What Does the Future Hold for Trace Evidence?

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Understanding the Problem

Revisiting the Roots of Forensic Science

Crime Scene as Scientific Endeavour

Holistic View of Trace Evidence

Significance and Pitfalls of Databases

Trace Evidence in the New World
The Future - Asymmetry of Time

Science has not yet mastered prophecy. We predict too much for the next year and yet far too little for the next 10.

Neil A. Armstrong (1930-2012)

“Computers in the future may weigh no more than 1.5 tons.”

Popular Mechanics, 1949
Democratic Society

• High expectations from forensic science
• Requires a process that is:
  – Impartial
  – Objective

• Requires results that are:
  – Relevant
  – Accurate
  – With known uncertainties
  – Expressed adequately and in an unambiguous manner

Symptomatic Examples
Forensic Science in a State of Confusion?

Too much fragmentation, and too many silos

Scientists must be segregated from police structures

Strong focus on court proceedings

Information sharing is essential

Scientists should not consider activity level

Integrated lab model

FS is assessed on turn around time and compliance with ever-complicated QA systems

Pathology lab model

FS is assessed on impact on the broader justice and security system

Only a small proportion of traces go through the lab and end up in court

Scientists are the best people to develop hypotheses and reconstruct events

Scientists must be segregated from police structures

Information sharing must be tightly controlled
Financial Realities

http://www.qls.com/Portals/20846/images/qls-price-increase.gif

End of the (Forensic Science) World?

http://cdn.themetapicture.com/media/funny-calendar-end-of-the-world.jpg
Trace Evidence Example

• Trace Evidence:
  – The surviving evidence of a former occurrence or action of some event or agent;
  – A very small amount of substance, often too small to be measured;
  – Needs to be detected, seen, and understood.

• As remnant of the crime:
  – Provide leads;
  – Eliminate suspects;
  – Reconstruct events and their sequence;
  – Establish charges;
  – Identify links in serial crime.
Trace Evidence Seminal to Forensic Science

H. Gross: Magistrate
A. Bertillon: Police
R.A. Reiss
E. Locard: Court expert

Photos:
Ecole des Sciences Criminelles, University of Lausanne
Typical Trace Evidence Materials
“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.”
Trace Evidence under the NAS Radar?
• Reveals two major stumbling blocks:
  – End users may be (too) focused on the identifying dimension of forensic science; and
  – Trace evidence is primarily perceived to be the endeavour of a high-tech laboratory that necessarily applies well-formalised, time-consuming and costly procedures.
The Problems Started 40-50 Years Ago!

- Moved away from problem solving;
- Institutionalised fragmentation.

Working Groups

NITE-CRIME
ROYAL COMMISSION
REPORT
concerning the conviction of
EDWARD CHARLES SPLATT
And then…the DNA Revolution

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<thead>
<tr>
<th>![Green Check]</th>
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<tr>
<td><strong>Highly discriminating</strong></td>
<td><strong>Resource sink away from other areas of forensic</strong></td>
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<td><strong>Increased resources for forensic science</strong></td>
<td><strong>CSI Factor</strong></td>
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<td><strong>Powerful intelligence tool through national databases</strong></td>
<td><strong>Many scientists turned into process workers</strong></td>
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<td><strong>Raised overall standards in forensic science</strong></td>
<td><strong>Too slow, too costly</strong></td>
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<td><strong>Business drivers stifling innovation</strong></td>
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<td><strong>Heavy emphasis on identification</strong></td>
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Apparent Cost-Benefit Issue

- Expensive to run;
- Challenging interpretation;
- Cost of training and R&D.

Viability of a full service trace evidence laboratory?

Low-Number-of-Service-Requests Paradigm

The evidence types that attract less demand and that are more time-consuming to examine tend to be culled first.
Spiraling out of Control?


Single process view

Absence of models for integrating forensic case data

Service laboratories with limited strict analytical functions

Feeding of Intelligence and supporting investigation secondary

Focus on fixing specific commercial issues

Inaccuracies in interpretation unacceptable

Increased overhead and budget cuts

Structures of control mitigate risks that very rarely materialise

Revisit and better understand the Roots of Forensic Science

Australian Journal of Forensic Sciences
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tajf20

Forensic intelligence: deregulation or return to the roots of forensic science?
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Develop the ‘Right’ Culture…

Hans Gross

Rodolphe Archibald Reiss

August Vollmer

Paul Kirk

Education and research

Photos:
Ecole des Sciences Criminelles, University of Lausanne
The trace can define our discipline…

• “Forensic science has an object: the study of crime and its traces. These are silent witnesses that need to be detected, seen, and understood to make reasonable inferences about criminal phenomena, investigation or demonstration for intelligence, investigation and court purposes. After all, traces are the most elementary information that result from crime.”

The truth is that none can act with the intensity induced by criminal activities without leaving multiple traces of his path. [...] The clues I want to speak of here are of two kinds: Sometimes the perpetrator leaves traces at a scene by their actions; sometimes, alternatively, he/she picked up on their clothes or their body traces of their location or presence.

Critical Questions for Trace Evidence

• How can we improve the knowledge base needed to better address activity questions through trace evidence?

• How can we address source questions without agonising on discrimination issues?

• How can we better direct investigations through trace evidence?

• How can we integrate trace evidence information with other forensic case data that may be physical or virtual?

• How can we optimize and rationalize trace evidence integration into intelligence and policing frameworks?

• How can trace evidence more broadly contribute to society’s effort in regards to security?
Tizzone Murder, Sydney, 1995-2000

Photograph 1. View looking south of the eastern side of Wakehurst Parkway.
Tizzone Murder, Sydney, 1995-2000
4 grey polypropylene fibres
7 blue polypropylene fibres
24 black polyester fibres
5 grey polypropylene fibres
5 blue polypropylene fibres
26 black polyester fibres
Microphotographs
Fibres are not unique, are they?

- This particular carpet was made exclusively for the 1991 Honda CRX
- Fibre samples were obtained from 175 cars (29 Hondas)
- Only 15% of samples contained 3 or more fibre types
- 296 of such vehicles had been sold in Australia.
- Only 5 vehicles were unaccounted for, one of which was this particular vehicle.

- IDENTIFICATION WAS NOT AN ISSUE IN THE CONTEXT OF THIS CASE, BUT THE CRUCIAL ARGUMENTS WERE AROUND WHEN? WHERE? WHY?

20 years for murder

Twice guilty killer sentenced

By ANTHONY PETERSON

JOHN Serratore refuses to accept he murdered his childhood sweetheart despite two juries finding him to be a killer.

After Serratore was sentenced to a maximum 20 years' jail yesterday for the second time, his lawyer said Serratore maintained he did not kill Frances Tizzzone and had already lodged an appeal against the conviction.

A jury found Serratore guilty in November 1998 at the conclusion of his first trial, but he appealed after sentencing. A year later the Court of Criminal Appeal ordered a retrial because of a legal error. In June this year a new jury again convicted Serratore but within weeks he had filed an appeal.

"We'd like to know who was involved. He'd like to know who it was, it could have been anyone," Serratore's lawyer Sam Macedone said outside the NSW Supreme Court.

While Serratore is claiming the verdict was "unsound and unsatisfactory", the Tizzzone family feels less than satisfied with the sentence, believing a life term would be appropriate.

Ms Tizzzone, a 21-year-old university student, had a turbulent and often violent relationship with Serratore before she was strangled. Her body was dumped near the Wakehurst Parkway at Frenchs Forest on March 29, 1995.

As their relationship soured, Serratore became jealous and obsessive but Ms Tizzzone felt attracted to him and secretly renewed contact after breaking up with him.

On the day she disappeared, Serratore arranged to meet her and fibres found on her boot soles proved she had been in his Honda CRX just before her death.

Justice David Kirby said the arrangements to meet and the efficient dispatching of Ms Tizzzone "point to premeditation and planning".

"Although Mr Serratore's act was, on the one view, a crime of passion, it was smouldering, vindictive passion, which had more to do with revenge than love," Justice Kirby said.

"This was a brutal and awful crime. A young woman, of considerable promise, was lured into a trap and slain.

The court heard Serratore enlisted a friend to hurl Ms Tizzzone in late 1994 which led to her taking out an apprehended violence order.

After the sentencing, Patricia Tizzzone said she longed for Serratore to show contrition for killing her daughter.

Mr Macedone publicly voiced Serratore's feelings.

"He still maintains he is innocent. He has never changed from that position," Mr Macedone said.

Serratore was sentenced to a minimum 14 years' jail but after taking into account time already served he will be eligible for parole on May 17, 2012.
“Fingerprints are wonderful. I would say (...) it is privileged evidence. But, beyond, one can find prints of a variety of species: tooth print, nails, traces from the entire body, hair, dusts. Dust analysis is an infinite, unlimited resource. One can exactly know what the man did”

Locard in a radio interview, 1955.
Recapturing the Holistic View of Trace Evidence

Criminals can’t control all the ‘traceogenic’ aspects of human action

A less specialised treatment of more than one type of trace is preferable to the specialised in-depth treatment of one type of trace only

Effective from scientific and cost viewpoints
Original Research Paper

Utilization of environmentally acquired very small particles as a means of association

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Exploitation of very small particles to enhance the probative value of carpet fibers

David A. Stoney a,*, Cedric Neumann b, c, Kim E. Mooney d, J. Matney Wyatt d, Paul L. Stoney a

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d Defense Forensic Science Center, Chemistry and Firearms Branch, 4930 N 31st Street, Forest Park, GA 30297-5205, USA
REPORT

INQUIRY INTO THE CIRCUMSTANCES THAT LED TO THE
CONVICTION OF
MR FARAH ABDULKADIR JAMA

es/4cd228fd-f61d-4449-b655-ad98323c4ccc/vincentreportfinal6may2010.pdf

THE HONOURABLE F H R VINCENT, AO QC

Ordered to be printed

VICTORIAN GOVERNMENT
PRINTER
May 2010
DNA ‘Match’ – What about Other Traces?

November 06
DNA profile identified to Farah Jama, 19 y.o.
No traces of Jama at or around the nightclub:
- Video-surveillance
- Fingerprints
- Phone records
- Parking – speed cameras
- Witnesses
Alibi – 3 testimonies

Farah Jama, aged 19
...we might previously have been sent a jacket and been told, “See what you can do with it.” Now, we will be sent a snip from the jacket with a bloodstain on it and told, “Tell me what blood that is. Give me a DNA profile.” Because we are now just being asked to do a test, it is clearer and the charging for it is easier in one sense, but the evidence that you might be able to get from it is perhaps less good.

D. Richardson, LGC, on P. 15
Recapturing the Crime Scene as a Scientific Endeavour

• Trace evidence starts at the crime scene;

• Mechanical process and administrative objectivity vs. true scientific endeavour;

• Integrating crime scene management within scientific scrutiny as a way to move forward.

UTS: Centre for Forensic Science
“We appear to have relegated the framing of questions to non-scientifically educated detectives leaving criminalists with technician functions and fancy hardware, operating in a reactive mode, doing only what is asked of them. This has certainly been the trend. When we take a good look at this model, to which we seem to have grown accustomed, does it make any sense? If the laboratory is set up on the clinical model and crime scenes are handled exclusively by non-scientists, there is no problem-solving scientist on the "front end”.

Bringing the Laboratory to the Scene


Agilent Technologies
Lab-on-a-Chip

Pyrene deposited on coloured wax.

Alison Bell, Alison-Wilton, Blanes*

EXPAD
8.0 mm diameter
CMTK 100,0,100,0
10.5 mm distance

UV LED
photodiode
LEDs
red = Explosive

green = Non-explosive
Drones

http://www.libertynews.com/wp-content/uploads/2013/06/policedrone-3-300x199.jpg
https://postmediacanadadotcom.files.wordpress.com/2014/12/bc_mill_shooting_20140430.jpg
Introducing Traces into the Digital Space
Blurring the Boundaries between the Scene and the Specialised Laboratory

Potential to reconnect forensic science with problems it is supposed to solve

- Scientists more directly engaged in the field and integrated with the other actors in the security system
- Policing and security with a more direct access to the detection, analysis and use of forensic case data and more pro-actively connected to forensic science
Critical Challenges with Technologies

Tested models for integration into well-formed policing and intelligence strategies?

True impact or enhanced capability and efficacy to forensic science?

More research required
Not only technical aspects, but also criminological, legal, ethical and more broadly sociological and philosophical dimensions.
A New Approach is Required

“The route towards effective use of new technologies is contrasted with how forensic science laboratories are currently choosing and employing them. The conclusion is that although new technologies are contributing, we are not on a path that will result in their most effective and appropriate use. A new approach is required.”

Exponential Changes in Technologies

What's next?
Whole-genome sequencing in the field for $5?
We can't define forensic science by specialisms.

One student generation

What's next?

2010: Big data
2000: Mobile phones
1985: DNA

1900: Fingerprints

One student generation
Combining Internet monitoring processes, packaging and isotopic analyses to determine the market structure: Example of Gamma Butyrolactone

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Institut de Police Scientifique, École des Sciences Criminelles, Université de Lausanne, 1015 Lausanne-Dorigny, Switzerland
Removing Silos

Forensic intelligence framework—Part I: Induction of a transversal model by comparing illicit drugs and false identity documents monitoring

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Effectiveness Interrogations

Graph developed by O. Ribaux in Collaboration with F. Crispino and C. Roux
for Aus Academy Forens Sci Conference on Interpretation, Dec 2011

High-volume crime

UTS: Centre for Forensic Science
Broadening the Applications of Trace Evidence
Why Databases?

- Australian Standard 5388.3:
  - Translation of qualitative and quantitative data into results
  - Assist in the interpretation of the result in context
Use of Databases = More Reliable FS?

• Issues to consider:
  – Forensic relevance
  – Scope
  – Representativeness
  – Currency
  – Fit for intended purposes
  – Integration of result with other information

Not asking the right questions gives a sense of wrong reliability
Trace Evidence in the New World?

Frontline detection

• Fast
• Fit for purpose (as opposed to completeness)
• Contextualised and integrated with other forensic case data
• Feeds intelligence and investigation processes in routine
• Collaborative problem solving

Specialised treatment

• More comprehensive
• More fragmented and specialised
• Results assessed considering hypotheses proposed by others
• Fulfills court requirements
• Centre of specialisation or outsourcing
Trace Evidence in the New World?

Strategic, measured use of particle analysis in a way that responds directly to investigative issues, contributing to the investigation at every stage and taking advantage of information from many different types of particles

• Stoney D.A & Stoney P.L. Illustration and analysis of a coordinated approach to an effective forensic trace evidence capability, Forensic Science International, 2015, 253, 14-27

Coordinated forensic particle analysis

• Dynamic forensic analytical approach
• Concise and efficient protocols addressing particle combinations
• Multidisciplinary capabilities of analysis and interpretation
• Readily accessible external specialist resources
• Information integration and communication
Key for a Brighter Future

- Crime scene as scientific endeavour
- Active holistic case management
- Culture of the trace mastered by a general forensic scientist
Conclusions

• Forensic science should not be centred around ‘specialisms’, but on advancing the expertise and knowledge of the trace – the remnant of presence and activity/action;

• Forensic science should not be centred on the current laboratory-centric conception of forensic science, but should recapture the crime scene as a scientific endeavour;
Conclusions

• Forensic science should be a significant contributor to crime investigation and the resolution of broader security problems;

• Forensic science should cover the study of its contribution along the whole chain of the judicial process, from the crime scene, to the presentation of forensic information in court;

• Research in forensic science needs an epistemological component for elaborating upon the foundations of an investigative logic exploiting information conveyed by traces;
Conclusions

• Research ON forensic science is equally important to research FOR forensic science;
• Forensic science should refocus on problem solving, which will provide a more central position to the discipline, as well as greater stability and sustainability;
• Data and databases are definitely part of the solution but they must be fit for the intended purpose and must be used within appropriate intellectual and logical frameworks.
Acknowledgments

- NIST for the invitation
- Shannan Williams
- Grace Hao
- Myesha Steadman
Together
InForming Justice

ANZFSS
23rd International Symposium on the Forensic Sciences
18 - 23 September 2016
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www.anzfss2016.org