A Review of Contextual Bias in Forensic Science and its potential Legal Implications

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THE VICTORIA LAW FOUNDATION LEGAL POLICY INTERNSHIP PROGRAM

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I. INTRODUCTION

Some forensic science fields require experts to examine objectively whether two pattern evidence are similar to conclude a match. These experts are required to base their conclusions on the information relevant to the task and free from any bias. Recently, there has been a dearth of literature produced on the subjective nature of pattern analysis, and has called attention to factors that may affect perception and judgement. One growing concern is what has been termed ‘contextual bias’ or ‘context effects’; that an examiner’s subjective decisions and observations can be misled by extraneous information and influences.¹ A report on forensic science from the United States and a few experimental studies on the issue suggest that this is a real concern that undermines the reliability of forensics and attempts should be made to address the issue in forensic laboratories. There is also a need to understand the scope of the issue in the justice system. Since forensics is a complex interaction between science and the law, possible outcomes may mean that legitimate evidence may be discounted, innocent individuals may be convicted or guilty people may be acquitted.² Indeed, recent cases have brought attention to the reliability of forensic expertise. Farah Jama’s case is one example that highlights the courts ready acceptance and faith in forensic evidence without understanding its fallibility and limitations.

This report will survey some of the experimental studies that have been conducted on contextual bias. First, contextual bias is discussed in depth. Since the terminology used for the issue is inconsistent across the literature, it is necessary to establish what is meant beforehand. The focus here is on environmental and emotional pressures that can contaminate forensic examiners’ observations and inferences, although other cognitive biases are briefly mentioned. Consistent with the literature, this report is primarily concerned with contextual bias in forensic pattern analysis fields. Examples of real case errors due to contextual bias are noted and, coupled with the literature review, suggest contextual bias is a potential issue that needs to be addressed. The issue is then looked at from a legal perspective and what it may mean for the admissibility of evidence thought to be contaminated by extraneous influences. The report concludes with a final recommendation for what forensic science in Australia should adopt to potentially reduce contextual bias.

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II. CONTEXTUAL BIAS

Human judgement is heavily relied on in some forensic sciences, particularly in pattern analysis fields. Despite procedures involving objective methods of analysis, the determination of a match or exclusion in pattern analysis ultimately rests with the examiner and is largely subjective. Cognitive psychology therefore plays a role in these forensic sciences and highlights the potential for bias and error in human observers.\(^3\) Since these disciplines rely on subjective assessments of examiners, their judgement can be vulnerable to different types of biases. Contextual bias is thus one of the ranging natural tendencies and influences that can contaminate an examiner’s judgement. To name a few, there is confirmation bias, desire to please others, belief perseverance, conformity, self-fulfilling prophecies and wishful thinking.\(^4\) These biases work unconsciously and without wrongful intention on an examiner. Errors are not deliberate or due to incompetence but are sincere and can therefore affect dedicated forensic experts.\(^5\)

**A. What is contextual bias?**

Contextual bias occurs when well-intentioned experts are vulnerable to making erroneous decisions by extraneous influences. Objectivity is hampered as the extraneous influences can cause experts to subconsciously develop expectations about the outcome of an examination. These extraneous influences and pressures bias the expert and are difficult to overcome due to the natural human tendency to see what is expected.\(^6\)

These influences can come from a myriad of sources. An investigator’s own theory of the case can embed an expectation of what to perceive, as well as the investigator providing more information than is necessary to conduct the examination.\(^7\) Communication in a laboratory between colleagues can also bias an examiner, particularly if forensic examiners working on the same case communicate with each other or share the results from evidence in other units.\(^8\) The close liaison between an expert and investigators, police and the prosecution or defence, whom can provide subtle cues or explicit suggestions, whether intended to or not, can also contaminate an examiner’s objectivity.\(^9\) Even transmittal letters that accompany evidence can induce a biased

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\(^3\) Ibid 8.


\(^5\) Dror and Cole, above n 1, 162.


\(^8\) Ibid.

expectation or ‘tunnel view’, as they often contain irrelevant information needed for an examiner to perform their task. An examiner may also receive information later in the examination process and start to rethink or reassess their conclusion. Police or other personnel unhappy with the result may ask for a re-examination, subtly biasing the reassessment.

B. What are the concerns?

These environmental factors carry risks of expectation and suggestion and are seen as a special problem for examiners. Considering the psychological principle that perceptions and interpretations of what is observed are distorted by desires and expectations of a task, these external influences can subsequently contaminate and bias the cognitive process involved in forensic analysis. Given the subjective nature of the work, particularly in pattern analysis, these contextual influences are seen to render the examiner vulnerable to these human factors. The primary concern is when these influences affect an examiner’s objectivity, leading them to a potentially erroneous conclusion that might not be the result of his particular expertise.

The literature suggests contextual bias is more of an issue in pattern analysis fields of forensics, although the problem has recently been extended to other fields. In these areas, experts examine where two pattern or print evidence are sufficiently similar to conclude a match. Pattern analysis fields include fingerprint identification, tyre and footwear impressions, bloodstain pattern analysis, tool mark impressions, and handwriting and hair analysis. Since it is not possible to discuss all forensic pattern analysis areas, the literature has mainly focused on fingerprint identification, as it is one of the most trusted amongst the forensic sciences. Moreover, recent cases of fingerprint identification error have also renewed attention on its perceived reliability. It is thought by focusing on fingerprint examinations, the results can be imputed to less established domains of pattern analysis.

Fingermark identification involves observing and examining a specific target ridge detail on one print and comparing it for a match to a target ridge detail on another print. The trust in fingerprint identification rests on the fact that no two fingerprints are the same; patterns differ from person to person and digit to digit. The friction ridge patterns form before birth and, apart from significant


11 Kerstholt et al, above n 7, 138.

12 Ibid.

13 Saks et al, above n 10, 78.


skin damage from scarring or illness, they remain unchanged during life.\textsuperscript{17} Perspiration or contact with other substances can leave a pattern ridge impression on a surface, which is called the latent print.\textsuperscript{18} Prints are sufficiently similar to conclude a positive identification when enough characteristics have been matched.

The criteria for identification (or individualisation) is via a methodology called ACE-V: Analysis, Comparison, Evaluation and Verification. First an analysis is done on the latent print, observing the papillary ridge detail, the patterns they form, ridge endings or minutiae, the shape of the ridge edges and pore positions.\textsuperscript{19} This is also performed on the comparison prints. The features between the latent print and the comparison print are then compared, and then evaluated, balancing the features compared before. The final step is verification, where a peer review process checks the procedure, results and objectivity.\textsuperscript{20} Many of the pattern analysis fields perform this same ACE-V protocol or a variation of it.

This illustrates that fingerprint identification and pattern forensic analysis is largely a decision making process. Prints are sufficiently similar to conclude identification when enough characteristics have been matched. Subsequently, fingerprint identification has enjoyed a solid acceptance in the judicial system. It is considered to produce zero error rates due to its strong individualisation character and the distinctiveness of the friction ridge.\textsuperscript{21} This perceived accuracy and reliability has rendered it one of the most trusted amongst the forensic sciences.

However if fingerprint examiners can be biased by extraneous influences and information, then so can other forensic sciences that rely on subjective perception and judgement, including DNA.\textsuperscript{22} A recent study examined DNA analysts on whether or not someone’s DNA matched a profile from a crime scene.\textsuperscript{23} The analysts reached different conclusions. Although more meticulously tested than other areas of forensic science, this study suggests that DNA analysis is not immune from the effects of subjectivity and bias when interpreting profiles, particularly when the samples are mixed with other people’s DNA or is partial.\textsuperscript{24}

\section*{C. Are there any benefits?}
There are different schools of thought on this issue. One is that examiners should be given no information of the case in order to effectively complete the task free from any bias. Or if information

\begin{footnotesize}
\textsuperscript{17} Schiffer, above n 14, 80.
\textsuperscript{18} Ibid 80.
\textsuperscript{19} Ibid.
\textsuperscript{20} Ibid 81.
\textsuperscript{21} Koppl, above n 9, 55.
\textsuperscript{22} See Thompson, above, n 6; Geddes, above n 15.
\textsuperscript{23} Geddes, above n 15.
\textsuperscript{24} Ibid.
\end{footnotesize}
is needed, they should only be given enough essential facts that are required to conduct the examination. On the other hand, in technical fields such as CCTV video footage identification and computer crime investigations, more information about the case undoubtedly ensures a more efficient conclusion. They cannot conduct an investigation without knowing what they are looking for. However, the current literature on contextual bias is primarily focused on pattern analysis fields, in particular fingerprint identifications. It is thought that when a print is ambiguous, distorted, smudged or incomplete, which is largely the situation with latent prints from a crime scene, then contextual influences help to ‘fill in the gaps’ of the missing data information.25

D. Other arguments
The debate on contextual bias and whether it exists is far from settled. A few prominent authors writing on this strongly espouse that it is a real concern in forensics.26 The literature suggests observations in the laboratory are the most crucial stage, followed by an assessment of results,27 whereas other experimental studies conclude the contrary; that it does not exist.28 Others have argued that contextual bias occurs from the outset of the investigation, with the choice and selection of which evidence to collect and take back to the laboratory.29 Since the whole crime scene cannot be brought back to a laboratory, the circumstances and initial theory on the offence will influence the choice of selection. It is argued that these choices are subject to different factors of bias.30 Evidence selection has also been suggested to provide a continuing expectation and bias within forensic culture that evidence is going to incriminate.31

E. Confirmation bias
Another form of bias can play hand in hand with contextual bias. Confirmation bias is when examiners give extra weight to or intentionally seek evidence that will endorse their expectations and beliefs while unintentionally ignoring evidence that could negate their belief.32 This can come into play when a second expert verifies the original expert’s conclusions, perhaps knowing the initial results or knowing the original expert is correct 99% of the time or has more experience. The subsequent examination can thus be biased by this initial examination. Selective retesting, for example only when an individualisation has been made, can also induce confirmation bias,

26 Prominent authors are Itiel Dror, David Charlton and Beatrice Schiffer.
27 Schiffer, above n 14, 107.
29 Schiffer, above n 14, 56.
30 Ibid 57.
31 Saks et al, above n 10, 88.
creating an expectation to conclude a match. Whether and to what extent results of a forensic analysis are contaminated by extraneous information or other potentially biasing influences, this current controversy puts into doubt the accuracy and reliability of forensics.

III. CASE EXAMPLES

Recent cases have heightened concerns of contextual bias in forensics and in particular pattern analysis fields.

A. Brandon Mayfield case

The Madrid train bombing case in 2004 is one of the most notorious examples of erroneous latent fingerprint identification due to contextual bias. The Spanish police gave digital images of a partial latent fingerprint taken from plastic bags of detonators to the United States Federal Bureau of Investigation (FBI). The FBI positively identified a Muslim, Brandon Mayfield, as the bomber and this was further confirmed by other FBI and fingerprint experts, including a court appointed expert. It was only through an exceptional circumstance that the error was found. A report on this erroneous fingerprint individualisation found the error was not due to methodology or technology, but was human. The extraneous context of being a high profile case and the pressure to solve it was found to have influenced the initial examiner in matching more characteristics between the prints. Subsequent examinations were then tainted, as the initial positive result was not withheld during the verification stage and the first examiner was seen as a highly respected supervisor. Overconfidence in being one of the best latent print agencies was also thought to have contributed to the error as well as the urgency of the case and knowledge of the suspect’s religious beliefs and terrorist associations.

B. Stephan Cowans

Another highly contentious case of potential contextual bias is that of Stephan Cowans. It is still largely unknown how Cowans came to be a suspect, but his name was suggested as someone who may have sold a hat to the actual perpetrator of the attempted homicide. This may have been the initial extraneous influence that biased the rest of the investigation and forensic examination. A latent print later found at a home where the perpetrator took hostage a mother and daughter was misattributed to Cowans. Cowans name is said to have mistakenly appeared on the

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33 Risinger et al, above n 9, 40-42.
35 Ibid.
36 Ibid 713.
37 Ibid p 714.
ten-print card containing prints of the hostages for elimination.\textsuperscript{39} After six years in prison, Cowans was later vindicated by DNA evidence. Another contributor to the error was said to be a fingerprint examiner, who discovered his mistake but proceeded to conceal it throughout the trial.\textsuperscript{40}

**C. Shirley McKie**

The Shirley McKie case has also scrutinised the system. Detective constable Shirley McKie was arrested and accused of perjury for stating under oath as a crown witness that a fingerprint found at the crime scene of a murder was not hers.\textsuperscript{41} McKie was later exonerated when world-renowned expert fingerprint examiners testified that the print was indeed not hers. Fingerprint expertise in this case was again later highlighted when the accused was freed after independent experts concluded another important fingerprint evidence to be erroneous.\textsuperscript{42}

**IV. LITERATURE REVIEW**

The above case examples have precipitated a few studies and research into the issue of contextual bias. The literature focuses more on pattern identification evidence and Miller is the earliest experimental study on whether environmental influences can bias results for human hair examination.\textsuperscript{43} Designed to replicate how criminal investigations proceed, it was found that the way hair evidence was submitted, with the hair from the crime scene coupled with a known hair sample from one suspect and a brief synopsis of facts, unintentionally biased observations compared to submitting a ‘hair line up’ of five samples.\textsuperscript{44}

Most studies on contextual bias have been conducted in the last few years and are varied. The majority of the studies concentrate on fingerprint examination. Some have used forensic experts and others have used general university students. Moreover, in some studies the participants knew they were being tested, whilst others have been covert with participants unaware of the experiment. This would have an important impact on the study, being more reflective of day-to-day work and free from any motivation to do well that occurs in experimental conditions. A few studies also suggest that contextual information will have more of an influence on prints that are ambiguous and highly distorted.\textsuperscript{45}
A. Covert studies

Two studies have been conducted covertly. One study by Dror, Charlton and Péron, asked five experienced latent fingerprint examiners to examine two similar prints.46 Unknown to them, they had previously examined the prints in a real criminal case, and had concluded an identification. The Mayfield case was the context in which the prints were presented. They were told one print was allegedly that of the Mayfield’s and the other was the latent print of the bomber, suggesting the prints were not a match. Four out of five examiners changed their conclusions they had previously reached, consistent with the contextually biasing information they were given.47 Three changed from identification to exclusion, one changed to inconclusive whilst only one expert stuck to their original decision.48 The biasing information therefore played a major role in how the fingerprint examiners based their decision.

Dror and Charlton also conducted a follow up study.49 Expanding the previous study, 48 pairs of fingerprints from real cases were used that were also previously examined by six experts. Each expert was given eight prints to examine, half of them they had concluded as identifications and the other half as exclusions. A control group was given no context information while the other half was given ordinary extraneous information such as ‘the suspect confessed to the crime’.50 The experts changed their decision on six pairs of fingerprints which also included the control group. For those given contextual information, the fingerprint experts changed four past decisions, consistent with the biasing information. Since the study was not confined to challenging comparisons, it revealed that bias can also occur in less difficult circumstances where the prints are not similar.51 The data used in both these studies was further collated by Dror and Rosenthal and meta-analytically quantified whether experts can be reliable or biased in their decision-making.52

B. Studies where experts were aware of the experiment

In other studies, experts have been aware there were being studied. Langenburg, Champod and Wertheim divided 43 experts between three experimental groups: a control group where no context information was given with the fingerprints; a low bias group who were given conclusions by an unnamed examiner; and high bias group who were provided with case information as well as

46 Ibid.
47 Ibid 76.
48 Ibid.
50 Ibid 608.
51 Ibid 612; Dror and Cole, above n 1, 165.
conclusions by an world renowned expert. Another control group of novices was also divided into the three experimental groups. The study aimed to measure the effects of context bias and confirmation bias. The results showed that contextual information did influence the participants but more so for the novices. Experts were likely to find an inconclusive result or exclusion rather than be influenced by the context to determine an individualisation. Novices, on the other hand, were more likely to be swayed by the biasing information.

Charlton, Fraser-Mackenzie and Dror conducted a qualitative study on 13 experts with seven years experience. The aim was to investigate the emotions and motivations of examiners themselves. The study found that the examiners viewed themselves as integral to solving a crime, drawing satisfaction from catching criminals, particularly in high profile and long running cases. Matching fingerprints was found to elicit positive emotions, with major crime being more rewarding. Examiners also had a fear of making errors and a need to close a case. The study highlights that cognitive influences play a role in affecting performance.

In another study, Kerstholt et al studied the effects of expectation and experience on 12 shoe print examiners. On the eight comparisons, expectation was induced in half by a story of the defendant’s guilt. The findings showed that expectation and experience did not affect the judgements. However, it was noted that one of the reasons for the result might be because Dutch shoe print examinations use a fairly proceduralised method for assessment. Kerstholt et al then conducted a further study on bullet comparisons, which is less standardised than shoe print examinations. Studying the effects of confirmation bias, two studies were conducted on six firearm examiners to see if prior knowledge affects the result in matching two bullets. The first study provided a transmittal letter with two bullets for comparison that were deemed to be quite difficult to assess. The letter either contained biasing information (there was only one perpetrator and one crime scene) or not (there were two perpetrators and two crime scenes) and were presented to each examiner twice, with and without the biasing information. The results again

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53 Glenn Langenburg, Christophe Champod and Pat Wertheim, ‘Testing for potential contextual bias effects during the verification stage of the ACE-V methodology when conducting fingerprint comparisons’, 54 (3) Journal of Forensic Sciences 571.
54 Ibid.
55 Ibid 578.
56 Charlton, Dror and Fraser-Mackenzie, above n 4.
57 Ibid 391.
58 Ibid.
60 Ibid 33.
61 Ibid
62 Kerstholt et al, above n 7.
found the biasing information had no effect and did not result in a confirmation bias.\textsuperscript{63} A further analysis was conducted on the conclusions between first and second examiners of 153 actual cases from 1997 to 2006. Since the second examiner had mostly no contextual information concerning the case, nor knew of the results of the first examiner, it was expected that the conclusions of the first examiner would give a more extreme conclusion than the second due to confirmation bias.\textsuperscript{64} The results were in fact opposite: second examiners gave a higher score than the initial examiners, suggesting the initial examiners were more careful in the assessment.\textsuperscript{65} Kerstholt et al suggested that examiners were perhaps subconsciously trying to control potentially biasing factors by being critical of the case information supplied to them.\textsuperscript{66}

Similarly, Hall and Player concluded giving emotional contexts by way of case information had no effect on the final opinions.\textsuperscript{67} There was no real difference between the high and low emotional context groups in this study. The participants were 70 volunteer fingerprint experts who were assigned to either a low context (given a report referring to a forgery) or high context groups (the report suggested an allegation of murder). The result of the study found the extraneous information had no effect on decisions, despite the authors finding the contextual information having an effect on their analysis.\textsuperscript{68} However, this study has been subject to criticism for its inappropriate analysis and scientific flaws.\textsuperscript{69} Dror pointed out that 19\% of participants did not read the context scenario given to them yet the results presented them as if they were influenced by the bias.\textsuperscript{70} On this point, Dror concluded that the data demonstrates bias exists.\textsuperscript{71}

C. Studies where students were used

Other studies have used university students to examine the effects of contextual bias. In one study, 27 psychology students examined 96 pairs of fingerprints to decide whether or not they originate from the same source.\textsuperscript{72} Half of the prints were clearly either from the same source or not, providing significant ‘bottom-up’ data (ie. the prints were quite clear and not distorted) for a decision to be made easily. The other half was ambiguous. The top-down influence was the

\textsuperscript{63} Ibid 140.
\textsuperscript{64} Ibid 141.
\textsuperscript{65} Ibid.
\textsuperscript{66} Ibid 141-142.
\textsuperscript{67} Hall and Player, above n 28.
\textsuperscript{68} Ibid 38.
\textsuperscript{70} Ibid 17.
\textsuperscript{71} Ibid.
emotional influence applied which were designed to reflect a real forensic setting. Participants were exposed to either low or high emotional contexts of background stories of crimes. The findings showed that the top-down component, in particular high emotional conditions, did have more of an influence on ambiguous prints and identifications were more likely to be made. This suggests that contextual information can fill in the gaps of low quality, difficult fingermarks. There was no significant difference between the controlled conditions and the low emotional contexts for the ambiguous prints. On the other hand, the top-down information could not overcome clear bottom up data.

D. Studies where forensic science students were used

Forensic science students were used to study factors that may influence the analysis stage in the ACE-V methodology. The analysis stage is the initial stage in the ACE-V process where an examiner only notes the features and characteristics of a print before a comparison with another print. Schiffer and Champod conducted two experiments. The first looked at the effect of training in fingerprint identification. Having assessed the students before and post training, the results showed that students found more characteristics and had a greater consensus after training. In the other experiment, participants were given the comparison print as well as subjected to contextual bias in the form of low and high emotional contexts. They found that the amount of fingermark characteristics was not affected during the analysis stage and concluded that the stages in the ACE-V process are not equally vulnerable to contextual bias.

The research demonstrates that contextual bias is a potential issue. Although there is a divergence in the studies on whether it exists and how strong it actually is, they do suggest that forensic scientists are not immune from cognitive influences that affect perception and judgement. Indeed, the subjective nature of analysing and judging prints naturally render some experts vulnerable to extraneous information. This suggests that forensic print analysis is not as objective and reliable as it’s commonly believed to be, although one study thought examiners were trying to control the biasing information. The studies advise that when prints are clear and not distorted, contextual pressures have less of an influence. Other studies found that contextual information helped to ‘fill in the gaps’ of ambiguous prints but one study also contested this finding. Taken together, these studies and the previously mentioned real case examples suggest contextual bias is a possible issue that needs to be addressed.

73 Ibid 806.
74 Ibid.
75 Ibid 807.
77 Ibid 118.
78 Ibid 119.
V. OPTIONS

A number of options have been put forward as a means to counter the effects of contextual bias. Such options are

- Blind verification processes
- Evidence line ups
- Blind testing
- Independent forensic labs from law enforcement agencies
- Double blind proficiency tests
- Competitive self-regulation

The literature is at odds on how serious contextual bias in forensic science actually is. Therefore it is difficult to ascertain what exactly is needed to be put in place to remedy the effects. What is certain is that the solution will not be judicially led and it is more of a policy and procedure question. Sophisticated error avoidance procedures need to be put in place to minimise the work of bias and other influences on examiners. However, context bias is difficult to control as it is working on the natural cognitive processes of humans.

A recent report on forensic science from the United States recognised the impact of contextual bias and the possible ramifications this influence may have. One strong recommendation from the report was that

NIFS should encourage research programs on human observer bias and sources of human error in forensic examinations. Such programs might include studies to determine the effects of contextual bias in forensic practice. In addition, research on sources of human error should be closely linked with research conducted to quantify and characterize the amount of error. Based on the results of these studies, and in consultation with its advising board, NIFS should develop standard operating procedures (that will lay the foundation of model protocols) to minimize, to the greatest extent reasonably possible, potential bias and sources of human error in forensic practice. These standard operating procedures should apply to all forensic analyses that may be used in litigation.79

The purpose of this section is to examine and review a number of potentially bias reducing options that have been suggested by the literature.

A. Competitive self-regulation

One recommendation put forward is to create a system of forensic check and balances by placing forensic laboratories in competition with each other. This would require forensic labs to be privatised, independent from law enforcement agencies and with several in each jurisdiction. The

79 National Research Council, above n 2, 24.
foundation of this suggestion rests on the monopoly of forensic labs, as another laboratory is unlikely to examine the evidence.\textsuperscript{80} Moreover, the threat of civil action or administrative fines would create financial incentives to work reliably.\textsuperscript{81} Koppl suggests the same evidence should be chosen at random for multiple testing at various labs.\textsuperscript{82} An evidence control officer in each jurisdiction would then manage the work and be the sole contact between those requesting the test and the lab. They would also decide on what tests are needed whilst filtering only domain relevant information to the examiner to shield against bias. Labs will be further subjected to statistical reviews. If they produce a number of inconclusive results, practices and procedures will be assessed.

This option’s strength is that each lab will then be a check on another lab. Moreover, forensic workers are aware someone else is examining the case, providing an incentive to work more reliably and minimise potential mistakes.\textsuperscript{83} On the other hand, factors of time coupled with the costs of privatisation and setting up more laboratories in a jurisdiction than perhaps is necessary, render this option unfeasible.

**B. Blind testing**

Blind testing is suggested to be the simplest option to shield against contextual bias.\textsuperscript{84} No domain irrelevant information on the case is given to the examiner, so ultimately the examiner cannot be influenced by details. It is not suggested that examiners be absolutely denied information needed to perform their task. Sometimes essential facts are required for the examination and thus only this information should be exposed.\textsuperscript{85} Other cases may call for information to be revealed in stages, where enough information to perform the examination is given with additional information later revealed that may lead to further testing.\textsuperscript{86}

This requires a filtration system of information. Risinger et al propose converting evidence in take personnel to evidence and quality control officers, similar to those mentioned above.\textsuperscript{87} These officers will remove suggestive domain irrelevant information from submissions and will co-ordinate the examination.\textsuperscript{88} Beliefs and expectations of police, prosecutors and other personnel are then guarded from the examiner as well as knowledge of other evidence. Blindness to the context will

\begin{footnotesize}
\textsuperscript{80} Koppl, above n 9, 5.
\textsuperscript{81} Ibid 10, 36.
\textsuperscript{82} Ibid 28.
\textsuperscript{83} Ibid 26.
\textsuperscript{84} Saks et al, above n 10, 87; Risinger et al, above n 9, 45.
\textsuperscript{85} Saks et al, above n 10, 87.
\textsuperscript{86} Risinger et al, above n 9, 46.
\textsuperscript{87} Risinger et al, n 10, 46-47.
\textsuperscript{88} Ibid.
\end{footnotesize}
ensure examiners base their results on the actual evidence. However, blind testing will not remove the culture of expectation in forensic laboratories that evidence will inculpate.89

**C. Blind verification processes**

In a blind verification process, all results from previous examiners are unknown to the verifier. To achieve this, it is suggested that an examiner’s documentation and results should be sealed in an envelope.90 Any tampering with the envelope should be recorded on a section below the seal.91 Although an increase in resources and personnel will be needed,92 a blind verification process will counter the effects of confirmation bias. On the other hand, Langenburg, Champod and Wertheim’s study concluded that blind testing for verifications would not be needed for every case, only for complex cases.93

**D. Double blind proficiency tests**

The aim of a proficiency test is to evaluate not only the quality of performance of a forensic laboratory but to also assess the competence of the examiner.94 It can be either internal or external with an independent agency such as NIFS conducting the tests. In a double blind proficiency test, both the examiner and the laboratory are unaware they are being tested. A series of samples, unknown to the laboratory or examiner, are sent on a regular basis.

Introducing a double blind proficiency test will not ultimately minimise the risk of extraneous influences on examiners. However, it would provide a clear indication of the performance of an examiner and his expertise.

**E. Independence of forensic science laboratories**

The recent report on forensic science from the United States’ National Academy of Science recommended forensic laboratories and facilities become autonomous.95 As part of the administrative limb of law enforcement agencies, forensic laboratories are seen as part of the prosecution team. To increase fairness in forensic testing and to overcome the expectation that evidence will inculpate, independence from law enforcement agencies is therefore ideal. However, this seems unrealistic to introduce. The cost and time needed to privatise forensic laboratories means the influence of context effects will not be procedurally remedied for a long period of time.

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89 Saks et al, above n 10, 88.
90 Bryan Found and John Ganas, *Removing contextual information from case submissions: a pilot program, (Speech delivered at NAME FORUM, LOCATION, FULL DATE) – Get information from Linzi*
91 Ibid.
92 Langenburg, Champod and Wertheim, above n 53, 2.
93 Ibid 8.
95 National Research Council, above n 2, 190-191.
F. Evidence line-ups

Procedures in photo and eyewitness identification line-ups could be followed to reduce contextual bias. This would require the latent print to be sent with further similar samples (‘foils’) for comparison with no accompanying suggestive information in verbal or written form to be given. The examiner would be blind as to which item is the true evidence. Miller’s study showed that such a line up for hair samples led to improved results.

Risinger et al propose that the evidence line up will be the responsibility of evidence and quality control officers. There is a problem that these officers will need to select and have on hand similar foils for the design to work, requiring more personnel and resources. On the other hand, an evidence line-up will reduce the intrinsic belief within forensics that tested evidence will inculpate. Since investigators select evidence on the basis it is connected to the crime, this provides a continuing expectation that the evidence is going to incriminate. In an evidence line-up, the examiner is aware that most evidence is not connected to the case so they are forced to demonstrate real expertise and reliability. This increases the likelihood that the correct decision was made rather than mere chance.

VI. LEGAL IMPLICATIONS

Challenges to forensic evidence based on contextual influences and confirmation bias have yet to appear before the Australian courts. However, as one commentator has pointed out, ‘it may very well be a fertile area of challenges for the future.’ This of course depends on how strong the effect is in reality. As illustrated, the divergence in the literature and experimental studies vary in this regard. Despite the inherent flaws, courts still have strong faith in forensic science and a challenge to an erroneous result because of extraneous influences is ultimately a challenge to the preconceived idea that forensic science is infallible.

It is unclear how the courts will be receptive to these concerns. Undoubtedly, forensic expert witnesses provide an invaluable role to the judge or jury. Their function is to provide an inference, which cannot be drawn by the trier of fact due to the technical nature of the facts. The judge and jury therefore need be made aware that the expert could be mistaken, particularly in light of recent

96 Saks et al, above n 10, 88.
97 Miller, above n 43, 162.
98 Risinger et al, above n 10, 46-47.
99 Saks et al, above n 9, 88.
100 Risinger et al, above n 9, 49.
101 Saks et al, above n 10, 89.
103 Quick v Stoland Pty Ltd (1998) 87 FCR 371 at 382 per Finkelstein J.
cases that have brought the integrity of forensic practices into question. 104 Indeed, proving that results have been contaminated by contextual influences will be difficult since the examiners themselves believe they are right. However, forensic science alone cannot produce a judicial error. 105 Other factors and circumstances are needed.

A. Admissibility

If forensic expert opinion evidence happened to be disputed because it was contaminated by suggestive or extraneous information, it seems it will more likely go to the weight of the evidence rather than its admissibility. Under section 76 of the Uniform Evidence Laws (UEL) 106, admission of an opinion is generally excluded ‘to prove the existence of a fact about the existence of which the opinion was expressed’. However expert opinion evidence is admissible if it is of sufficient probative value, 107 relevant 108, and satisfies section 79:

If a person has specialised knowledge based on the person’s training, study or experience, the opinion rule does not apply to evidence of an opinion of that person that is wholly or substantially based on that knowledge.

To be able to give an opinion on the evidence, the forensic expert witness therefore must meet three requirements: they must have ‘specialised knowledge’ and that specialised knowledge is to be ‘based on training, study or experience’. Finally, the opinion expressed by the witness must be ‘wholly or substantially based on that knowledge’. 109 This has to be established on a balance of probabilities. 110

Section 79 appears not to have had a rigorous application when admitting unreliable expert opinion evidence. This is made clear in R v Tang. 111 Tang was an appeal over whether opinion evidence of facial and body mapping identification was admissibl e. Facial mapping is a form of identification evidence where images of a suspect or known person are compared to the image from security

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104 In 2008, Mr Farah Abulkadir Jama was convicted of rape in Victoria. DNA found on a slide and swab was said to have a high probability that it was his. The case rested on this forensic evidence alone. He spent 18 months in prison before he was exonerated. It was found that the DNA evidence had been contaminated due to procedural defects.

105 Schiffer, above n 14, 50.

106 The Uniform Evidence Act shares a basic uniformity in the statutory provisions amongst the Commonwealth, the ACT, New South Wales, Victoria, Tasmania and all external Territories. The remaining states, Queensland, South Australia, Western Australia and the Northern Territory have yet to enact the legislation, but there is strong indication that this will occur. This section will thus focus on the Uniform Evidence Act. Uniform Evidence Laws (UEL) will be used to refer to the Evidence Act 1995 (Cth), Evidence Act 1995 (NSW), Evidence Act 2008 (Vic), Evidence Act 2004 (NI) and the Evidence Act 2001 (Tas).

107 Section 135 of the UEL.

108 Section 55 of the UEL.


110 Section 142 of the UEL.

footage of a crime.\textsuperscript{112} Similarly, body mapping uses this process on the body, posture and movement.\textsuperscript{113} The prosecution called a qualified forensic anatomist who identified the person in the security video footage of a robbery as the accused. Since the quality of the footage was not clear, the anatomist was allowed to proffer her opinion. The Court focused on ‘special knowledge’ in section 79 and found that facial mapping was not shown to be specialised knowledge that would allow her to offer her opinion on the identity of the perpetrator in the video footage.\textsuperscript{114} It was found to be more of a subjective belief rather than ‘special’ for the purposes of section 79.\textsuperscript{115} However, the Court allowed the anatomist to offer her opinion as an ad hoc expert about the resemblance between the accused and the perpetrator, which further circumvented examining the reliability of the evidence.\textsuperscript{116}

What is important in this case is that Spigelman CJ, with whom the court agreed, stressed that attention was not on ‘an extraneous idea such as “reliability”’ but on the words ‘specialised knowledge’ in section 79.\textsuperscript{117} The United State’s \textit{Daubert}\textsuperscript{118} case was used to define ‘specialised knowledge’\textsuperscript{119}. A narrow view of the section was espoused and subsequently, it has advantaged the expert’s training and their accepted expertise over questioning the validity of forensic techniques and procedures.\textsuperscript{120} To a similar effect, this was emphasised by Heydon JA in \textit{Makita (Australia) Pty Ltd v Sprowles}.\textsuperscript{121} Heydon JA also drew attention to other requirements not mentioned in section 79; that the reasoning for the opinions must be sufficiently explained as well as the facts and assumptions, which the evidence is based.\textsuperscript{122}

For our purposes, this illustrates that expert opinion evidence will still be admissible despite perhaps erroneous due to the influence of contextual bias. The focus will not be on whether the forensic expert’s opinion can be trusted as deriving ‘wholly or substantially’ from their ‘specialised knowledge’ but on their formal training and recognisable skills. This would seem to be the case if the questioned opinion evidence was on fingerprint identification, which has over 100 years of judicial acceptance. Judges seem to have taken a laissez-faire approach in admitting unreliable yet
incriminating expert opinions, believing cross-examination, rebuttal experts and judicial warnings and discretions can deal with reliability problems. Moreover, judges seem to place faith in the jury to weigh up and resolve conflicting expert opinion themselves.

**B. Discretionary exclusions**

There is a possibility that forensic evidence contaminated by contextual bias might influence the court to exercise its discretionary exclusion powers. The exclusionary discretions are found in sections 135 and 137 of the UEL and have codified the common law position held in *R v Christie*\(^{124}\) that allowed a trial judge to exclude evidence where the prejudicial effect would outweigh its probative value.\(^{125}\) Section 137 is a mandatory exclusion: if the prosecution adduces evidence and its prejudicial effects are outweighed by unfair danger to the accused, it must be excluded. Section 135, on the other hand, is a discretionary refusal to admit evidence if it is found to be unfairly prejudicial, misleading or confusing, or cause or result in undue waste of time. There must also be a substantial disproportion between the ‘probative value’ and the ‘danger’ for the purposes of section 135.\(^{126}\)

However, it does not appear that the judicial discretions will safeguard against contextual biased evidence either. It is difficult to see how a relatively novel theory of forensic science, backed up by a few experimental studies, could successfully exclude an incriminating expert witness opinion, particularly given that expert opinion evidence is not lightly ignored.\(^{127}\) As one commentator has pointed out, judges seem reluctant to use these discretionary sections to exclude unreliable expert opinion evidence.\(^{128}\) Rather evidence is taken at its highest value when balancing the prejudicial and probative effect.\(^{129}\) This means the unreliability of evidence can be overlooked in preference for leaving it to the jury to weigh.

**C. R v Li**

*R v Li*\(^{130}\) is a case that concerned a slight issue of contextual bias. *Li* was an appeal concerning, amongst other grounds, the admissibility of expert voice similarity evidence and visual identification evidence. Evidence from three voice identification experts familiar in translating Cantonese were admitted: one an experienced interpreter and translator; another a Sergeant with qualifications as

\(^{123}\) Edmond, above n 112, 89.

\(^{124}\) [1914] Ac 545.

\(^{125}\) Ibid [559].


\(^{127}\) *Anderson v R* [1971] 3 All ER 768.

\(^{128}\) Gary Edmond, above n 120, 2.


\(^{130}\) [2003] NSWCCA 290.
a translator in Cantonese and English; and the other a University lecturer in linguistics. These experts expressed a positive identification of the accused from listening to a voice recording of the appellant and comparing to surveillance video and audio recordings of a person suspected of importing heroin. Counsel for the defence submitted that the experienced interpreter and translator’s evidence should not have been admitted because it was ‘tainted’ as he must have known that Li was a suspect when he compared the recorded interview with the surveillance tapes.\footnote{Ibid [58].} The Court did not agree, but recognised that there may be certain situations, albeit limited, where this would be appropriate.\footnote{Ibid [60]; The court agreed with the point made by Simpson J in \textit{R v Leung} (1999) 47 NSWLR 405 at [45] ‘that care must be taken not to suggest that a particular person is the suspect’ in voice identification, similar to situations of police line-ups or identifications by photographs.} The Court further disagreed that its probative value outweighed the danger of unfair prejudice to the defendant, per section 137 of the UEL. Counsel also submitted that the Sergeant, as a member of the police, was vulnerable to unconscious bias. On this point, Ipp JA said,

\begin{quote}
In my opinion the arguments raised in relation to [the] Sergeant... concerned matters of weight and were essentially matters for the jury... The risk of bias (unconscious or otherwise) is no reason not to admit evidence of an expert.\footnote{Li [2003] NSWCCA 290, [71].}
\end{quote}

In summary, Ipp JA emphasised that,

\begin{quote}
[A]ll the matters raised on behalf of the appellant were matters that went to the weight. They were essentially jury questions. In my view, none of them gave rise to a danger of unfair prejudice to the appellant.\footnote{Ibid [78]}
\end{quote}

It seems that evidence influenced by contextual influences will still be admissible and unlikely to be excluded by the discretionary sections. The issue will rather go to the weight of the evidence attributed to it by the trier of fact. It will therefore be up to good defence counsel in cross-examination to suggest the expert was given overly suggestive information or was swayed by external pressures.

\section*{VII. CONCLUSION}

Contextual bias presents a problematic issue for forensic science. Although opinions differ in the literature over its existence and how strong it actually is, recent cases demonstrate that contextual bias could potentially cause erroneous decisions. The solution cannot be judicially led, therefore it is more of a policy and procedure question.

This report recommends more research to be done on contextual bias. The research should focus on a broader range of disciplines and perhaps a comparison of pattern matching and non-matching...
disciplines to fully determine any influence contextual bias may have. The introduction of blind proficiency testing should also be done to firstly measure the extent of the situation. Once the level and extent of the influence is properly determined then appropriate measures from the series presented can be introduced.
## VIII. GLOSSARY

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>ACE-V methodology</td>
<td>Analysis, Comparison, Evaluation, and Verification. It is a method used by fingerprint examiners to evaluate fingerprints.</td>
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<tr>
<td>Bloodstain pattern analysis</td>
<td>The examination of shapes, locations, splatter and distribution of bloodstain patterns that could give an interpretation of what occurred at the crime scene.</td>
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<tr>
<td>Cognitive psychology</td>
<td>Psychology that studies mental processes, such as how people think, perceive, remember and learn.</td>
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<tr>
<td>Confirmation bias</td>
<td>When examiners give extra weight to or intentionally seek evidence that will endorse their expectations and beliefs while unintentionally ignoring evidence that could negate their belief.</td>
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<tr>
<td>Contextual bias</td>
<td>When an examiner’s subjective decisions and observations can be misled by extraneous information and influences.</td>
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<tr>
<td>Fingerprint analysis</td>
<td>Process of comparing two friction ridge impressions to determine whether these impressions could have originated from the same individual.</td>
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<tr>
<td>Friction ridge</td>
<td>Minute raised ridges of skin found on the inside surfaces of hands and fingers and on the bottom of feet and toes. No two friction ridge detail are identical.</td>
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<tr>
<td>Footwear impression analysis</td>
<td>Process of comparing footwear marks, shapes, design features or general patterns to a specific piece of footwear.</td>
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<tr>
<td>Handwriting analysis</td>
<td>Comparing written documents to determine whether the same person wrote them. The handwriting’s characteristics such as quality, form, content and arrangement are analysed and is used to determine whether documents were forged.</td>
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<tr>
<td>Individualisation</td>
<td>Refers to identification in forensic science.</td>
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<td>Latent prints</td>
<td>Termed used to refer to a fingerprint or partial fingerprint that has been left at scene of a crime.</td>
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<tr>
<td>Tool mark impression analysis</td>
<td>Process of comparing marks of a tool to those marks found at a crime scene to determine what type of tool made the mark.</td>
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<tr>
<td>Tyre impression analysis</td>
<td>Process of comparing impressions of tyre thread designs and dimensions left at a crime scene to a specific tyre. Every tyre has different amounts of thread wear and damage such as tiny cuts and nicks.</td>
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