Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions

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OSAC Proposed BPR

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Disclaimer:

This document has been developed by the Friction Ridge Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science through a consensus process and *proposed* for further development through a Standard Developing Organization (SDO). This document is being made available so that the forensic science community and interested parties can consider the recommendations of the OSAC pertaining to applicable forensic science practices. The document was developed with input from experts in a broad array of forensic science disciplines as well as scientific research, measurement science, statistics, law, and policy.

This document has not been published by a SDO. Its contents are subject to change during the standards development process. All stakeholder groups or individuals are strongly encouraged to submit comments on this proposed document during the open comment period administered by the Academy Standards Board (ASB).

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1. Introduction

1.1. This document has been developed to improve the quality and consistency of friction ridge examination practices.

1.2. The examination of friction ridge impressions is conducted in accordance with a methodology consisting of Analysis, Comparison, and Evaluation. Analysis is the interpretation of observed data in a friction ridge impression in order to categorize its utility. Comparison is the search for and detection of similarities and differences in the observed data between two friction ridge impressions. Evaluation is the weighting of the aggregate strength of the observed similarities and differences between the observed data in the two friction ridge impressions in order to formulate a source conclusion.

1.3. In this document, the following verbal forms are used: "*shall*" indicates a requirement, "*should*" indicates a recommendation; "*may*" indicates permission; and "*can*" indicates a possibility or capability.

2. Scope

2.1. This document provides the best practice recommendation for the comparison and evaluation of friction ridge impressions.

2.2. This document does not address the analysis stage of the friction ridge examination methodology.

3. Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

3.1. Analysis (phase of the Examination methodology): The interpretation of observed data in a friction ridge impression in order to categorize its utility.

3.2. Blind Verification: A type of verification in which the subsequent examiner(s) has no knowledge of the original examiner's decisions, conclusions or observed data used to support the conclusion.

3.3. Comparison (phase of the Examination methodology): The search for and detection of similarities and differences in observed data between two potentially corresponding friction ridge impressions.

3.4. Complexity (of a Comparison): A characteristic of a comparison in which the attributes of one or both impressions may require additional consideration and quality control measures as it relates to the evaluation of a source conclusion. Comparisons can be designated as high complexity, low complexity, or non-complex.

3.5. Complexity (of an Impression): A characteristic of an impression whose attributes may require additional consideration and quality control measures. Impressions can be designated as high complexity, low complexity, or non-complex.

3.6. Consensus opinion: A type of examination in which a reported decision or conclusion is determined that reflects the collective judgment (e.g. majority) of a group of examiners.

3.7. Correspondence: An observation of friction ridge details and other information in agreement in terms of their type, orientation, and relative spatial relationship to each other; an accumulation of similarities between two impressions resulting in an overall conformity or agreement.

3.8. Evaluation (phase of the Examination methodology): The weighting of the aggregate strength of the observed similarities and differences between the observed data in the two friction ridge impressions in order to formulate a source conclusion.

3.9. Examination: The act or process of observing, searching, detecting, recording, prioritizing, collecting, analyzing, measuring, comparing, and/or interpreting.

3.10. Exemplar Impression: An impression to which a questioned impression is compared; it can include impressions from an unknown source or a known source.

3.11. Forensic Service Provider (FSP): A forensic science entity or forensic science practitioner providing forensic science services.

3.12. Friction Ridge Detail/Features: The combination of ridge flow, ridge characteristics, and ridge structure of friction ridge skin, as observed and reproduced in an impression. A large subset of the observed data used to compare and interpret similarity or dissimilarity between two impressions.

3.13. Interpretation: Explanations for the observations, data, and calculations.

3.14. Minutia: The point where a friction ridge begins, terminates, or splits into two or more ridges. A subset of the friction ridge detail/features traditionally consisting of ridge endings, bifurcations, and dots/short ridges used to compare and interpret similarity and dissimilarity between two impressions.

3.15. Observed Data: Any demonstrable information observed within an impression that an examiner relies upon to reach a decision, conclusion, or opinion. This has historically been expressed as “features” or “minutiae,” but the use of the broader term “observed data” is inclusive of other types of data that may be considered beyond minutiae, such as quality, scars, creases, edge shapes, pore structure, and other friction ridge features.

3.16. Open (non-blind) verification: A type of verification in which the subsequent examiner has access to the original examiner's decisions, conclusions or observed data used to support the conclusion.

3.17. Questioned Impression: An impression used for comparison against an exemplar impression; it can include impressions from an unknown source or a known source.

3.18. Similarity: An observation that two impressions share a general likeness of details; not to be confused with correspondence.

3.19. Suitability for Comparison Decision (Suitability for Source Conclusions): A decision made by an examiner in accordance with FSP policy and/or procedure, that a friction ridge impression contains sufficient observed data to be utilized for comparison and a Source Conclusion can potentially be reached. This designation is often referred to as "suitable for comparison" or "of value for comparison".

3.20. Target Group: A specific set of friction ridge features selected as a starting point during comparison.

3.21. Utility: The usefulness of an impression for a further step in the examination process, such as comparison or Automated Biometric Identification System entry.

3.22. Verification: Confirmation, through either re-examination or review of documented data by another examiner, that a conclusion or opinion conforms to specified requirements and is reproducible. NOTE: "Specified requirements" are the FSP's policies and procedures relating to Analysis, Comparison and Evaluation of friction ridge impressions.

4. General Recommendations

4.1. Comparison

4.1.1. A questioned impression, which has previously been deemed "suitable for comparison" following Analysis, shall be selected. Selection should take into consideration:

4.1.1.1. Quality of the observed data in the impression.

4.1.1.2. Complexity of the impression.

4.1.1.3. Sequential or arbitrary selection.

4.1.2. An exemplar impression shall be selected to compare against the questioned impression. Selection of an exemplar impression for comparison should take into consideration:

4.1.2.1. Apparent similarity of the exemplar impression to the questioned impression.

NOTE: Similarity can be determined by visual observation or automated comparison algorithms.

4.1.2.2. Completeness of the recording of the impression.

4.1.2.3. Sequential or arbitrary selection.

4.1.3. The exemplar impression should be analyzed and assessed for its complexity and utility for comparison.

4.1.4. Comparison of features shall proceed from the lower quality impression to the higher quality impression.

4.1.4.1. If the lower quality impression is determined to be the exemplar impression, a full and independent analysis shall be conducted on the exemplar prior to comparison.

4.1.5. The target group in the lower quality impression identified during Analysis or another target group should be selected for comparison with the higher quality impression.

4.1.6. Comparison of features shall account for all of the features interpreted during Analysis.

4.1.7. Features of the two impressions shall be assessed for correspondence or non-correspondence in a side-by-side comparison.

4.1.8. Features assessed as corresponding shall be documented for comparisons which will be evaluated for a source conclusion. Features assessed as non-corresponding may be documented.

4.1.8.1. Documentation should be preserved digitally. The annotations may be done manually by the examiner or with the assistance of automated comparison software.

4.1.8.2. Documentation shall occur contemporaneously during the side-by-side comparison and should be done in a non-destructive manner on a digital image copy of each friction ridge impression.

4.1.8.3. Documentation should continue until an accumulation of features supports a source conclusion.

4.1.8.4. Documentation shall distinguish between features initially interpreted during comparison and features interpreted during analysis (prior to side-by-side comparison).

4.1.9. Once the features have been documented to support a source conclusion, the complexity *of the comparison* should be assessed and conform to the following criteria[1]:

4.1.9.1. Non-complex Comparison: All of the following conditions are met:

4.1.9.1.1. Both impressions have been determined to be non-complex during Analysis.

4.1.9.1.2. The observed data on both impressions provide strong indications of the anatomical regions.

4.1.9.1.3. The observed data on both impressions provide strong indications of the orientations.

4.1.9.1.4. The observed data in the relevant overlapping areas of both impressions necessary to support a source conclusion are designated as Category 3 (green) quality or higher during Analysis.

4.1.9.1.5. Fewer than three features interpreted during comparison are not consistent with how they were documented during analysis.

4.1.9.2. Low complexity Comparison: Neither impression has been determined to be of high complexity during Analysis *and* one or two of the following conditions are met:

4.1.9.2.1. At least one impression has been determined to be of low complexity during Analysis.

4.1.9.2.2. The observed data on at least one impression does not provide a strong indication of the anatomical region(s).

4.1.9.2.3. The observed data on at least one impression does not provide a strong indication of the orientation(s).

4.1.9.2.4. The observed data in the relevant overlapping area of at least one of the impressions necessary to support a source conclusion is

[1] The criteria provided in this document are recommended for quality assurance purposes and based on consensus opinion of the OSAC Friction Ridge Subcommittee where supporting evidence in the scientific literature is limited. Adherence to these criteria will provide a common foundation for categorizing comparisons as complex in a structured and consistent manner.

designated as Category 2 (yellow) quality or lower during Analysis.

4.1.9.2.5. Three or more features interpreted during comparison are not consistent with how they were documented during analysis.

4.1.9.3. High complexity Comparison: At least one impression has been determined to be of high complexity during Analysis *or* at least three of the following conditions are met:

4.1.9.3.1. At least one impression has been determined to be of low complexity during Analysis.

4.1.9.3.2. The observed data on both impressions do not provide strong indications of the anatomical regions.

4.1.9.3.3. The observed data on both impressions do not provide strong indications of the orientations.

4.1.9.3.4. The observed data in the relevant overlapping area of at least one of the impressions necessary to support a source conclusion is designated as Category 2 (yellow) quality or lower during Analysis.

4.1.9.3.5. Three or more features interpreted during comparison are not consistent with how they were documented during analysis.

4.2. Evaluation

4.2.1. The similarities and differences shall be evaluated to formulate a source conclusion and should be supported by the following criteria[2]:

4.2.1.1. Source Exclusion: All of the following conditions are met:

4.2.1.1.1. The observed data in the relevant areas of both impressions are present and designated as Category 2 (yellow) quality or higher during Analysis.

4.2.1.1.2. The observed data between the impressions do not correspond.

4.2.1.2. Support for Different Sources: The following condition is met:

[2] The criteria provided in this document are recommended for quality assurance purposes and based on consensus opinion of the OSAC Friction Ridge Subcommittee where supporting evidence in the scientific literature is limited. Adherence to these criteria will provide a common foundation for differentiating between conclusions in a structured and consistent manner.

4.2.1.2.1. The observed data between the impressions do not appear to correspond, but a more definitive determination of non-correspondence cannot be made due to limiting factors. The limiting factor(s) affecting a more definitive determination shall be documented.

NOTE: This conclusion is applicable when the criteria for Source Exclusion is not supported by the observed data.

4.2.1.3. Inconclusive: At least one of the following conditions are met:

4.2.1.3.1. The observed data in the relevant area of at least one of the impressions are not present or designated as Category 1 (red) quality or lower during Analysis thus preventing a determination of correspondence or non-correspondence. The limiting factor(s) affecting a more definitive determination shall be documented.

4.2.1.3.2. The similarities and differences of the observed data are insufficient to support either correspondence or non-correspondence. The limiting factor(s) affecting a more definitive determination shall be documented.

4.2.1.4. Support for Same Source: The following condition is met:

4.2.1.4.1. The observed data between the impressions appear to correspond, but a more definitive determination of correspondence cannot be made due to limiting factors. The limiting factor(s) affecting a more definitive determination shall be documented.

NOTE: This conclusion is applicable when the criteria for Source Identification is not supported by the observed data.

4.2.1.5. Source Identification: All of the following conditions are met:

4.2.1.5.1. The observed data in the relevant areas of both impressions are present and designated as Category 2 (yellow) quality or higher during Analysis.

4.2.1.5.2. The observed data between the impressions correspond.

4.2.1.5.3. The corresponding data include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during Analysis.

4.2.2. Source conclusions that are not supported by the criteria specified above shall be subject to additional quality control measures, such as blind verification, multiple

verifications, or consensus opinion. Additionally, written approval by a quality assurance manager or supervisor shall be documented.

4.2.3. Features that have been documented during Comparison shall be retained on each impression.

4.2.4. Changes to the interpretation of observed data in the questioned impression after comparison to the exemplar impression shall be documented such that they are clearly distinguished from the observed data interpreted prior to comparison.

4.2.5. The case record shall include documentation of the following:

4.2.5.1. Each questioned and exemplar impression compared, including relevant information to uniquely identify the impressions (e.g. name, identifier, date recorded).

4.2.5.2. The source conclusion reached for each comparison.

4.2.5.3. The complexity determination for each comparison.

4.2.5.4. The observed corresponding data necessary to support inclusive source conclusions.

4.2.6. Routine monitoring of examiners' performance should be completed as part of verification and technical review of the case file. The monitoring should address all of the following:

4.2.6.1. Assessment and documentation of observed corresponding data on images of each impression.

4.2.6.2. Determination and documentation of the complexity *of the comparison*.

4.2.6.3. Evaluation and documentation of source conclusions.

5. Appendix A: Change Log

Version	Date	Change
1.0	09/30/2020	Original Issue