgde.org).

### 20 2.3 Other Referenced Documents:

21 Biederman, I., & Kalocsai, P. (1997). Neurocomputational bases of object and face  
22 recognition. *Philosophical Transactions of the Royal Society B: Biological Sciences*  
23 352(1358), 1203-1219.

24 Bruce, V., Henderson, Z., Greenwood, K., Hancock, P., Burton, A., Miller, P.,  
25 Verification of face identities from images captured on video, *Journal of Experimental*  
26 *Psychology: Applied*, 5, 339-360, 1999.

27 Bruce, V., Henderson, Z., Newman, C., Burton, A. M., Matching identities of familiar  
28 and unfamiliar faces caught on CCTV images, *Journal of Experimental Psychology:*  
29 *Applied*, 7, 207-218, 2001.

30 Burton, A. M., Wilson, S., Cowan, M., Bruce, V., Face recognition in poor-quality  
31 video: evidence from security surveillance, *Psychological Science*, 10, 243-248, 1999.

32 Butavicius, M., Mount, C., MacLeod, V., Vast, R., Graves, I., Sunde, J., An experiment  
33 on human face recognition performance for access control, *Knowledge-Based Intelligent*  
34 *Information and Engineering Systems*, 12th International Conference KES, 141-148,  
35 2008.

36 Edmond, G., Biber, K., Kemp, R., Porter, G., Law's looking glass: expert identification  
37 evidence derived from photographic and video images, *Current Issues in Criminal*  
38 *Justice*, 20, 337-377, 2009.

39 Henderson, Z., Bruce, V., & Burton, A. M., Matching the faces of robbers captured on  
40 video, *Applied Cognitive Psychology*, 15, 445-464, 2001.

41 Hill, H. and Bruce, V, Effects of lighting on matching facial surfaces, *Journal of*  
42 *Experimental Psychology: Human Perception and Performance*, 22, 986-1004, 1996.

43 Iscan, M.Y. and Helmer, R.P. (ed.), *Forensic analysis of the skull: craniofacial*  
44 *analysis, reconstruction, and identification*, Wiley-Liss, 57-70, 1993.

45 Kemp, R., Towell, N., Pike, G., When seeing should not be believing: photographs,  
46 credit cards and fraud, *Applied Cognitive Psychology*, 11, 211-222, 1997.

47 Lee, W.J., Wilkinson, C.M., Memon, A., Houston, K., Matching unfamiliar faces from  
48 poor quality closed-circuit television (CCTV) footage: an evaluation of the effect of  
49 training on facial identification ability, *AXIS*, 1, 1, 19-28, 2009.

50 Maurer, D., Le Grand, R., & Mondloch, C. J. (2002). The many faces of configural  
51 processing. *Trends in Cognitive Sciences*, 6(6).

52 Megreya, A.M. and Burton, A.M., Unfamiliar faces are not faces: evidence from a  
53 matching task, *Memory & Cognition*, 34, 865-876, 2006.

54 Penry, J., *Looking at faces and remembering them: a guide to facial identification*,  
55 Elek, 1971.

56 Rossion, B. (2008). Picture-plane inversion leads to qualitative changes of face  
57 perception. *Acta Psychologica*, 128(2), 274-289.

58 Ritz-Timme, S., Gabriel, P., Obertová, Z., Boguslawski, M., Mayer, F., Drabik, A.,  
59 Poppa, P., De Angelis, D., Ciaffi, R., Zanotti, B., Gibelli, D., Cattaneo, C., A new atlas for  
60 the evaluation of facial features: advantages, limits, and applicability, International  
61 Journal of Legal Medicine, 125, 2, 301-306, 2010.

62 Vanezis, P., Lu, D., Cockburn, J., Gonzalez, A., McCombe, G., Trujillo, O., Vanezis M.,  
63 Morphological classification of facial features in adult caucasian males based on an  
64 assessment of photographs of 50 subjects, Journal of Forensic Sciences, 41, 786-791,  
65 1996.

### 66 3. Terminology

67 3.1 Definitions: See Terminology E2916 for digital and multimedia evidence  
68 examination terms.

### 69 4. Summary of Guide

70 4.1 This document reviews general types of facial comparisons, methods, and  
71 applications of facial comparison.

72 4.2 This document provides recommendations for general practices and  
73 methodologies to conduct facial comparisons.

### 74 5. Significance and Use

75 5.1 Facial comparison is a manual process conducted by a human which entails  
76 identifying similarities and differences between two images or an image and a live  
77 subject to determine whether they represent the same person.

78 5.1.1 Practitioners conduct facial comparisons to support different applications for the  
79 purpose of identity verification. The application, purpose, and resources available for a  
80 facial comparison task determine which category of facial comparison should be  
81 conducted.

82 5.1.2 Most applications fall primarily into one of the following four categories, however  
83 crossover may exist.

84 5.1.2.1 **Intelligence Gathering** for Identity Management comparisons is a component  
85 of the compilation of information relating to what is **believed** to be a single subject, even  
86 if the identity of the subject is not known.

87 5.1.2.2 **Screening and Access Control** includes both image-to-image and image-to-  
88 person comparisons. Both occur in a high throughput environment and are thus limited  
89 in time (e.g., customs and immigration checkpoints).

90 5.1.2.3 **Investigative and Operational Leads** comparisons provide information,  
91 generally not intended for presentation in court, to assist operational personnel with  
92 meeting their objective (e.g., comparing an unknown subject featured in one or many

93 images to images of known subjects to provide investigators with a potential name for a  
94 crime suspect).

95 5.1.2.4 **Forensic comparisons** provide information to assist a trier of fact (e.g., judge  
96 or jury).

97 5.2 There are three broad categories of facial comparison: assessment, review, and  
98 examination.

99 5.2.1 **Assessment** is a quick real time comparison of image-to-image or image-to-  
100 person typically carried out in screening and access control applications. Due to time  
101 constraints, assessment is often undocumented and is considered the least rigorous of  
102 all the facial comparison categories.

103 5.2.2 **Review** is a comparison of image-to-image often used in either investigative  
104 and operational leads or intelligence gathering applications. A broad range of purposes  
105 and levels of rigor are involved in review, though it is by nature more rigorous than the  
106 assessment process and may require some level of documentation. An independent  
107 technical review should be conducted.

108 5.2.3 **Examination** is a comparison of image(s)-to-image(s) often used in a forensic  
109 application. Examination is the most rigorous category of facial comparison and typically  
110 requires more detailed documentation. An independent technical review should be  
111 conducted.

112 5.3 There are three comparison methods (morphological analysis, superimposition,  
113 and photo-anthropometry) currently recognized in facial comparison.

## 114 6. Comparison Methodology Guidelines

115 6.1 Depending on the application of the comparison, procedures may include some  
116 or all of the following steps: Analysis, Comparison, Evaluation, and Verification (referred  
117 to as ACE-V). As stated above, verification should be carried out in both facial review  
118 and facial examination.

119 6.2 **Morphological analysis** is direct comparison of class and individual facial  
120 characteristics without explicit measurement. The method of facial comparison in which  
121 the features and components of the face are compared.

122 6.2.1 Morphological analysis (in some form) should be the primary approach used for  
123 facial comparison in all categories: assessment, review, and examination. Opinions in  
124 relation to similarity or difference are based on subjective assessment, evaluation, and  
125 interpretation of observations.

126 6.2.2 Morphological analysis is based on the evaluation of the correspondence  
127 among facial features, components and their respective component characteristics  
128 (presence, shape, appearance, symmetry, location, relative proportion, etc.). Features  
129 include those corresponding to the overall face, anatomical structures such as the nose  
130 or ear and their components (e.g., nose bridge, nostrils, ear lobes, helix), and

131 discriminating characteristics, such as scars, marks and tattoos. The E3149 “Standard  
132 Guide for Facial Image Comparison Feature List for Morphological Analysis” provides a  
133 standard list of facial components and component characteristics to be assessed and  
134 evaluated during a morphological analysis. This methodology is used during the  
135 Analysis and Comparison steps in the ACE-V process.

136 6.2.3 The morphological analysis process should not rely on classification schemes  
137 (e.g., round face, Roman nose) which result in interobserver differences and are,  
138 therefore, not best practice (Iscan, 1993; Penry, 1971; Ritz-Timme et al., 2010; Vanezis  
139 et al., 1996).

140 6.2.4 Documentation of a morphological analysis is required. Documentation  
141 processes will depend on the agency guidelines and application of comparison  
142 undertaken. Screening and access control applications apply a more basic level of  
143 morphological analysis, therefore, documentation of the decision-making process is  
144 generally not required. Alternatively, when using morphological analysis for facial  
145 examination as in a forensic application, the examination and decision-making process  
146 should be fully documented and include an independent technical review.

147 6.2.5 Morphological analysis is highly dependent on the quality and quantity of the  
148 facial features and characteristics that can be compared. Image quality can be affected  
149 by factors including, but not limited to, image resolution, lighting, focus, pose, angle,  
150 orientation, and obstructions of facial features.

151 6.2.6 The morphological analysis method requires training consistent with the  
152 category of the comparison carried out.

153 6.3 **Superimposition** is the process of creating an overlay of two aligned images and  
154 comparing them visually.

155 6.3.1 Superimposition is *only* used in conjunction with morphological analysis. It shall  
156 never be used as a stand-alone approach for facial image comparison.

157 6.3.2 Superimposition can be applied only when two images are taken from the same  
158 viewpoint (images may be photographs, frames or images from video, or images  
159 synthesized from 3D face or head models). Images are aligned (e.g., scaled, rotated)  
160 with each other. There should be a concordance between images in all aspects of angle  
161 and perspective to avoid distortion of the spatial distribution of facial features and  
162 characteristics. Practitioners use tools which preserve shapes and shall not use image  
163 processing techniques which may skew the images, facial proportions, or shapes.

164 6.3.3 Since superimposition is sensitive to image quality, both images should be  
165 captured under optimal conditions (as defined by E3115) or the use of this method may  
166 be misleading. Loss of image quality through blurring, compression artifacts, reduction  
167 in spatial resolution (e.g., number of pixels between the pupils), lens distortion,  
168 perspective distortion, etc. reduces the ability to determine the specific location of  
169 individual features, which subsequently reduces the ability to generate an accurate  
170 overlay/superimposition.

171 6.3.4 In cases where there are multiple copies of the same original image (e.g.,  
172 forged identity documents), superimposition may be carried out on images displaying  
173 less than optimal quality.

174 6.4 **Photo-anthropometry** is the measurement of dimensions and angles of  
175 anthropological landmarks and other facial features visible in an image in order to  
176 quantify characteristics and proportions. The measurements taken from one image are  
177 compared to the measurements taken from a separate facial image.

178 6.4.1 Photo-anthropometry shall not be used for facial comparison in any categories:  
179 assessment, review, or examination.

180 6.4.2 As in superimposition, photo-anthropometry is highly sensitive to image  
181 capture and quality factors including but not limited to resolution, focus, distortion,  
182 obscuration, viewpoint, lighting, and pose. In addition, the following information should  
183 be known about the images prior to conducting the comparison: focal length, lens  
184 distortion and subject distance. Photo-anthropometry should only be conducted when  
185 the image capture and quality factors of the images being compared are controlled and  
186 are the same. Given the uncontrolled conditions under which many questioned images  
187 (e.g., security camera images) are captured, it is often not possible to conduct a  
188 proper photo-anthropometric comparison.

189 6.4.3 The limitations described above regarding image requirements preclude the use  
190 of photo-anthropometry in any facial comparison. This technique should not be used as  
191 an independent comparison method or in conjunction with another method. (Evison et  
192 al., 2010; Kleinberg, 2007; Moreton and Morley, 2011)

193 6.5 Apart from the methods described above, **holistic process** (i.e., the innate  
194 human ability to compare faces) will take place. It should be stressed that holistic  
195 process is not a method. Human ability for holistic face comparison is highly variable  
196 and is dependent on a multitude of factors including, but not limited to, personal ability  
197 and familiarity with the subject. Studies have shown that human ability to compare  
198 unfamiliar faces is highly prone to error whereas comparison of familiar faces may be  
199 carried out accurately even when image conditions are poor. (Biederman & Kalocsai,  
200 1997; Maurer, Le Grand, & Mondloch, 2002; Rossion, 2008).

## 201 7. Summary of Recommendations

202 7.1 Morphological analysis method is considered to be the best practice by the Facial  
203 Identification community for facial comparison. When conducting morphological analysis  
204 for facial comparison, and the application warrants, the examination and decision-  
205 making process should be fully documented.

206 7.2 In the ACE-V process, morphological analysis is utilized during the analysis and  
207 comparison steps. Opinions are based on the results of the morphological comparison.  
208 Additionally, an independent technical review or check (verification or peer review)  
209 should be conducted on all documented observations relating to facial examinations.

210 7.3 Superimposition shall only be used in conjunction with morphological analysis.  
211 Photo-anthropometry shall not be used for facial image comparison.

212 FISWG documents can be found at: [www.FISWG.org](http://www.FISWG.org)

DRAFT