



Prosecutor's Guide

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Introduction

This prosecutor's guide to expert witness testimony for fingerprint examiners has been developed by the Canadian Friction Ridge Working Group (CanFRWG) to assist Crown counsel in presenting expert fingerprint identification evidence. It is based on the experience of practicing fingerprint experts, trial transcripts, and related articles.

This guide can serve as a reference for both prosecutors and expert witnesses in their preparations for a trial. The initial portion of the guide provides a summary of the ACE-V process and the three conclusion scale. A more detailed explanation of ACE-V will be provided later in the document. This document provides high level guidance that may not be applicable to all situations. It is highly recommended that the Crown prosecutor meets with the fingerprint expert prior to the trial, particularly with multiple fingerprint identifications.

The content related to the *voir dire* and the examination in chief of the expert witness who initially identified the fingerprint(s), are equally relevant for the verifying expert

Reference fingerprints should be obtained for the offence related to the case before the courts. The fingermark(s) should be compared to the corresponding reference fingerprints.

Definitions

Expert report: A report that summarises the Analysis, Comparison, Evaluation, and Verification of the expert's fingerprint identification(s).

Investigative report: A report that details the entire involvement of the Forensic Specialist, including the processing of a crime scene and the treatment of any exhibits.

Analysis documentation: Any documentation that records the analysis phase, including any photographs and annotations to images.

Fingerprint: A general term that is used to describe crime scene impressions, a person's recorded impressions (inked or digital), and the friction skin on the fingers.

Unknown Fingerprint: an impression of friction ridge detail left as a result of the uncontrolled contact of the digits of the hand with a surface¹

Known Fingerprint: an impression of the friction ridges of all or any part of the finger from a known source recorded under controlled conditions.

¹ Definition based on definition of the term 'fingermark' from the Forensic Science Regulator, Codes of Practice and Conduct – Friction Ridge Detail (Fingerprint) Examination – Terminology, Definitions and Acronyms, FSRC-126, Issue 2, _FSR_fingerprint_terminology.pdf accessed 2021-06-29.

ACE-V Summary

Analysis – an assessment of the unknown fingerprint to determine its suitability and any factors that may affect the appearance of the ridges.

Comparison – The second step in the process involves a side-by-side, ridge to ridge observation sequentially, of all available friction ridge detail, against a known fingerprint. All available detail in the unknown fingerprint is compared the known fingerprint.

Evaluation – The third step seeks to answer two questions. Is there agreement between the two impressions and is there sufficient quantity and quality of agreement to reach an identification opinion

Verification – The fourth step is a separate ACE process, by another qualified examiner to either validate or refute the original examiner's conclusion.

Conclusion Scale²

Identification – the opinion that two friction ridge impressions originate from the same source

Inconclusive – the opinion that two friction ridge impressions could not be identified or excluded

Exclusion – the opinion that two friction ridge impressions did not originate from the same source.

Voir dire

The expert witness should be qualified as:

An expert in fingerprints, including the taking, locating, collecting, preserving, analyzing, comparing, and identifying of fingerprints.

Qualifications

- Impartiality statement
- Experts CV should be entered as an exhibit
- Present employment
- Present unit and duties
 - Present title
 - Highlight that these duties include; the taking, locating, collecting, preserving, analyzing, comparing, and identifying of fingerprints.
- Any post secondary education
- Policing history, including years of experience and areas of assignment
 - Emphasise any pre-forensic identification training experience such as a scenes of crime officer, or property crimes examiner. Typically, these duties include the attendance at crime scenes for purpose of locating, collecting, preserving unknown fingerprint evidence
- Acceptance to forensic identification

² CanFRWG Position Paper on the Definitions of Friction Ridge Opinions – 2021, www.canfrwg.ca.

- Agency's selection criteria
- Basic forensic identification course. A forensic identification course is offered at the Canadian Police College and the Ontario police college. Recently some agencies have begun their own training program.
 - Expand on the training received, as this forms the base of the expertise, as shown below.
- Basic forensic identification course includes the following;
 - Forensic photography
 - Crime scene processing
 - Fingerprint detection and development techniques
 - Powders and chemicals, including the use of fluorescence and fluorescent photography
 - Preservation of friction ridge skin impressions
 - Fingerprint analysis and comparison
 - History of scientific research of friction ridge skin
 - Physiology and anatomy of friction ridge skin
 - Pattern recognition
 - AFIS
 - Digit determination
 - ACE-V
 - Analysis phase
 - Comparison phase
 - Evaluation phase
 - Verification phase
 - Distortion analysis
 - Current research
 - Includes research into bias and strategies to reduce the risks associated with bias
 - Fingerprint comparison exercise
 - Expert report (Friction Ridge Analysis Report)
 - Expert witness testimony, including admissibility criteria
 - Final fingerprint comparison exam
- Any post basic forensic identification course requirement. This will be agency specific
- Forensic identification section history or performance
 - Can include the number of crime scenes attended
 - Number of criminal fingerprint identifications
 - Court testimony as an expert witness
 - Proficiency testing results
- Forensic conferences attended
- Any membership in forensic identification organizations
- Any presentation given, courses taught or articles written by the expert on fingerprint analysis and comparison, or any other relevant material.

Examination in chief

Scene or exhibit

- Date and time of attendance at the crime scene, or receipt of an exhibit by an investigator
- Steps taken
 - Description of the scene
 - Any other persons present
 - Recording of the scene. Photographs, and or video/scans
 - Measures taken to prevent cross contamination
 - Items of surfaces examined, including method used
 - Results of any examinations
 - Were unknown fingerprints suitable for comparison developed
 - Were the unknown fingerprints photographed and lifted
 - Any factors relating to how the unknown fingerprints came to be on the surface(s)
 - Continuity of any exhibits

Fingerprint(s) identification

- Person of interest provided by investigator
- Person of interest acquired by other means
- Friction Ridge Analysis Report
 - Author of report
 - Marked as an exhibit
 - Date of the report
 - Summary of the ACE-V process
- Analysis (see ACE-V in-depth review for a better understanding of the analysis process)
 - Purpose of the analysis phase
 - The seven aspects analysed and the results of that analysis
 - The analysis is documented, including annotating the features observed during the analysis
 - A second analysis is completed of the known fingerprint (documentation is only required, if the known fingerprint is of low quality or displays significant distortions)
- Comparison
 - The comparison process should be described as, ridge to ridge in sequence comparing all available detail in the unknown fingerprint to the known fingerprint
 - The use of a fingerprint chart can assist the expert in describing the comparison process
 - The chart does not play a role in the ACE-V process, it is produced purely for court demonstration purposes
 - There are different styles of charts, however these charts will only show a sample of the detail used during the comparison. It is important to stress that all available detail in the unknown fingerprint was compared to the known fingerprint

- Evaluation
 - Is there agreement between the fingermark and the reference fingerprint?
 - Is the quantity and quality of agreement sufficient to reach an opinion of identification?
 - Is this considered a complex or a non-complex comparison
 - Are you familiar with bias?
 - What steps did you take to reduce the risk of bias?
- Verification
 - Was this fingerprint submitted for a verification?
 - Who was the verifying officer?

ACE-V – in-depth review

The Analysis, Comparison, and Evaluation (ACE) method for conducting a forensic comparison was introduced in 1959 by Chief Supt. Huber, assistant director of the RCMP Laboratories and Identification Directorate. A verification phase was added as a means of quality control and peer review.

ACE-V is the method used in both Canada and the United States. Canadian fingerprint examiners receive their training in ACE-V at either the Canadian Police College or the Ontario Police College, though more recently some agencies that been providing in house ACE-V training. ACE-V can best be described as a quantitative and qualitative method. If the quality (clarity) of the friction ridge detail is high then a lesser amount of friction ridge detail may suffice to reach an opinion of either identification, exclusion, or inconclusive. If the quality of the impression is low, then a greater quantity of friction ridge detail will be required to reach a valid opinion.

Another aspect of the quantitative/qualitative analysis is the specificity of the detail. A weighing of the rarity of the feature types and their configurations, which an examiner interprets using their knowledge training and experience.

Analysis

An assessment of the quality and quantity of the friction ridge detail in the unknown fingerprint, to determine if it's suitable for a comparison. If the impression is not suitable, the process stops at the analysis phase.

The analysis also identifies any factors that may affect or alter the appearance of the friction ridge detail. Factors such as, the type of surface and the amount of pressure used when the friction skin touched the surface. Heavy pressure by the finger or palm on a surface can flatten the ridges and make the furrows appear narrower. Since skin is flexible, movement of the finger on the surface can distort the appearance of the details. The factors analysed are: anatomical factors, substrate, matrix, development method, deposition pressure, lateral distortion, clarity and tolerance.

The analysis phase takes place prior to seeing the known fingerprint and prior to the comparison. The analysis is documented and this includes annotating the features observed during the analysis. Many agencies use the GYRO³ method of annotating the features. This colour coded system allows the

³ Langenburg, G., and C. Champod. 2011. "The GYRO System--A Recommended Approach to More Transparent Documentation." *Journal of Forensic Identification*, 61(4):373-384

examiner to indicate their confidence in finding those features in a known fingerprint. Green indicates a high level of confidence, Yellow is for moderate confidence and red for a low level of confidence. Orange is used during the comparison, for features that are identified after seeing the known fingerprint. The GYRO markings can provide support for opinions reached during the evaluation.

Comparison

The comparison is accomplished through side-by-side observations of all available levels of details. The comparison can be done using a fingerprint loupe for magnification and fingerprint picks, or digitally with Adobe Photoshop, or comparison software such as CS!pix. The comparison follows a basic 4 step process.

Step 1 is an analysis of the ridge flow and the distance between the core of the unknown fingerprint and the delta(s), should these features be available

Step 2 if a potential source is present, which means it cannot be excluded based on ridge flow and pattern type, then a target area in the unknown fingerprint is identified, typically the core or delta. Several distinctive features are selected within the target area for a preliminary comparison to the same spatial area of friction ridge features in the known fingerprint.

Step 3 if a potential source contains similar distinctive features and cannot be excluded, a specific feature, such as a ridge ending or bifurcation is selected as a starting point.

Step 4 Beginning at the starting point a ridge to ridge comparison is conducted, always going from the unknown fingerprint to the known fingerprint. During the comparison the examiner is assessing if there is agreement in the detail, but even more importantly, if there are any difference that would lead to an exclusion. The comparison continues until all available friction ridge detail in the unknown fingerprint has been compared to the known fingerprint

Evaluation

The comparison and evaluation phases are occurring simultaneously. The examiner is evaluating the agreement and disagreement with each compared ridge segment. At the end of the comparison and evaluation, the examiner will determine if there is agreement and if the quantity and quality of agreement is sufficient to warrant an opinion of identification.

When evaluating the sufficiency of the agreement the examiner is weighing the probability between two competing propositions. Proposition one; the two impressions were made by the same source and proposition two; the two impressions were made by different sources. An identification is the opinion of the examiner that the amount of agreement provides enough support for proposition 1.

Forensic Science Reviews and Current Research

There are a number of authoritative reports that can be used to support the testimony of the fingerprint expert.

a. *Ulery, B.; B.T.; Hicklin, R.A.; Buscaglia, J.; and Roberts, M.A. Accuracy and reliability of forensic latent fingerprint decisions. Proceedings of the National Academy of Sciences, 2011; 108(19):7733-7738.*

This study, often referred to as the “Black Box Study”, or the “FBI Black Box Study”, is deemed to be the gold standard of research into the accuracy and reliability of fingerprint examiners.

- False positives error rate 0.1 % (erroneous identifications)
- False negative error rate 7.5 %
- This study did not include a verification phase, which would have lowered the error rates

b. *Tangen JM, Thompson MB, McCarthy DJ. (2011). Identifying fingerprint expertise. Psychological Science, 22, 995- 997.*

This study compared the performance of novices to experienced fingerprint examiners. For unknown fingerprints that appeared to be similar to the known fingerprints but were actually from different sources the novice error rate was 55.18% compared to the expert error rate of 0.68%.

President’s Council of Advisors on Science and Technology (PCAST). Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods; Executive Office of the President’s Council of Advisors on Science and Technology: Washington, D.C., 2016.

This review of the forensic comparison sciences found that latent print analysis is a foundationally valid subjective methodology.

- This report presents an incorrect estimation of the potential error rate. They concluded the error rate could be as high as 1 in 18 comparisons.
- The error rate of 1 in 18 was calculated using an incorrect error rate from the Miami-Dade unpublished black box study⁴.
- The calculation error from the Miami-Dade study is explained in a response to the PCAST report by the friction ridge sub-committee of the Organization of Scientific Areas Committee.
- The calculation error in the Miami-Dade study is also dealt with in an article⁵ detailing the RCMP expert witness testimony in *R v Bornyk*⁶.

c. OSAC Friction Ridge Subcommittee’s Response to the President’s Council of Advisors on Science & Technology’s (PCAST) Request for Additional References. Submitted December 14, 2016.

<https://www.nist.gov/topics/forensic-science/friction-ridge-subcommittee> (accessed February 7, 2018).

The OSAC response explains the calculation error from the Miami-Dade report and pushes back on the insinuation in the PCAST report that the error rate in case work is likely considerably higher.

- PCAST claims the rate would be higher because participants in the study over-performed, due to the “Hawthorne effect”. Over performing when being observed.

⁴ Pacheco, I.; Cerchiai, B.; Stoiloff, S. Miami-Dade Research Study for the Reliability of the ACE-V Process: Accuracy and Precision in Latent Fingerprint Examinations; NCJRS Doc. No. 248534, Dec, 2014.

⁵ Wilkinson, D.; Hockey, D.; Richard D. Expert Fingerprint Testimony Post-PCAST—A Canadian Case Study. *Journal of Forensic Identification* 68 (3), 2018 \ 299

⁶ *R v Bornyk*, 2017 BCSC 849

- OSAC cites research that shows that participants under-perform in anonymous studies.
- OSAC points out that the studies evaluated by PCAST did not use a verification phase. A verification stage would likely have greatly reduced the error rates from those studies.

Frequently Asked Questions and Defense Strategies

The purpose of this section is to provide some information and clarification in relation to some frequently asked questions. We will also present some frequent strategies used by defense lawyers during cross-examination of an expert witness. We have provided the recommended responses that may require additional questioning in re-direct to elicit the necessary information. These responses accord with the opinions of CanFRWG experts and would be appropriate or suitable responses. Your response in court must be of course, accurate, truthful and complete and must be your opinion. These responses are for your consideration only.

Can the age of a fingerprint be determined?

No. Currently, fingerprints can only be aged circumstantially e.g. when the surface was last known to be cleaned.

How many “points” are required to make an identification?

International Association for Identification (IAI), Jackson, Wyoming –August 1st, 1973. Standardization Committee stated:

“no valid basis exists at this time for requiring that a pre-determined minimum number of friction ridge characteristics must be present in two impressions in order to establish positive identification.”

International Symposium, Ne’urim, Israel –June 1995

“No scientific basis exists for requiring that a predetermined minimum number of friction ridge features must be present in two impressions in order to establish a positive identification.”

The International Association of Identification resolution 2009-18 states:

“There currently exists no scientific basis for requiring a minimum amount of corresponding friction ridge detail information between two impressions to arrive at an opinion of single source attribution.”

These types of questions often devolve into “could you identify with X number of features or points in agreement. A fingerprint expert cannot assess the value of hypothetical detail, but no reasonable examiner would consider identifying with only 2 or 3 features.

Another line of questions may involve covering a portion of the fingermark in question and asking if the examiner would still be able to reach an identification opinion. The problem here, is that the examiner made the identification using all available detail. You cannot un-see what you’ve seen.

Can you give the probability of another person having the same fingerprint?

No. There are quantitative methods being developed for assessing the strength of association between a latent and an exemplar. However, no statistical models have been validated for use in Canadian courts.

What are the types of potential errors in your discipline?

False positive (erroneous identification) –the incorrect determination that two areas of friction ridge impressions originated from the same source.

False negative (erroneous exclusion) –the incorrect determination that two areas of friction ridge impressions did not originate from the same source.

Have errors occurred in your discipline?

Yes. We do not claim a zero error rate.

According to a study published in the Proceedings of the National Academy of Sciences involving mainly US experts the rates of error:

False positive rate of 0.17% without verification.

False negative rate of 7.5% without verification.

The fingerprint examiner should make clear that there is no one size fits all error rate. The risk of error must be measured against the complexity of the unknown fingerprint in the case at hand. Additionally, the examiner should describe the process put in place to reduce the risk of error:

- Analysis of the unknown fingerprint before the comparison
- Documentation of the analysis
- Annotating the features observed during the analysis phase
- Annotating of the features during the comparing phase
- Opinion submitted for verification

Are you aware of controversial errors?

Yes

The 1997 erroneous identification to Shirley McKie by the Scottish Criminal Records Office (SCRO)

The 2004 erroneous identification to Brandon Mayfield by the Federal Bureau of Investigation (FBI)

The fingerprint examiner should make clear that the unknown fingerprints in both the SCRO and FBI errors are considered very complex. As a result of those errors, processes were put in place to reduce the risk of error;

- Analysis of the unknown fingerprint before the comparison
- Documentation of the analysis
- Annotating the features observed during the analysis phase
- Annotating of the features during the comparing phase
- Opinion submitted for verification

Have you ever made an error?

To date, it has not been brought to my attention that I have made an error in either training or casework.

The expert must leave open the possibility of error. If the expert has made an error, the error should be described and factors contributing to the error should be explained. Additionally, the expert should describe any corrective measures taken to prevent a re-occurrence.

Will an unknown fingerprint be left if a surface is touched, or an item is handled?

There is no guarantee an unknown fingerprint will be left on a surface. There are multiple factors that can affect the depositing and recovery of unknown fingerprints, including the type of surface, the environment of the surface (indoor or outdoor), the amount of sweat on the friction skin, and any contaminants that may be on the friction skin, or on the surface.

Are you familiar with bias in forensic sciences?

Yes, during our training we studied the potential of effects of bias, some of the recent research, and strategies to reduce the risk of error due to bias.

The examiner should describe the process put in place to reduce the risk of bias leading to an error in judgement:

- Analysis of the unknown fingerprint before the comparison
- Documentation of the analysis
- Annotating the features observed during the analysis phase
- Annotating of the features during the comparing phase
- Unknown fingerprint submitted for verification

Check List

- Expert's CV
- Expert's report
- Pre-trial meeting with expert
- Multiple fingerprint identifications – Discuss with expert
- Verifier's CV
- Verifier's report (can say/will say)
- Current known fingerprints (associated to case)
- Photographs associated to the case and the fingerprint identification(s)
- Any exhibits associated to the fingerprint identification(s)
- Fingerprint chart
- Forensic Science Reviews, Current Research, and related articles (if required)