Managing Contextual Bias in Forensic Science

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University of California, Irvine
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• “Forensic science experts are vulnerable to cognitive and contextual bias…”
• “…renders experts vulnerable to making erroneous identifications”
• “These disciplines need to develop rigorous protocols to guide these subjective interpretations…”
• “…to date there is no good evidence that the forensic science community has made a sufficient effort to address the bias issue…”
Preliminary communication

Contextual information renders experts vulnerable to making erroneous identifications

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Abstract

We investigated whether experts can objectively focus on feature information in fingerprints without being misled by extraneous information, such as context. We took fingerprints that have previously been examined and assessed by latent print experts to make positive identification of suspects. Then we presented these same fingerprints again, to the same experts, but gave a context that suggested that they were a no-match, and hence the suspects could not be identified. Within this new context, most of the fingerprint experts made different judgements, thus contradicting their own previous identification decisions. Cognitive aspects involved in biometric identification can explain why experts are vulnerable to make erroneous identifications.

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Keywords: Psychology; Cognition; Erroneous identification; Bias; Extraneous information; Contextual influence; Fingerprints
Only one participant (20%) judged the prints to be a match, thus making a consistent identification regardless of the extraneous context. The other four participants (80%) changed their identification decision from the original decision they themselves had made five years earlier. Three of these four participants directly contradicted their previous decision and now judged the fingerprints as definite non-matches, whereas, the fourth participant now judged that there was insufficient information to make a definite decision (either a match or a non-match) (Fig. 2).
Studies Showing Contextual Bias in Forensic Science

- Document examination (Miller, 1984)
- Fingerprint interpretation (Dror, Charlton & Peron, 2006; Dror & Rosenthal, 2008)
- Crime scene analysis (Helsloot and Groenendaal, 2011)
- Bite mark analysis (Osborne, Woods, Kieser & Zajac, 2013)
- DNA Interpretation (Dror & Hampikian, 2011)
- Blood spatter analysis (Taylor et al. 2014)
- Forensic Anthropology (Nakhaeizadeh, Dror & Morgan, 2014)
Issues

• The nature of these biases
• Evidence for their existence
• What we can do about them
• How they might affect forensic statistics
Context Influences Perception
Context Influences Perception
Context Influences Perception

A

/ 

I2

I3

I4

C
• Expectations (arising from context) influence interpretation of visual stimuli
• Expectations/theories can also influence interpretation of more complex types of evidence
  – Context effects
  – Observer effects
Observer Effects

- Often very helpful
  - (when expectations/theories are well-grounded)
- Occur largely without conscious awareness
- Ubiquitous: “…one of the better demonstrated findings of 20th century psychology…”
  - (Nisbett & Ross, 1980)
- Demonstrated in:
  - political and policy evaluation
  - consumer decision making
  - employee evaluation
  - scientific assessments
Contextual Bias
Contextual Bias

- *Contextual bias* is said to occur when judgment is influenced by information *irrelevant or inappropriate* to the task.
- Example: Stereotyping
TRUE: WHEN ASKED TO REVIEW JOB APPLICATIONS IDENTICAL IN EVERY WAY EXCEPT FOR NAMES, BOTH MALE AND FEMALE SCIENTISTS PREFERRED THE MALE CANDIDATE.*

SEEMS QUALIFIED!

EH.
Managing Contextual Bias in Orchestra Auditions

- Women 5x more likely to be selected in blind auditions
- % of women in top 10 orchestras
  - 1970s—5%
  - Today—25%
Contextual Bias

• Mechanisms:
  – Motivational—affecting desired outcome
  – Cognitive—affecting interpretation of data
  – Largely unconscious—“Bias blind spot”
• May be impossible to recognize (in oneself)
• Difficult to correct
Recognized and addressed in most areas of science

- Prevalence of blind and double-blind procedures *whenever an important determination rests on subjective judgment*
- Examples from Astronomy to Zoology
- Failure to control for observer effects called a *hallmark of junk science*

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*Peter Huber, Galileo's Revenge: Junk Science in the Courtroom (1991)*
Exposure to Contextual Information

From crime lab notes:

– “D. Aboto [prosecutor] left msg. stating this S. is suspected in other rapes but they can’t find the V. Need this case to put S away.”

– “Suspect-known crip gang member--keeps ‘skating’ on charges-never serves time. This robbery he gets hit in head with bar stool--left blood trail. Miller [deputy DA] wants to connect this guy to scene w/DNA …”

– “We need you to match [this latent print] to our crook right away because he is about to leave the country”
DNA Lab Notes (Commonwealth v. Davis)

- “I asked how they got their suspect. He is a convicted rapist and the MO matches the former rape…The suspect was recently released from prison and works in the same building as the victim…She was afraid of him. Also his demeanor was suspicious when they brought him in for questioning…He also fits the general description of the man witnesses saw leaving the area on the night they think she died…So, I said, you basically have nothing to connect him directly with the murder (unless we find his DNA). He said yes.”
Arguments Against Blinding Procedures in Forensic Science

• We’re immune to bias

• Contextual information is relevant and appropriate to our scientific work
  – “It's not a bias if it leads us to the truth…”

• Even if it is not relevant to all of our work, we need it for some of our work, so it is not practical for us to be blind to it
  – Collection Phase
  – Analytic Phase (Analysis/Comparison)
  – Interpretation/Contextualizing
Immunity to Bias?

We’re not biased (and we’re insulted that you have suggested we are)!!

– “I reject the insinuation that we do not have the wit or the intellectual capacity to deal with bias, of whatever sort. If we are unable to acknowledge and compensate for bias, we have no business in our profession to begin with, and certainly no legitimate plea to the indulgence of the legal system.”

Response to Thornton

“Let us be clear. We are not “insinuating” that forensic scientists lack this intellectual capacity; we are asserting that it is a proven and well-accepted scientific fact that all human beings, including forensic scientists, lack this capacity.”

(Thompson et al. Response to Thornton, JFS 2010)
Arguments Against Blinding Procedures in Forensic Science

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• Contextual information is relevant and appropriate to our scientific work
  – “It’s not a bias if it leads us to the truth…”
Nakhaeizadeh, Dror & Morgan (Science & Justice, 2014)

41 forensic anthropologists assess gender, race and age (at death) of decedent

<table>
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<tr>
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<th>Experts Say</th>
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<td>50-55</td>
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<tr>
<td>Nothing</td>
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</table>
Taylor et al. (2014) Blood Pattern Analysis Study

- When witness’ statements mentioned a gunshot, pattern was more likely to be interpreted as “high velocity” splatter
- When witness’ statements mentioned coughing, pattern was more likely to be interpreted as “expiration”
- These effects were stronger when
  - Less information was available (smaller sample)
  - Pattern more ambiguous due to background
Does a bite mark expert need to know about DNA?

• If I then found that DNA [evidence] came back as not excluding that same person, my confidence level would increase. I might be willing to upgrade my opinion from cannot exclude to probable….Now, many odontologists say you shouldn’t have any awareness of the DNA results compared to the bite mark…but if I subsequently get them, then I reserve the right to write a revised opinion. And I have done that.

(Testimony of David Senn in NY v. Dean, 2012, RT p. 87)

• Is the DNA result “relevant”?
How is the DNA relevant?

The DNA matches the defendant

Defendant is the perpetrator

Defendant is probably the source of the bitemark
Federal Rules of Evidence, Rule 401

• Evidence is relevant if:
  – it has any tendency to make a fact more or less probable than it would be without the evidence
  – the fact is of consequence in determining the action

*This is a good “rule of relevance” for detectives, lawyers, jurors—but not expert witnesses.*
What aspects of context are relevant to a forensic science assessment?

• FRE 401 is too broad
• Academic suggestions focus on
  – “domain relevance” (Risinger et al., 2002);
    • Vague; Circular?
  – Can we develop a clearer, more rigorous standard?
• Issue is being addressed by
  – Human Factors Committee of OSAC
  – Human Factors Subcommittee of National Commission
Key Principles

Forensic scientists should draw conclusions:

– From the physical evidence designated for examination
  • *Not from other evidence in the case,*
  • *unless that other evidence helps them interpret the physical evidence*

– Using valid methods from their discipline that they are trained to use
Proposed Views/Guidance Statement

Forensic scientists should rely solely on task-relevant information when performing forensic analyses.

Information is task-relevant if it is necessary for drawing conclusions:

(i) about the propositions in question,
(ii) from the physical evidence that has been designated for examination,
(iii) through the correct application of an accepted analytic method by a qualified analyst.
A Mathematical Restatement

• Let $P, NP$ designate two mutually exclusive (and exhaustive) propositions that a forensic scientist is asked to evaluate.

• Let $E$ designate the features or characteristics of the physical evidence designated for examination.

• To draw conclusions about $P, NP$ from $E$, the forensic scientist must consider the conditional probability of $E$ under $P, NP$.
  – And this is true regardless of whether conclusions are quantified.

• Therefore….
A Mathematical Restatement

Information is task relevant iff it has the potential to assist the examiner in evaluation of either $p(E|P)$ or $p(E|NP)$;

Information is task-irrelevant if it has no bearing on the conditional probabilities $p(E|P)$ or $p(E|NP)$.

Consider:

- Substrate for latent print
- Suspect’s background
- DNA evidence (for the bite mark analyst)
Reducing Contextual Bias in Forensic Science

- Context Management Systems
  - Case Managers
  - Delayed Exposure (Sequential unmasking)
  - Independent blind reviews
Shielding Analysts from Task-Irrelevant Information

- Level 1: Trace evidence
- Level 2: Reference materials
- Level 3: Case information
- Level 4: ‘Base rate’ expectations
- Level 5: Organizational & cultural factors
Recommendation

• Forensic scientists in each discipline should:
  – Think carefully about what types of information are task-relevant and task-irrelevant for common forensic tasks
  – Think about ways to shield analysts from exposure to task-irrelevant information

• Will require modifications in work-flow and separation of responsibilities
The Temptation of the Irrelevant

• Analysts will be tempted to use task-irrelevant information

• Their motive:
  – not partisanship, venality or malice
  – truly powerful (especially for expert witnesses):
    • The desire to be right
Incremental Probative Value of Forensic Evidence

Guilty or Not (G, NG)

Eyewitness ID (E)

Suspect Print at Scene? (S, NS)

Similarity of Suspect and Crime Scene Prints (DS)

Match Reported (F*)

Guilty or Not (G, NG)

Eyewitness ID (E)

Suspect Print at Scene? (S, NS)

Similarity of Suspect and Crime Scene Prints (DS)

Match Reported (F*)
The Criminalist’s Paradox

- By considering “task-irrelevant” information (in an effort to reach the correct conclusion)
- Analysts undermine the probative value of their conclusions for the jury
- By trying to be “right,” analysts increase chances the justice system will go wrong.
Danger of Merging Role of Forensic Scientist and Detective
Presents:

SHERLOCK HOLMES –
THE FIRST CSI

7 p.m., Monday, Feb. 17, 2014
Sheraton Seattle Hotel
1400 6th Ave., Seattle

Open and Free to the Public

World-renowned forensic science experts join Paul Bernays, filmmaker of the new PBS documentary "How Sherlock Changed the World," to reveal the fictional detective's astonishing and lasting impact on criminal investigations. Presenters will answer audience questions about the program and the popular field of forensic science following the lecture.

Guest presenters include:

Paul Bernays, television documentary maker who has made programs for the BBC and other international broadcasters

Henry Lee, Ph.D., one of the world’s foremost forensic scientists and founder of the Henry C. Lee Institute of Forensic Science who has consulted on more than 8,000 criminal cases, including the O.J. Simpson trial and the JonBenet Ramsey murder investigation

Jeff Teitelbaum, head of the Forensic Science Library Services for the Washington State Patrol Crime Lab

Kathy Reichs, Ph.D., New York Times bestselling author of forensic mysteries and producer of the popular TV series "Bones"

The lecture is a public service of the American Academy of Forensic Sciences.
DNA Interpretation

- Effect depends on ambiguity of evidence
Does defendant really “match” this evidentiary sample?

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<th>D3</th>
<th>vWA</th>
<th>FGA</th>
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<tr>
<td>Sally</td>
<td>12, 17</td>
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**Painting the target around the arrow**

Frequency estimates (for Tom):

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<th>vWA</th>
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Thank you

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