Evidence for Expertise in Fingerprint Identification
(2011) Psychological Science, 22, 995–997

Matthew Thompson
Jason Tangen
Duncan McCarthy

The University of Queensland
National ICT Australia
Queensland Police Service
President Barack Obama has offered his congratulations to the Fulbright Program in Indonesia for reaching their 60th anniversary.

Secretary Clinton Celebrates Fulbright Vietnam 20th Anniversary
On July 10, Secretary of State Hillary Clinton spoke at an event in Hanoi, Vietnam for the 20th anniversary of the Fulbright Program.
THE FORENSIC REASONING PROJECT

We study the nature of expertise in identification to improve training and the value of expert testimony.

MEET THE TEAM
Fingerprinting Doesn't Hold Up as a Science in Court

Fingerprints — A True Science?
by Gary W. Jones

The New York Times

Fingerprinting's Reliability Draws Growing Court Challenges
April 7, 2001
By ANDY NEWMAN

Is Fingerprint Identification Valid? Rhetorics of Reliability in Fingerprint Proponents' Discourse
SIMON A. COLE

ANNALS OF CRIME

DO FINGERPRINTS LIE?
The gold standard of forensic evidence is now being challenged.
BY MICHAEL SPECTER

The Fingerprint Controversy

Astonishingly, one of the most trusted forms of forensic evidence, fingerprint identification, has yet to be validated. Lacking validation studies, proponents of fingerprint evidence have resorted to pseudoscientific arguments.

SIMON A. COLE

Fingerprints: Infallible Evidence?
Lesley Stahl Explores The Problem With Fingerprint Evidence
June 6, 2004

FINGERPRINTS MEET DÂUBERT:
THE MYTH OF FINGERPRINT "SCIENCE" IS REVEALED
ROBERT EPSTEIN

Forensic evidence stands accused
Despite a century of use, doubts remain over the reliability of using fingerprints to convict suspects

$145K settlement: Botched fingerprints put innocent man in jail for 17-month Rikers 'nightmare'
NYDailyNews.com
DAILY NEWS
Exclusive

do fingerprints lie?
The gold standard of forensic evidence is now being challenged.
may 27, 2002
“...testimony based on faulty forensic science analyses may have contributed to **wrongful convictions of innocent people**.”

“frequent absence of solid scientific research demonstrating the **validity** ... **reliability** and **accuracy** of forensic analyses...”

“The simple reality is that the interpretation of forensic evidence is not always based on scientific studies to determine its validity. **This is a serious problem**.”
The terrorist explosions that ripped through Madrid’s crowded commuter trains on the morning of 11 March 2004 killed 191 people, wounded some 2,000 more and prompted an international manhunt for the perpetrators. Soon after, Spanish investigators searching the area near one of the blasts discovered an abandoned set of detonator caps inside a plastic bag that bore a single, incomplete fingerprint. They immediately shared the clue with law-enforcement colleagues around the world. And on 6 May 2004, the US Federal Bureau of Investigation (FBI) arrested Oregon lawyer Brandon Mayfield, proclaiming that his print was a match. Two and a half weeks later, a chagrined FBI was forced to release Mayfield after Spanish police arrested an Algerian national — one of several terrorists later charged with the crime — and found one of his fingerprints to be a much better match. The FBI eventually admitted that it had made multiple errors in its fingerprint analysis.

The Mayfield case is a textbook example of ‘false positive’ fingerprint identification, in which an innocent person is singled out erroneously. But the case is hardly unique. Psychologist Erin Morris, who works with the Los Angeles County Public Defender’s Office, has compiled a list of 25 false positives, going back several decades, that is now being used to challenge fingerprint evidence in US courts.

Those challenges, in turn, are being fed by a growing unease among fingerprint examiners and researchers alike. They are beginning to recognize that the century-old fingerprint-identification process rests on assumptions that have never been tested empirically, and that it does little to safeguard against unconscious biases of the examiners.

That unease culminated last year in a stinging report by the US National Academy of Sciences (NAS), which acknowledged that fingerprints contain valuable information — but found that long-standing claims of zero error rates were “not scientifically plausible”. Since then, fingerprint examiners have found themselves in an uncomfortable situation. “How do you explain to the court that what you’ve been saying for 100 years was exaggerated, but you still have something meaningful to say?” asks Simon Cole, a science historian at the University of California, Irvine.

The only way out of the dilemma is data, says Cole: do the research that will put fingerprinting on solid ground. And that is what researchers are starting to do. In January, for example, the US Department of Justice’s research branch, the National Institute of Justice, launched the first large-scale research programme to classify fingerprints according to their visual complexity — including incomplete and unclear prints — and to determine how likely examiners are to make errors in each class. “The vast majority of fingerprints are not a problem,” says Itiel Dror, a cognitive psychologist at University College London who is involved in the study. “But even if only 1% are, that’s thousands of potential errors each year.”

Even fingerprinting’s harshest critics concede that the technique is probably more accurate than identification methods based on hair, blood type, ear prints or anything else except DNA. Granted, no one has ever tested its underlying premise, which is that every print on every finger is unique. But no one seriously doubts it, either. The ridges and furrows on any given fingertip develop in the womb, shaped by such a complex combination of genetic and environmental factors that not even identical twins share prints. Barring damage, moreover, the pattern is fixed for life. And thanks to the skin’s natural oiliness, it will leave an impression on almost any surface the fingertip touches.

Leaving a mark

A single incriminating fingerprint can land someone in jail. But, Laura Spinney finds, there is little empirical basis for such decisions.
The Real CSI
WASHINGTON, D.C.—I don’t often get the chance to say that a Commerce Committee hearing is about truth and justice. But that’s exactly what this hearing is about today. It’s about using more science in our criminal justice system. And it’s about creating standards that judges, prosecutors, defense lawyers, and juries all can trust.

This is the second hearing we’ve held on this subject. In December, we heard from the bestselling author John Grisham and other experts about the challenges and needs of the forensic science community. We heard that many disciplines in forensic science, like ballistics, bite marks, and even fingerprint analyses, are not based on peer-reviewed science. And we heard that the forensic science community does not have the resources—or sometimes the desire—to conduct this type of research.

Most disturbingly, we heard that many forensic science disciplines lack
Proposed bill calls for better forensic science

13 Jul 2012 | 21:30 BST | Posted by Amy Maxmen | Category: Policy

Investigators who linked DNA from Occupy Wall Street protesters to a murder scene in New York City recently admitted that they had made a mistake. No one was put behind bars, but all too often, they are. A piece of legislation proposed yesterday seeks to end wrongful convictions through better forensic science.

Democrats in the US Senate and House of Representatives say that the Forensic Science and Standards Act would spur more research and higher standards in forensic work.

“To ensure justice is being served, we want law enforcement and forensic practitioners to work alongside scientists and researchers to make sure that forensic evidence stands up to scientific rigor,” said Representative Eddie Bernice Johnson (Democrat–Texas) in an official statement.
Forensic identification can no longer be regarded as a “methodology” that is detached from human judgement and subjective decision making.
Recommendation 9.1: Management should foster a culture in which it is understood that some human error is inevitable and that openness about errors leads to improvements in practice.

Recommendation 9.5: The latent print community should develop and implement a comprehensive testing program that includes competency testing, certification testing, and proficiency testing.
The subjective nature of fingerprint evidence

**Recommendation 1**
(Para 35.132)
Fingerprint evidence should be recognised as opinion evidence, not fact, and those involved in the criminal justice system need to assess it as such on its merits.
**Recommendation 2**

Examiners should receive training which emphasises that their findings are based on their personal opinion; and that this opinion is influenced by the quality of the materials that are examined, their ability to observe detail in mark and print reliably, the subjective interpretation of observed characteristics, the cogency of explanations for any differences and the subjective view of ‘sufficiency’.

(Para 35.133)
Recommendation 3
Examiners should discontinue reporting conclusions on identification or exclusion with a claim to 100% certainty or on any other basis suggesting that fingerprint evidence is infallible.
Forensic DNA Evidence: The Myth of Infallibility

William C. Thompson
Department of Criminology, Law & Society
and School of Law
University of California, Irvine

September 2011

Subjectivity and bias in forensic DNA mixture interpretation

Itiel E. Dror a,b,*, Greg Hampikian c

a Institute of Cognitive Neuroscience, University College London (UCL), London, UK
b Cognitive Consultants International (CCI), London, UK
c Departments of Biology and Criminal Justice, Boise State University, USA

The objectivity of forensic science decision making has received increased attention and scrutiny. However,
Recommendation 3:

Research is needed to address issues of accuracy, reliability, and validity in the forensic science disciplines. The National Institute of Forensic Science (NIFS) should competitively fund peer-reviewed research in the following areas:

(a) Studies establishing the scientific bases demonstrating the validity of forensic methods.

(b) The development and establishment of quantifiable measures of the reliability and accuracy of forensic analyses. Studies of the reliability and accuracy of forensic techniques should reflect actual practice on realistic case scenarios, averaged across a representative sample of forensic scientists and laboratories. Studies also should establish the limits of reliability and accuracy that analytic methods can be expected to achieve as the conditions of forensic evidence vary. The research by which
How should human fingerprint matching expertise be tested?
Stimuli

Representative

  Tightly
  Controlled

Difficult
Stimuli
- Representative
- Tightly Controlled
- Difficult

Participants
- Baseline Performance
- Qualified Experts
Stimuli
- Representative
- Tightly Controlled
- Difficult

Participants
- Baseline Performance
- Court-qualified Experts

Design
- Representative
- Signal Detection
Stimuli
- Representative
- Tightly Controlled
- Difficult

Participants
- Baseline Performance
- Court-qualified Experts

Design
- Representative
- Signal Detection

Results
- Understandable across Disciplines
- Inform Expert Testimony
Participants

Baseline Performance
Court-qualified Experts

Results
Understandable across Disciplines
Inform Expert Testimony

Design
Representative
Signal Detection

Stimuli
Representative
Tightly Controlled
Difficult

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Baseline Performance
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Results
Understandable across Disciplines
Inform Expert Testimony

Design
Representative
Signal Detection

Stimuli
Representative
Tightly Controlled
Difficult
Stimuli
Queensland Police Training Materials
Let's test experts

You mean the experts you want to test?

They were identified by experts

But how do you know the matching prints actually come from the same source?
Stimuli

Ground truth

Participants

Design

Results
Stimuli

Ground truth

Simulated crime-scene
Stimuli

Ground truth
Simulated crime-scene

Participants

Design

Results
Distractors
Stimuli

Ground truth

Simulated crime-scene

Targets

Distractors

Participants

Design

Results
Stimuli

- Ground truth
- Simulated crime-scene

Participants

Design

Results

Targets

Distractors
Participants
Stimuli

- Ground truth
- Simulated crime-scene

Targets
Distractors

Participants

- Experts
  - QLD, NSW, SA, VIC, AFP
- Novices
  - UQ Undergrads

Design

Results
Stimuli

Ground truth
Simulated crime-scene

Targets
Distractors

Participants

Experts
QLD, NSW, SA, VIC, AFP

Novices
UQ Undergrads

Design

Results
Design
36 Pairs

12 matches (targets)

12 non-matches (not similar distractors)

12 non-matches (highly similar distractors)
**Stimuli**

Ground truth

Simulated crime-scene

**Targets**

**Distractors**

**Participants**

Experts

QLD, NSW, SA, VIC, AFP

Novices

UQ Undergrads

**Design**

**Comparison**

2AFC + Signal Detection

**Untimed**

**Results**
Stimuli

- Ground truth
- Simulated crime-scene

Targets

Distractors

Participants

- Experts
  - QLD, NSW, SA, VIC, AFP
- Novices
  - UQ Undergrads

Design

- Task
- Comparison
  - 2AFC
- Untimed

Results
Results
Not Similar

Similar

Match

Experts

Novices

All pairwise < .05
<table>
<thead>
<tr>
<th></th>
<th>Hits</th>
<th>False Alarms</th>
<th>Misses</th>
<th>Correct Rejections</th>
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<tr>
<td><strong>Accuracy</strong></td>
<td>92%</td>
<td></td>
<td></td>
<td>99.32%</td>
</tr>
<tr>
<td><strong>Error Rates</strong></td>
<td></td>
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</tbody>
</table>
Hits 92%
Misses 8%
False Alarms 0.68%
Correct Rejections 99.32%
Roughly 5% of autopsies reveal lethal diagnostic errors for which a correct diagnosis coupled with treatment could have averted death, and an estimated 40,000 to 80,000 US hospital deaths result from misdiagnosis annually (Institute of Medicine, 1999; Newman-Toker & Pronovost, 2009).
These figures suggest that more Americans are killed in US hospitals every 6 months than died in the entire Vietnam War, and is equivalent to three fully loaded jumbo jets crashing every other day.
There is a benefit of expertise
Experts are conservative
Experts make mistakes
Our experiment was not designed to measure the pervasiveness of errors in practice or even assess the accuracy of individual examiners or forensic departments.

We were measuring expertise rather than absolute performance. That is, how well fingerprint examiners perform relative to novices at comparing matching and non-matching prints.
Qualified fingerprint examiners now have evidence to legitimately claim specialised knowledge, which may satisfy legal admissibility criteria.
We need to conduct similar validation experiments for other forensic disciplines.

- Shoeprints
- Toolmarks
- Firearms
- DNA
- Hair and fibre
- Bite marks
- Bloodstain patterns
- CCTV comparison
- etc.
We study the nature of expertise in identification to improve training and the value of expert testimony.

MEET THE TEAM ▶
Expertise

What sets an expert apart from a novice?
How does forensic expertise develop over time?
Does the speed of expert decision making influence performance?
How does memory for forensic information relate to matching accuracy?
Training

Can training time be reduced without compromising performance?
What’s the best way to provide feedback?
Do examiners know when to ask for help?
Are textbook instructions more important than experience?
Testimony

What can examiners reasonably claim when testifying in court? What’s the most effective way to present forensic evidence to juries? On what basis should judges admit forensic testimony? Should examiners report opinions or statistics?
THE FORENSIC REASONING PROJECT

We study the nature of expertise in identification to improve training and the value of expert testimony.

MEET THE TEAM
Forensic Informatics Biometric Repository

FIB-R.com

Fingerprints

Shoeprints Voices & Handwriting

Irices

Faces & CCTV Footage