



OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:

Validation of the Suitability of Standard Practice for Interpretation and Report Writing in Forensic Comparisons of Trace Materials

Keyword(s):

Trace evidence, interpretation, validation, report writing, expert opinion

Submitting subcommittee(s):

Materials/Trace

Date Approved:

9/24/18

(If SAC review identifies additional subcommittees, add them to the box above.)

Background Information:

1. Description of research need:

In trace evidence comparisons, the forensic examiner analyzes the evidence and resulting data, forms an opinion, and summarizes the findings in a written report. The examiner shall also interpret and report the overall meaning of those findings. This information can assist in the early investigative stages as well as during the legal management of a case. As a result, the meaning of the findings should be clearly communicated to crime scene investigators, law enforcement officers, lawyers, jury, and judges.

A three-step process may be used in forming the expert opinion. Step one involves a binary decision to determine whether the compared samples can be discriminated based on the comparison of the measured data. Step two is the evaluation of the results on a source level to determine and explain the significance of finding no differences between the samples being compared (i.e., how discriminating and rare the material's characteristics are). Finally, step three is the evaluation of these results on an activity level to determine and explain the relevance of the findings under given circumstances (i.e., evaluation of the evidence considering competing propositions of alleged activities, and factors such as transfer mechanisms and persistence). These steps can be conducted sequentially or simultaneously, depending on the methods used for the description and evaluation of the qualitative and/or quantitative data.

A vast majority of trace evidence comparisons cannot definitively establish that the items originated from the same source, but instead can lead to associations with class characteristics and also eliminations. Unless the examiner's opinions are accompanied of an assessment by the level of support for the conclusion that the items originated from the same source as opposed to the conclusion they originated from different sources, the meaning and value of the association can lead to subjective interpretations.

To date, there is no standard forensic practice for the interpretation and report writing in forensic comparison of trace materials. Thus, there is a critical need to develop and validate an interpretation standard to ensure proper assessment of the significance of comparative conclusions. In the absence of such standard practices, objectivity and agreement among examiners to arrive at conclusions and to communicate their meaning will likely remain difficult.

In response to this need, the OSAC Trace/Materials Subcommittee created the Interpretation Task Group at its 2015 kickoff meeting with the primary goal of developing a standardized practice for interpretation and report writing in forensic comparisons of trace materials. The central hypothesis is that the use of this interpretation document will help forensic examiners to standardize criteria used during the interpretation process and consistency of the language used for communicating their conclusions.

The proposed practice uses a qualitative approach to communicate the significance of an association or exclusion, based on a) the foundational validity of the scientific methods used for the comparison of the items; b) discrimination capabilities of the analytical protocol, and c) existing knowledge of discriminating power based on survey studies, reference collections and/or databases. If error rates and formal statistical methods are available to provide a quantitative approach (e.g.,

likelihood ratio, Bayesian framework), they may be used to supplement the qualitative approach described in this practice.

At this moment, it is essential to design interlaboratory studies to validate the suitability of the proposed interpretation guide to measure how much examiners vary from each other when they consider the same case, and how much examiners diverge from consensus conclusions. The data derived from the research will provide a better understanding of the effectiveness of the interpretation document and will help identify areas for improvement.

2. Key bibliographic references relating to this research need:

1. Aitken CGG, Taroni F (2004) *Statistics and the evaluation of evidence for forensic scientists*, 2nd edn. Wiley, Chichester
2. Colyvan M, Regan HM (2007) Legal decisions and the reference class problem. *Int J Evidence Proof* 11:274–285
3. Cook R, Evett IW, Jackson G, Jones PJ, Lambert JA (1998) A hierarchy of propositions: deciding which level to address in casework. *Sci Justice* 38:231–239
4. Curran JM, Hicks TN, Bucketon JS. *Forensic interpretation of glass evidence*. Taylor & Francis, 2000.
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6. Jan de Keijser&HenkElffers (2012) Understanding of forensic expert reports by judges, defense lawyers and forensic professional, *Psychology, Crime & Law*, 18:2, 191-207
7. Kaye DH (2010) *The double helix and the law of evidence*. Harvard University Press, Cambridge
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9. Redmayne M (2001) *Expert evidence and criminal justice*. Oxford University Press, Oxford
10. Robertson B, Vignaux GA (1995) *Interpreting evidence: evaluating forensic science in the courtroom*. Wiley, Chichester
11. Roux C, Talbot-Wright B, Robertson J, Crispino F, Ribaux O. (2015) 370, 1674, The end of the forensic science world as we know it? The example of trace evidence, *Phil. Trans. R. Soc B*. 370: 20140260.
12. Saks MJ, Koehler JJ (2005) The coming paradigm shift in forensic identification science. *Science* 309:892–895
13. Taroni F, Bozza S, Biedermann A, Garbolino P, Aitken CGG (2010) *Data analysis in forensic science: a Bayesian decision perspective*. Wiley, Chichester
14. Thompson WC, Schuman EL (1987) Interpretation of statistical evidence in criminal trials-the prosecutor's fallacy and the defense attorney's fallacy. *Law Hum Behav* 11:167–187
15. Berner, E. S., et al. (1994). Performance of four computer-based diagnostic systems. *The New England Journal of Medicine*, 330(25), 1792-1796
16. Berner, E. S., et al. (1999). Effects of a decision support system on physicians' diagnostic performance. *Journal of American Medical Informatics Association*, 6(5), 420-427
17. R Corzo, T Hoffman, P Weis, J Franco-Pedroso, D Ramos, and JR Almirall, The Use of LA-ICP-MS Databases to Estimate Likelihood Ratios for the Forensic Analysis of Glass Evidence, *Talanta*, **2018**, 186(15) 655-661. <https://doi.org/10.1016/j.talanta.2018.02.027>.
18. T Hoffman, R Corzo, P Weis, E Pollock, A v Es, W Wiarda, A Stryjnike, H Dorne, A Heydon, E Hoise, S Le Franc, X Huifang, B Pena, T Scholz, J Gonzalez, J Almirall, An Inter-Laboratory Evaluation of LA-ICP-MS Analysis of Glass and the Use of a Database for the Interpretation of Glass Evidence, *For Chem*, **2018**, <https://doi.org/10.1016/j.forc.2018.10.001>

3a. In what ways would the research results improve current laboratory capabilities?

To date, there is no standard forensic practice for the interpretation and report writing in forensic comparison of trace materials. Further, members of the Materials Subcommittee regularly get questions from the trace evidence community regarding the progress on the Interpretation document, as they are awaiting OSAC guidance before improving their report writing practices. Thus, the development and validation of an interpretation standard is anticipated to assist crime laboratories to ensure proper assessment of the significance of the expert opinions and forensic reports.

Research that can support the validity of an interpretation standard practice can enhance objectivity and agreement among

examiners arriving at conclusions and communicating their meaning to the trier of fact.

3b. In what ways would the research results improve understanding of the scientific basis for the subcommittee(s)?

At the subcommittee level, these type of research would provide valuable support to the interpretation and report writing guidelines that are being developed for trace materials, particularly if we can integrate early in the process the feedback from practitioners, statisticians, the legal community and human resource experts. This research will also help different stakeholders within the OSAC to assess the utility and validity of the proposed guide.

3c. In what ways would the research results improve services to the criminal justice system?

Harmonization of scientific language and interpretation of findings is anticipated to assist criminal justice with the assessment of the significance of the evidence. The data derived from the research will provide a better understanding of the effectiveness of the interpretation document and will help identify areas for improvement.

4. 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.

Approvals:

Subcommittee

Approval date:

9/24/18

(Approval is by majority vote of subcommittee. Once approved, forward to SAC.)

SAC

1. Does the SAC agree with the research need?

Yes

No

2. Does the SAC agree with the status assessment? Yes No

If no, what is the status assessment of the SAC:

Approval date:

(Approval is by majority vote of SAC. Once approved, forward to NIST for posting.)