Between Science and Subjectivity: An Assessment of the Misinterpretation of Forensic Evidence by Legal Professionals in Canada and Beyond

Rangika Rajapakse

J0472190

Post Baccalaureate Diploma in Law Enforcement Studies, Justice Institute of British Columbia

Author Note

This paper was completed for LAWS 4003: Research Project, instructed by Asif Hossain and supervised by Marjory Jardine. This paper is 6,917 words and is due on March 27, 2024.

Abstract

This research paper examines the challenges surrounding the interpretation of forensic evidence within the courtroom. Focusing on the implications of flawed interpretations and a potential framework to interpret forensic evidence for legal professionals, this research attempts to answer the questions: how is forensic evidence misinterpreted in the Canadian legal system, and can a workable framework be developed to assess the misinterpretation. For this paper, secondary research was conducted where data was collected from existing peer-reviewed sources. Literature was used primarily from Canada with a less focus on other adversarial legal systems. The paper critically examines the various factors contributing to erroneous interpretations, including human errors, court oversight failures, and inherent weaknesses in forensic evidence, and resulting wrongful convictions. Through an evaluation of subjective and objective standards of interpretation, this paper recommends a framework to be used by legal professionals in the interpretation of forensic evidence. As further recommendations, the paper highlights the importance of rigorous scrutiny and continuous education on forensic evidence analysis to mitigate the risk of wrongful convictions. This research aims to contribute to a deeper understanding of the complexities inherent in forensic evidence interpretation and advocate for measures to ensure fairness and accuracy in legal proceedings.

Keywords: forensic evidence, legal professionals, wrongful convictions, biases, experts, accused, interpretation, framework

Table of Contents

Between Science and Subjectivity: An Assessment of the Misinterpretation of Forensic Evidence by Legal Professionals in Canada and Beyond

Forensic evidence plays a crucial role in criminal trials by providing essential scientific insights that can significantly influence legal proceedings. Forensic evidence refers to physical evidence collected from crime scenes or victims and subjected to scientific analysis in crime laboratories. This analysis aims to generate scientifically supported information presented in court through expert witness testimony to establish a nexus between the accused and the crime (Olaborede & Walt, 2020). Employing scientific methods for investigation and experimentation leads to the production of evidence that can be reliably used in court. This evidence is critical for solving crimes, which will prove guilt or innocence of the accused. Scientific evidence ensures that the judicial process is based on factual, objective, and scientifically verified information. It highlights the importance of the rigorous application of science in the legal field, to ensure that conclusions are based on solid evidence rather than conjecture or flawed methodology (Chayko and Gulliver, 1999). In the process of admitting forensic evidence to the trial, the judge interprets the forensic evidence based on the guidance of the forensic expert and the lawyers. Therefore, the role of the judge and the lawyers in the interpretation of forensic evidence is significant, as their interpretation could decide the outcome of the trial.

The critical role played by forensic experts in the legal process has gained recognition from scholars and legal professionals alike. Various studies and methodologies, such as the Likelihood Ratio approach (Stoel & Sjerps, 2012) and Bayes Theorem (Gettinby et al., 1993) have been developed to aid these experts in interpreting forensic evidence. However, there is a notable gap in research addressing standards for interpreting forensic evidence in the courtroom. Studies have highlighted that flawed forensic science ranks as the second leading cause of wrongful convictions (Macfarlane, 2014). In such instances, the accused's right to a

fair trial is at risk of violation (Canadian Charter, 1982). Therefore, this study aims to bridge this gap by assessing the misinterpretation of forensic evidence in the courtroom and propose suggestions to improve the interpretation.

The aim of this study is to contribute to the broader conversation about the intersection of forensic science and criminal justice. To achieve this objective, this study will critically analyze the reliability and limitations of forensic evidence and experts, examine the guiding principles shaping expert testimony, scrutinize factors influencing how legal professionals interpret forensic evidence, examine factors contributing to wrongful convictions resulting from misinterpretation of forensic evidence, and suggest a framework for future reference to minimize erroneous interpretations.

Theoretical Framework and Philosophical Worldview

In examining the interpretation of forensic evidence within legal proceedings, this research can be effectively analyzed through the framework of Bayes' theorem. Bayes' theorem provides a probabilistic framework for evaluating the significance of forensic findings and a systematic approach for assessing the probative value of forensic evidence in the courtroom by legal professionals (Gettinby et al., 1993). By applying Bayes' theorem, this study seeks to enhance the understanding of the reliability and utility of forensic evidence in the criminal justice system.

This research is approached from a constructivist worldview. The constructivist worldview emphasizes the socially constructed nature of reality and knowledge. It identifies that individuals interpret information based on their own experiences, beliefs, and societal context. Constructivism recognizes the subjectivity inherent in human interpretation. In the context of legal professionals' interpretation of forensic evidence, constructivist worldview emphasizes that the interpretations are not purely objective but are influenced by the perspectives and biases of those involved.

The theoretical framework proposed in this research can be regarded as the objective parameters for interpretation, while the philosophical worldview proposed can be considered as the subjective parameters for interpretation. This research will demonstrate how these two parameters can be combined to achieve the correct balance in the interpretation of forensic evidence.

Research Problem and Research Question

The interpretation of forensic evidence by experts is typically rooted in scientific principles. However, the interpretation of forensic evidence during a trial by legal professionals, such as the judge, prosecutor, and defense counsel, depends on the case and the perspective of these professionals. The central problem this research aims to address is to understand how misinterpretations of forensic evidence can occur, assess how they influence legal outcomes, and look into developing a workable framework to address this concern in the Canadian legal context and beyond. Therefore, this research aims to answer the questions: how is forensic evidence misinterpreted in the Canadian legal system, and can a workable framework be developed to assess the misinterpretation.

Search Methodology

To address the research questions, this paper will review Canadian legal literature and international studies in adversarial legal systems. After providing a comprehensive overview of the research question, the paper aims to apply the broader literature to the specific context of the Canadian legal system. With the advancement of technology, forensic evidence has gained a crucial importance as decisive evidence in establishing the guilt of the accused. Therefore, this study will be limited to analyzing forensic evidence that will have an impact on the rights of the accused.

For this paper, secondary research was conducted where data was collected from existing sources. This study adopts a systematic literature review as the primary research

design. A comprehensive search strategy was implemented across legal and academic databases such as JIBC Library, JIBC Online Library databases such as EBSCO, Google Scholar, Peace Palace Online Library and CANLII to search literature. Articles and books identified during the initial literature search were then subjected to a systematic review to assess their relevance. This involved a detailed examination of each source's abstract and conclusion.

A thematic analysis was employed to identify and analyze key themes emerging from the selected literature. Keywords such as "interpretation of forensic evidence", "Court," "Criminal Justice Professionals," and "Common-Law systems" were used to identify pertinent literature. The sources were cross-referenced with other available literature for validation. Table 1 shows the search strategy utilized for this literature search and the search results. Table 2 depicts the revised search strategy and the revised search results.

Table 1

Search Strategy and Search Results of the Literature Search

Database	Search Terms	Search Results
Google Scholar	Interpretation of Forensic Evidence (Filter- 2004- 2024)	129,000
EBSCO	Interpretation of Forensic Evidence	3,849
Peace Palace Online Library	Interpretation of forensic evidence	411
Peace Palace Online Library	Wrongful convictions, forensic evidence	152
CANLII	expert evidence, forensic evidence, interpretation	7,175

Note. Table 1 depicts the initial literature search conducted on Google Scholar, EBSCO, Peace Palace Online Library and CANLII databases. Search terms show the keywords used for the search on the databases. Search Results indicate the number of hits received for each search.

Table 2

Revised Search Strategy and Revised Search Results of the Literature Search

Database	**Search Terms**	**Search Results**	**Reason for Revision**
Google Scholar	Interpretation of Forensic Evidence in Court	20,700	Added 'in Court' to narrow down the search
Google Scholar	Interpretation of Forensic Evidence in court in Canada	19,900	Added 'in Canada' to narrow down the search
Google Scholar	Interpretation of Forensic Evidence by criminal justice professionals in court in Canada	17,700	Added 'by criminal justice professionals' to narrow down the search
EBSCO	Interpretation of Forensic Evidence in Canada	124	Added 'in Canada' to narrow down the search

Note. Table 2 depicts the revised literature search conducted on Google Scholar and EBSCO databases, as the initial search was too broad. Search terms show how the keywords were revised on the second search. Search Results indicate the number of hits received for each revised search. Reason for Revision show the changes made to search terms and the reason for revision.

In the course of this research, 34 sources were reviewed. This process led to the identification of 26 sources that proved relevant. Many of these studies, particularly those from adversarial legal systems, including Canada, extensively discussed the lack of adequate standards employed by the court when interpreting forensic evidence. Some articles and books examined the recommended standards that forensic experts should adhere to during the interpretation process. This paper will evaluate these standards in order to highlight the existing gap in guidelines for legal professionals. Some articles focused on the implications of prosecutors misinterpreting forensic evidence, while others explored broader misinterpretations by judges and defence lawyers. A loose-leaf practical guide titled *DNA: A Practical Guide* by the Honourable Justice D. S. Rose and L. Goos on existing standards for prosecutors was also used for the research, as it is directly relevant to the research to identify existing standards in Canada. Additionally, some caselaw studied in this research discussed the existing judicial standards in interpreting and admitting forensic evidence in Canada. Finally, the literature review revealed numerous articles and books addressing wrongful convictions due to the misinterpretation of forensic evidence.

In conducting the literature search, specific criteria were established to ensure the relevance and applicability of the selected studies. The inclusion criteria comprised studies originating from Canada and other adversarial legal systems, including the United Kingdom, the United States, Australia, South Africa, and New Zealand. While the Netherlands does not fall under the adversarial legal system, certain principles from a relevant study were considered due to its universal applicability. The primary focus of this literature search is on academic works published within the last 15 years. However, selected few principles from sources predating this timeframe were included for their significance. The central theme guiding the search was the interpretation of forensic evidence by legal professionals.

Exclusion criteria were also established to maintain the precision and focus of the literature review. Research focusing on forensic evidence in crime scene investigation was deliberately excluded to maintain a more concentrated focus on the interpretation of forensic evidence by legal professionals. This research focuses on the misinterpretation of evidence that has an impact on accused's rights. Therefore, the study excluded other instances of miscarriages of justice, such as instances where the defence lawyer's wrong interpretation resulting in the acquittal of the accused even if the accused actually committed the crime. This study acknowledges potential limitations, such as the inherent biases in the selected literature and the evolving nature of legal interpretations. Further, due to time constraints, the research is limited only to secondary sources.

Literature Review

The literature review presented several key and recurring themes. The first theme was the challenges in interpreting forensic evidence in the courtroom which highlighted the issues relating to the prosecutor's fallacy and presence of inherent biases. Secondly, the inherent weaknesses of forensic evidence recurrently emerged. Under this theme, observations were made in relation to the weaknesses of forensic pathology, issues surrounding forensic serology, and weaknesses of hair and trace evidence. The third theme which emerged during the literature review was admitting unreliable expert evidence. Fourthly, the lack of thorough scrutiny by courts in admitting forensic evidence was noted. Lastly, wrongful convictions resulting in misinterpretations of forensic evidence was a theme that was discussed in many sources. Through the literature review, it was evident that there is a serious gap in relation to a standard framework that can be used by legal professionals to assess forensic evidence.

Challenges in Interpreting Forensic Evidence in Courtroom

Scholars have discussed many issues surrounding the interpretation of forensic evidence by legal professionals in court. The significance of forensic evidence being properly

accessed, and then communicated to be understood by the courts have been discussed by Adam (2016). The English scholar Leung (2002) and the New Zealand Barrister, Robertson et al. (2016) have contributed to the area of the first challenge recognized under this theme, the prosecutor's fallacy, which can be identified as a common error in the interpretation of forensic evidence by the prosecutor. This is a particular type of error which can be seen in the interpretation of forensic evidence, which is often given in terms of a mathematical probability (Leung, 2002). This theme is relevant to this study as it falls within the first research question of how forensic evidence is misinterpreted. In their book, Robertson et al. (2016) discussed the defence attorney's fallacy as well. However, this research is limited to the issues that have an impact on the rights of the accused. Therefore, the defence attorney's fallacy will not be dealt with in this paper.

Secondly, the presence of inherent biases when interpreting evidence was seen as a recurrent issue. The British Columbian scholars Carla L. MacLean and Lynn Smith along with the English cognitive neuroscientist Dr. Itiel Dror evaluate the failure of courts to develop strategies to identify and counteract experts' biases caused by factors that unconsciously affect the quality of their evidence to prevent unreliable information from tainting the decision-making process (Maclean et al., 2020). Dror (2009) has discussed various human biases and their sources, such as *idola tribus* (idols of the tribe), *idola specus* (idols of the den or cave), *idola fori* (idols of the market), and *idola theatric* (idols of the theatre).

The Inherent Weaknesses of Forensic Evidence

Chayko and Gulliver (1999) identified that forensic experts contribute to the fact-finding process in many ways by: investigating and interpreting injury and death resulting from violence or occurring in an unexplained manner; aiding in the tracing and identifying of physical objects such as guns and bullets; aiding in the tracing of and identifying if people by

means of DNA identification, fingerprints, bloodstain and fibers; developing and preserving demonstrative evidence by means of recording and photography; and testing for impairment. As scientific findings get increasingly necessary in the process of criminal trials, the use of forensic experts in the courts have increased dramatically.

However, there are inherent weaknesses of forensic evidence as well as the experts testifying on the findings of their scientific examinations. Chayko and Gulliver (1999), and the South African legal scholars, Dr. A. Olaborede and Professor L. Meintjes-van der Walt (2020), have identified common and inherent weaknesses of forensic evidence. A few examples of inherent weaknesses that have been identified are: the expertise of the medical expert witness in relation to forensic pathology evidence, possible presence of semen from a consensual intercourse prior to the sexual assault in victim's vagina being misinterpreted in forensic serology, and the possibility of chance occurrence in relation to hair or trace evidence.

The Absence of Adequate Guidelines to Interpret Forensic Evidence in Court

Many articles that examine the absence of adequate guidelines for legal professionals, emphasize the standards followed by experts in interpreting evidence and expose gaps in guidelines for legal professionals (Edmond, 2016; Cunliffe & Edmond, 2013). In the Canadian context, the case of *R v Bornyk* (2017) addresses systemic issues within the Canadian criminal legal system in relation to the production and evaluation of forensic evidence. A thorough review of this case was done by Professors Emma Cunliffe and Gary Edmond. The same authors have contributed significantly to the Canadian criminal justice system through their research on the area of inadequacy of Canadian judges and lawyers to conduct a sound assessment of the reliability of incriminating expert testimony and forensic evidence examined by them (Cunliffe & Edmond, 2013). They have discussed the issues surrounding the reliability of expert opinion which has been especially apparent in cases with

conflicting expert opinions on forensic evidence (Cunliffe & Edmond, 2013; Maclean et al., 2020; Edmond, 2016).

The Honourable Justice DS Rose & L Goos (2004) have provided a practical guide that can be followed by legal professionals in interpretation of DNA evidence. The guide has cautioned about the problem of secondary transfer of DNA, limits to expert testimony, and discussed presenting statistical evidence, frequency of occurrence, random match probability, source attribution, likelihood ration, the two fallacies: the prosecutor's fallacy and the defence lawyer's fallacy in relation to reporting a DNA match made from a database search, and relatives. However, the standards introduced are not adequate nor binding.

Admitting Unreliable Expert Evidence

Cunliffe and Edmond (2013), have discussed the court accepting unreliable expert testimony and the lack of thorough scrutiny placed in admitting forensic evidence in court. It shows how admitting unreliable expert evidence leads to a miscarriage of justice and have an impact on the accused's rights. Robertson et al. (2016), have discussed the guidelines often used in relation to expert witness testimony: basis rule, field of expertise rule, qualifications rule and ultimate issue rule. These guidelines serve as foundational principles for determining the admissibility and relevance of expert testimony in legal contexts. The Basis rule requires that an expert's testimony be grounded in a solid foundation of knowledge or data. The Field of expertise rule ensures that the testimony provided falls within the expert's area of specialized knowledge. The Qualifications rule mandates that the individual offering testimony has the appropriate qualifications for the subject matter. Lastly, the Ultimate issue rule allows experts to address the central issues of a case, although they must refrain from making legal judgments, which are reserved for the judge or jury.

However, many articles reviewed during this research suggested that while there are certain guidelines in place pertaining to admitting forensic evidence provided by experts,

there is a lack of thorough and adequate scrutiny (Cunliffe & Edmond, 2013). When forensic evidence and expert testimony are admitted without proper scrutiny, there is a risk of incorrect findings being presented during the trial against the accused.

Wrongful Convictions

The convictions resulting in misinterpretations of evidence would be erroneous. As a consequence, the fair trial rights of the accused could be violated, leading to a wrongful conviction. This has been a primary theme centered among most of the articles that were reviewed. Pakosh (2016), has identified many instances of wrongful convictions as a result of wrong interpretation of forensic evidence. Through case studies presented in commissions of inquiry, the book discusses the serious consequences faced by wrongfully convicted individuals.

Pakosh (2016), has examined the principles and guidelines introduced by various commissions of inquiries and bodies, including the Kaufman Commission on Proceedings Involving Guy Paul Morin, Commission of Inquiry into Certain Aspects of the Trail and Conviction of James Driskell, Inquiry into Pediatric Forensic Pathology in Ontario (the Goudge Inquiry), and the National Judicial Institute, in relation to the interpretation of forensic evidence by lawyers and judges. He has also highlighted the serious gaps present in the interpretation of forensic evidence by lawyers and judges in Canada. This theme is central to the research as it explains how forensic evidence is misinterpreted in the Canadian legal system and the implications of misinterpretations.

Gaps in Literature

Forensic evidence is commonly employed by prosecutors to establish the *mens rea,* or criminal intent, of an offense. For instance, when an expert opinion infers that a death was caused by a stab to the chest, the prosecutor may argue that this indicates the accused used a sharp weapon with the intent to commit murder. However, these interpretations are inherently

subjective and prone to error. Surprisingly, a notable gap exists in literature concerning the conclusions drawn from the interpretation of forensic evidence to establish the *mens rea* of the accused, which warrants further research in this area.

Findings

Through the literature review, several themes emerged related to the research. These themes facilitated the identification of many findings in relation to the misinterpretation of forensic evidence in Canada and other adversarial legal systems, thereby addressing the first research question of this paper.

Prosecutor's Fallacy

Leung (2002) has identified the prosecutor's fallacy as a logical fallacy that occurs when the probability of evidence pointing towards a certain outcome in a criminal trial is incorrectly interpreted. It typically involves misconstruing the conditional probability of evidence given the accused's guilt, and vice versa. It occurs by assuming that the likelihood of event A happening, given that event B has happened, is equivalent to the likelihood of event B happening, given that event A has happened. This fallacy occurs when the prosecutor misinterprets the significance of forensic evidence in a way that strengthens the prosecution's case and undermines the defence's position.

The correct theoretical approach to interpret forensic evidence is the Bayes' theorem. It calculates the probability of the hypothesis (e.g. innocence or guilt) by combining the prior probability of the hypothesis with the likelihood of observing the evidence given each hypothesis, while also considering the total probability of the evidence. Applying Bayes' theorem opens the way to calculate the probability of the accused being innocent knowing that the DNA found at the scene matches that of the accused. This approach helps avoid the prosecutor's fallacy by explicitly incorporating both the prior probability of the accused's guilt and the likelihood of observing the evidence under both the guilty and innocent

hypotheses (Leung, 2002). Therefore, due to the inaccurate attribution of probative value to forensic evidence, the prosecutor's fallacy leads to misinterpretation of forensic evidence.

Inherent Biases

Over the years, courts have developed evidentiary and procedural rules to safeguard the decision-making process against unreliable information. In relation to expert opinion evidence, courts have succeeded in eliminating intentional biases to a certain extent. However, courts have failed to counteract experts' biases caused by unintentional biases. Experts often make decisions drawing from their previous experiences when faced with uncertainty. However, these experiences can sometimes lead to biases in their decision-making. Research shows that experts' judgments can be influenced by unconscious factors, such as stereotypes or organizational pressures. These influences may introduce errors or misinterpretations in their evaluation of case evidence (Maclean et al., 2020).

On the other hand, human cognition is complex. Individuals isolate information and process it with speed. Experts generally outperform novices in their field of experience, and they accomplish this because they attend to and process information differently than non-experts. Enhanced pattern recognition permits experts to isolate and attend to information-rich areas of a scene and harvest information from it quickly. Methods like pattern recognition and chunking support experts in making higher-quality decisions than non-experts. Much information processing happens automatically and without awareness, and as expertise develops, so does the automaticity of cognitive actions associated with the expert skill. It is in these blind spots created by lack of awareness that experts are especially vulnerable to biasing factors. Maclean et al. (2020) have identified seven different sources which can influence the expert's opinion to be biased, such as, cognitive and brain factors, training and motivation, organizational factors, base rate expectations, irrelevant case information, reference materials, and case evidence.

Dror (2009) has utilized the Bacon's doctrine, a doctrine theorized by Francis Bacon, to explain human biases. Bacon formulated the doctrine of idols and presented his insights into the barriers obstructing the truth and science. He depicted these impediments as false idols that hinder our ability to make accurate observations and attain comprehension. These idols distort the truth and thereby stand in the way of science. He categorized these obstacles into four groups: idola tribus (idols of the tribe), idola specus (idols of the den or cave), idola fori (idols of the market), and idola theatri (idols of the theatre). These idols explain how human biases which are rooted in our nature, personal experiences, language imperfections, and acceptance of established ideas, can cloud our judgment. These biases influence how we perceive patterns, interpret communication, and accept information, potentially distorting our understanding and decision-making processes (Dror, 2009). In forensic analysis, such biases may lead to misinterpretation of evidence.

Lack of thorough Scrutiny by Courts

Cunliffe and Edmond (2013) highlight an increasing acknowledgment of incriminating expert testimony as a significant contributor to wrongful convictions in recent years. They note that certain forensic sciences, such as fingerprint identification, tool mark comparison, and bite mark analysis have not undergone rigorous validation studies, proficiency testing, or other assessments of reliability.

In the case of *R v Bornyk*, the accused was convicted based on fingerprint identification from a single, partial latent print found at the crime scene. In the long history of fingerprints evidence in Canada, *Bornyk* stands as the sole instance where a court extensively deliberated expert evidence regarding the scientific research and reliability of fingerprint identification. Typically, Canadian courts and legal practitioners have treated fingerprint evidence as conclusive proof without thorough examination of its reliability or potential for error within the field. *Bornyk* therefore represents a rare challenge to the reliability of routine

forensic science in Canada. This instance alone highlights the inadequacy of traditional adversarial methods to provide independent checks on the reliability of forensic evidence (Cunliffe & Edmond, 2021).

The test for admissibility of expert evidence was originally set out by the Supreme Court of Canada in *R v Mohan*, 1994 (*Mohan*). In *Mohan*, Sopinka J. outlined a number of limitations in the use of forensic experts in trial proceedings and set out the criteria to be adopted in admitting expert evidence to be: relevance, necessity in assisting the trier of fact, a properly qualified expert, and the absence of any exclusionary rule. As indicated in *Mohan*, when the expert is relying upon novel science, a special scrutiny is required. Furthermore, as the level of debate or uncertainty surrounding a theory or technique increases, so must the level of scrutiny applied to the prospective evidence (Chayko & Gulliver, 1999). In recent years, the Supreme Court of Canada has increased the threshold for admitting expert opinion evidence and highlighted the ongoing gatekeeping role of trial judges during an expert's testimony. In 2009, Doherty JA modified the test for admissibility of expert evidence in the Ontario Court of Appeal decision *R v Abbey*, 2009. The modified test offers a clear place for a reliability analysis (Cunliffe & Edmond, 2013).

The US Supreme Court proposed four criteria to be used as a checklist to aid trial judges in evaluating the reliability of scientific evidence. These criteria include whether the theory or technique can be (and has been) tested, whether the theory or technique has been subjected to peer review and publication, the known or potential rate of error associated with the technique and the application of standards, and the degree to which the technique has gained general acceptance (Cunliffe & Edmond, 2013).

In forensic science, the reliability of scientific tests and observations is crucial and can be evaluated using six key terms: accuracy, precision, sensitivity, specificity, validity, and discrimination power. These terms collectively assess how closely tests measure true

values, the consistency of results upon repetition, the correct identification of true positives and negatives, and the test's ability to measure what it is intended to, as well as its capability to distinguish between different individuals or items (Robertson et al., 2016).

Although various such standards and tests have been introduced, there is no standard framework that can be followed by the legal professionals when evaluating forensic evidence. A 2012 study supported by the United States Department of Justice highlighted that forensic errors may determine the outcome of a case and that such errors occur most often during the interpretation and testimony stage, rather than during testing. This emphasizes that forensic errors primarily arise at the intersection of legal and scientific practices (Parkosh, 2016). Therefore, the lack of thorough scrutiny by courts is another way in which forensic evidence can be misinterpreted by legal professionals.

Inherent Challenges in Forensic Evidence Interpretation

There are several potential problems in the interpretation of forensic serology testing. As a group, catalytic and presumptive tests, which are used to detect the presence of blood, are not exclusively specific to blood. Therefore, they may produce false positive results, indicating the presence of blood when it is not actually present (Chayko & Gulliver, 1999). In relation to semen and vaginal secretion also, false positives can occur. Since semen can remain in the vagina for several days, there can be semen present from a recent intercourse previous to a sexual assault. The inherent weakness of hair evidence lies in its inability to definitively establish the occurrence of a specific event. Rather, its significance stems from the coincidental presence of elements that can be examined for meaning. Expert opinions on hair or trace evidence typically rely on probabilistic studies. Hence, it is imperative for lawyers to be thoroughly prepared and acquainted with forensic evidence and expert opinions prior to trial. Additionally, hair evidence is often accompanied by other trace materials,

which can greatly impact its perceived strength. Therefore, legal professionals must accurately attach the probative value of such evidence (Chayko & Gulliver, 1999).

A possible error of interpretation in the field of forensic pathology can emerge in relation to the expertise of the medical witness as well (Parkosh, 2016). There is a lack of trained forensic pathologists in Canada. As a result, the quality and accuracy of the opinion presented by the expert could be less, potentially leading to errors in the interpretation of forensic evidence. Furthermore, in terms of intentional poisoning, there is a limitation in the use of expert opinion as well. As poison could be self-administered, administered by another individual or covertly administered, the scientific examination will not throw light to the intention of the accused. Therefore, these inherent weaknesses of forensic evidence can result in misinterpretations.

Implications of Flawed Forensic Evidence Interpretation

In the Kaufman Commission on Proceedings Involving Guy Paul Morin, the Honorable Fred Kaufman concluded his report involving the wrongful conviction of Guy Paul Morin by stating “An innocent person was convicted of a heinous crime he did not commit. Science helped convict him. Science exonerated him” (Parkosh, 2016, p. 37). This embodies the paradox of integrating scientific principles within the criminal justice system.

The misinterpretations of forensic evidence by legal professionals result in wrongful convictions against the accused. Guy Paul Morin was wrongfully convicted for the murder of his neighbor, a 9-year-old girl, Christine Jessop (Pakosh, 2016). The hair and fiber evidence relied on by the prosecution played a crucial role in Mr. Morin’s wrongful conviction. The Crown counsel at his second trial regarded this evidence as some of the most significant evidence incriminating Mr. Morin. However, Commissioner Kaufman concluded that despite its apparent weight, this evidence was essentially valueless and that it had little or no probative value in demonstrating Mr. Morin’s guilt.

The Goudge inquiry was another landmark commission of inquiry that highlighted the tragedies that can be caused by flawed forensic pathology evidence. The expert opinions of pediatric pathologist Charles Smith were central to the inquiry. The inquiry scrutinized Smith's role in several cases where his expert testimony was instrumental. It identified several cases that raised serious concerns, highlighting errors in Smith's work that contributed to wrongful convictions. These errors had profound consequences, including the wrongful conviction of individuals for murder, manslaughter, and other serious charges based on incorrect pathological findings or interpretations. The report illustrated how Smith's inadequate and erroneous findings led to miscarriages of justice (Pakosh, 2016). As evidenced by the findings on wrongful convictions, the consequences of misinterpretations are profound on individuals. Therefore, it is important to establish a framework that standardizes the interpretation of forensic evidence, especially for judges.

Discussion

Through the findings of this research, several causes leading to the misinterpretation of forensic evidence by legal professionals were identified. These causes can be broadly categorized as human errors in interpretation, court oversight in evidence analysis, and inherent limitations of forensic science. The findings also highlight the significant implications of flawed interpretations: wrongful convictions.

The prosecutor’s fallacy and the inherent biases, which can be identified under human errors in forensic interpretation, highlight critical issues within the field of forensic evidence interpretation. The prosecutor's fallacy underscores the importance of adopting rigorous statistical methods, such as Bayes theorem in assessing the meaning of forensic evidence within the context of criminal trials. By incorporating both the prior probability of guilt and the likelihood of observing evidence under different hypotheses, Bayes theorem provides a more objective approach to evaluating evidence, thereby mitigating the risk of erroneous

conclusions. The findings on inherent biases reveal how interpretations inadvertently influence the outcome of the legal proceeding against the accused. Despite efforts by courts to mitigate intentional biases, other unintentional biases emerging from factors such as experience-based expectations and cognitive limitations continue to persist. The human errors in forensic analysis demand both a framework to standardize the interpretation of forensic evidence by legal professionals, as well as ongoing training and awareness initiatives for experts and legal professionals to serve as procedural safeguards.

The findings regarding the lack of thorough scrutiny by courts in admitting forensic evidence and in accepting incriminating expert testimony can be categorized under courts' oversight in forensic evidence analysis. To overcome this, the criminal justice system demands an ongoing commitment to uphold the integrity of expert testimony and to safeguard against miscarriages of justice. Furthermore, the findings revealed inherent weaknesses in forensic evidence. While many limitations exist in the interpretation of forensic evidence, it should be noted that many of these weaknesses could be mitigated through a thorough scientific examination by the expert, informed reception of forensic evidence by legal professionals, and thorough scrutiny by the courts when admitting findings related to forensic evidence. The findings demonstrated that flawed interpretations can have dire consequences for the individuals wrongfully convicted and for the integrity of the legal system as a whole. In light of these challenges, it is imperative for legal professionals and forensic experts alike to exercise diligence and scrutiny in the interpretation of forensic evidence. As a recommendation to mitigate the misinterpretations of forensic evidence, this research proposes a framework to be followed by legal professionals, especially judges.

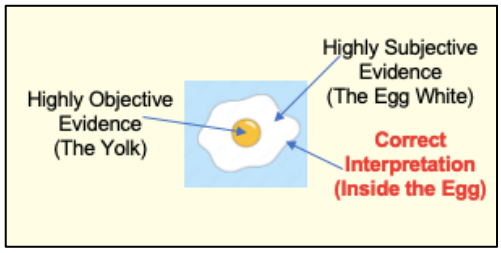
A Framework for Interpreting Forensic Evidence: The Egg Analogy

Through the course of this research, an original framework was developed to interpret forensic evidence. This framework, referred to here as the Egg Analogy, was created to

identify the correct balance between subjective parameters and objective parameters in interpreting forensic evidence. The framework categorizes evidence into two main types, parallel to the yolk and the egg white of an egg, to guide judges in their evaluation process.

Figure 1

The Egg Analogy



Note. This figure illustrates a framework wherein highly objective evidence is represented as the yolk, and highly subjective evidence as the egg white. The correct interpretation must fall within the egg. The nature of forensic evidence, whether subjective or objective, determines where the interpretation falls.

Highly Technical and Scientific Evidence (The Yolk)

The yolk represents evidence that is highly technical and objective, such as DNA findings. This category of evidence is based on strong scientific principles and provides substantial probative value. When dealing with such evidence, judges are encouraged to rely heavily on expert analysis and scientific conclusions. A larger yolk in the analogy signifies evidence with a stronger scientific foundation, suggesting that less interpretative effort is required from the prosecutor or the judge.

The yolk can be understood through Bayes' theorem as well. Bayes' theorem represents the objective, scientific analysis of forensic evidence. It provides a mathematical framework to quantify how new evidence affects the probability of certain hypotheses being true. This is similar to the yolk of the sunny side up egg, which symbolizes the solid, technical core of evidence interpretation. Bayes' theorem ensures that the interpretation of

forensic evidence is grounded in statistical and probabilistic reasoning, and offers a clear, objective basis for evaluations.

More Subjective Evidence (The Egg White)

The egg white surrounds the yolk and symbolizes evidence that requires more subjective interpretation. Examples include forensic conclusions regarding the cause of injuries that are not directly observable and may have resulted from multiple possibilities, such as being struck by a club, a pole, or a rod. Such findings are not conclusive as DNA evidence. This type of evidence, while important, does not have the same level of scientific certainty as the yolk. Therefore, it allows judges and prosecutors to exercise more discretion and consider broader context. The size of the egg white reflects the need for subjective interpretation: a larger egg white indicates more room for discretion.

The egg white includes additional evidence presented in the case, different aspects of the evidence, the credibility of witnesses, and the legal standards applicable to the case. The egg white represents this discretion, going beyond the yolk and adding a layer of interpretive flexibility that allows for human judgment and contextual understanding. It should be noted that not all aspects of a case can be quantified or directly derived from scientific evidence; they also require careful consideration of broader factors.

Excluding External Influences (Beyond the Egg White)

This framework emphasizes the importance of judicial discretion and prosecutor's subjectivity within the bounds of the egg white. However, it is crucial to also define what lies beyond the egg white. These are the factors that should not influence the interpretation of forensic evidence. The psychology of the prosecutor, including potential biases, errors due to overreliance on experience, or the misidentification of patterns where none exist, fall outside the egg white. These external influences that are not directly related to forensic evidence, can influence the interpretation process, as discussed in inherent human biases. It is imperative

that such factors be consciously excluded to maintain the integrity and objectivity of the interpretation.

In this sunny side up egg analogy, the yolk and egg white together illustrate how forensic evidence should be interpreted in the courtroom. The yolk, or Bayes' theorem, ensures that there is a strong, objective basis for the analysis. Surrounding this, the egg white, representing judicial discretion, introduces the necessary flexibility and human judgment into the process. This balance is crucial for making accurate interpretations in legal proceedings. Although this framework outlines a device for interpreting forensic evidence, future research is essential to establish both subjective and objective parameters for various types of forensic evidence and offenses. This framework can serve as a basis for further research.

Recommendations

In contrast to the open-ended process of scientific inquiry, the law prioritizes finality and aims to administer justice in a manner that ensures the reliability of a trial court’s decision for those affected by the process. Consequently, significant tension arises between science and law when they intersect in the courtroom. This research has developed and proposed a framework that can address this problem. The Egg Analogy framework is expected to provide a holistic guide for legal professionals to use as a compass to maintain a clear path through the complexities of interpretation of forensic evidence. This framework provides a balanced interpretation of forensic evidence, where decisions are made based on the evidence's scientific merit and relevance to the case, free from undue external influences. Furthermore, another approach to lessen this tension would be to educate legal professionals concerning interpretations of forensic evidence in courtrooms. Hence, there is a pressing need for scientific literacy within the legal community.

Moreover, considering the rapid evolution of science, and the law’s difficulty in keeping up with scientific developments, it is potentially dangerous for criminal lawyers to

formulate *rules of thumb* regarding science solely based on reading case law or accepting the expert opinions they meet in court (Pakosh, 2016). To mitigate the risk of the creation of inaccurate *rules of thumb*, educational resources should be provided to facilitate on-the-job learning about the basics of science easier for the busy lawyer or judge.

When forensic errors occur, such as errors in testing, technique, or testimony, there is a corresponding increased likelihood of wrongful convictions. The tragic human costs of miscarriages of justice are difficult to calculate and represent a triple failure of the justice system: a person is unjustly convicted, the true perpetrator remains free, and the victim's family must face the reality that the person convicted for the crime is not the true culprit. It is therefore crucial for the trial judge to act as a gatekeeper and allow only reliable opinion evidence that aids accurate fact-finding, while excluding irrelevant, prejudicial, or scientifically unfounded evidence. The Goudge inquiry recommended that judges should consistently prioritize the reliability of expert evidence in their gatekeeping role during criminal trials. Moreover, existing case law mandates trial judges to critically analyze expert testimony methodologically when its reliability is contested, irrespective of whether similar testimony has been admitted in prior cases (Cunliffe & Edmond, 2013).

Conclusion

The interpretation of forensic evidence by legal professionals profoundly affects the rights of the accused in the Canadian legal system. As evaluated in this paper, there are many limitations to the interpretation of forensic evidence, such as fallacies, biases, lack of standards in admitting expert evidence by the court, unreliability of expert testimony, and inherent weaknesses in forensic evidence. As a result of the errors caused by legal professionals, experts, the court, and the inherent weaknesses of forensic evidence, wrongful convictions consistently occur. These wrongful convictions seriously undermine and violate the rights of the accused.

As proposed in this paper, the sunny side up egg analogy serves as a framework for legal professionals to achieve the correct balance between subjective and objective parameters in the interpretation of forensic evidence. This approach aims to mitigate errors in attributing probative value to evidence, thereby reducing misinterpretations caused by human errors, court oversights, and the inherent weaknesses of forensic evidence.

Furthermore, several steps including educating legal professionals, providing on-the-job learning about the basics of sciences, having the judge serve as a gatekeeper and scrutinize the admission and interpretation of forensic evidence, and conducting critical methodological analysis of expert testimony are recommended to help reduce the misinterpretation of forensic evidence. Where a person's liberty is at stake, procedural fairness and the principles of fundamental justice should dictate that only good science inform the decisions of the court and impact the future of the individual. Therefore, it is vital to place checks on the interpretation of forensic evidence by legal professionals, to mitigate the dangers of wrongful convictions.

References

Adam, C. (2016). *Forensic evidence in court: evaluation and scientific opinion*. John Wiley & Sons, 5. https://doi.org/10.1002/9781119054443.ch5

Canadian Charter of Rights and Freedoms, Part I of the Constitution Act, 1982, being Schedule B to the Canada Act 1982 (UK), 1982, c11.

Chayko, G. M., & Gulliver, E.D. (Eds.) (1999). *Forensic Evidence in Canada* (2nd Ed). Canada Law Book Inc.

Cunliffe, E., & Edmond, G. (2013). Gaitkeeping in Canada: Mis-Steps in assessing the reliability of expert testimony. *Canadian Bar Review, 92*, 327- 368.

Cunliffe, E., & Edmond, G. (2021). Justice without science? Judging the reliability of forensic science in Canada. *Canadian Bar Review*, *99*, 65- 112.

Dror, I. E. (2009). How can Francis Bacon help forensic science-the four idols of human biases. *Jurimetrics*, *50*, 93- 110.

Dror, I. E. (2017). Human expert performance in forensic decision making: seven different sources of bias. *Australian Journal of Forensic Sciences*, *49*(5), 541-547.

Edmond, G. (2016). Legal versus non-legal approaches to forensic science evidence. *The International Journal of Evidence & Proof*, *20*(1), 3-28.

Frederiksen, S. (2011). The national academy of sciences, Canadian DNA jurisprudence and changing forensic practice. *Manitoba Law Journal*, *35*, 111- 142.

Gettinby, G., Peterson, M., & Watson, N. D. (1993). Statistical interpretation of DNA evidence. *Journal of the Forensic Science Society*, *33*(4), 212- 217.

Leung, W. C. (2002). The prosecutor's fallacy—A pitfall in interpreting probabilities in forensic evidence. *Medicine, science and the law*, *42*(1), 44- 50.

Macfarlane, B. A. (2014). Wrongful convictions: Determining culpability when the sand keeps shifting. *UBC Law Review*, *47*, 597- 672.

Maclean, C. L., Smith, L., & Dror, I. E. (2020). Experts on trial: Unearthing bias in scientific evidence. *UBC Law Review, 53*, 101- 140.

Olaborede, A., & Meintjes-Van der Walt, L. (2020). The dangers of convictions based on a single piece of forensic evidence. *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad, 23*(1). http://dx.doi.org/10.17159/1727-3781/2020/v23i0a6169

Pakosh, C. (Ed.). (2016). *The Lawyer's Guide to the Forensic Sciences*. Irwin Law.

Robertson, B., Vignaux, G. A., & Berger, C. E. (2016). *Interpreting evidence: evaluating forensic science in the courtroom*. John Wiley & Sons.

Smith, R. L., Kannemeyer, M., Adams, E., Nguyen, V. V., Munshaw, R., & Burr, W. S. (2020). Comparing jury focus and comprehension of expert evidence between adversarial and court-appointed models in Canadian criminal court context. *Canadian Society of Forensic Science Journal, 53*(2), 43-70.

Stoel, R.D., Sjerps, M. (2012). Interpretation of Forensic Evidence. In: Roeser, S., Hillerbrand, R., Sandin, P., Peterson, M. (eds) Handbook of Risk Theory. Springer, Dordrecht. https://doi.org/10.1007/978-94-007-1433-5_6

The Honourable Justice DS Rose & L Goos, *DNA: A Practical Guide*, 1st ed (Toronto: Thomson Reuters, 2004) (loose-leaf updated 2023, release 1) vol 1 at para 5.

van Straalen, E. K., de Poot, C. J., Malsch, M., & Elffers, H. (2020). The interpretation of forensic conclusions by criminal justice professionals: The same evidence interpreted differently. *Forensic science international, 313*, 110331.

Weathered, L., Wright, K., & Chaseling, J. (2020). Dealing with DNA evidence in the courtroom: A plain English review of current issues with identification, mixture and activity level evidence. *Wrongful Convictions Law Review, 1*, 59- 73.