Alternative Interpretations

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Evidence evaluation problems

- Many speakers have commented on the need to do something about evaluation of the evidence
- Peter deForest's physical evidence continuum
  - Good at the middle bit
- Claude Roux: Worry less about the discrimination and focus on the value of the added information

Role of Forensic Scientist

"Tendency to concentrate on providing analytical findings….

If we do not evaluate results, how do others evaluate them; what framework, what knowledge and what understanding do they have to help them evaluate the evidence in a robust, reliable way?"

Jackson, Science and Justice 2000, 40 (2)

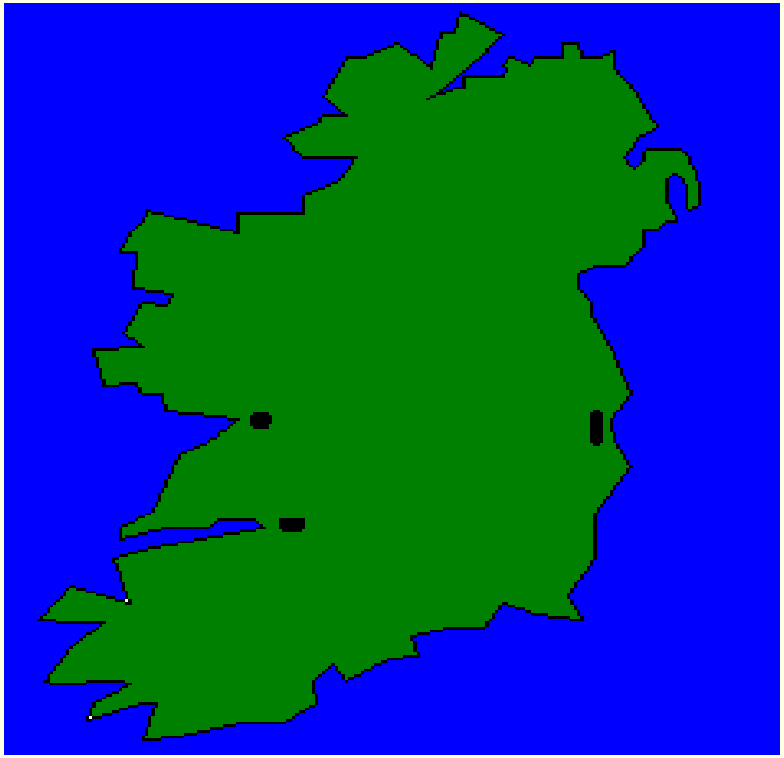
Obligations of the analyst Inman and Rudin 2001

"Because we provide results and information to parties who lack the expertise to independently understand their meaning and implications, it is up to us to furnish an accurate and complete interpretation of our results"

A complete interpretation must include the limitations of the test and evidence, inferences, assumptions, what the results mean and don't mean.

The Irish Forensic Science laboratory's experience

- Only forensic science laboratory in Ireland
  - Established in 1975
- 70 staff, 60 FTEs
- Population 4 million
- 13,000 cases per year

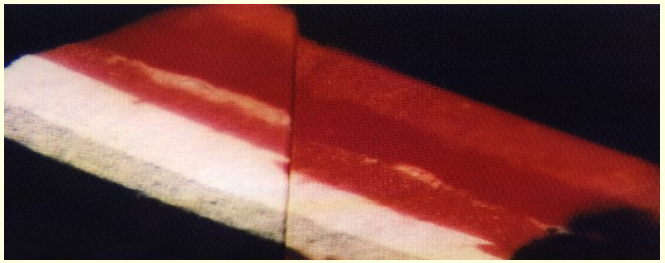


Early issues

- Should we know about the case circumstances or will the knowledge cause bias?
- Which tests?
  - Do requested tests regardless of value?
  - Unreasonable court expectations
- Did not work on cases once there was legitimate access
- Reported the findings without comment on their significance

Consequences of non-evaluation

- Container with explosives found buried on beach;

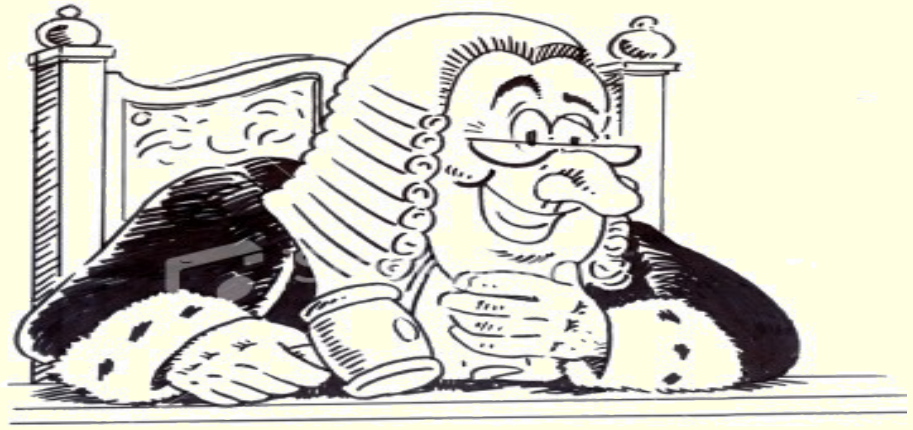


- 10 layers of different coloured paint
- Partial oil tank found on suspect's farm; multiple paint layers match
- Scientist reported matching paint layers without comment on significance
- Surprised when suspect was not charged.

If forensic scientists do not interpret: court misunderstanding

- Murder of Lord Mountbatten in 1979
  - Paint fragments with three layers of green paint were found on suspect's jacket that matched paint from boat
  - Scientist got opportunity in court to explain significance of findings
- New case with same judge, same scientist and white paint.
  - Judge pronounces:

"paint is
very significant evidence"



Interpretation journey

- Perspective of practitioners who are struggling with evaluating evidence
- Not an expert in the Bayesian approach
- Not a statistician
- Forensic scientist

Principles for interpretation

Graham Jackson Science and Justice, 2000, 40, (2)

- Awareness of the relevant background information provides the framework within which the scientist operates

- We need to consider at least two competing propositions – *is there a better way to demonstrate impartiality?*

- How likely are we to observe the results if the prosecution proposition was true and if the defence proposition was true?

Likelihood ratio

2 competing propositions:

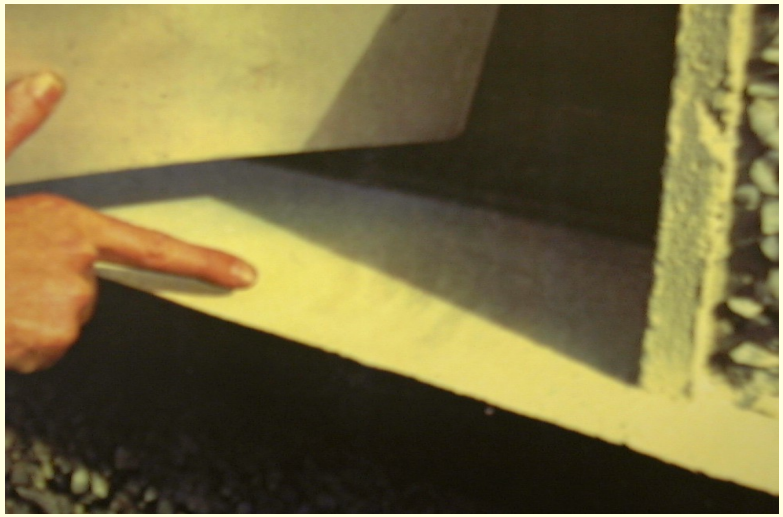
Probability of the evidence if the assertion is true

Probability of the evidence if the assertion is not true

Hp - Prosecution hypothesis – numerator

Hd - Defence hypothesis - denominator

Abduction and shooting in County Clare



10 navy acrylic fibres on window sill
7 navy acrylic fibres on net curtain

Propositions

Hp: Brendan O'Donnell climbed through the window wearing these gloves

Hd: Somebody else climbed through the window

Expectations prosecution hypothesis

What is the probability of finding matching fibres if O'Donnell climbed through this window while wearing these gloves?

O.7

Expectation
Defence proposition

If somebody else climbed through the window what is the chances of them having clothing with the same blue acrylic fibres?

Frequency of matching blue acrylic in the population

1:100?

1:1000?

1:10,000?

Frequency of bleached fibres:

1:500?

Likelihood ratio

O.7/0.001x0.02

The fibres are 350,000 times more likely if O'Donnell climbed through the window wearing these gloves than if somebody else climbed through.

Verbal scale

Evett et al Science and Justice 2000, 40

Likelihood ratio	Verbal equivalent
>1 to 10	Slight support
10 to 100	Moderate support
100 to 1000	Moderately strong support
1000 to 10,000	Strong support
> 10,000	Very strong support

Report

I have considered the following alternative propositions:

O'Donnell climbed through the window while wearing these gloves

Somebody else climbed through the window

The findings provide very strong support for the proposition that O'Donnell climbed through the window wearing the gloves rather than somebody else

Does not address the issue of whether O'Donnell climbed through the window!

This approach allows the jury to combine the scientific evidence with the other evidence in the trial

Bayesian approach

Prior odds X likelihood ratio → the posterior odds

Prior odds: the other evidence in front of the jury

Likelihood ratio: weight of the scientific evidence

Posterior odds: combination of the scientific and other evidence **by the jury**

Alternative hypothesis nobody climbed through the window

Frequency of fibres on outdoor surfaces

Grieve and Biermann Science and Justice 1997, 37

14% of fibres found were synthetic

3.2% of synthetic fibres were acrylic

0.5% of fibres in outdoor populations were acrylic

" because of their rarity, a collective of synthetic fibres could be considered highly significant, especially when they are of unusual colour"

Tendency to undervalue our evidence

Evaluation issue

- Police chase stolen car which crashes and driver runs off.
- Suspect arrested 10 minutes later in nearby street. Wearing jumper that sheds readily.
- Scientist finds four matching fibres on driver's seat.

How would you report the results?

1. The findings provide slight support for the suggestion that the suspect was in the driver's seat
2. Could have come from the suspect's jumper
3. Does not support
4. No support

Expectation

- If the suspect had been in the driver's seat, wearing this jumper, expectation of a lot of matching fibres

  Hp: lot of matching fibres

  Hd: none or a few matching fibres

- The findings support the defence hypothesis

  The findings do not support the suggestion that the suspect had been in the driver's seat.

- Will the courts understand if we don't explain?

Constraints against using the evaluative approach

- Deviates from hard factual information: uncomfortable zone for scientists
  - Evett's slippery soap concept
- Lack of data/up-to-date data
- Time consuming?
- Prosecutor's fallacy or the transposed conditional
- Communication issues

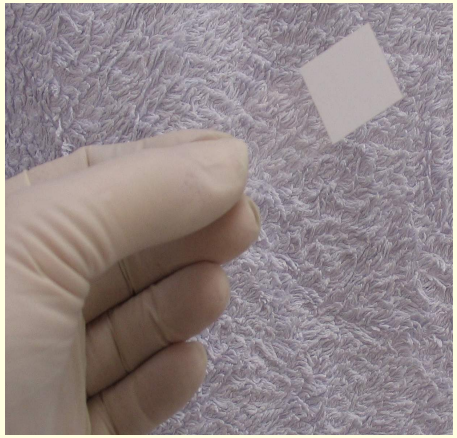
Communication

- Communication between science and law has always been difficult
- Robertson and Vignaux maintain that logic, probability and inference provide the language for this discussion
- This approach is what distinguishes forensic science from other science
  - "….concerned with drawing inferences relating to an event that is the concern of a court from individual items of non-replicating data."

Robertson and Vignaux 1995 *Interpreting Evidence*

ISBN 0471 96026 8

Data collection example



Minitapes to collect gunshot residue

Now used to collect epithelial DNA

Increased sensitivity

Application in sexual assault

cases without semen

Female DNA found on inside front of underpants

Hp: What is the likelihood of the evidence if intercourse occurred?

Hd: What is the likelihood of the evidence from secondary transfer?

Body Fluid Forum Trial

Maximise transfer opportunities

High shedding female

2 minutes contact

Immediate simulation of urination

Early results, female DNA on male underpants

Extend trial to other social situations

Any volunteers to work on the numerator!!!

Evidence Evaluation

- Case circumstances
- Select the appropriate alternative hypotheses
- Pre-assessment
- Consider the probability of the evidence given the propositions that have been addressed
- Re-evaluate should the circumstances change
- Best way to achieve correct interpretation by the court

Early stage of the journey

Situation in the Irish Forensic Science Laboratory

- Scientist's understanding of pertinent case circumstances is included in the report
- State that examinations are selected on the basis of this understanding.
- Explain significance of evidence through using a scale
  - Use alternative propositions in a few cases
- Always state " should the circumstances be different to that outlined in my understanding, I will have to re-evaluate the significance of my findings"

Next stage of the journey for the Irish FSL

- Pre-assessment of expectations before commencing examination
- Selection of appropriate hypotheses in more cases
- Report findings in likelihood ratio format
- Engage the legal system

Alternative interpretations

a journey worth taking?

is there an alternative?

Interpreting Evidence: evaluating Forensic Science in the Courtroom

Robertson and Vignaux

Wiley

Prosecutor's fallacy

Consider probability that a person who is over 6 feet high is a man

5% males and 0.5% females are at least 6 feet

If perpetrator is over 6 feet tall, then the odds are10:1 that it is a man

Prosecutor's fallacy would interpret this as 105 of men are at least 6 feet tall.

Role of Forensic Scientist

Kirk 1953

The criminalist “understands the methods of testing identities and is qualified to state whether two objects are identical or not, and whether they had or had not a common origin. **He moreover is qualified to evaluate the significance of his identity”**

European Fibre Group Interpretation Trial 2005

Kornelia Nehse

Expected results

Actual results

How would you have reported these results?

Could have come from?

Supports contact?

Does not support direct contact?

EFG interpretationTrial
What happened

Suspect taken to police station first and victim picked up subsequently by same car and sat in same seat

Suspect questioned after victim in same room and on same chair. Victim did not wear her jacket while sitting on chair.

EFG trial results of interpretation

- 37/41 commented on the discrepancies
- Most labs identified the critical issues that underlined the discrepancies
- Most interpreted the discrepancies as not supporting direct contact between suspect and victim.
- But 29% found evidence of direct contact

If forensic scientists do not consider the alternative

Incest allegation

Complainant puts on mother's knickers after incident.
Lab reports that DNA matches father.

Is it from semen related to the incident or is it from intercourse between parents and has survived washing?

Individualisation

- Principle that nothing is identical, continue to increase discrimination to find uniqueness
- Footmarks, finger marks, physical fits and DNA all have potential to be very strong evidence.
- Discriminating power is neutralised once there has been legitimate contact

Individualisation does not always help

- DNA from semen matches suspect
- Bullet can be linked backed to manufacturer's batches, but bullets are not necessarily distributed in batches