E92 On-Going Decision Analysis (a.k.a. Black Box) Studies at the Federal Bureau of Investigation (FBI) Laboratory

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Learning Overview: After attending this presentation, attendees will understand the development and purpose of the FBI's Footwear Examiner Decision Analysis Study, Handwriting Examiner Decision Analysis Study, and Firearms Decision Analysis Study, commonly known as "Black Box" studies.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by addressing the concerns of the results from the Decision Analysis Studies (DAS) presented in the 2009 National Academy of Sciences (NAS) Report on "Strengthening Forensic Science in the United States" and the 2016 President's Council of Advisors on Science and Technology (PCAST) Report on "Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods" with regard to narrowing gaps within "feature-comparison" methods of footwear, handwriting, and firearms disciplines.[1,2]

In early 2016, the Organization of Scientific Area Committees (OSAC) Footwear and Tire Subcommittee and Forensic Document Examination Subcommittee identified a major gap in current knowledge with regard to the reliability of Forensic Footwear Examiners (FFEs) and Forensic Document Examiners (FDEs). The need for firearms/toolmarks examiners to support subjective opinions with logical, scientifically based explanations as the basis for their identifications was reinforced in the 1991 case of *Ramirez v. State of Florida*. Along with the needs identified by NAS, OSAC, and the courts, the PCAST study was centered on the reliability of an examiner's conclusion that an evidentiary item was likely to have been derived from the same source as a known exemplar. To date, few studies have been conducted to establish objective measures of examiner accuracy in the forensic feature comparison disciplines. Decision analysis studies are one means to test the reliability and accuracy of these disciplines. A DAS only considers the evidence provided to examiners and the conclusions reached. It does not examine the decision-making process of examiners.

Test packets were created in each study to simulate casework and were assembled so that the combination of questioned and known samples would provide participants with challenging comparisons. Known (K) and Questioned (Q) handwriting exemplars, footwear impressions, and bullet and cartridge casings were collected and used to create each QKset. The studies were all double blinded and adhered to Institutional Review Board (IRB) protocols. For example, in the footwear DAS, each examiner received 100 QKsets to examine and then submit their conclusions within a custom graphical user interface. In addition, participants in the studies were required to have been actively employed in their field within a specified amount of time (e.g., 2 years for FDEs).

The objective of decision analysis studies of FDEs, FFEs, and Forensic Toolmark Examiners (FTEs) is to determine the rate at which examiners provide the appropriate forensic conclusion and, in turn, to estimate the rate of errors (accuracy). The consistency of responses between examiners (reproducibility) and their ability to reach the same conclusion when provided with the same specimens at a later time (repeatability) will be measured. When testing is concluded, accuracy, reproducibility, and repeatability will be quantified through statistical analysis. Any inter-relationships and correlations among the various factors will be explored and analyzed. Areas of improvement that warrant further study will be identified, and it will be determined what range of conclusions are appropriate. This knowledge can be leveraged by implementing a re-evaluation of examiners' suitability measures, training programs, and/or quality control methodologies. Results will be published in peer-reviewed forensic journals. These studies were administered in partnership with Ideal Innovations, Inc. and Noblis (FDE, FFE), and AMES Laboratories (FTE).

Reference(s):
[1.] National Research Council (NRC), Committee on Identifying the Needs of the Forensic Science Community. (2009). *Strengthening Forensic Science in the United States: A Path Forward.* Washington, DC: The National Academies Press.
[2.] President's Council of Advisors on Science and Technology (PCAST). *Report to the President: Forensic Science in Criminal Courts: Ensuring Scientific Validity Of Feature-Comparison Methods.* (2016). Washington, DC: Executive Office of the President of the United States.

Feature Comparison, Decision Analysis, Black Box