



# Forensic science evidence and criminal proceedings

Never Stand Still

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‘The life of the law has not been logic: it has been experience.’

Oliver Wendell Holmes Jr, *The Common Law* (1881)



# Reasons for expert evidence

‘... if matters arise in our laws which concern other sciences and faculties we commonly call for the aid of that science or faculty which it concerns, which is an honourable and commendable thing for thereby it appears that we do not despise all other sciences but our own, but we approve of them and encourage them.’

*Buckley v Rice Thomas* (1554) 1 Plowden 118

## Adversarial essentials

‘It is a primary duty imposed on experts in giving opinion evidence to furnish the trier of fact with the criteria to enable the evaluation of the expert conclusion: *Makita (Australia) Pty Ltd v Sprowles* (2001). ... The ‘bare *ipse dixit*’ of a scientist upon an issue in controversy should carry little weight: *Davie v Magistrates of Edinburgh* (1953).’

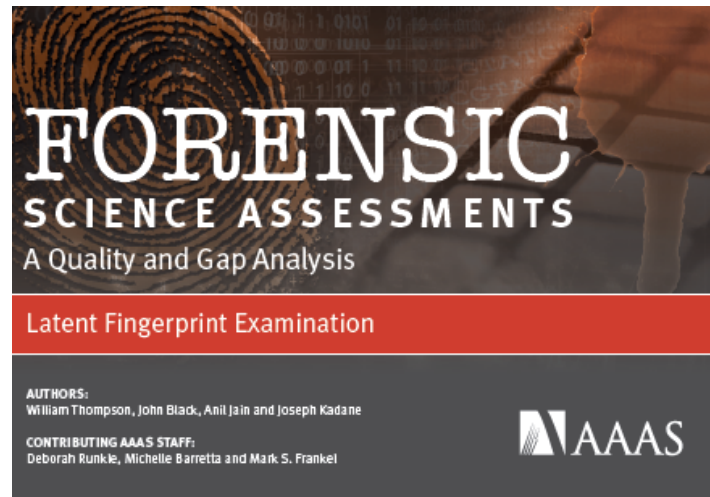
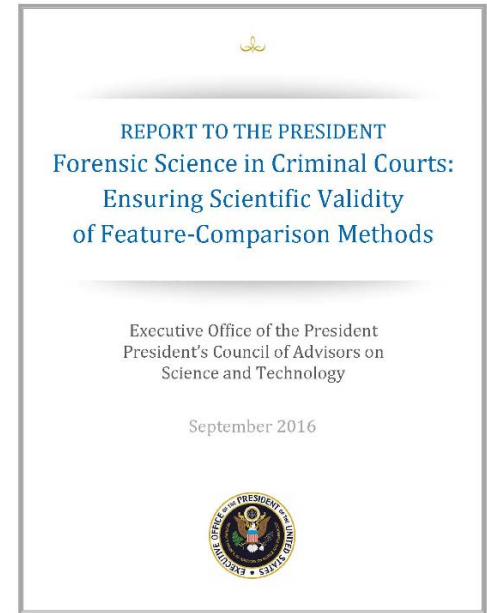
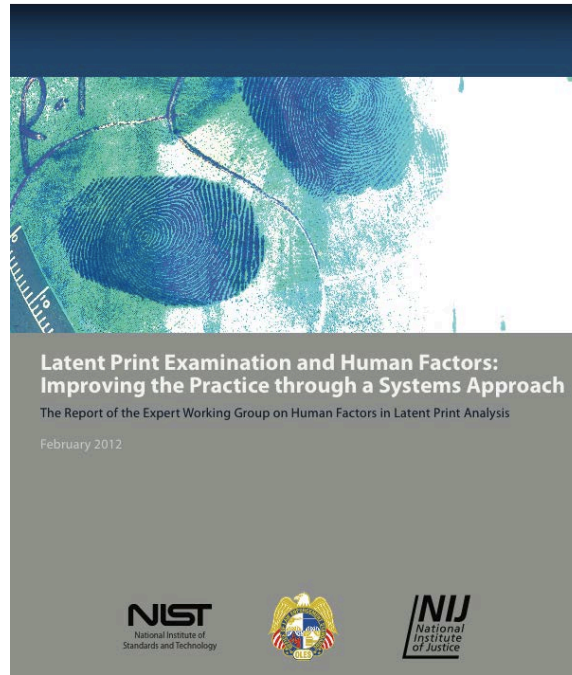
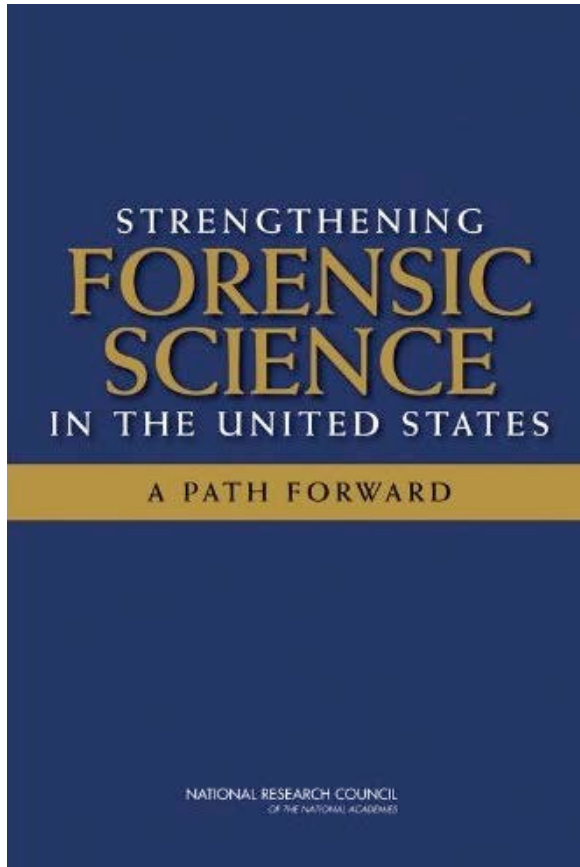
*Hillstead v The Queen* [2005] WASCA 116, [48]

See Edmond, ‘Forensic science evidence and the conditions for rational (jury) evaluation’ (2015) 39 *Melbourne University Law Review* 75-123.



# EVIDENCE-BASED FORENSICS INITIATIVE

# Scientific 'benchmark'



# Forensic science: Guiding principles

‘Two very important questions should underlie the law’s admission of and reliance upon forensic evidence in criminal trials:

- (1) the extent to which a particular forensic discipline is founded on a reliable scientific methodology that gives it the capacity to accurately analyze evidence and report findings and
- (2) the extent to which practitioners in a particular forensic discipline rely on human interpretation that could be tainted by error, the threat of bias, or the absence of sound operational procedures and robust performance standards.’

# Validation

‘... valid scientific knowledge can *only* be gained through *empirical* testing of specific propositions.’

‘For a metrological method to be scientifically valid and reliable, the procedures that comprise it must be shown, based on empirical studies, to be *repeatable*, *reproducible*, and *accurate*, at levels that have been measured and are appropriate to the intended application.’

‘... methods must be presumed to be unreliable until their foundational validity has been established based on empirical evidence.’

# Validation of the feature comparison forensics

‘With the exception of nuclear DNA analysis, however, 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.’

**National Academy of Sciences, *Strengthening Forensic Science in the United States* (2009)**

(i.e. latent fingerprint\*, shoe, foot, ear, tyre, bite mark, hair, fibre, soil, ballistic, toolmark, handwriting, bloodstain, voice and image comparisons, and so on).

\* in 2009, before Ulery et al (2011), Tangen et al (2011).



# Human factors

‘Some initial and striking research has uncovered the effects of some biases in forensic science procedures ... The forensic science disciplines are just beginning to become aware of contextual bias and the dangers it poses. The traps created by such biases can be very subtle, and typically one is not aware that his or her judgment is being affected.’

**National Academy of Sciences, *Strengthening Forensic Science in the United States* (2009).**

See also Expert Working Group, *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* (US National Institute of Standards and Technology & National Institute of Justice, 2012); EBF1, ‘Thinking forensics: Cognitive science for forensic practitioners’ (2017) 57 *Science & Justice* 144 and ‘Just cognition’ (2019) 82 *Modern Law Review* 633.

## Do not rely upon bare experience ...

‘We note, finally, that neither experience, nor judgment, nor good professional practices (such as certification programs and accreditation programs, standardized protocols, proficiency testing, and codes of ethics) can substitute for actual evidence of foundational validity and reliability.

...

Similarly, an expert’s expression of *confidence* based on personal professional experience or expressions of *consensus* among practitioners about the accuracy of their field is no substitute for error rates estimated from relevant studies. For forensic feature-comparison methods, establishing foundational validity based on empirical evidence is thus a *sine qua non*. Nothing can substitute for it.’

**President’s Council of Advisers on Science and Technology (2016)**

# Reliability is not an admissibility issue for the UEL

## Section 79(1)

‘The focus must be on the words “specialised knowledge”, not on the introduction of an extraneous idea such as “reliability”.’

***R v Tang* [2006] NSWCCA 167, [137], per Spigelman CJ; *Tuite v The Queen* [2015] VSCA 148 (Vic).**

‘Section 79 is not concerned with reliability of the expert’s opinions: *Tuite v R* (2015) 49 VR 196 at [70] applying *R v McIntyre* [2001] NSWCCA 311 and *R v Tang* [2006] NSWCCA 167. In a jury trial the question of whether the expert’s opinion should be accepted, is a matter for the jury.’

***Chen v R* [2018] NSWCCA 106, [62]**

Martire, K., & Edmond, G. (2017). Rethinking expert opinion evidence. *Melbourne University Law Review*, 41, 967-998; Edmond, G. (2008). Specialised knowledge, the exclusionary discretions and reliability: Reassessing incriminating expert opinion evidence. *UNSW Law Journal*, 31, 1–55.

# Case study 1

## Latent fingerprint comparison



# Categorical identification from the start to ...

‘... the witness arrived at the conclusion that the finger marks were made by the same person.’

*R v Blacker* (1910)

‘... he was of opinion that, the prisoner’s finger must have made the print on the bottle. He had examined tens of thousands of fingerprints, and never found two alike.’

*R v Parker* (1912)

‘The examiner testified that the latent fingerprint was “identical to a fingerprint taken from Mr Bennett”, had come “from the same person” and “excluding all others”. ... There was no dispute about the fingerprint examiner being ‘qualified to express the opinion that he gave. ... There was “no suggestion that the process of comparison that he followed is not a recognised and appropriate process”.’

*Bennett v Police* (2005)

# **The science: Critical of the ACE-V ‘method’**

‘ACE-V\* ... is not specific enough to qualify as a validated method for this type of analysis. ACE-V does not guard against bias; is too broad to ensure repeatability and transparency; and does not guarantee that two analysts following it will obtain the same results. For these reasons, merely following the steps of ACE-V does not imply that one is proceeding in a scientific manner or producing reliable results.’

\* Analysis, Comparison, Evaluation and Verification

**National Academy of Sciences, *Strengthening Forensic Science in the United States* (2009)  
See also NIST, 2012: 8-9; PCAST, 2016: 66-81.**

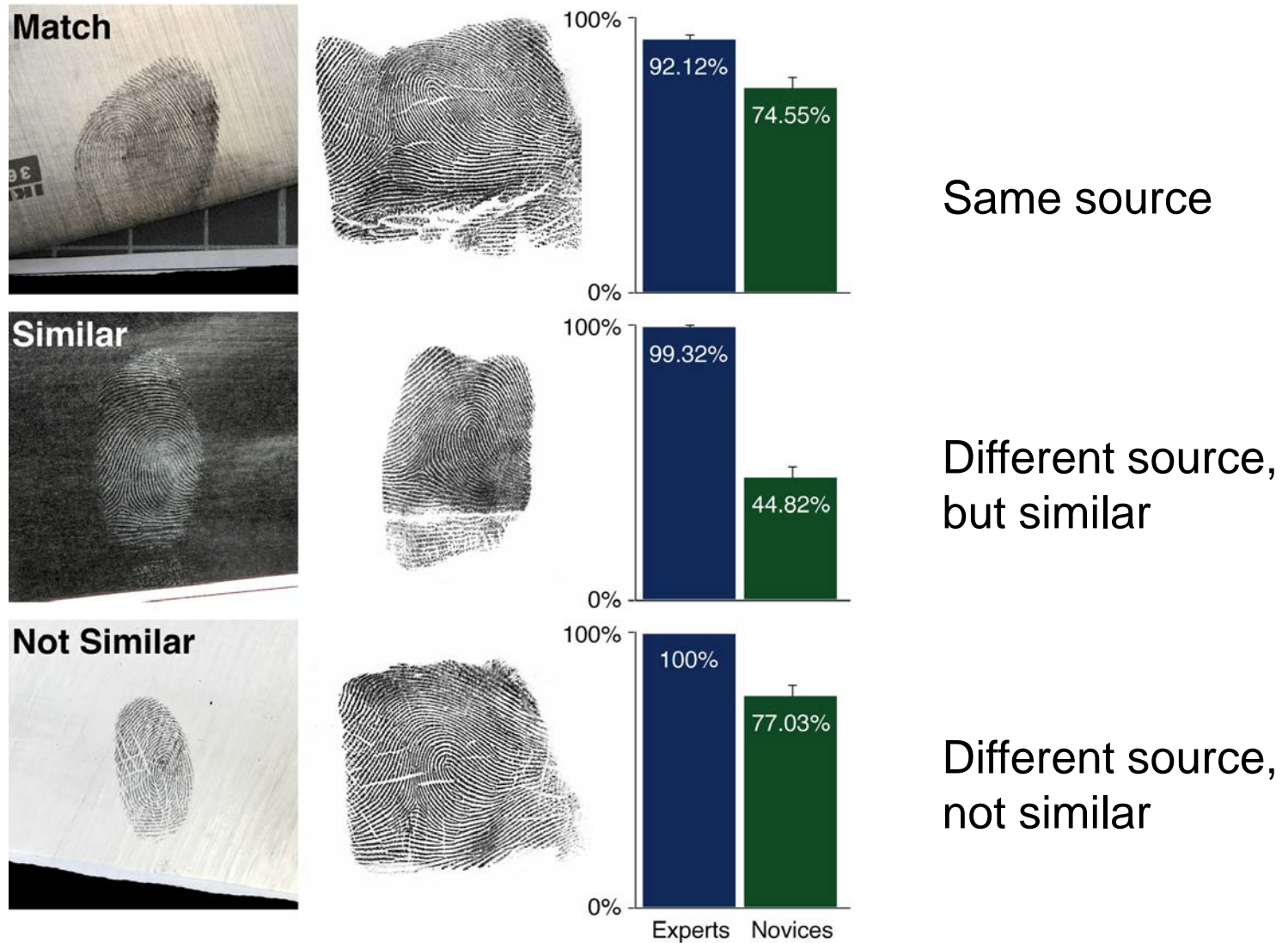
# The science: Against categorical opinion of identity

‘At present, fingerprint examiners typically testify in the language of absolute certainty. ... Claims of ‘absolute’ and ‘positive’ identification **should be replaced by more modest claims** about the meaning and significance of a “match”.’ (NRC, 2009: 142, 184)

‘Because empirical evidence and statistical reasoning do not support a source attribution to the exclusion of all other individuals in the world, **latent print examiners should not report or testify, directly or by implication, to a source attribution ...**’ (NIST, 2012: Recommendation 3.7)

‘Latent fingerprint examiners traditionally claimed to be able to ‘identify’ the source of a latent print with 100% accuracy. **These claims were overstated and are now widely recognized as indefensible.** (AAAS, 2018, 71)

# Fingerprint examiners are genuine experts



Jason Tangen, Matthew Thompson, and Duncan McCarthy, 'Identifying fingerprint expertise' (2011) 22 *Psychological science* 995.



# The science: Reporting errors and limitations

‘PCAST finds that latent fingerprint analysis [has] ***a false positive rate that is substantial*** and **is likely to be higher than expected by many jurors** based on longstanding claims about the infallibility of fingerprint analysis. The false-positive rate could be as high as 1 error in 306 cases based on the FBI study [Ulery et al] and 1 error in 18 cases based on a study by another crime laboratory [Miami-Dade]. **In reporting results of latent-fingerprint examination, it is important to state the false-positive rates based on properly designed validation studies.**’

# The science: Cognitive bias (studies by Itiel Dror)



Even genuine experts are vulnerable to unconscious biases  
e.g. suggestion or confirmation

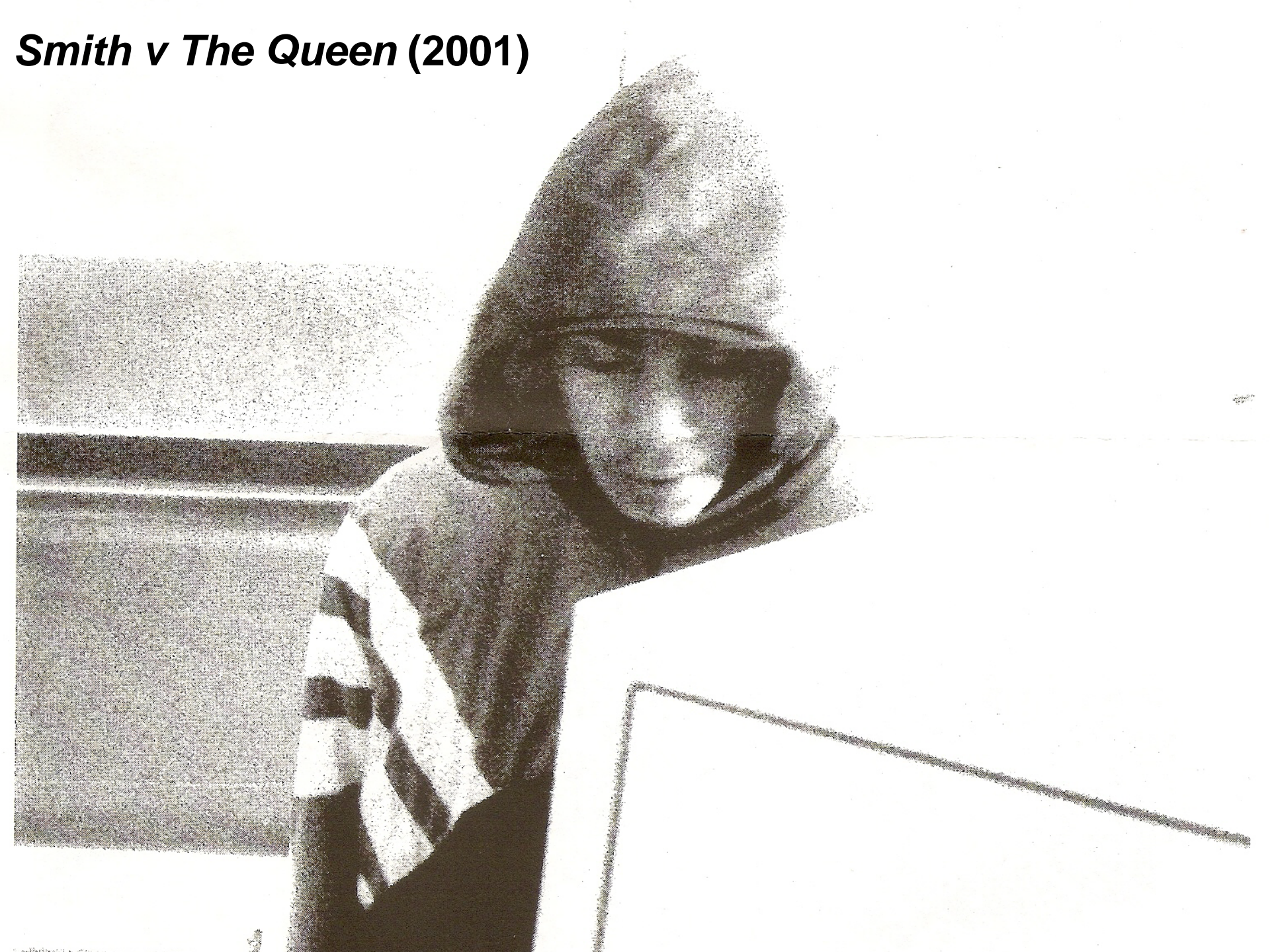
# Case study 2

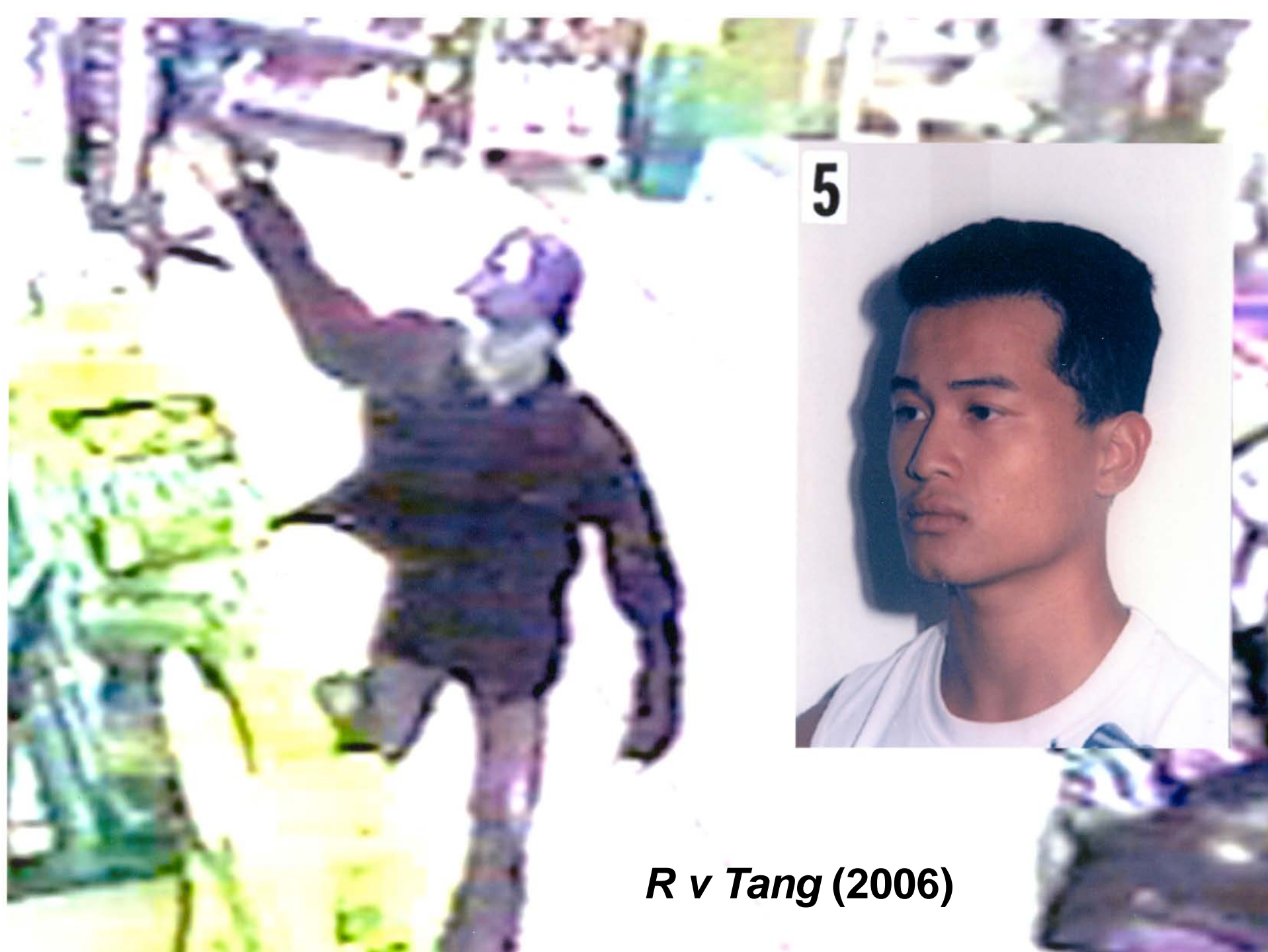
## Image comparison evidence



'Identification by investigators, familiars, experts, super-recognisers and algorithms'  
(2021) 45 *Melbourne University Law Review* (forthcoming).

***Smith v The Queen (2001)***





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*R v Tang (2006)*

*Honeysett v R (2014)*



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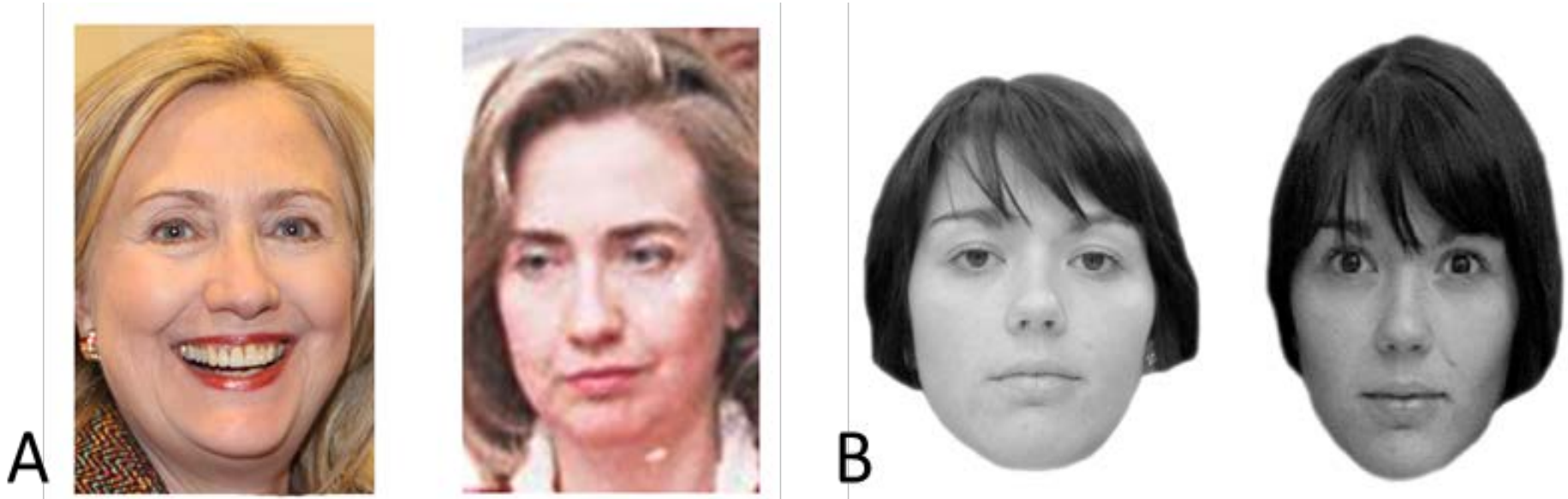
# The High Court's 'explanation'

'Professor Henneberg's opinion was not based on his undoubted knowledge of anatomy. Professor Henneberg's knowledge as an anatomist, that the human population includes individuals who have oval shaped heads and individuals who have round shaped heads (when viewed from above), did not form the basis of his conclusion that Offender One and the appellant each have oval shaped heads. That conclusion was based on Professor Henneberg's subjective impression of what he saw when he looked at the images. This observation applies to the evidence of each of the characteristics of which Professor Henneberg gave evidence.'

*Honeysett v R* [2014] HCA 29, [43]

**But what's the upshot (and what about reliability)?**

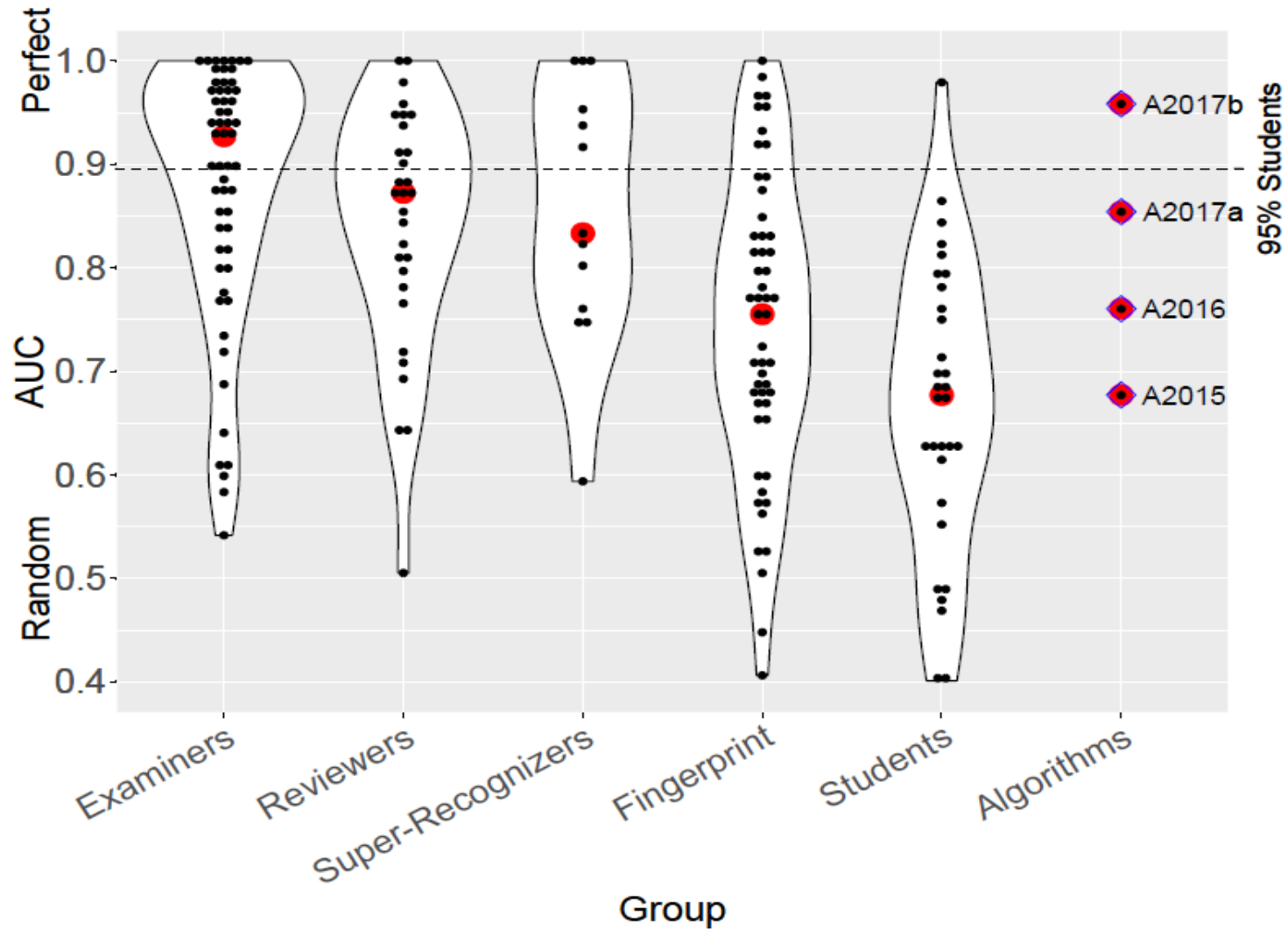
# Scientific research on face comparison



**Cognitively, the comparisons in A and B are very different tasks**



# Evidence of ability at unfamiliar face comparison



PJ Phillips et al, 'Face Recognition Accuracy of Forensic Examiners, Superrecognizers, and Face Recognition Algorithms' (2018) 115(24) *Proceedings of the National Academy of Sciences* 6171.

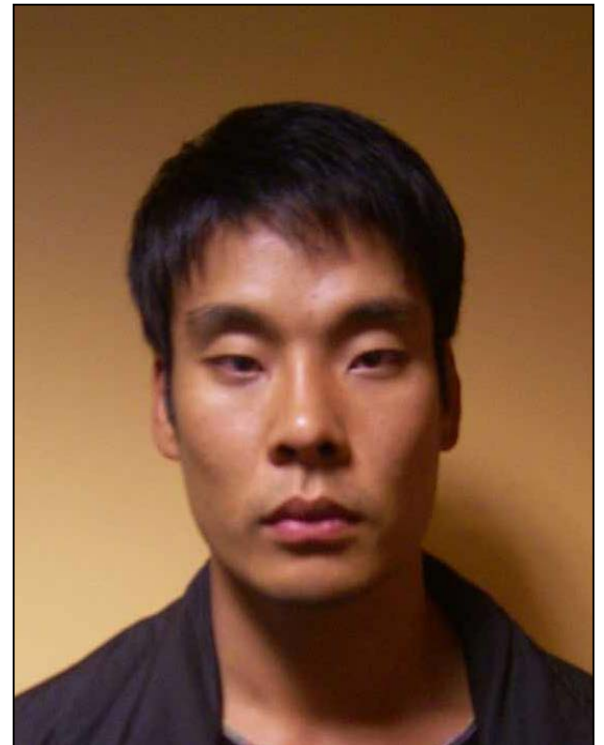
# Leave it for the jury (with other evidence)?



ATM image  
(person of interest)



Jung remand  
image (exemplar)



Jung arrest image

# Case study 3

## Voice comparison evidence

(admitting the impressions of investigators)



# 'Experienced': Australian passport officers

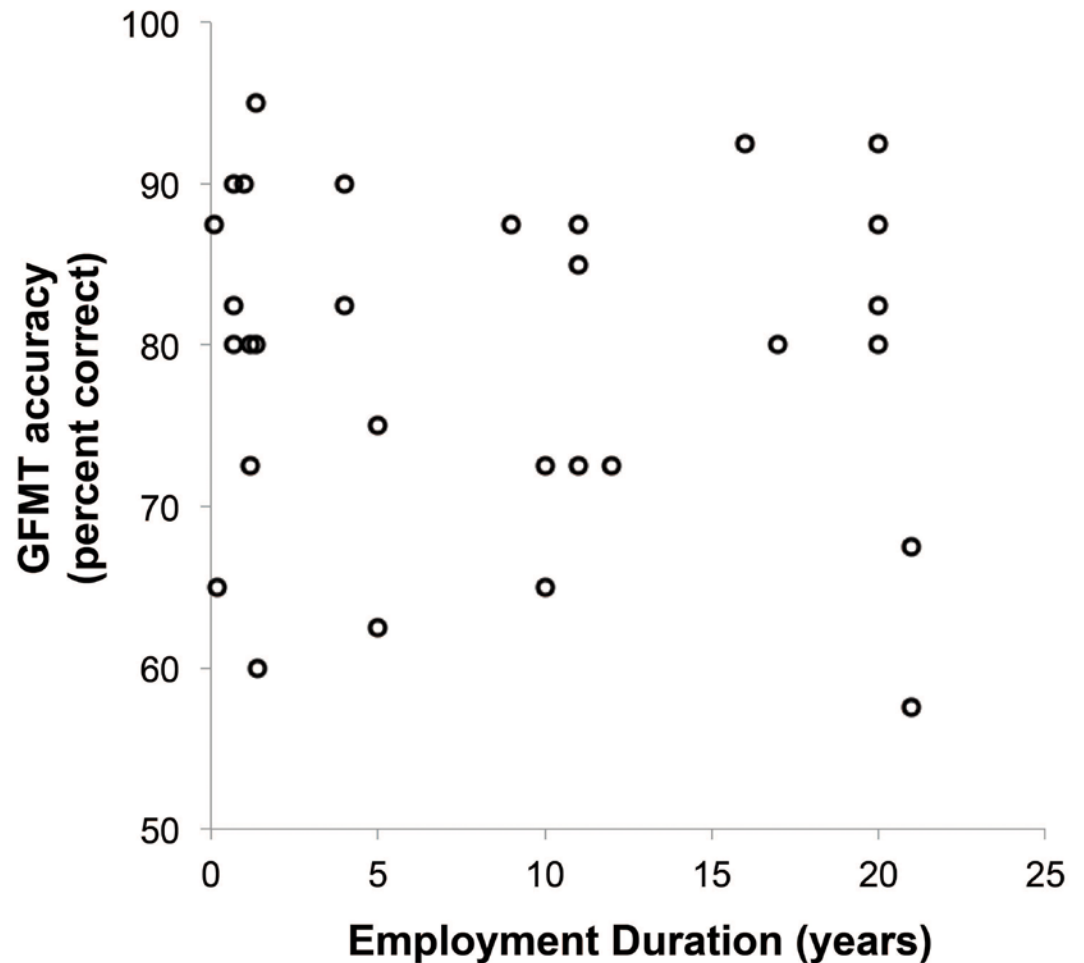


**Normative (students):**

M = 81.3%; SD = 9.7

**Passport Officers:**

M = 79.2%; SD = 10.4



‘For the rational study of the law the blackletter man may be the man of the present, but the man of the future is the man of statistics and the master of economics.’

Oliver Wendell Holmes Jr, *The Path of the Law* (1897)



# **Trial safeguards and forensic science**

‘Cross-examination, the adduction of contrary expert evidence and judicial guidance at the end of the trial are currently assumed to provide sufficient safeguards in relation to expert evidence ... However, ... it is doubtful whether these are valid assumptions.’

**Law Commission of England and Wales, *Expert Evidence in Criminal Proceedings in England and Wales*, Report No 325 (HMSO, 2011)**

# Expression of opinion

- **DNA profiles:** **probabilistic** (usually frequentist). (Validated – derived from mainstream scientific research)
- **Latent fingerprints:** **positive ID** (i.e. **individualisation**).
- **Ballistics:** **individualisation** to a specific weapon. (PV)
- **Incriminating images** (e.g. CCTV): No individualisation, just **similarities** (and, in theory, differences). (PV)
- **Shoe prints:** **varies**, now framed in Bayesian terms – e.g. strong support. (NV/PV)
- **Blood spatter and stain interpretation:** **varies** from positive assertions to qualified, but high error rates (NV/PV)
- **Incriminating voice recordings:** **individualisation**, even across languages. (NV)
- **Microscopic hair comparison:** historically, **very similar** or **the same** and cannot exclude (Invalid)
- **Bite marks:** historically **individualisation**. (Invalid)

V – validated; PV – partially validated; NV – not validated



# How to cross-examine forensic scientists: A guide for lawyers\*

*Gary Edmond, Kristy Martire, Richard Kemp, David Hamer, Brynn Hibbert, Andrew Ligertwood, Glenn Porter, Mehera San Roque, Rachel Searston, Jason Tangen, Matthew Thompson and David White†*

*This article is a resource for lawyers approaching the cross-examination of forensic scientists (and other expert witnesses). Through a series of examples, it provides information that will assist lawyers to explore the probative value of forensic science evidence, in particular forensic comparison evidence, on the voir dire and at trial. Questions covering a broad range of potential topics and issues, including relevance, the expression of results, codes of conduct, limitations and errors, are supplemented with detailed commentary and references to authoritative reports and research on the validity and reliability of forensic science techniques.*

‘How to cross-examine forensic scientists: A guide for lawyers’ (2014) 39 *Australian Bar Review*, 39, 174–197.