



# Implementing context information management in forensic casework: Minimizing contextual bias in firearms examination



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## ABSTRACT

Managing context information in forensic casework aims to minimize task-irrelevant information while maximizing the task-relevant information that reaches the examiner. A design and implementation of context information management (CIM) is described for forensic firearms examination. Guided by a taxonomy of different sources of context information, a flow-chart was constructed that specifies the process of casework examination and context information management. Due to the risk of bias, another examiner may need to be involved when context information management is unsuccessful. Application of context information management does not make a subjective examination objective, but can limit the risks of bias with a minimal investment of time and resources.

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## 1. Introduction

Traditional forensic identification sciences, which have been accepted in court for over a hundred years, are now criticized for their lack of scientific rigor (e.g. [1–5]). Part of the criticism focuses on the biasing effect of domain-irrelevant information on the judgment of experts in forensic casework.<sup>1</sup> Such concerns were originally raised long ago [7–10], but were mainly ignored. The change in the forensic domain came only with the presentation of empirical evidence for the existence and importance of cognitive problems [11–13].

It has been argued that forensic scientists should acknowledge the risks of contextual and other biases, and minimize their effects by implementing appropriate methods and procedures for forensic casework [3,14–17]. With the growing acceptance that these issues are real and relevant, it seems appropriate to take steps to deal with

contextual bias. However, while much has been written and is being written on contextual bias in forensic science (e.g. [2,3,15,18–26]), there is a need to develop and provide sufficiently detailed guidelines.

Blind procedures such as (linear) sequential unmasking [15,27,28], evidence line-ups [14], and the ‘case managers’ model [3,17] have been proposed. Sequential unmasking minimizes bias by ‘preventing analysts from knowing the profile of submitted references (i.e., known samples) when interpreting testing results from evidentiary (i.e., unknown or questioned) samples.’ [27]. While sequential unmasking is a very powerful methodology, it can only be implemented for specific types of evidence. For these types of evidence the features can be defined and measured prior to examining the reference material and prior to the comparison. This is the case for domains such as DNA and fingerprint examinations, but much more challenging for areas such as toolmark examination, firearms examination, and handwriting analysis, where in current practice it is not as straightforward to objectively define and record all features of the evidence.

Risinger’s ‘case managers model’ distinguishes a case manager who is fully informed of the facts of the case, and an analyst who is ‘blind’ to irrelevant information [3,15–17]. Page et al. propose to apply a combination of the case managers model and sequential unmasking in forensic odontology [29]. Found et al. describe the management of context information in forensic handwriting examination casework [30].

Although there is a call for the development of appropriate methods and procedures to minimize the effects of (contextual) bias, others

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<sup>1</sup> In contrast to earlier publications we will use the terms ‘task-relevant’ and ‘task-irrelevant’ in the remainder of this article. It is our opinion that when managing information to minimize contextual bias this usually focuses on a specific task, e.g. the comparison of markings in two bullets. Information which is irrelevant for this specific task (comparison) might be relevant for another task (e.g. shooting scene reconstruction) within the same forensic domain [6].

question the need for this. As a recent example, Langenburg et al. claim that only a small proportion (2%) of the casework from the Minnesota Bureau of Criminal Apprehension Latent Print Unit, from 2009 to 2010, consisted of cases where there was a high level of interaction between the examiner and the investigator(s) or prosecutor and which had a high amount of context information [31]. However, serious concerns have been raised about the methodology of this study, which call the findings into question [32]. Champod voiced the concern that examiners will be deprived completely from external information and that the need for fundamental research in various forensic fields will be neglected by prioritizing research on the presence of contextual bias [33]. Context information management (CIM) should take these concerns into account ensuring that it is efficient and does not lead to depriving the examiner of relevant information.

Indeed, when implementing CIM, it should be practical and efficient while at the same time enabling an effective use of task-relevant context information [17]. In a reply to Champod [33], Berger and Stoel [34] stress that managing context information should both decrease the amount of task-irrelevant information and increase the amount of task-relevant information. They agree that implementing procedures to deal with context information does not require the research agenda to be switched from fundamental issues to the existence of bias in every single forensic discipline.

This article describes the development and implementation of an efficient CIM procedure to deal with context information within forensic firearms examination. Managing context information [30, 35] aims to optimize the flow of information to and from a forensic examiner in a case, by minimizing as much as possible the exposure to task-irrelevant information while maximizing the role of and focus on task-relevant information. The specific procedure to be applied in practice depends on the type of context information. We will use the classification of context information as proposed by Stoel, Berger, Kerkhoff, Mattijssen & Dror [35] in order to decide on the appropriate CIM procedure.

The structure of this article is as follows: We will first give a short overview of the classification of context information, and the corresponding CIM procedures as proposed by Stoel et al. [35]. Then we will describe the consecutive steps that were taken, and choices that were made during the implementation of CIM in the Firearms section of the Netherlands Forensic Institute (NFI). The project confirmed that the implementation of CIM was as feasible as expected; it is currently being implemented for other disciplines within the institute, wherever applicable.

We want to make explicit that we do not quantify whether, how, and how much bias by context information is an issue in forensic casework in practice. While these questions are important and interesting from an academic perspective, we took the position that we cannot ignore the large amount of findings from cognitive research outside of forensic science (e.g. [11–13]) providing convincing evidence for the existence of contextual influences. Therefore, it is prudent to perform forensic examinations in such a way that the risk of contextual bias is minimized, while not leading, of course, to inefficient approaches that result in much longer lead times. As Dror stated: “For forensic science to successfully take on the issue of contextual bias, it is important that one correctly considers the risks, that measures are taken when needed, and that they are proportionate and appropriate” [36]. Procedures that deal with rare occurrences should not make the everyday work of examiners (too) inefficient, as implied by Helsloot and Groenendaal [37]. During the design of CIM in the Firearms section we have taken into consideration both the positive effects of minimizing bias in forensic casework as well as the negative impact on e.g. lead times. Given current best practice, this has resulted in a procedure that both maximizes benefits in overall casework and minimizes cost in terms of resources and efforts.

## 2. Levels of context information, and CIM

### 2.1. Levels of context information

Stoel et al. [35] classify sources of context information into four levels ordered by their proximity to the information in the trace: the trace itself (Level 1), the reference material (Level 2), the case information (Level 3), and the ‘base rate’ information (Level 4).<sup>2</sup>

Level 1 contains context information inherent to the examined questioned material and can usually not easily be separated from it. This information is coming from (physical) features of the questioned material, some of which are relevant and some of which may not be relevant for the examination.

Whenever questioned material is analyzed simultaneously with reference material of a known source (be it a suspect, a firearm, etc.), the perception of the relevant features of the questioned material may become partly dependent on what the examiner has seen in the reference material. Usually the forensic question is whether the questioned material comes from the same source as the reference material. The comparison therefore depends on both the questioned material and the reference material. However, the perception of the features of the questioned material should not be affected by the reference material, since the relevance of the reference material to the case is the very thing at stake. The reference material itself is denoted as Level 2 context information when analyzing the questioned material.

Level 3 contains case information in the broadest sense. That is, all information (both oral, written, and non-verbal information) that concerns the case.

Level 4 contains information that is not specific to the case, it includes information such as base rate. Base rate information is organization and discipline specific information about the outcomes of previous cases that can create an expectation about obtaining inculpatory evidence prior to any examination in the present case.

### 2.2. Managing levels of context information

Minimizing bias may require a different approach for each type of context information. Exposure to Level 1 context information is generally difficult to control since this type of context information is inherent to the evidential material. Even so, approaches do exist to control the exposure to Level 1 context information, for instance by removing task-irrelevant features from the questioned material. For example, in a signature comparison, only the signature on the questioned document can be given to the examiner by using a physical (or digital) overlay. If there is any doubt about the effect of managing level 1 information, a sequential procedure can be applied where the examination is first carried out *without* Level 1 context information, and then *with* the specific Level 1 context information. Managing Level 1 context information as described above constitutes Level 1 CIM.

Exposure to Level 2 context information is relatively easy to manage for disciplines like DNA and fingerprint examination. Since the reference material can have a biasing effect on the perception of the features of the questioned material, it should not be given to the examiner before or during the analysis of the questioned material. This sequential analysis of the questioned material and the reference material, and the comparison of the two, has been termed ‘sequential unmasking’ for forensic DNA examination [27], but applies to most forensic disciplines. The expert can only proceed to a next step after having finished and documented the current step. Sequential unmasking is now a standard procedure in some forensic DNA laboratories [e.g. 39] and is relatively easy to implement for evidence types where the questioned material can be examined without knowledge of the reference material. This requires that the

<sup>2</sup> Dror et al. [28,38] added a fifth level to the taxonomy of Stoel et al. [35] containing cultural and organizational factors (Level 5). This level is not discussed in this paper.

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