



Multimedia Section
Comparative Analysis

Digital and Multimedia Evidence Division



1. Comparative Analysis

1.1. Scope

- 1.1.1. This procedure applies to Multimedia Section analysts who are authorized to analyze, process, and/or enhance/clarify digital multimedia evidence for the purpose of conducting comparative image analysis or demonstrative comparisons.
- 1.1.2. Comparative image analysis, also known as forensic image comparison, is the process of comparing images of questioned objects or persons (or images thereof) and assessing the correspondence between features in these items for rendering an opinion regarding identification or elimination.
 - 1.1.2.1. Comparative analysis differs from demonstrative comparison in that a demonstrative comparison is a process in which no expert opinion regarding identification or elimination is given.
- 1.1.3. This procedure only applies to comparisons involving vehicles, clothing, objects, and/or distinguishing marks/features. This procedure does not apply to height analysis, speed analysis, etc.

1.2. Limitations

- 1.2.1. Image/video processing and adjustments should assist the analyst in the overall examination. Over-processing could negatively affect the quality of the video/image.
- 1.2.2. Opinion-based conclusions must be corroborated with documentation from a credible source.

1.3. Recommended Equipment/Hardware

- Computer/Laptop – administrative access, CD/DVD optical drive, USB ports etc.
- Media card reader
- DSLR Camera for photographing known objects
- Color/White Balance reference card
- Aspect ratio reference tool

1.4. Recommended Software

- Adobe Photoshop
- Amped FIVE
- iNPUT-ACE

1.5. Procedure

- 1.5.1. Submitted video/images must first be examined to determine if comparative analysis is a possibility. Factors affecting this determination include but are not limited to: resolution, distance from camera, artifacts, compression, lighting conditions, camera angles, frame



rate, aspect ratio, hardware/recording limitations, etc. These factors must be documented in the case record.

- 1.5.1.1. If the video/images are not suitable for comparative analysis, a report will be issued informing the requesting agency.
- 1.5.2. Images may need enhancements/adjustments prior to a comparison being done. Refer to the Forensic Multimedia Unit's procedure on Forensic Video/Image Enhancement.
- 1.5.3. Once the image(s) is determined to be of good quality for a comparison, a known item/image must be submitted or identified. This can be done in the following ways:
 - 1.5.3.1. The physical item can be submitted and then photographed by the analyst. This method would be the preferred method for clothing/shoe comparisons.
 - 1.5.3.2. Images of an item can be submitted if the actual item cannot (i.e. vehicle).
 - 1.5.3.3. An image can be used from credible sources such as the website of a vehicle manufacturer. The analyst must be sure to use images of similar nature to the original submitted item (i.e. angle of vehicle). The source address where the image was located must be documented in the case record. A scan or PDF copy of the website with the image must be uploaded into LIMS.
- 1.5.4. If the known image(s) submitted is not suitable for comparative analysis, and no other options are available, a report will be issued informing the requesting agency.
- 1.5.5. An assessment must be made of the submitted item and the known item to determine any class and/or individualizing characteristics. Once these are determined, a composite can be created. (Refer to *SWGDE Best Practices for Photographic Comparison for All Disciplines* and *SWGIT Best Practices for Forensic Photographic Comparison* for more information)
 - 1.5.5.1. The unknown object/images are analyzed before the known object/images as a means to mitigate bias throughout the examination.
 - 1.5.5.2. The **ACE-V** (Analysis, Comparison, Evaluation, Verification) method should be implemented when doing a comparison. Not all comparisons will need this method (i.e. demonstrative comparisons). This method involves four stages:
 - 1.5.5.2.1. **Analysis** involves the thorough assessment of the properties and attributes of the features contained in the items under examination. The properties and attributes identified are grouped into class or individualizing characteristics.
 - 1.5.5.2.2. **Comparison** is the assessment of the similarities/dissimilarities of the characteristics that were identified in the Analysis stage.
 - 1.5.5.2.3. **Evaluation** is the stage where a tentative conclusion is reached, and the similarities/dissimilarities are tested against it. Analysts will use their subject matter expertise to determine if similarities and differences observed reflect true correspondences/discordances between the compared items. Differences found will be categorized as explainable, unexplainable, or exclusionary.



- 1.5.5.2.3.1.1. **Explainable differences** = may result from the imaging process or conditions at the scene
- 1.5.5.2.3.1.2. **Unexplainable differences** = dissimilarities exist but are of unknown source and may or may not lead to an elimination
- 1.5.5.2.3.1.3. **Exclusionary differences** = dissimilarities that are true differences between the images being compared
- 1.5.5.2.4. **Verification** is the stage in which the technical work and results of the examination are reviewed/evaluated by a second trained and competent analyst. (Refer to 1.8 of this SOP)
- 1.5.5.3. The comparative analysis will be concluded once the analyst deems that characteristics of sufficient significance and number have been identified to produce an informed opinion. Demonstrative comparisons will be concluded once the analyst deems that the request criteria has been met.
- 1.5.6. After completion of the comparative analysis, the analyst will create a demonstrative image composite based on the needs of the case. More than one composite may be needed.
- 1.5.7. Compared characteristics whether similar or dissimilar must be documented on the composite (excluding demonstrative comparisons). This can be done using arrows, lines, bullet points, etc. Characteristics which were not compared or could not be compared between the objects due to factors such as obstructions in view or camera angle, may be omitted in the demonstrative comparison.
- 1.5.8. The composite must have the forensic case number, agency case number, and the analyst's initials on it.
- 1.5.9. Images must be clearly identified on the composite so as to show origin.
- 1.5.10. The analyst will produce a complete, clear, and accurate report that thoroughly discusses the criteria used throughout examination, correspondences and discordances between the compared objects, and conclusions derived from examination.

1.6. Considerations

- 1.6.1. It may be necessary to determine the conditions in which the video/image was recorded (i.e. infrared camera, camera angle, etc.). Photographing/recording the known under the same conditions may be necessary in order to compare. This process must be documented in the case record. If this cannot be done, the analyst must document this as a possible factor affecting the comparison.
- 1.6.2. It is important that the analyst not mistake artifacts as characteristics. Throughout all stages of a comparative analysis, the training, experience, and expertise of the analyst will be used in evaluating image and video properties to determine their reliability. These properties include but are not limited to Spatial Resolution, Optical Resolution, Aspect Ratio, Frame Rate, Compression, Artifacts, Interlacing, Codecs, Analog to Digital



Conversion, Image Sensors, Image/Video Enhancement, Lens Distortion, Perspective Distortion, Aperture, ISO, Shutter Speed, and Focal Length.

1.7. Conclusions

1.7.1. Comparative analysis may require an opinion-based conclusion. The following conclusions can be used when doing a comparison:

1.7.1.1. **Identification** = The ability to identify an individual person or object requires a correspondence of individual characteristics of such number and significance as to preclude the possibility of their having occurred by mere chance and establishing that there are no differences that cannot be explained. The number of such characteristics necessary for such an identification is a function of the subject matter, the quality and quantity of details in the images, and the expertise of the analyst; no arbitrary number of characteristics is required. A conclusion of identification can be further subdivided into a verbal scale with different levels of support:

1.7.1.1.1. **Strong support for identification:** Significant individualizing and class characteristics that can be compared in detail are shared in one or multiple images. No unexplainable or exclusionary differences exist.

1.7.1.1.2. **Moderate support for identification:** Individualizing and class characteristics are shared. Images attributes may prevent detailed analysis of characteristics. No unexplainable or exclusionary differences exist.

1.7.1.1.3. **Similarities observed/Weak support for identification:** Class characteristics are shared. No individualizing characteristics are shared. Image attributes may allow only a superficial analysis of characteristics. Characteristics may only be present in a limited number of images. No unexplainable or exclusionary differences exist.

1.7.1.2. **Elimination** = The ability to eliminate an individual person or object from being a questioned person/object. Elimination requires a discordance of characteristics as to preclude identification. A conclusion of elimination can be further subdivided into a scale with different levels of support:

1.7.1.2.1. **Dissimilarities observed/Limited support for elimination:** Class characteristics are shared. No individualizing characteristics are shared. Discordant characteristics may exist though image attributes may allow only a superficial analysis of characteristics. Unexplainable differences may exist. No exclusionary differences exist.

1.7.1.2.2. **Moderate support for elimination:** Class characteristics are shared. Discordant characteristics may exist though Image attributes may prevent detailed analysis of characteristics. No individualizing



characteristics are shared. Unexplainable or exclusionary differences exist.

1.7.1.2.3. **Strong support for elimination:** A limited number of class characteristics or no class characteristics are shared. No individualizing characteristics are shared. Discordant characteristics exist and image attributes are such that characteristics can be observed in detail. Significant unexplainable or exclusionary differences exist.

1.7.1.3. **Inconclusive** = Sufficient data or resolvable characteristics are not available to render an opinion. This result may be due to image properties (limited resolution, lighting differences, distance of object to camera) and does not exclude the known objects from being the identified or eliminated.

1.7.1.4. **Not Suitable for Comparison** = reason for this must be documented in case report

1.7.1.5. **No comparison possible** = reason for this must be documented in case report

1.7.2. Demonstrative comparisons will not have an opinion-based conclusion.

1.8. Technical Review

1.8.1. A second analyst who is trained and competent in comparative analysis must review each composite and technically review the case.

1.8.2. If the second analyst agrees with the composite(s) then the technical review will be done in compliance with the Multimedia Section's Administrative/Quality procedures and the HFSC Quality Manual.

1.8.3. If the technical reviewer does not agree with the composite(s), the reviewer will discuss it with the primary analyst in the case.

1.8.4. If no agreement can be made between the technical reviewer and the analyst, then it must be brought to the section supervisor/lead or manager's attention and resolved.

1.9. Derivatives

1.9.1. The composite(s) with all layers must be saved to the section's server under the forensic case number's file until all reviews are completed.

1.9.2. The composite must be flattened with no layers when saved and returned to the submitting agency.

1.9.3. Both technical and administrative reviews must be completed prior to releasing opinion-based comparisons.

1.9.4. Demonstrative comparisons can be released after a technical review and with approval from the section supervisor/lead or manager.

1.10. References

SWGIT Best Practices for Forensic Video Analysis, Version 1.0 2009.01.16



SWGDE Best Practices for Photographic Comparison for All Disciplines, Version 1.0
SWGIT Best Practices for Forensic Photographic Comparison, Version 1.1 2013.01.11