

OSAC RESEARCH NEEDS ASSESSMENT FORM



Title of research need: Complexity in Analysis and Comparison of Friction Ridge Impressions

Describe the need: (1) Research to address the operational utility and reliability of complexity determinations during both the Analysis and Comparison phases of a comparison. (2) Consider criteria/thresholds and assumptions for measures and potential assignment of labels of complexity and demonstrate their validity for casework. (3) Define, if feasible, a list of characteristics that can be used to support complexity labels and validate these for casework. (4) Research into the possibility of automating the measurement of complexity.

Keyword(s): Friction Ridge, Analysis, Comparison, Complexity, ACE-V

Submitting subcommittee(s): Friction Ridge **Date Approved:** June 27, 2022

Background Information:

1. Does this research need address a gap(s) in a current or planned standard? (ex.: Field identification system for on scene opioid detection and confirmation)

Yes. Two best practice recommendation documents already posted as drafts and sent to SDO (BPR for Analysis and BPR for Comparison and Evaluation) incorporate recommendations for thresholds of non-complex, low complexity, and high complexity. These thresholds are currently based upon a consensus of expert experience overlaid loosely with prior black box study research (such as the Noblis/FBI series), but no research that directly tests or validates these criteria/thresholds has been conducted, nor have the assumptions that underlie these criteria been elucidated and tested. Essentially, these guidelines lack a research basis to demonstrate their validity.

2. Are you aware of any ongoing research that may address this research need that has not yet been published (e.g., research presented in conference proceedings, studies that you or a colleague have participated in but have yet to be published)?

Yes, there are several ongoing research projects working on quality measurements, but these have not yet been linked to thresholds of complexity, nor tested for examiner reliability in applying them.

3. Key bibliographic references relating to this research need: (ex.: Toll, L., Standifer, K. M., Massotte, D., eds. (2019). Current Topics in Opioid Research. Lausanne: Frontiers Media SA. doi: 10.3389/978-2-88963-180-3)

Ulery, B. T., Hicklin, R. A., Buscaglia, J. & Roberts, M. A. 2011. Accuracy and Reliability of Forensic Latent Fingerprint Decisions. Proceedings of the National Academy of Sciences, USA, 108, 7733-7738.

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Ulery, B. T., Hicklin, R. A., Roberts, M. A. & Buscaglia, J. 2014. Measuring What Latent Fingerprint Examiners Consider Sufficient Information for Individualization Determinations. PLoS One, 9, e110179.

Kalka, N. D., Beachler, M., & Hicklin, A. (2020). LQMetric: A Latent Fingerprint Quality Metric for Predicting AFIS Performance and Assessing the Value of Latent Fingerprints. Journal of Forensic Identification, 70(4), 443-463.

Swofford, H., Champod, C., Koertner, A., Eldridge, H., & Salyards, M. (2021). A method for measuring the quality of friction skin impression evidence: Method development and validation. Forensic Science International, 320, 110703.

Eldridge, H., De Donno, M., Furrer, J. & Champod, C. 2020. Examining and expanding the friction ridge value decision. Forensic Science International, 314, 110408, <https://doi.org/10.1016/j.forsciint.2020.110408>

Eldridge, H., De Donno M. & Champod C. (2021). Predicting suitability of finger marks using machine learning techniques and examiner annotations. Forensic Science International 320, 110712, <https://doi.org/10.1016/j.forsciint.2021.110712>

4. Review the annual operational/research needs published by the National Institute of Justice (NIJ) at <https://nij.ojp.gov/topics/articles/forensic-science-research-and-development-technology-working-group-operational#latest>? Is your research need identified by NIJ?

Fits into the following identified categories: Scientific foundations for expert conclusions of forensic evidence; Development and validation of standardized forensic methods and conclusions; and Determination of accuracy and reliability of forensic analyses and conclusions, including potential sources of error

5. In what ways would the research results improve current laboratory capabilities?

Clear criteria to define thresholds of low and high complexity, versus those marks that are not complex, will allow laboratories to set Quality Assurance (QA) policies that are in alignment with these thresholds. This will help laboratories by identifying those marks and comparisons that represent a higher risk of error and thus should be subject to additional QA measures to mitigate this risk, as well as identifying those that are very high quality/low risk and could be subjected to fewer QA requirements, thus freeing up time that could be dedicated to the complex cases. These changes could result in higher laboratory efficiency and reduced errors. However, research is needed to validate the criteria and thresholds that have been proposed in OSAC documents, or to propose new ones if those are found through research to be ineffective.

6. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

See Number 5, above. The subcommittee has already developed best practice recommendation documents, but these are based largely on the combined experience of the committee and lack a strong empirical basis. The assumptions and criteria used to build these thresholds should be scientifically evaluated for validity.

7. In what ways would the research results improve services to the criminal justice system?

The criminal justice system would benefit from a reduction in errors that could be expected from the implementation of validated complexity thresholds and the attendant QA policies. Additionally, since these policies will likely include a requirement for additional documentation of complex cases, the criminal justice system will benefit from additional reviewable documentation in complex cases.

8. Status assessment (I, II, III, or IV):

I

	Major gap in current knowledge	Minor gap in current knowledge
No or limited current research is being conducted	I	III
Existing current research is being conducted	II	IV

This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.