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The Bias Snowball and the Bias Cascade Effects: Two Distinct Biases that May Impact Forensic Decision Making

ascade
cision

Seven different potential sources of bias are presented in Fig. 1 (for their full descriptions and examples see (1)). They include innate sources relating to the mere fact that we are human (the very bottom of the taxonomy), general sources that emerge from the experience, training and environment in which forensic examiners operate, and also the specifics of the case being investigated (the top of the taxonomy that includes the improper use of reference material as "targets" that drive the forensic comparison—suspect-driven bias—i.e., working backward from the suspect/target to the evidence, rather than the other way around; see (1,2) for details). Official bodies, such as the UK Forensic Regulator (3) and the US National Commission on Forensic Science (4), have now acknowledged the potential of cognitive bias in forensic work.

However, the question remains as to the mechanisms of how such sources translate to actually cause bias. Here, we should distinguish between the bias cascade and the bias snowball effects.

Consider, for example, that in some jurisdictions, the CSI personnel who collect evidence from the crime scene are the same people who also do the forensic work back in the laboratory. In such cases, the analysis, evaluations, interpretations, and conclusions at the forensic laboratory may be influenced by irrelevant contextual information that examiners may have been exposed to at the crime scene. It is not always simple and self-evident what information is relevant and what is irrelevant, but clearly there are many pieces of information that are totally irrelevant to the forensic examiner (see the National Commission on Forensic Science document "Ensuring that forensic analysis is based upon task-relevant information" (4)). The *bias cascade effect* is when bias arises as a result of irrelevant information cascading from one stage to another, e.g., from the initial evidence collection to the evaluation and interpretation of the evidence.

The bias cascade effect can take many forms, all sharing the characteristic that irrelevant information in Time 1 (e.g., during evidence collection at the crime scene) cascades to Time 2 (e.g., when the evidence is interpreted). Countering such bias cascade can be achieved by controlling the information flow between the different stages of the forensic investigation (2,5,6).

First, it is best to have different people involved at the various stages of the forensic investigation. For example, it is ill-advised that those who collect evidence at the crime scene (who are exposed to a variety of contextual information, much of it needed to do their job) will be the same people who examine and interpret the evidence back at the forensic laboratory (where the initial information from the crime scene may now be irrelevant and potentially put them in a mindset affecting the laboratory work).

Second, people at the various stages of the forensic investigation should determine which information is relevant and needed for the next stage. They will only convey that information while isolating any information that is irrelevant. This segregation approach allows the control of the flow of information, and to optimize three factors: what information is provided, when it is provided, and who are the right people to provide it to (the case manager, the context information management, and the Linear Sequential Unmasking (LSU) approaches all fit well within this framework, (2,5,6). In the example above, the CSI will convey with the evidence only the relevant contextual information needed. The point here is that without such measures, irrelevant information and bias can cascade from one stage to another.

The *bias snowball effect* is quite different than that of the bias cascade effect. With the bias snowball effect, bias is not only cascading from one stage to another, but bias increases as irrelevant information from a variety of sources is integrated and influences each other (7–10).

The issue is not only that forensic work can be biased by other sources (e.g., by knowing that the suspect confessed to the crime), but that it can also bias other lines of evidence. For example, when one piece of forensic evidence (biased or not) is known to other forensic examiners who are analyzing different forensic evidence, and their examination is affected and biased by their knowledge of the results of the other lines of evidence. Think of a situation where a forensic examiner who is looking at a bite mark may be influenced and biased in their examination of the bite mark if they know that the DNA found at the bite location was matched to the suspect. The bias snowball effect is not limited to forensic lines of evidence; for example, an eyewitness may be influenced by knowing about evidence implicating the suspect, and in turn, then the eyewitness evidence can influence the interpretation of other evidence.

When different, and supposedly independent, lines of evidence (e.g., bite mark and DNA evidence) affect and influence one another; then, their value is diminished. Additionally, this causes double counting of the same evidence; for example, when the bite mark examiner is exposed and influenced by the DNA findings, then the DNA evidence is presented twice to the fact finder: once indirectly and implicitly through the bite mark evidence and, then again, directly and explicitly through the DNA evidence itself (7–10).

Part of the problem here is that forensic examiners are integrating different lines of evidence, rather than focusing on their domain of expertise, doing their analysis, and leaving the

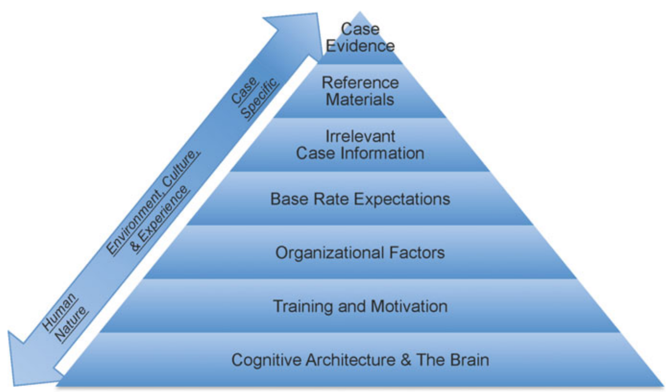

FIG. 1—*A taxonomy of different sources that may affect forensic observations and conclusions (1).*

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integration of evidence to those who should be doing it (e.g., the detective, the jury, or the forensic case manager (5)).

In the bias snowball effect, as one piece of evidence influences another, then greater distortive power is created because more evidence is affected (and affecting) other lines of evidence, causing bias with greater momentum, resulting in the increasing snowball of bias.

The bias cascade effect is therefore quite distinct from the bias snowball effect. As we move forward and work to enhance forensic work, it is important to gain better understanding of the different sources of bias (1), different mechanisms in which the bias may operate, and to be able to assess whether and when bias may impact forensic observations and conclusions. To achieve this, a holistic understanding of the forensic reconstruction process may be beneficial. Appreciation of the full forensic science process from the crime scene through to court, as well as how and where different types of knowledge (both explicit and tacit) are generated, and then interact and contribute to evidence based decisions.

The forensic community has taken major steps in addressing the potential for bias, and further insights into various forms of bias can help consider if and what further steps may be needed.

References

1. Dror IE. Human expert performance in forensic decision making: seven different sources of bias. Aust J Forensic Sci 2017;49. doi: 10.1080/00450618.2017.1281348
2. Dror IE, Thompson WC, Meissner CA, Kornfield I, Krane D, Saks M, et al. Context management toolbox: a Linear Sequential Unmasking (LSU) approach for minimizing cognitive bias in forensic decision making. J Forensic Sci 2015;60:1111–2.
3. Forensic Science Regulator. Guidance: cognitive bias effects relevant to forensic science examinations. FSR-G-217, 2015; https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/510147/217_FSR-G-217_Cognitive_bias_appendix.pdf.
4. National Commission on Forensic Science. Ensuring that forensic analysis is based upon task-relevant information, 2015; https://www.justice.gov/ncfs/file/818196/download.
5. Dror IE. Practical solutions to cognitive and human factor challenges in forensic science. Forensic Sci Policy Manag 2014;4:105–13.
6. Stoel RD, Berger CEH, Kerkhoff W, Mattijssen EJAT, Dror IE. Minimizing contextual bias in forensic casework. In: Hickman M, Strom K, editors. Forensic science and the administration of justice. Thousand Oaks, CA: SAGE Publications Inc, 2015;67–86.
7. Dror IE. Cognitive bias in forensic science. In: The 2012 yearbook of science & technology. New York, NY: McGraw-Hill, 2012;43–5.
8. Kassin SM, Dror IE, Kukucka J. The forensic confirmation bias: problems, perspectives, and proposed solutions. J Appl Res Mem Cogn 2013;2:42–52.
9. Dror IE, Stoel R. Cognitive forensics: human cognition, contextual information and bias. In: Bruinsma G, Weisburd D, editors. Encyclopedia of criminology and criminal justice. New York, NY: Springer, 2014;353–63.
10. Edmond G, Tangen J, Searston R, Dror IE. Contextual bias and cross-contamination in the forensic sciences: the corrosive implications for investigations, plea bargains, trials and appeals. Law Probability Risk 2015;14:1–25.

Itiel E. Dror,[1,2] Ph.D.; Ruth M. Morgan,[3,4] D.Phil.; Carolyn Rando,[5] Ph.D.; and Sherry Nakhaeizadeh,[3,4,5] M.Res.
[1]University College London, London, UK
[2]Cognitive Consultants International, London, UK
[3]University College London – Security and Crime Scene, London, UK
[4]University College London – Centre for the Forensic Sciences, London, UK
[5]University College London – Institute of Archaeology, London, UK
E-mail: i.dror@ucl.ac.uk