



## Cognitive Bias in Forensic Science

**Aditi Borkar; Amol Pushp**

Symbiosis Law School, Pune, India E-mail : [borkaraditi1@gmail.com](mailto:borkaraditi1@gmail.com)

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### ABSTRACT

*Within the realm of forensic science, there has been a notable surge in recognition of the role of human cognition. This has led to a more comprehensive understanding of the limitations and weaknesses of human decision-making when faced with ambiguity, and how they can impact the admissibility and trustworthiness of forensic research. These limitations are often caused by motivational or cognitive biases, which have led to misidentifications and, consequently, wrongful convictions of innocent individuals. It is critical to address these concerns given the significant impact that forensic science has on society. This article delves into the issue of prejudice and its potential impact on the opinions of forensic professionals in criminal cases, as well as the dangers of bias in several forensic science fields, including fingerprint examination, trace evidence, bullet comparison, and DNA analysis. The essay posits that several factors, such as the quality and clarity of forensic evidence, contextual case information, and subjective interpretation of forensic analysis, can contribute to prejudice. To mitigate bias, various strategies such as blind testing, blind verification, independent review, linear sequential unmasking (LSU), and the filler control approach are recommended. The article evaluates the benefits and drawbacks of these tactics and suggests cross-examination questions that may reveal bias in forensic examination.*

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### Corresponding Author:

Aditi Borkar,  
Symbiosis Law School,  
Symbiosis Law School, Pune, India,  
shop no 14, 10 Biz Park, Survey No 227, Rohan Mithila, New VIP Road,  
Plot No. 11, Symbiosis Law School Rd, Maharashtra 411014, India  
Email: [borkaraditi1@gmail.com](mailto:borkaraditi1@gmail.com)

### 1. Introduction

For more than a century, forensic evidence has been utilized in criminal proceedings. Unlike most other forms of evidence, scientific experts are believed to provide impartial scientific evidence. As a result, their testimony is highly valued by the courts and can be utilized in criminal trials. With the proliferation and recognition of forensic evidence in criminal situations, the role of forensic scientists in both the detection and examination of criminal occurrences has grown over time. The significance of forensic evidence in crime scene investigations has given rise to the development and implementation of cutting-edge procedures and techniques,

particularly in dealing with crime scene evidence collection, analysis, and the interpretation of evidence presented in court.

For many years, courts have generally recognized forensic evidence as scientific, objective, and unbiased, as well as extremely reliable and verified. The remarkable effectiveness of forensic investigations presented in the media and television shows such as CSI reinforces the notion that forensic evidence is almost always infallible, consistent, or accurate.

However, in reality, there has recently been a surge in criticism of various forensic science procedures and approaches. One area of criticism has been highlighted in terms of evidence admissibility and mistake rates in forensic scientists' methodologies and expert testimony presented in court. The National Academy of Sciences in the United States, as well as the Fingerprint Inquiry and the Forensic Scientific Regulator in the United Kingdom, have drawn attention to the possibility of subjective interpretations and biases across forensic science fields. Some of the flaws that have been identified have been addressed by new studies in the field of forensic science, including the presence of cognitive biases.

Despite significant hurdles, forensic science's capabilities have grown and improved over time. One of its major flaws is its susceptibility to cognitive bias. Today, like any scientific subject, forensic science has limitations and weaknesses, while remaining a critical component of the judicial system and playing a vital role in establishing and reconstructing events to uncover the truth. These concerns may arise at any point during an investigation, from the acquisition of forensic evidence at the crime scene to its presentation in court.

## **2. Method**

The importance of forensic science lies in its capacity to identify offenders and clear the names of the innocent. An expert witness ought to provide impartial, objective, independent, and unbiased testimony to support the court in matters that transcend the investigator's general comprehension. Forensic science's capabilities have expanded and developed over time, overcoming numerous significant challenges. Its primary weakness, however, is its susceptibility to cognitive biases. The British and American legal systems, where jury trials are the standard, the role of the expert witness and the evidence presented in court are regarded not only as methodological concerns but also as ethical ones. It is not the job of a forensic scientist to pass judgment on the validity of various crime-related propositions. Instead, the forensic scientist is responsible for providing input to the legal system, in which the accuracy of the source of various premises pertinent to the evidence presented is typically determined by a judge or jury. Nevertheless, it has been established that specialists are frequently excessively confident in their abilities, and much of the forensic scientific evidence presented in court has likely been accepted without proper scrutiny. For instance, research in psychology and social science has demonstrated that an individual's emotional state can significantly affect how information is processed and perceived, as perceptions and understandings are highly correlated with emotional states

## **3. Analysis and Results**

### **Analysis**

#### **3.1 Intrinsic role of forensic expert witness in Criminal trials.**

The criminal justice system's adversarial nature demands that the prosecution establish the guilt of the accused beyond a reasonable doubt, while the defense must counter the prosecution's arguments and create uncertainty through exhaustive cross-examination and the provision of alternative evidence. In situations where forensic evidence is procured from a crime scene, the primary task of a forensic expert is to scrutinize said evidence by comparing patterns or features in order to identify or exclude the accused as the perpetrator of the crime. The scientific opinion is admissible in court if it is relevant and reliable, in the sense that it is based on the expert's specialized knowledge and that he or she is more equipped than the court to make conclusions from the facts. Due to the court's lack of specialized knowledge, it is imperative

that an expert is enlisted to provide guidance in reaching a sound decision on matters pertaining to their area of expertise.

In numerous forensic domains, research is being conducted to scrutinize the cognitive processes and potential biases that humans may exhibit. Studies have shown that cognitive patterns can lead to human errors, which may affect the impartiality of forensic specialists when analyzing evidence. The intricate interplay of various factors can significantly impact the observation and decision-making processes. These factors span across the external environment, time pressure expectations, and motivating remarks.

### **3.2 Risk of Bias in DNA testing**

Incomplete or partial DNA profiles are frequently encountered in DNA analysis, presenting a challenge in the interpretation of such profiles and the identification of the quantity and identity of donors to a mixed sample. Consequently, the presumption that the DNA of a defendant may have generated the observed profile can significantly enhance the analyst's confidence in the defendant's contribution.

### **3.3 Risk of Bias in fingerprint examination**

To ascertain the identity of the culprit behind a crime, the customary approach involves fingerprint analysis employing a four-stage process referred to as Analysis, Comparison, Evaluation, and Verification (ACE-V). In instances where the latent prints appear equivocal during the comparison stage, where the examiner compares the friction ridge patterns from the unknown latent fingerprints with the known fingerprint, ambiguity arises if the prints are incomplete or of substandard quality due to smudging, distortion, or other causes. Since there are two sets of prints, experts may be susceptible to cognitive bias.

Liden expounds that in situations where fingerprints exhibit ambiguity, the probability of predisposition increases as fingerprint examiners are susceptible to the sway of extraneous (or superfluous) knowledge that they possess but which surpasses the bounds of the requisites for the fingerprint assessment

## **Results**

The issue of addressing bias in forensic sciences and criminal investigative procedures still remains a challenge, as practical solutions are severely lacking. Even in cases where solutions have been implemented, there is significant variation across disciplines, jurisdictions, and countries. Despite growing awareness of the role of cognitive biases in forensic science and criminal investigations, procedural changes have not been structurally implemented. One potential explanation for this is that the misinterpretation of cognitive biases is an ethical issue. Cognitive biases are a predictable result of the human cognitive and psychological systems, occurring without awareness or intention, rather than deliberate misconduct. It has been demonstrated that willpower alone cannot overcome cognitive biases, as the extent to which people are affected by cognitive errors is impossible to fully comprehend. While education can potentially improve an expert's decision-making, it alone cannot eliminate the effects of cognitive bias. As outlined in the following section, there are a variety of creative approaches to addressing cognitive bias in the legal sciences.

Unjustified and irrational conclusions serve as the wellspring of cognitive biases. These deductions are a result of the utilization of subconsciously developed cognitive shortcuts towards rationality. The most extensively researched potential factors in forensic science are motivated reasoning and contextual bias. Furthermore, the flip side of cognitive bias is that it can either enhance or diminish the accuracy of forensic decisions. However, to mitigate consequential effects, numerous recommendations are proffered to ensure that experts deliver objective decisions. For instance, Stevenage and Bennett discovered that students scrutinizing fingerprint evidence were positively and negatively influenced or biased by pertinent background knowledge (DNA match, DNA uncertain, unmatched). Moreover, when analyzing

fingerprints that were a match, knowledge of the DNA match bolstered accuracy, but it reduced accuracy in non-matching trials. These findings evince that in forensic science, contextual misinformation and predisposition are essentially round figures used to convey results in a reductionist manner. In summary, the difficulty in evaluating cognitive biases stems from methodological deductions in studies resulting in a lack of external validation.

The alignment of expertise helps to explain the difference between the two. Decision scientists have the expertise to perform highly controlled experimental research to study the biases and fallacies that may or may not have a subtle impact on forensic decision-making. Contextual manipulations could be supplied to disciplines for a constructive and decisive choice. Both dimensional scientists would be able to present ecologically valid scientific data that reveals the genuine impact of knowledge based on forensic decision-making.

Although verification is one of the four fundamental stages of fingerprint testing mentioned earlier, there is scarce evidence of its application in other forensic science disciplines such as bite marks, hair, tool marks, footwear impressions, and the like. The apparent reason for this divergence could be attributed to the well-defined standard operating procedures followed by fingerprint analysis facilities. Thus, biometric examination has progressed more in terms of methodologies when compared to other forensic fields. Kellman reported that the distribution of error rates varies depending on.

the visual content of the specific comparison, which emphasizes the difficulties of assessing fingerprints. Consequently, there might be some impact on judicial pronouncements in terms of comprehending and admitting the comparisons. The study has provided support for the opinions of forensic examiners, who believe that the cognitive ability to perform better and quantify the abilities is necessary in any forensic domain.

Edmond argues that existence of contextual and confirmation biases undermines the independence of the analyst's opinion and threaten the validity of the inferences. Thus, we often see prosecution, defence, and judges/juries to come at similar conclusions with negative connotations on results and expert's opinions. In the trial simulation experiment, Thompson and Scurich used a trial modelling project to look at how jury members reacted to cross-examination and opinions and viewpoints contextual bias in a hypothetical case. The defence lawyer began the terms of inter of half the cases with a sequence of questionnaires aimed to stress the subjectivity of forensic comparison evidence and the lack of clear procedures for source assessments.

The examiner's credibility was deemed less by factfinders in instances where task-irrelevant information was permitted, as opposed to cases where context management measures were employed to prevent exposure. The results of this study indicate that factfinders possess a rudimentary comprehension of the perils of contextual partiality, and that they would accord less significance to forensic evidence that may have been influenced by contextual bias. The results indicate that forensic scientists could potentially enhance the weight given to their evidence by decision-makers if they were able to safeguard themselves from bias concerns by utilizing context management processes to obscure task-irrelevant information.

#### **4. Conclusion**

The present article aimed to conduct an analysis of recent developments in forensic science and to identify the challenges that this field encounters within the judicial system, from a perspective that pays particular attention to the critical role played by forensic scientists in the legal and societal domains. The issues affecting forensic inquiry arise at various stages of the process, from the initial stages of investigation to the presentation of results in court. Addressing these issues would require a significant amount of effort. Some approaches that could help reduce bias, such as blind testing, blind verification, independent review, and LSU, have been briefly discussed. Additionally, the article provides a list of potential cross-examination topics that may reveal bias. The risk of bias and its impact on certain forensic

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science disciplines, such as fingerprint analysis, trace evidence examination, bullet matching, and DNA analysis, have been examined in this article. In these areas, interpretation appears to be somewhat vague and generic concerning the risk of bias, which represents a more significant source of concern than in other objective and quantitative disciplines that use unbiased methods to produce clear results.

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