



Guidance for Friction Ridge Research

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Objective

When a Forensic Identification practitioner learns about a new product or technique for fingerprint detection they might believe that it shows potential for use on their own casework, but what options are available? One option is to simply ignore the information because the new technique is not part of the agency's Standard Operating Protocols (SOPs). Another high risk option is to use it, untested, on casework. Many will want to test new techniques on samples in a controlled and repeatable manner and the objective of this guidance document is to provide a road-map for operational units to compare new products or techniques to methods they are currently using on casework.

Background

The International Fingerprint Research Group (IFRG) has published guidance on performing research within operational units that will produce robust data upon which to draw conclusions and make recommendations for further work to assist in implementing new techniques into operations [1]. They outline four phases of research and development from novel research (phase 1-pilot study), optimizing and measuring relative performance of a new method compared to established techniques (phase 2-optimization and comparison), to rigorously comparing the optimized methods to existing techniques in simulated casework (phase 3-validation), and casework implementation (phase 4-operational evaluation and casework trials).

We assume that the comparison of a new method to existing SOPs forms the bulk of the type of research activity being performed by practitioners in Canada. This is identified as a phase 2 study according to the IFRG and assumes that there already exists a number of publications outlining the optimal formulation and development conditions for the new technique.

Currently, there are numerous Forensic Science programs in Canadian universities that are seeking placements for their students to complete a research project within an operational setting. This influx of students has increased the number of research projects occurring in operational units across Canada.

Research Setup

The Canadian Friction Ridge Working Group (CanFRWG) has created a fillable template (see below) to assist the user in developing a research plan that will lead to meaningful data when comparing a new fingerprint technique to an existing technique. Be sure there is enough time to conclude the research so that all involved parties meet their due dates. Consider consulting a research scientist in either your police agency or a separate agency to discuss the experimental design.

Pre-set conditions for the comparison of technique A to technique B include:

1. A minimum of 5 donors, preferably a range in donor types from poor to good.
2. Fingerprint samples will be a minimum of 10 depletions repeated 3 times (sets). Number of depletions multiplied by the number of sets will be 30 at a minimum for each variable combination (substrate x donor x time, etc).
 - It is advised to increase the number of sets or donors if more time/resources are available. Increasing other variables will make the final analysis more complicated.
 - Less depletions can be done for certain experiments, in which case, sample size should be increased with more sets.
3. Donors will deposit natural fingerprints from unwashed hands (at least 60 minutes since washing with no intentional grooming by rubbing highly sebaceous areas, e.g. nose).

- The deposition of the fingerprints should occur at least 24 hours before development is attempted but further aging periods can be selected. Aging periods must be consistent. For example, you could select an aging period of 48 hours or 7 days, or both.
- Samples will be halved (see Figure 1) with one side processed with technique A and the other side processed with technique B.

Score	Definition
+2	Half-impresion developed by technique A exhibits far greater ridge detail and/or contrast than the corresponding half-impresion developed by technique B
+1	Half-impresion developed by technique A exhibits slightly greater ridge detail and/or contrast than the corresponding half-impresion developed by technique B
0	No significant difference between the corresponding half-impresions
-1	Half-impresion developed by technique B exhibits slightly greater ridge detail and/or contrast than the corresponding half-impresion developed by technique A
-2	Half-impresion developed by technique B exhibits far greater ridge detail and/or contrast than the corresponding half-impresion developed by technique A
NA	No development by either technique

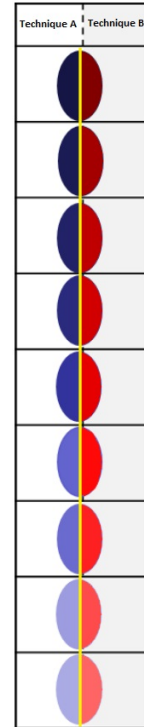


Table 1: Modified University of Canberra scale for fingerprint comparison of split fingerprints
 Figure 1: Split fingerprints based on Technique A (left side) and Technique B (right side)

- The environmental conditions of the workplace, such as room temperature and relative humidity, at the time of development should be recorded.
- An individual will perform fingerprint assessments using a comparative scale [2], see Table 1. Multiple assessors is possible, but it is recommended for simplicity to have one assessor. A record should be kept of donor, depletion, depletion set, substrate and age of impression along with the comparative scale score for each impression.
- Analysis will be done visually using tables and charts and/or using a Wilcoxon signed-rank test. Analyses should be done separately for each combination of donor, substrate, and age of impression. One can combine donors, however, they must be aware of the potential issues related to combining multiple sources of variation.

Outcomes

The user will generate data that can be used to observe the limit of detection of each technique by measuring the quantity of depletion impressions that have been developed and assessed. By reconstructing the sample, they can directly observe performance of the two techniques side-by-side on the same fingerprint. When forming conclusions, it is important to consider the limitations of the project and clearly communicate them in any written documentation of the research [1,3].

Next steps/Conclusions

If the new product shows potential improvements compared to the existing technique being used by the police service then further pseudo-operational research might be warranted before considering the technique for casework implementation. Pseudo-operational research trial involves collecting samples that have been naturally-handled such as sourcing drinking cans or bottles from recycling containers or collecting opened envelopes from the mail room, etc. A significant number of items should be collected and randomly assigned to either the new or existing reagents for fingerprint development. It is important to ensure that similar types of items are equally represented in both groups and that a record of developed fingerprints judged to be suitable for comparison, as well as fingerprints assessed as identifiable are recorded over the course of the trial.

None of this is to say, however, that CanFRWG suggests that the experimental design outlined in this document must be followed. There are other types of experiments and alternate analyses (such as other assessment scales) that can be used for fingerprint research. It will be up to the researcher and/or agency to decide what is best for their project. What is most important, regardless of the experimental design, is that limitations are clearly defined and conclusions are not overstated.

Number of Assessments Calculator

This calculator determines the total number of assessments needed given the number of variables selected in an experiment. Enter in the number of each variable you wish to include in the experiment and the total number of assessments required will be returned.

Default values of 10 and 3 have been enter for depletions and depletion sets. It is recommended that your depletions multiplied by your depletion sets is not too small (a general rule of thumb is 30).

Number of Development Techniques:

Number of Donors:

Number of Substrates:

Number of Depletions:

Number of Depletion Sets:

Number of Aging Periods:

Number of Assessments:

References

- [1] International Fingerprint Research Group, Guidelines for the Assessment of Fingermark Detection Techniques, *J. Forensic Ident.* 2014, 64(2), 174-200.
- [2] McLaren, C.; Lennard, C.; Stoilovic, M. Methylamine Pretreatment of Dry Latent Fingermarks on Polyethylene for Enhanced Detection by Cyanoacrylate Fuming. *J. Forensic Ident.* 2010, 60 (2), 199–222.
- [3] Hockey, D., Dove, A., Kent, T., Guidelines for the use and statistical analysis of Home Office fingermark grading scheme for comparing fingermark development techniques, *For. Sci. International*, 2021, 318, 110604.