



NATIONAL COMMISSION ON FORENSIC SCIENCE



Ensuring That Forensic Analysis is Based Upon Task-Relevant Information

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Statement of the Issue:

What is the proper evidentiary basis for a forensic science opinion? In other words, what facts should forensic scientists consider and what facts should they not consider when drawing conclusions from physical evidence? These are questions of fundamental importance to forensic science. The need for clear answers has become increasingly important as forensic scientists are being called on to address the problem of contextual bias.

It is the view of the National Commission on Forensic Science that:

1. Forensic scientists should rely solely on task-relevant information when performing forensic analyses.
2. The standards and guidelines for forensic practice being developed by the Organization of Scientific Area Committees (OSAC) should specify what types of information are task-relevant and task-irrelevant for common forensic tasks.
3. Forensic laboratories should take appropriate steps to avoid exposing analysts to task-irrelevant information through the use of context management procedures.

1 – Pertinent Principles:

This document will set forth principles that forensic scientists can use to assess the relevance of information to specific forensic tasks. It will use the term *task-relevant* to describe information that a forensic scientist should consider when performing a particular task; it will use the term *task-irrelevant* to describe information that should not be considered.

This document focuses on analytic tasks that require expert judgment, such as comparing items to assess whether they have, or might have, a common source or examining items to determine their physical properties. It also applies to assessment of propositions about the activity that produced a given piece of evidence (e.g., assessing the activity that produced a bloodstain pattern). This document does not apply to broader tasks such as surveying crime scenes to determine what evidence should be collected or advising police and lawyers on the meaning of test results and how various test results might fit together.¹

The principles are derived from several important considerations:

- What is relevant to a particular forensic task will depend, in part, on the propositions the forensic scientist is asked to assess. A forensic scientist who is asked to assess propositions

¹ While this document addresses analytic, comparison disciplines in forensic science, concerns about cognitive and contextual bias have been raised about other aspects of forensic science and about expert evidence generally. These broader concerns will be examined and, where appropriate, addressed in future Commission documents.

about the source of samples (e.g., whether two blood stains came from the same person), will obviously need to consider different information than a forensic scientist who is asked to assess propositions about the activity that caused the particular sample to be deposited (e.g., whether the blood stain pattern resulted from a high velocity impact or some other activity).

- Forensic scientists should draw conclusions about the propositions in question solely from the physical evidence that they are asked to evaluate (along with any task-relevant context), and not from any other evidence in the case. Fingerprint examiners should draw conclusions from fingerprints, tool mark examiners from tool marks, DNA experts from biological evidence. When evaluating whether a latent print at a crime scene came from a particular suspect, for example, it would be inappropriate for the fingerprint examiner to be influenced by whether the suspect made incriminating statements or had a convincing alibi, or whether other forensic evidence implicated the suspect. Those are matters to be considered by police, prosecutors and jurors. But this kind of information is irrelevant to a scientific assessment of the latent print, and thus should not be allowed to influence the examiner's assessment.

Forensic scientists should base their conclusions on methods that are accepted as valid within their specific disciplines. They should draw conclusions only from methods or techniques that they are trained and qualified to use.

From these considerations, it follows that information is *task-relevant* if it is necessary for drawing conclusions:

- (i) about the propositions in question,
- (ii) from the physical evidence that has been designated for examination,
- (iii) through the correct application of an accepted analytic method by a qualified analyst.

Information is *task-irrelevant* if it is not necessary for drawing conclusions about the propositions in question, or if it assists only in drawing conclusions from something other than the physical evidence designated for testing, or assists only in drawing conclusions by some means other than an appropriate analytic method.

As previously indicated, forensic scientists will sometimes need contextual information in order to perform a particular task. For example, a fingerprint examiner may need information about the surfaces from which the prints were lifted in order to assess whether discrepancies between prints could have been caused by curvature or distortion of one of the surfaces. A blood pattern analyst may need information about the location of the blood in order to assess various propositions about how it was deposited. The test of whether such ancillary contextual information is relevant to a forensic assessment is whether it helps the examiner draw an accurate forensic conclusion from the physical evidence designated for testing using accepted methods. Any contextual information that helps the analyst assess directly the strength of the inferential connection between the evidence in question and the propositions the analyst is evaluating is task-relevant.

But contextual information often supports inferences about a proposition only through a chain of logic that does not involve assessment of the physical evidence. Contextual information of this type is task-irrelevant. A more formal definition of task-relevance and task-irrelevance is offered in the technical appendix to this document.

Let us consider several examples involving a latent print examiner who is asked to evaluate the proposition that a fingerprint on an item at a crime scene came from a particular suspect.

Information about the suspect's criminal history. Forensic scientists sometimes have access to "rap sheets" of suspects and may be tempted to look at them. But the suspect's criminal history (or lack thereof) is not necessary for drawing conclusions *from the physical evidence designated for examination* and therefore is not task-relevant.

Information that the suspect confessed to the crime. This information may well support an inference that the fingerprint found at the crime scene was that of the suspect. But this inference has nothing to do with comparison or evaluation of the prints. Hence it fails to meet the requirement that it help the analyst draw conclusions *from the physical evidence that has been designated for examination and through correct application of an accepted analytic method*. It is an inference that neither requires nor entails expertise in fingerprint comparison.

Information that the suspect was implicated by other physical evidence at the crime scene (e.g., DNA evidence). This information also supports an inference that the fingerprint found at the crime scene was that of the suspect. But once again, this inference does not arise from the comparison or evaluation of the fingerprints. Hence it fails in the same ways as the evidence of the confession.

Information that another latent print examiner identified the suspect as the source of a print found on a different item at the same crime scene. Even though this information involves fingerprints, it does not help the analyst draw conclusions *from the physical evidence that has been designated for examination, through correct application of an accepted analytic method*. An examiner might reason that a person who touched one item at a crime scene is also likely to have touched another, but that kind of reasoning does not constitute scientific assessment of the evidence in question, nor does it constitute the application of an accepted analytic method. Latent print examiners should draw conclusions by examining and comparing prints, not by reasoning about whether a particular suspect is likely or unlikely to have touched a particular item.

Of course, information that is irrelevant to analytic tasks like comparing fingerprints may sometimes be relevant to other forensic science tasks. A forensic scientist who surveys a crime scene to determine what evidence to collect or confers with the assigned detective to determine what evidence to analyze, what examinations are required, and with what priority, will obviously need more contextual information than the analysts who compare specific items of evidence. Forensic scientists who confer with police or lawyers to help them understand the picture emerging from the examination of multiple items of evidence from a crime scene will also need more contextual information than those whose job it is to perform a specific analysis or comparison. What is task-relevant will always depend on the nature of the task.

2 – Contextual Bias: Unwanted Influence of Task-Irrelevant Information:

In 2009, the National Research Council (NRC) concluded that "forensic science experts are vulnerable to cognitive and contextual bias." (p. 4, note 8). This concern arose, in part, from empirical studies showing that forensic scientists are sometimes influenced by information that is task-irrelevant. For example, fingerprint examiners were less likely to report a match between a latent print from a crime

scene and a suspect when they were told that the suspect had a solid alibi (Dror & Charlton, 2006; Dror, Charlton & Peron, 2006; Dror & Rosenthal, 2008).

Forensic scientists, like all human beings, are subject to contextual bias. Contextual bias is a universal phenomenon that affects decision making by people from all walks of life and in all professional settings (Kassin, Dror & Kukucka, 2013). Particularly when their evaluations involve subjective elements, and when there are ambiguities in the underlying data, forensic scientists may be influenced by information that is irrelevant to their task.

Studies show that the contaminating impact of contextual bias can occur beneath the level of conscious awareness (Kassin, Dror & Kukucka, 2013; Thompson, 2011). This finding means that contextual bias is by no means limited to cases of misconduct or bad intent. Rather, exposure to task-irrelevant information can bias the work of forensic scientists who perform their job with utmost honesty and professional commitment. Moreover, the non-conscious nature of contextual bias also means that people cannot detect whether they are being influenced by it. It follows that task-irrelevant information can bias the work of forensic scientists even when they earnestly and honestly believe they are operating with utmost objectivity.

3 – Ways to Minimizing Contextual Bias: A Path Forward

The most effective way to address the problem of contextual bias is to avoid exposing analysts to task-irrelevant information (Risinger, et al. 2002). Analysts can be shielded from exposure to task-irrelevant information in several different ways through the use of context management procedures (Stoel, Berger, Kerkhoff, Mattijssen & Dror, 2015).

One approach involves dividing duties within a forensic laboratory between a case manager, who is fully informed about the facts of the underlying case, and analysts, who are told only what they need to know to perform specific tasks (Thompson, 2011; Found and Ganas, 2013). Under this approach, case managers communicate with investigators, decide what evidence needs to be examined or tested, and then assign the evidence to analysts, who conduct the examinations and tests. The case manager decides what information is task-relevant and task-irrelevant for each task to be performed, and conveys to the analyst only information that is relevant to that task. Under this system the analyst may eventually learn the broader facts of the case, but only after the analytic task has been completed and the results recorded. Laboratories might designate a single individual to serve as case manager for a number of analysts, or they might rotate the role of case manager among analysts, allowing them to diversify their experience. A rotating arrangement might be particularly suitable for smaller laboratories with a limited number of analysts. Even if there were only two analysts in a particular section, each might act as case-manager for the cases examined and analyzed by the other, so that both could be shielded from exposure to task-irrelevant information while performing important analytic tasks.

A second approach is to design the workflow in the laboratory in a manner that assures that analysts make critical assessments before they become aware of potentially biasing information. This strategy is helpful in instances in which information that is irrelevant for some tasks is relevant and necessary for other tasks that are performed by the same analyst. For example, information about the DNA profile of a suspect is irrelevant and potentially biasing when a DNA analyst is attempting to determine what genotypes are present in an evidentiary profile (Dror & Hampikian, 2011; Thompson,

2009), but is necessary and relevant when the analyst evaluates whether the suspect could be a contributor to the DNA in the evidentiary profile.

To reduce the potential for bias in DNA testing, some laboratories require analysts to follow a procedure known as “sequential unmasking” (Krane et al., 2008; Dror et al. in press), in which evidentiary samples from crime scenes are typed and interpreted before analysts learn of the profiles of any known or suspected contributors. The DNA profiles of known contributors and possible suspects are then “unmasked” in a specific sequence to minimize the likelihood that information about the reference profiles will influence interpretation of the evidentiary samples. This procedure has been adopted successfully by the Netherlands Institute of Forensic Sciences (Stoel, Berger, Kerkhoff, Mattijssen & Dror, 2015).

Similar procedures have been adopted by laboratories in the United States. For example, the FBI laboratory has reportedly adopted a similar procedure for latent print analysis, as has the Virginia Department of Forensic Science and the Minnesota Bureau of Criminal Apprehension. Called “linear ACE-V,” the FBI’s procedure involves temporary masking of reference prints while analysts make and record their initial assessments of the evidentiary prints (Office of the Inspector General, Department of Justice, 2011).

Forensic laboratories should begin to implement context management procedures. As they do so, they should systematically monitor laboratory performance in order to identify strengths and weaknesses of the new procedures, document unanticipated consequences, and learn from trial and error which context management procedures are most successful and practical.

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Technical Appendix: Formal Definition of Task-Relevance

The distinction between task-relevant and task-irrelevant information can be described formally as follows:

Let P and NP designate two mutually exclusive propositions that a forensic scientist is asked to evaluate. For example, P might designate the proposition that a particular suspect was the source of a fingerprint found at a crime scene; while NP designates the proposition that someone other than the suspect made that print.

Let E designate the features or characteristics of the physical evidence that has been designated for examination. For a fingerprint examination, E will typically consist of the observable features of the questioned latent print and the reference prints from a suspect.

In order to draw conclusions about P, NP from E , the examiner must consider the conditional probability of E under those alternative propositions. It follows that any information that could assist the examiner in making that evaluation is task-relevant, while information that has no bearing on that evaluation is task-irrelevant. Specifically:

- (1) information is task-relevant if it has the potential to assist the examiner in evaluating either $p(E|P)$ or $p(E|NP)$;
- (2) information is task-irrelevant if it has no bearing on the conditional probabilities $p(E|P)$ or $p(E|NP)$.

Consider, for example, information about the surface from which the latent print was lifted. This information might be needed to understand how discrepancies could arise between the reference prints and the latent prints, hence it could be helpful for assessing $p(E|P)$ in a fingerprint examination. If so, it is task-relevant.

By contrast, consider information about the suspect's prior criminal record, statements to police, and alibi. This type of information might affect the examiner's evaluation of the likelihood that P or NP is true, but it has no effect whatsoever on the relevant conditional probabilities, $p(E|P)$ and $p(E|NP)$. If the suspect is the source of the latent print, then a high degree of similarity between the prints is to be expected regardless of whether the suspect confessed, or has an alibi, or a criminal record. If suspect is not the source of the latent print, then a low degree of similarity is to be expected, regardless of these other factors.

Because information of this type does not affect the relevant conditional probabilities, it does not help the analyst assess the strength of the inferential connection between the evidence designated for examination and the relevant propositions. Hence, it does not help the analyst draw inferences about the propositions in question *from the physical evidence that has been designated for examination through correct application of an accepted analytic method*. Any inferences the analyst might draw from this information involve matters beyond their scientific expertise that are more appropriately considered by others in the justice system, such as police, prosecutors and jurors.