



UNIVERSITY OF
TECHNOLOGY SYDNEY



**TRACE
EVIDENCE**
SYMPOSIUM

AUGUST 2-7, 2009
[www.ojp.usdoj.gov/nij/events/
trace-evidence-symposium](http://www.ojp.usdoj.gov/nij/events/trace-evidence-symposium)

UTS

THINK.CHANGE.DO

Marketing Trace Evidence...And Other Thoughts

Claude Roux

Centre for Forensic Science, University of Technology, Sydney, Australia

— You're fluent in twenty-four programming languages, but you can't even talk about the weather with me!"



- Marketing Trace Evidence??

Igor Aleshin

DATAART
Enjoy IT

Marketing Trace Evidence

- No long term value to “preach to the choir” – Outreach essential
- However, we must strike a consensus about our strengths, value, limitation, scope of application, etc.
- We tend to agree that we do the “middle part” of the process (i.e. lab analysis) pretty well

Challenges Discussed within Steering Committee

- Maintaining a case load that provides meaningful information considering the affect of DNA to forensic science
- Cost and maintenance of instrumentation necessary to do state of the art analysis in trace evidence
- Cost and time required to train a trace evidence analyst
- Consumer ignorance as to the utilization of trace evidence



Challenges Discussed within Steering Committee

- Consumer ignorance as to the meaning of trace evidence reports
- Regionalization or centralization of trace evidence – shared governance
- ISO accreditation and its implication for the general trace evidence analyst and its implication to subcontract or outside referral of trace evidence cases
- Fee for service – advantages and disadvantages

Challenges Discussed within Steering Committee

- Partnerships with colleges and universities
- The challenge to training good scientists rather than good analysts
- Models or strategies for coordinating forensic evidence recognition, collection, and analysis in the era of forensic specialization.
- Future funding and training resources in trace evidence
- Integration of trace evidence into investigation

Most Crucial Steps

- Consider traces as the starting point – remnants of an activity
- Make significant effort to integrate trace evidence in investigations and intelligence – don't wait for the known specimen; don't necessarily apply a long and costly series of tests
- Address the 'could have come from' syndrome – write qualified opinions in reports
- More broadly, evaluate the impact the impact of forensic science, including trace evidence on crime and security

Forensic Scientist ≠ Analyst



Trace Evidence in Investigations

Photos: David Royds, Australian Federal Police



Bali Bombing I: Material Found at Paddy's Pub

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High-Tech Solutions



Fibres: FTIR Chemical Imaging



Fibres: Raman Microprobe



Explosives: IRMS



Tartan Found During Suicide Bomber's Post-Mortem



Photo: David Royds, Australian Federal Police



Tartan Found Inside a Metal Drum at Presumed Bomb Making Facility



Photo: David Royds, Australian Federal Police

Scientific Reasoning vs. Bureaucracy

- “Fear of auditors rather than scientific reasoning governs the collection of large numbers of data points... thus, the application of a new technology for solving cases more quickly can be delayed because an overzealous number of validation experiments are performed”

Validation: What Is It, Why Does It Matter, and How Should It Be Done? By John M. Butler, National Institute of Standards and Technology, 2007.

SOUTH AUSTRALIA



ROYAL COMMISSION

REPORT

concerning the conviction
of

EDWARD CHARLES SPLATT



UNIVERSITY OF
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- Murder of Mrs Simper, a 77 year-old Adelaide woman who had been badly beaten, sexually assaulted and strangled in her bedroom.

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- *“The vital obligation which lies upon the testifying scientists is that they **spell out to the jury, in non-ambiguous and precisely clear terms, the degree of weight and substance and significance** which is or ought properly to be attached to the scientific tests and analyses and examinations as to which they depose; and specifically the nature and degree of any limitations or provisos which are properly appended thereto.”*



- *“ And the critical responsibility which rests upon the legal persons is to ask such detailed and probing questions of the scientist as are most likely to elicit the type of evidence just mentioned.”*



Debris recovered from bed
(Courtesy of Dr. James Robertson,
Australian Federal Police)

Inference of Identity of Source

By

Quon Yin Kwan

B.S. (University of California) 1970
M.Crim. (University of California) 1972

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF CRIMINOLOGY

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, BERKELEY

1977



A Forgotten Work

- Hypothetical-deductive process.
- Criminalists need to delve more into the properties of objects generally encountered as physical evidence rather than dive into applications of novel techniques.
- Criminalists must not only examine the properties characterizing an object but also the rules that determine those properties.
- Criminalists must use quantitative techniques appropriate to the context of a given problem of identity of source.

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Expression of Opinion

- Match
- Could have come from
- (Entirely) consistent with
- Cannot exclude
- Provides evidence of contact
- Points towards
- Indicates
- There is an association between
- Provide strong evidence of a link between
- Very likely came from
- Likely to have been caused by
- Has come from
- Has been made by
- Supports an assertion that
- The findings are what I would expect if (H) were true
- The findings are very likely to be seen if (H) were true
- Provides strong support for the view that
- No support for

Strengths and limitations of these phrases are discussed in *Jackson G., Understanding forensic science opinions, In: Handbook of Forensic Science, Fraser J. & Williams R., (Eds), Willan, 419-445, 2009.*



A hierarchy of propositions: deciding which level to address in casework

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Science & Justice 1998; 38: 231–239

Received 2 April 1998; accepted 19 June 1998



Hierarchy of Propositions

III	Offence	A	Mr A committed the burglary Another person committed the burglary
		B	Mr B raped Ms Y Some other man raped Ms Y
		C	Mr C assaulted Mr Z Mr C had nothing to do with the assault of Mr Z
II	Activity	A	Mr A is the man who smashed window X Mr A was not present when window X was smashed
		B	Mr B had sexual intercourse with Ms Y Some other man had sexual intercourse with Ms Y
		C	Mr C is the man who kicked Mr Z in the head Mr C was not present at the kicking of Mr Z
I	Source	A	The glass fragments came from window X They came from some other broken glass object
		B	The semen came from Mr B The semen came from some other man
		C	The blood on Mr C's clothing came from Mr Z The blood on Mr C's clothing came from an unknown person

NSW Murder Case

On April 2, 1995, the victim's body is found at Frenchs Forest

Only forensic evidence: fibres on her shoe soles

Susan Bennett's Presentation at the 2007 Trace Evidence Symposium



5 grey polypropylene
5 blue polypropylene
26 black polyester



4 grey polypropylene
7 blue polypropylene
24 black polyester

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 (i.e. **source**) WAS NOT AN ISSUE IN THE CONTEXT OF THIS CASE, BUT THE CRUCIAL ARGUMENTS WERE AROUND WHEN? WHERE? WHY? (i.e. **activity**)



Court Outcome

DAILY TELEGRAPH 21/07/00

20 years for murder

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 Tizzone 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

Twice guilty killer sentenced

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 "unsafe and unsatisfactory", the Tizzone family feels less than satisfied with the sentence, believing a life term would be appropriate.

Ms Tizzone, a 21-year-old uni-

versity 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 Tizzone 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 Tizzone "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 hurt Ms Tizzone in late 1994 which led to her taking out an apprehended violence order.

After the sentencing, Patricia Tizzone said she begged for Serratore to show悔悟 for killing her daughter.

Mr Macedone publicly voiced Serratore's feelings.

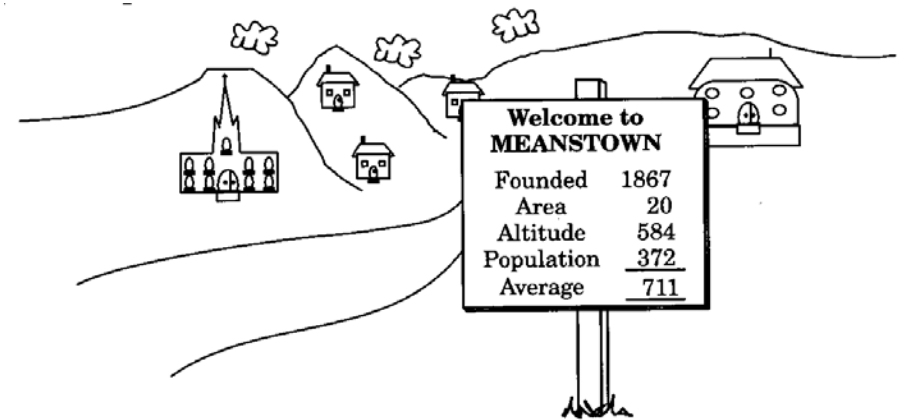
"He still maintains he is innocent. He has never changed from that position," Mr Macedone said.

Serratore was sentenced to a minimum 14 years' jail but after taking into account time already served he will be eligible for parole in May 17, 2012.



Interpretation Issue

- “The knowledge base that underpins analysis and the interpretation of evidence—which enable the forensic science disciplines to excel at informing investigations, providing strong evidence for prosecutions, and avoiding errors that could lead to imperfect judgment—is incomplete in important ways.”
- “Yet, despite the lack of a statistical foundation, examiners make probabilistic claims based on their experience.”
- “A statistical framework that allows quantification of these claims is greatly needed.”



Suggested by a 1977 cartoon in *The New Yorker* magazine by Dana Fradon.

Courtesy of S. Walsh & J. Buckleton



Rev. T. Bayes
(1702-1761)

Strengthening Forensic Science in the United States: A Path Forward, p. 6-5 2009

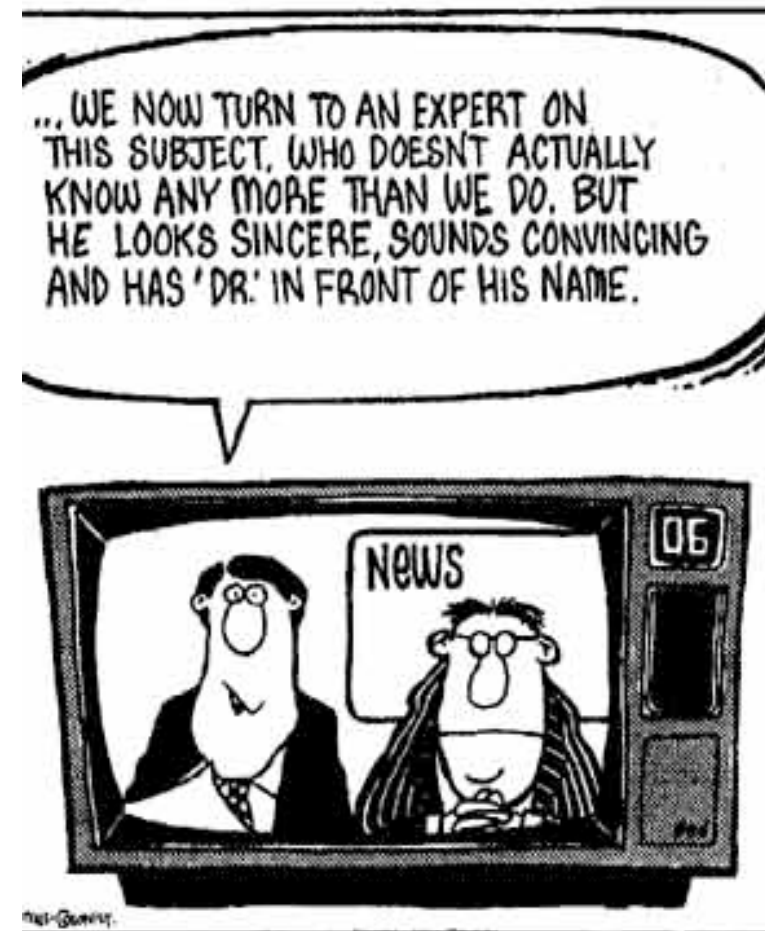
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Knowledge - The Single Most Critical Resource

- Of the various facets of under resourcing, the committee is most concerned about the **knowledge base**.
- Adding more dollars and people to the enterprise might reduce case backlogs, but it will not address fundamental limitations in the capabilities of forensic science disciplines to discern valid information from crime scene evidence.

Strengthening Forensic Science in the United States: A Path Forward, p. S-11, 2009



Knowledge - Not Only Process

- Knowledge needed to recognise, select, recover, record, analyse and interpret relevant information, intelligence and ultimately evidence.
- Transfer of existing knowledge and creation of new knowledge are crucial.
- Significance of academia and FS as an academic discipline.
- Outcomes of having better knowledge are however far from being academic only:
 - Eg: **Better knowledge & expertise have a significant effect on the quality and/or quantity of forensic evidence that is collected**
(Jacquemet Papilloud J. L'incendie volontaire. Méthodes et outils d'investigation - analyses stratégiques et opérationnelles, PhD Thesis, UNIL, 2003; Girod A. Exploitation et gestion systématique des traces de souliers: une approche complémentaire pour l'investigation criminelle des cambriolages, PhD Thesis, UNIL, 2002)

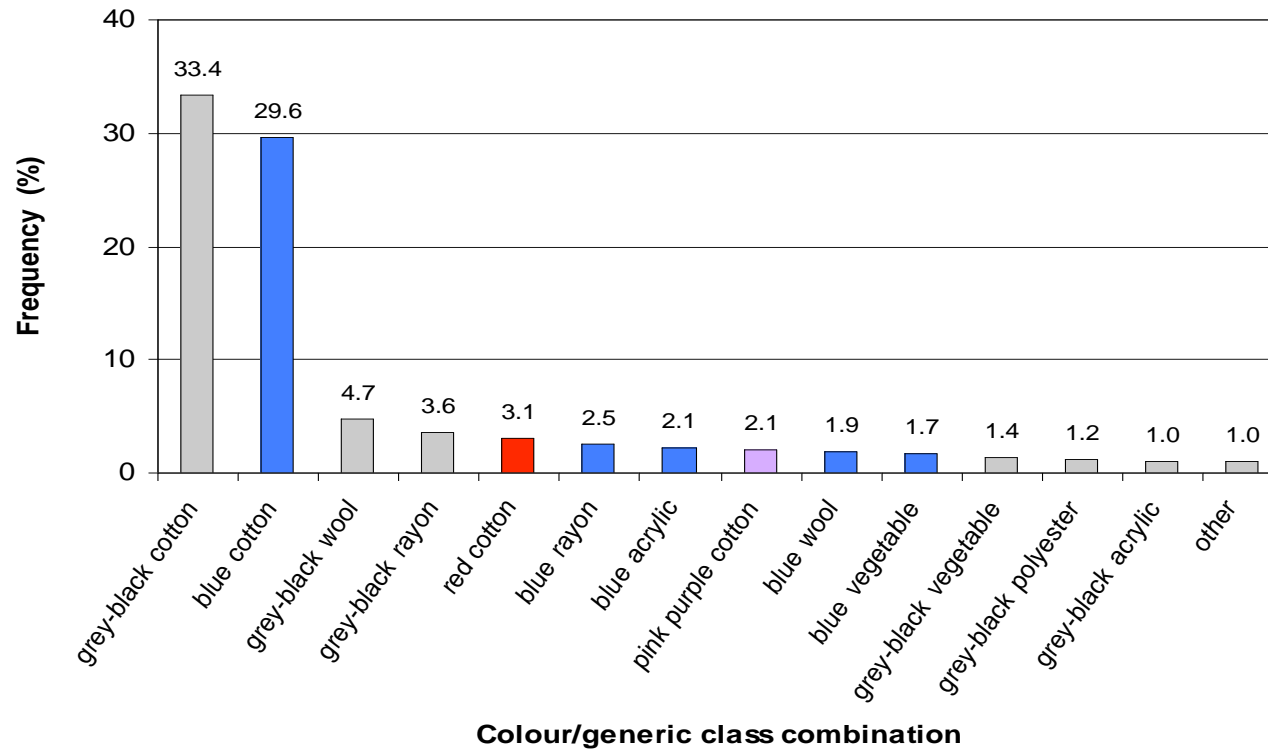


Need for More Research - ID Bias?

- “It is fair to say that, with the exception of nuclear DNA analysis, **there is a lot we do not know about other forensic disciplines.** Considerably more research and development is needed to provide a rigorous evaluation of the capacity of a method to consistently, and with a high degree of certainty, demonstrate a connection between evidence and a specific individual or source.”

*Prof. Constantine Gatsonis, Co-Chair, Forensic Science
Committee, Strengthening Forensic Science in the United
States: A Path Forward, 2009*

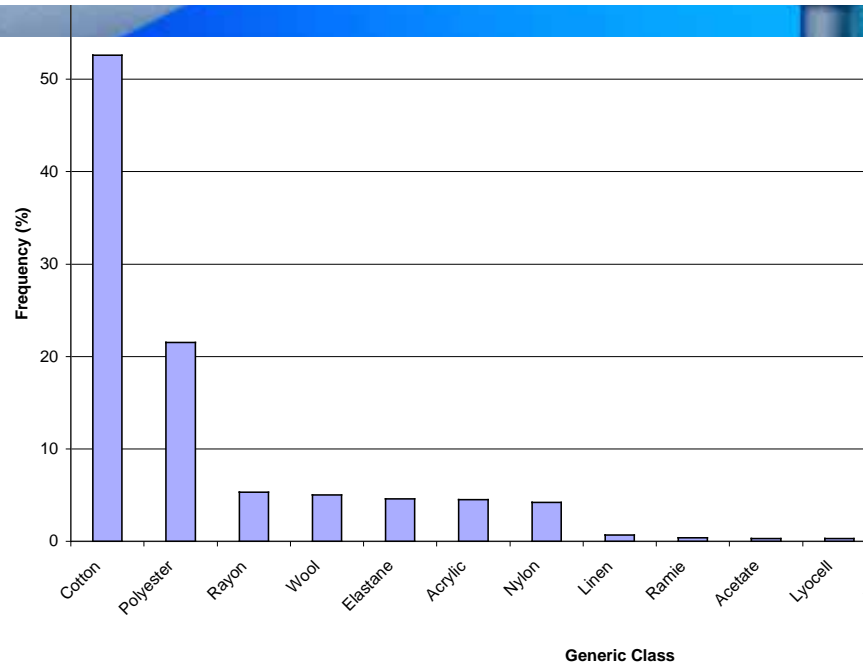
Fibre Population on Cinema Seats



3025 fibres from 16
seats

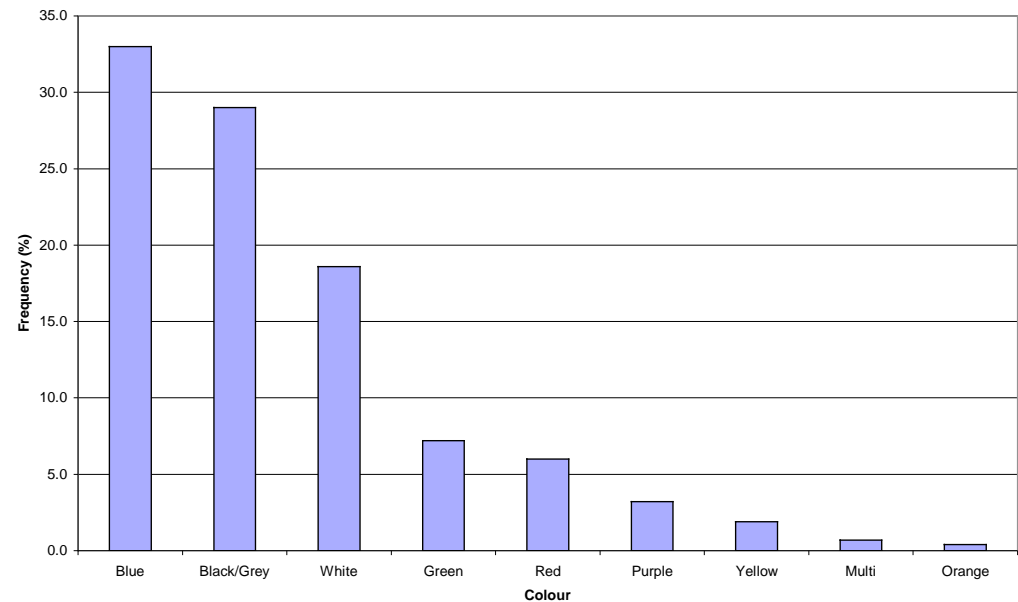
Cantrell S., Roux C., Maynard P., Robertson J., A Textile Fibre Survey as an Aid to the Interpretation of Fibre Evidence in the Sydney Region, *Forensic Science International*, 123, 2001,48-53

Fibre Classes Worn by the Population

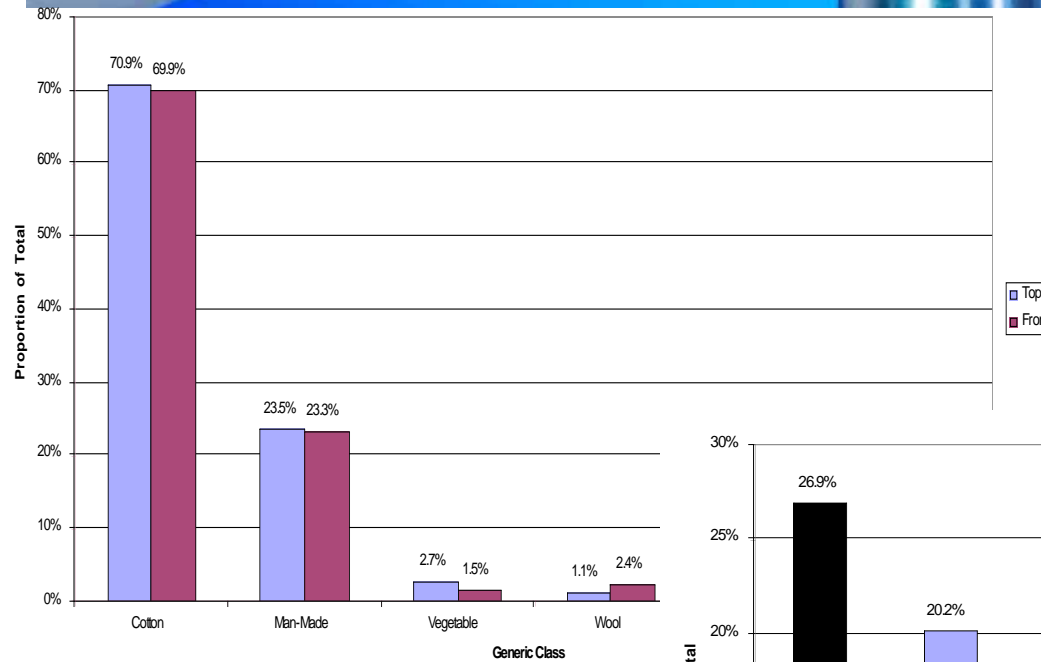


Langdon S., The Evidential Value of Textile Fibres in Criminal Investigations, PhD Thesis, UTS, 2003

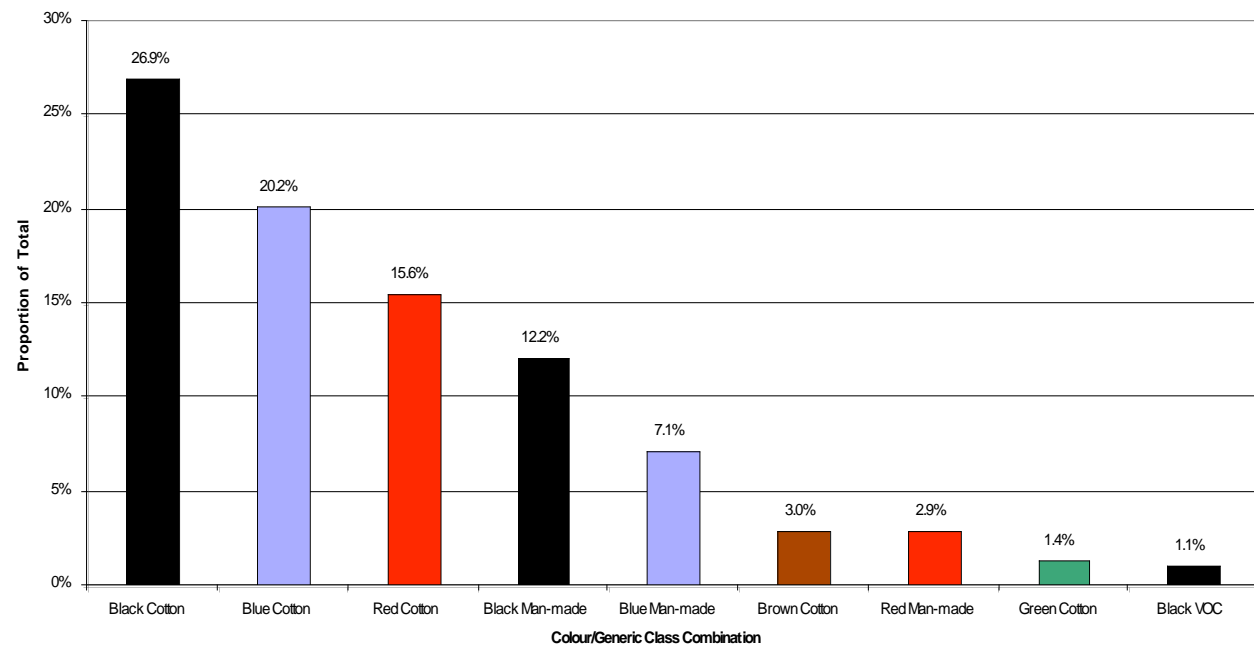
543 garments (360 F, 231 M)



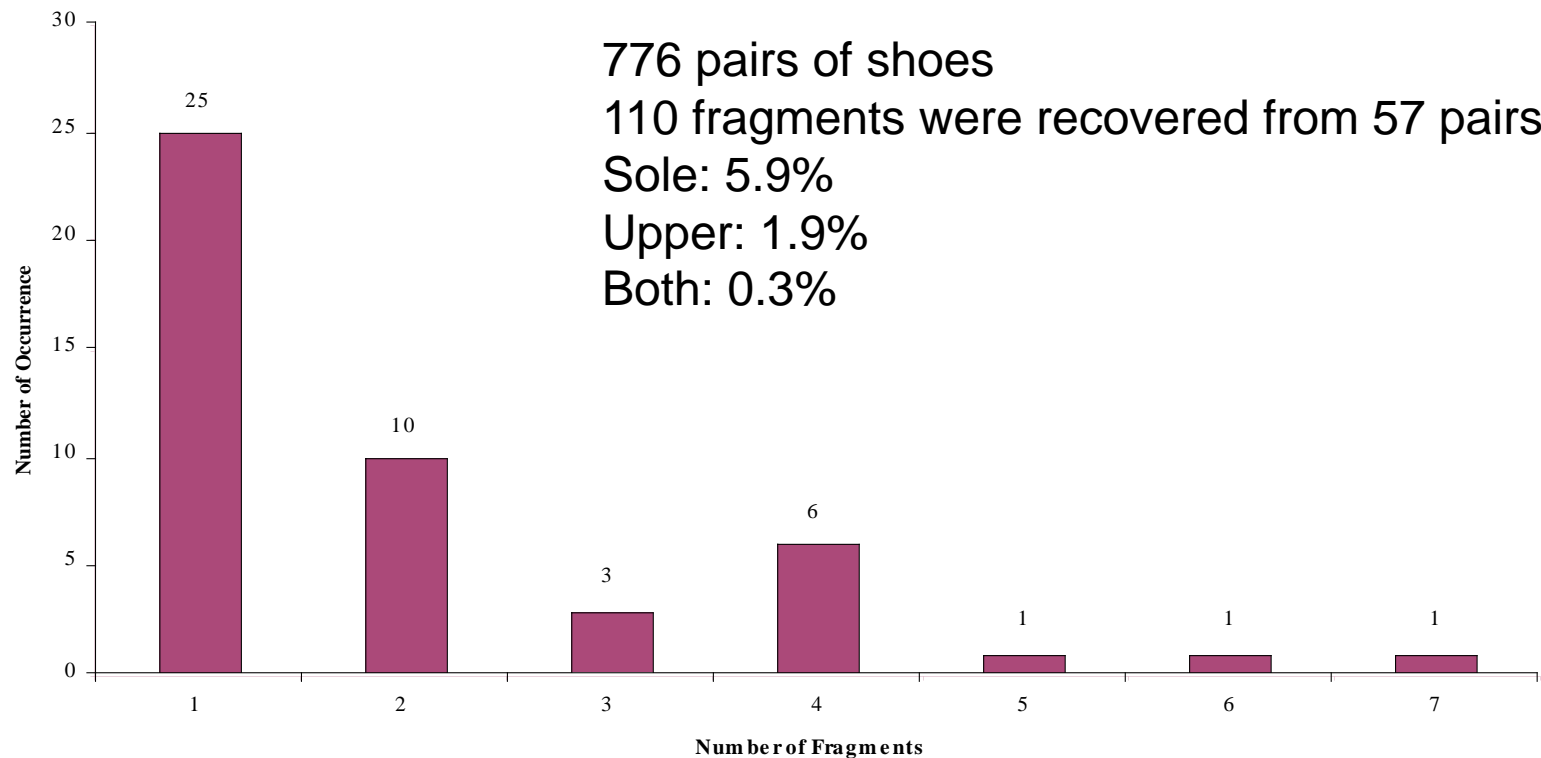
Fibre Population After Washing



Watt R., Roux C., Robertson J., (2005), 'The population of coloured textile fibres in domestic washing machines, *Science & Justice*, 45:2, 75-83.



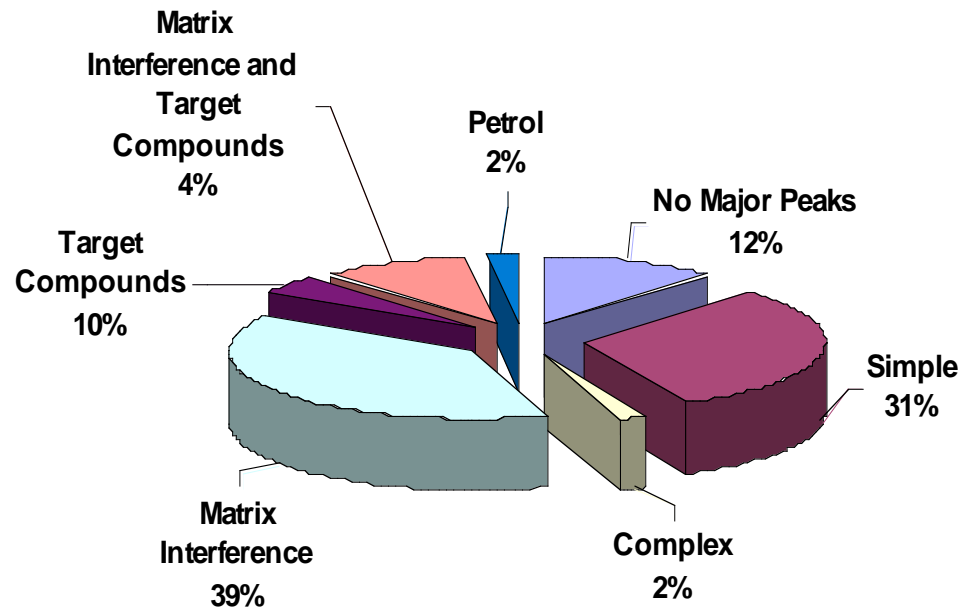
Glass on Shoes



Roux C., Kirk R., Benson S., Van Haren T., Petterd C.I. Glass particles in footwear of members of the public in south-eastern Australia— a survey, *Forensic Science International*, 116, 2001, 149-156

Background Level of Petrol in Cars

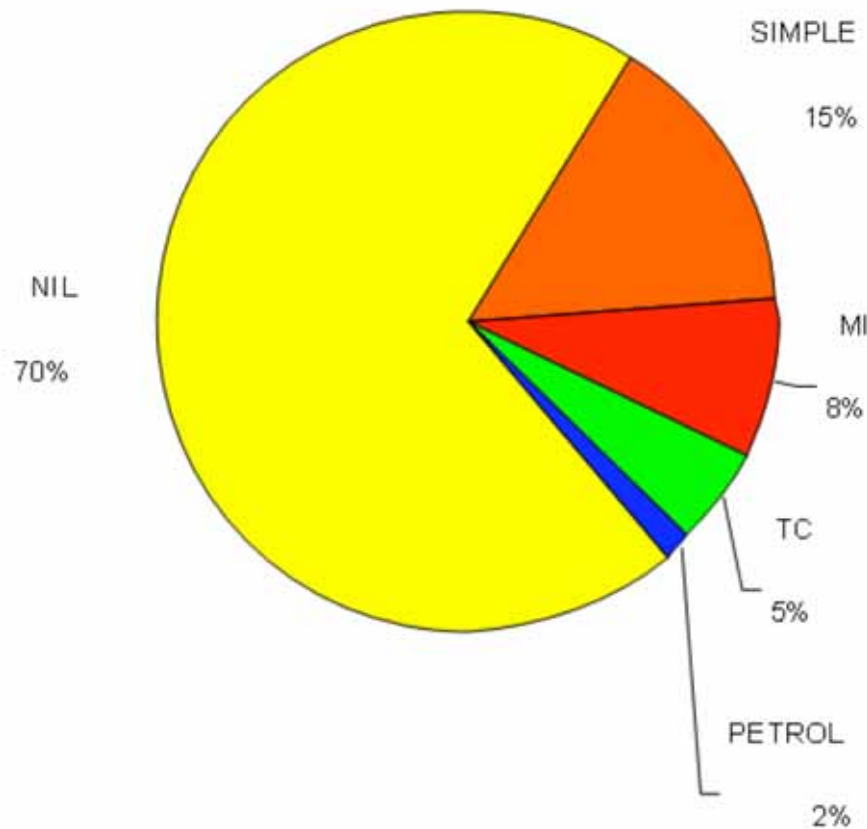
98 different vehicles from insurance salvage yards
71 Car carpets and 229 car mats



17 and 52 car mats inserted in cars
(known history)
No 'positive' for petrol

Cavanagh-Steer K., Du Pasquier E., Roux C., Lennard C., (2005), 'The transfer and persistence of petrol on car carpets', *Forensic Science International*, 147:1, 71-79.

Background Level of Petrol in Car Boots



120 different vehicles from insurance salvage yards

Hancock M., A Study of the Presence of Petrol in Car Boots, UTS Honours Project, 2007



Research article

Assessing trace DNA evidence from a residential burglary: Abundance, transfer and persistence

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Abstract

The considerable identifying power of DNA can see it treated as an absolute form of evidence, rather than as any other trace evidence. This study aimed to provide data into the abundance, transfer and persistence of trace DNA, in a particular crime scenario—residential burglary. Background levels of DNA on common burglary entry points were found to be low, however transfer of DNA during the action of a break-in is also low. The ability to recover analyzable DNA from outdoor surfaces decreases rapidly over several weeks.

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Keywords: Trace DNA; Abundance; Transfer; Persistence; Burglary

Error Rate? Subjectivity?

- What is an error? – Error \neq lack of ability to discriminate
- Error rate of a methodology extremely difficult to assess, as opposed to error rate of an individual. However, we can rely on:
 - Past experience
 - Statistical studies
 - Proficiency testing
- The absence of statistics or error rates does not necessarily mean unreliability.

EVALUATING THE ROLE AND IMPACT
OF FORENSIC DNA PROFILING ON
KEY AREAS OF THE CRIMINAL
JUSTICE SYSTEM

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Real Impact of Forensic Science?

- Forensic Science is increasingly being asked to demonstrate its **real efficiency**, not only in terms of justice, but also in relation to wider security.
- Very few studies are actually coming from the forensic science community itself.
- Work of Ribaux and co-workers.

The Effectiveness of Forensic Science in the Criminal Justice System

Chief Investigators: *Associate Professor Roberta Julian (UTAS), Professor Rob White (UTAS), Professor Claude Roux (UTS), and Dr Hugh Sibly (UTAS)*

Partner Investigators: *Alastair Ross (VicPol), Peter Woodman (VicPol), Robert Hayes (VicPol), Terry Purton (VicPol), Dr James Robertson (AFP), Anna Davey (NIFS) and Professor Pierre Margot (University of Lausanne)*

Funding: *Australian Research Council (ARC), Victoria Police, Australian Federal Police and the National Institute of Forensic Science*

The research aims to assess the effectiveness of forensic science in the criminal justice system (in both police investigations and court outcomes). This collaborative research with Victoria Police and the Australian Federal Police will develop an evidence-based best practice model for using forensic science in both the reactive and proactive investigation of serious and volume crime. This research is significant in that, for the first time in Australia, an attempt will be made to establish the value of forensic science thereby assisting in the achievement of intelligence-led policing and improving court outcomes that will serve to safeguard Australia from crime.

Trace Evidence- The Future

- Economic realities and the change of status of trace evidence = significant challenges for this discipline.
- Need to re-assess the place and shape of trace evidence, as well as the need to think about new models applicable to trace evidence.
- The successful re-emergence of trace evidence in the 21st Century will depend on:
 - The end of ultra-specialisation and a return to the generalist approach
 - Trace evidence experts with a holistic view of forensic science will optimise the value that can be drawn from trace evidence, both from court and intelligence viewpoints.
 - The successful implementation of relevant emerging technologies:
 - To be successful, these developments must occur with prime consideration of the forensic context (holistic forensic approach, fit for purpose, etc).

Trace Evidence – The Future

- Successful implementation of relevant emerging technologies will:
 - Blur the boundaries between lab and field forensic science.
 - Streamline the analytical process leading to quicker results
 - Free up the forensic scientist who can in turn have more time to spend on difficult cases, background survey assisting the interpretation, etc., leading to more meaningful results.



Trace Evidence – The Future

- The realisation that discrimination is not the most significant feature for trace evidence:
 - Trace evidence is a value-added source of information for reconstruction of a case, or, more broadly, for investigative purposes.
 - Trace evidence can help answer the “what happened?” question.

Conclusions

- We must to face the challenges, seize the opportunities and convince the stakeholders that trace evidence plays a crucial role in law enforcement, in the administration of justice and in security.
- Implementing the right strategic directions will not only 'save' trace evidence, but also prompt its re-emergence.

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- Adj. Prof. James Robertson (AFP)
- Simon Walsh (AFP) and Dr John Buckleton (ESR)
- Alastair Ross (NIFS) and Dr Tony Raymond (NSW Police Force)

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