JOURNAL OF FORENSIC SCIENCES

J Forensic Sci, July 2015, Vol. 60, No. 4
doi: 10.1111/1556-4029.12805
Available online at: onlinelibrary.wiley.com

Context Management Toolbox: A Linear Sequential Unmasking (LSU) Approach for Minimizing Cognitive Bias in Forensic Decision Making

The 2009 NAS report (1) criticized forensic scientists for making insufficient efforts to reduce their vulnerability to cognitive and contextual bias. Over the past few years, however, the field has begun to take steps to address this issue. There have been major workshops on cognitive bias, and the Organization of Scientific Area Committees (OSAC),[1] as well as the National Commission on Forensic Science, have created committees on Human Factors that are specifically charged with examining this issue.[2]

A number of tools and methods for minimizing bias are under consideration. Some of these tools have already been implemented in a few forensic laboratories. In general, these tools are designed to protect and enhance the independence of mind of forensic examiners, particularly those who rely on subjective judgment to make their decisions.

Several types of contextual information are of concern, as illustrated in Fig. 1. We organize them into a taxonomy of five levels (based on a four-level taxonomy suggested by Stoel et al. [2]). The five-level taxonomy differentiates task-irrelevant information that may be conveyed to an analyst by the trace evidence itself (Level 1), the reference samples (Level 2), the case information (Level 3), examiners' base rate expectations that arise from their experience (e.g., when the examiner expects a particular result—Level 4), and organizational and cultural factors (Level 5).

A variety of tools are available for addressing cognitive bias. Different tools are useful for managing exposure to each level of task-irrelevant information. For example, case managers (3,4) is a straightforward tool for dealing with bias from case information (Level 3). In general, these procedures are designed to prevent contextual bias by protecting the examiner from exposure to task-irrelevant information.

However, it is important to note that some types of information, while potentially biasing, may also be task relevant (5). These types of biasing information are more difficult to deal with. For example, in some instances, evidence that analysts must examine to perform their duties may contain information that is potentially biasing. This can pertain to cases in which Level 1 information, the trace evidence being evaluated, contains contextual information (e.g., blood spatter patterns that contain information about the nature of the crime, or handwriting and voice samples in which the meaning of the words is potentially biasing).

Reference samples are another example of relevant material that is also potentially biasing (Level 2). These samples are clearly relevant because the analyst must compare them to trace evidence samples to determine whether they are similar enough to conclude that they come from the same source. But it is possible that an analyst's interpretation of the trace evidence might inadvertently be influenced by knowing the characteristics of the reference samples—a form of bias arising from circular reasoning. To manage this type of bias, one must look to other tools in the context management toolbox. The most widely discussed tool for this purpose is sequential unmasking (6).

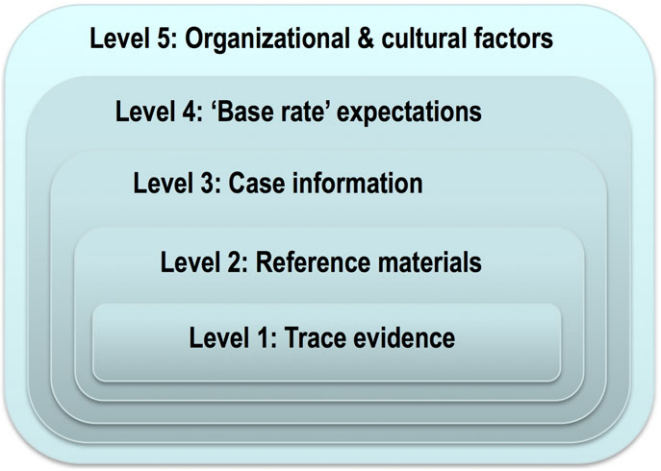

Fig. 1—*A taxonomy of the different levels at which task-irrelevant and potentially biasing contextual information may reach a forensic scientist.*

In contrast to other context management tools (3,5), the sequential unmasking approach does not prevent exposure to biasing *relevant* information. However, it does mandate that this information be presented as late as possible in the examination process and only when it is necessary. A critical element of sequential unmasking is that the forensic examiner must first examine and document the trace evidence from the crime scene (Level 1), before being exposed to the known reference material (Level 2).

This approach is linear in the sense that one must begin with the trace evidence before being exposed to and working with the reference material, thus working from the evidence to the suspect, rather than from the suspect to the evidence. The trace evidence should be interpreted the same in this initial step, regardless of any suspect who is considered as a possible (or even likely) source of the trace evidence. However, according to sequential unmasking (6), examiners are permitted to revisit, as well as change, their initial analysis of the trace evidence once they have reviewed the reference material, provided that they document these changes.

Sequential unmasking allows unlimited and unrestricted changes to the evidence once exposed to the reference material. We believe it is important to impose limits and restrictions for when examiners are permitted to revisit and alter their initial analysis of trace evidence. The analysis of traces is most objective when the examination is "context free"—that is, prior to exposure to the known reference samples. However, seeing the reference samples could alert the examiner to a possible oversight, error, or misjudgment in the analysis of the trace evidence.

Here, we seek to strike a balance between restrictive procedures that forbid analysts from changing their opinion and those that allow unlimited and unrestricted changes. The requirement that changes be documented does not eliminate the possibility that such changes arose from bias—it only makes that possibility more transparent.

[1]See: http://www.nist.gov/forensics/osac/hfc.cfm.

[2]The authors of this letter are comprised primarily from members of the OSAC Human Factors Committee, the Human Factors Subcommittee of the National Commission on Forensic Science, and authors of the original Sequential Unmasking.

We therefore suggest a *Linear Sequential Unmasking* (LSU) procedure that not only requires examiners to first examine the trace evidence in isolation from the reference material, but also provides a balanced restriction on the changes that are permitted postexposure to the reference material.

We believe that there are a number of approaches to achieve such a balance. A LSU approach could restrict the number of changes that are allowed postexposure to the reference materials —simply limiting examiners to a certain number of changes (rather than a constant number, this can be set as a proportion of the overall analysis). Another LSU approach might allow examiners to add to their initial analysis, but prohibit them from removing or deleting from it.

A different LSU approach for achieving a balanced restriction in changing the initial analysis depends on the confidence of the initial analysis. Clearly, there is a difference between revisiting and revising prior analysis decisions that an examiner initially perceived as only suggestive (low confidence) versus revisiting and revising analysis decisions that an examiner perceived as obvious and certain (high confidence).

We propose that distinguishing between these instances is important for four primary reasons:

- If the examiner can show that the initial judgment was tentative and uncertain, it will be easier for the examiner to justify and explain their revision of it.
- If the initial judgment was made with high confidence and certainty, special attention may be warranted when examiners seek to revise that judgment. In such cases, additional quality assurance measures, such as blind review by another examiner, could be appropriate. Alternatively, alteration of high confidence judgments could be prohibited altogether.
- Knowing the confidence with which an examiner renders an initial analysis could assist in understanding and quantifying the degree to which judgments about trace evidence were changed following exposure to reference materials (e.g., number of changes as a function of confidence). A recent FBI study found that an erroneous identification contained substantive revisions to the initial analysis of the trace evidence following exposure to reference materials (7).
- Initial confidence information could also be effective in raising early (preceding exposure to the reference) concerns about potential for erroneous identifications (i.e., identifying the "bias danger zone" [3]). Such cases (e.g., a large number of low confidence assessments) might call for a special procedure in which multiple examiners are required to assess the trace evidence independently and then work together to reach consensus regarding the trace evidence (all prior to exposure to the reference sample). Such processes might also improve the diagnostic value of evidence offered by forensic examiners.

This LSU approach requires examiners not only to first examine the trace evidence in isolation of the reference material, but also to specify their confidence levels. Expressions of confidence could take many forms, from simply indicating confidence scores or ratings, to developing verbal expressions of confidence, or to procedures that code confidence levels with different colors (e.g., "green for certainty," "yellow for low certainty," and "red for questionable"). Although adding confidence assessments will require a bit more specification during the analysis process, we believe that this procedure could provide clear benefits and could make the good tool of sequential unmasking even better.

We refer to these proposed procedures as "Linear Sequential Unmasking" (LSU) not only because the method further specifies a linear reasoning process (from evidence to suspect) that limits the potential for circular reasoning, but because it also offers reasonable restrictions that will minimize bias while providing examiners flexibility in forensic work.

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