



Are Forensic Scientists Experts?



Alice Towler*

David White

University of New South Wales, Australia

Kaye Ballantyne

Victoria Police Forensic Services Department, Australia

Rachel A. Searston

University of Melbourne, Australia

The University of Adelaide, Australia

Kristy A. Martire

Richard I. Kemp

University of New South Wales, Australia

Despite playing a critical role in our criminal justice system, very little is known about the expertise of forensic scientists. Here, we review three disciplines where research has begun to investigate such expertise: handwriting analysis, fingerprint examination, and facial image comparison. We assess expertise against the scientific standard, but conclude that meeting this standard does not provide a sufficiently high benchmark for the forensic sciences. Forensic scientists must demonstrate a minimum standard of performance, the ability to defer judgement in cases at high risk of error, and the ability to effectively communicate the strength of their evidence to factfinders. We discuss the limitations of current forensic science expertise research to adequately capture factors affecting operational accuracy and outline crucial differences between studies assessing perceptual skill and operational accuracy. Finally, we identify key areas for future research and encourage cognitive scientists to engage in forensic science research.

General Audience Summary

Forensic scientists provide investigators and courts with information about the source of traces left at crime scenes, such as fingerprints, hair, and blood. However, with the exception of DNA, there is limited scientific evidence that the methods used by forensic scientists can link evidence to a source with high levels of certainty, or whether forensic scientists themselves are experts at making those decisions. Here, we describe research in three forensic disciplines—handwriting analysis, fingerprint examination, and facial image comparison—and consider whether forensic scientists in those disciplines should be considered experts. We identify key issues related to how we define and measure expertise in the forensic sciences, the adequacy of current research to assess expertise in real-world settings, and key areas for future research.

Keywords: Forensic science, Expertise, Handwriting analysis, Fingerprint examination, Facial image comparison

Author Note

Alice Towler, David White, Kristy A. Martire, Richard I. Kemp: School of Psychology, University of New South Wales, Australia; Kaye Ballantyne: Office of the Chief Forensic Scientist, Victoria Police Forensic Services Department, Australia; Rachel A. Searston: Melbourne Graduate School of Education, Melbourne Centre for the Study of Higher Education, University

of Melbourne, Australia; School of Psychology, The University of Adelaide, Australia.

* Correspondence concerning this article should be addressed to Alice Towler, School of Psychology, University of New South Wales, NSW 2052, Australia. Contact: a.towler@unsw.edu.au

In 1992, three-year-old Christine Jackson was abducted from her home, brutally raped, and murdered. Her body was found in a nearby creek two days later. Attention quickly turned to the victim's stepfather Kennedy Brewer who had been looking after Christine in the hours before she went missing. An autopsy revealed suspected bite-marks on the victim's body and a forensic odontologist testified these were inflicted by Brewer. Brewer was found guilty of capital murder and sexual battery and sentenced to death.

But Kennedy Brewer was innocent. Advances in DNA analysis allowed archived biological evidence to be examined. As a result, Brewer was exonerated before he could be executed, but not before serving 13 years on death row ([Innocence Project, 2017](#)).

In the years since the Brewer case, forensic bite-mark analysis has been classified as “junk science” (see [PCAST, 2016](#)). Indeed, studies have shown that forensic odontologists cannot reliably determine whether a bite-mark was left by a human, let alone identify *which* human ([Freeman & Pretty, 2016](#); [Page, Taylor, & Blenkin, 2012](#)).

Forensic bite-mark analysis is not the only forensic science discipline with questionable reliability. In 2009, a scathing report by the [National Research Council](#) (hereafter, NRC Report) stated,

“With the exception of nuclear DNA analysis . . . no forensic method has been rigorously shown to have the capacity to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.” (p. 7)

More recently, President Barack Obama commissioned the Presidents' Council of Advisors on Science and Technology (PCAST) to conduct a comprehensive investigation into the status of forensic pattern-matching disciplines (see [PCAST, 2016](#)). Pattern-matching disciplines are those where a forensic scientist compares two samples “by eye” to determine if they have the same or different origin, for example fingerprint examination and hair comparison. PCAST reported that in five of the seven examined disciplines—bite-marks, firearms, footwear, complex-mixture DNA and hair analysis—there was little evidence that forensic scientists were able to reliably link samples of unknown origin to their source. In some forensic science disciplines research has revealed poor accuracy and reliability in forensic scientists' judgements, but more commonly, foundational research establishing their expertise has simply not been carried out.¹

There is limited scientific evidence supporting the validity and reliability of the techniques forensic scientists' use. In addition, very few studies have examined the question of whether forensic scientists show expert-level performance. Despite this, forensic scientists regularly provide their opinions in court as expert witnesses. Ordinarily, witnesses are only permitted to

testify to their first-hand experiences relevant to the facts at issue. However, a common legal exception in many countries permits opinion evidence if the opinion is based on “specialised knowledge” acquired through training, study, or experience (e.g., s79 Evidence Act, 1995). It is exceptions of this kind that allow forensic scientists to share their “expertise” with the court and which have established precedent for future admissions. However, simply having training, study, or experience in a particular forensic discipline is insufficient to guarantee expertise ([Edmond, 2016](#); [Edmond & Martire, 2017](#); [PCAST, 2016](#)).

Cognitive scientists have studied expert performance for many decades, and as such, are well-placed to examine the question of whether forensic scientists are experts. Prominent researchers in this field have defined expertise as “consistently superior performance on a specified set of representative tasks for a domain” ([Ericsson & Lehmann, 1996](#)). It is curious that this definition is not the one used by forensic scientists to benchmark their abilities. Instead, they rely on the presence of “specialised knowledge” together with legal assent as evidence of expert status. Furthermore, the court's willingness to accept “expertise” in unvalidated forensic science disciplines has been credited as a source of serious miscarriages of justice (see [Edmond, 2016](#); [Edmond, Found, et al., 2017](#); [Edmond & Martire, 2017](#); [Edmond et al., 2014](#); [Edmond & San Roque, 2016](#); [Koehler, 2016](#); [Martire & Edmond, 2017](#); [Mnookin et al., 2011](#); [PCAST, 2016](#); [Saks & Koehler, 2005](#)). In fact, the Innocence Project estimates that nearly half of all wrongful convictions overturned by DNA evidence involved unvalidated or improper forensic science evidence ([Innocence Project, 2017](#)).

The NRC and PCAST reports prioritise empirical validation (or “black box”) studies to establish (a) whether methods routinely used by forensic scientists allow them to make accurate determinations of the source of questioned samples, and (b) whether forensic scientists demonstrate expertise in using these methods compared to untrained novices. But forensic scientists do not necessarily know how to design, run, and analyse human performance studies, and thus may lack the skills necessary to undertake this critical research ([Martire & Kemp, 2016](#); [Mnookin et al., 2011](#)). There is also a conflict of interest for forensic scientists who wish to establish the validity and reliability of their discipline's methods to provide evidence that they and their colleagues are in fact experts. We argue that cognitive scientists possess the skills needed to design, administer, and statistically analyse fair tests of human performance without being invested in the results. As such, cognitive scientists are particularly well-suited to conducting research on human expertise in the forensic sciences (see also [Edmond, Towler, et al., 2017](#); [Koehler, 2013, 2016](#); [Martire & Kemp, 2016](#); [Mnookin et al., 2011](#)).

Here, we review research from three forensic science disciplines—handwriting analysis, fingerprint examination, and facial image comparison—where efforts to assess expertise have already begun. We draw on this research to determine whether forensic scientists in those disciplines should be considered experts. We then discuss some of the broad issues related to establishing expertise in the forensic sciences.

¹ See [Koehler \(2016\)](#) for a discussion of the reasons why this kind of basic research in forensic science disciplines has not been conducted.

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