



Forensic Science Potential and limitations

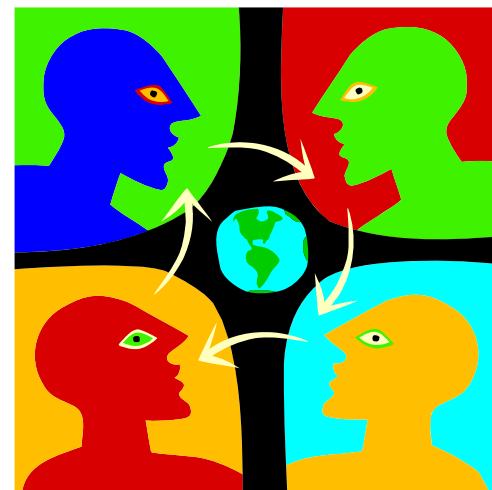
S. M. Willis

Shared language

- Scientists serve the truth and discover
- Civil servants serve the law and exercise
- Politicians serve interests and decide

We have not yet learned to live in peace and harmony ...

... and do we really need to?



Purpose



- Use science to assist justice;
- Forensic Science Laboratory - work on cases that make a difference;
- VFM – value linked into point 2 – not just numbers
- Limitless demand
- Maximise inclusions or exclusions



Report on analysis



- Most straightforward aspect of the work of the laboratory from a reporting viewpoint
- Not without difficulties
- Large quantities of controlled Drugs submitted
- Sampling policy in place – accepted by any scientist
- Laboratory tests at least a sufficient number of samples to enable the inference to be made with 99% certainty that more than 90% of the population share the properties of the tested samples.



Case before the courts this year

- Phipps; Section 15(a); 143,000 ecstasy tablets
- Issue seemed to me to be validity of sampling policy
- Not directly addressed in the court of criminal judgement
- Admission
- “represented placing the case of the prosecution or considering the case for the prosecution “at its strongest”.”



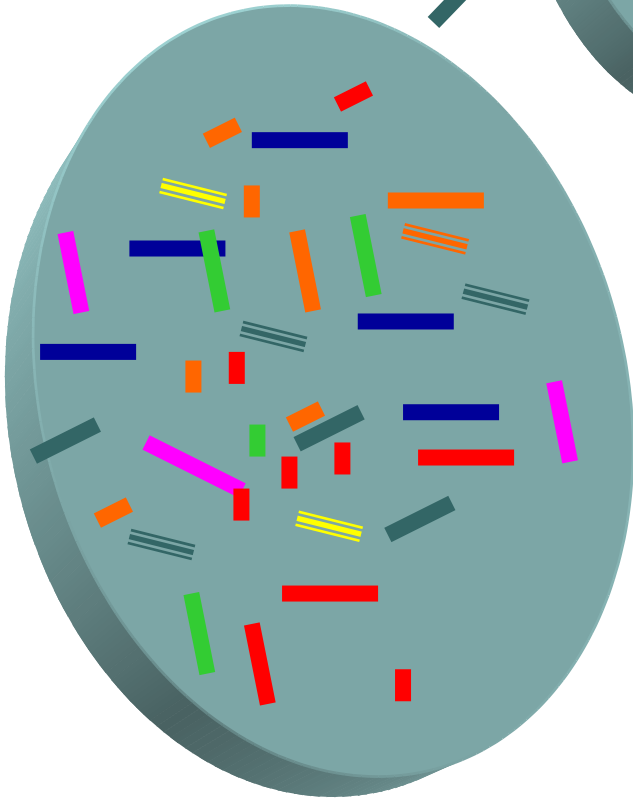
Types of work in the laboratory

- Largest volume of work is concerned with producing certificates of analysis following analyses of suspected controlled substances;
- Other work relates to work to check whether or not there are links between people and places

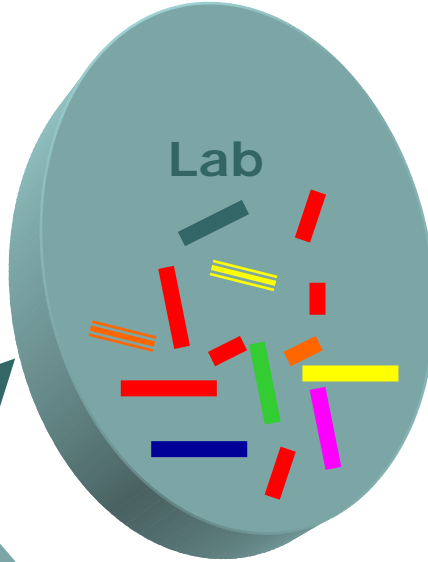




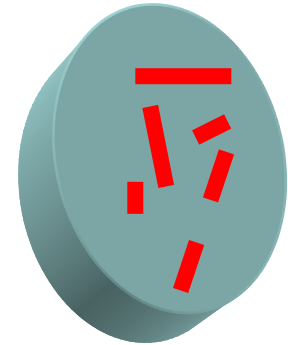
General Crime



Lab



Cases with useful forensic evidence



Janus



- Working in two modes –
- Investigator
- Evaluator



Investigator

- Working closely with AGS during investigation
- Generation of explanations to account for observations
 - Often in early part of an investigation
 - May be the only opinion possible
- Are there accelerants in the debris at a fire scene?
- Are footprints recovered from scene?
- Does blood pattern provide information about an assault?
- Is DNA recovered?



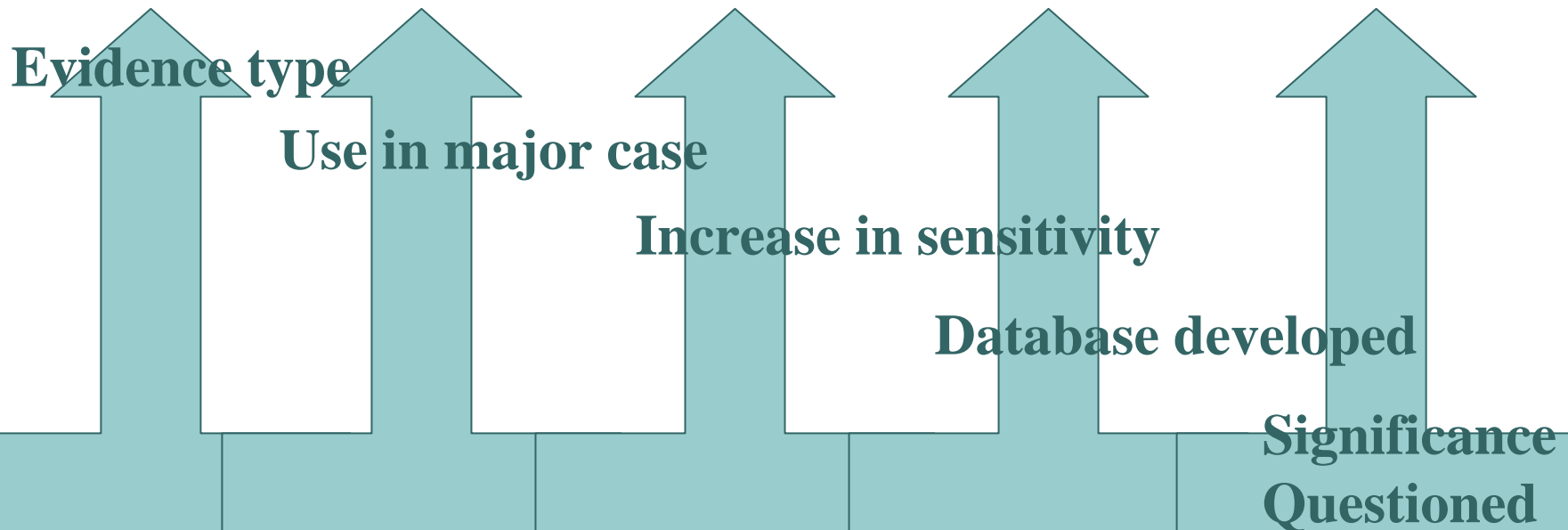
Evaluator

- Opinion of evidential weight based on
 - Case specific propositions
 - Framework of circumstances
 - For use as evidence in court
- Examples -
 - Significance of matching DNA profiles
 - Value of fibres recovered from car seat matching suspect jumper
 - Firearm residue on jacket cuff of suspect



Trends

- Involved with Forensic Science for more than 30 years
- The following is the trend I have observed in evidence types - though not necessarily in court



DNA most spectacular example



First use



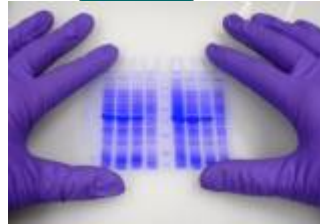
1984

Used in Irl



1995

Service in Irl



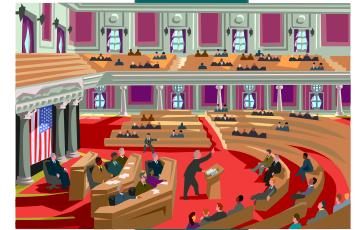
1994

UK database



1995

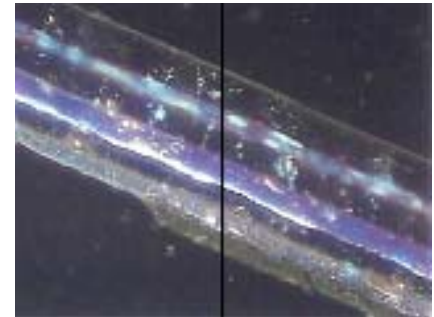
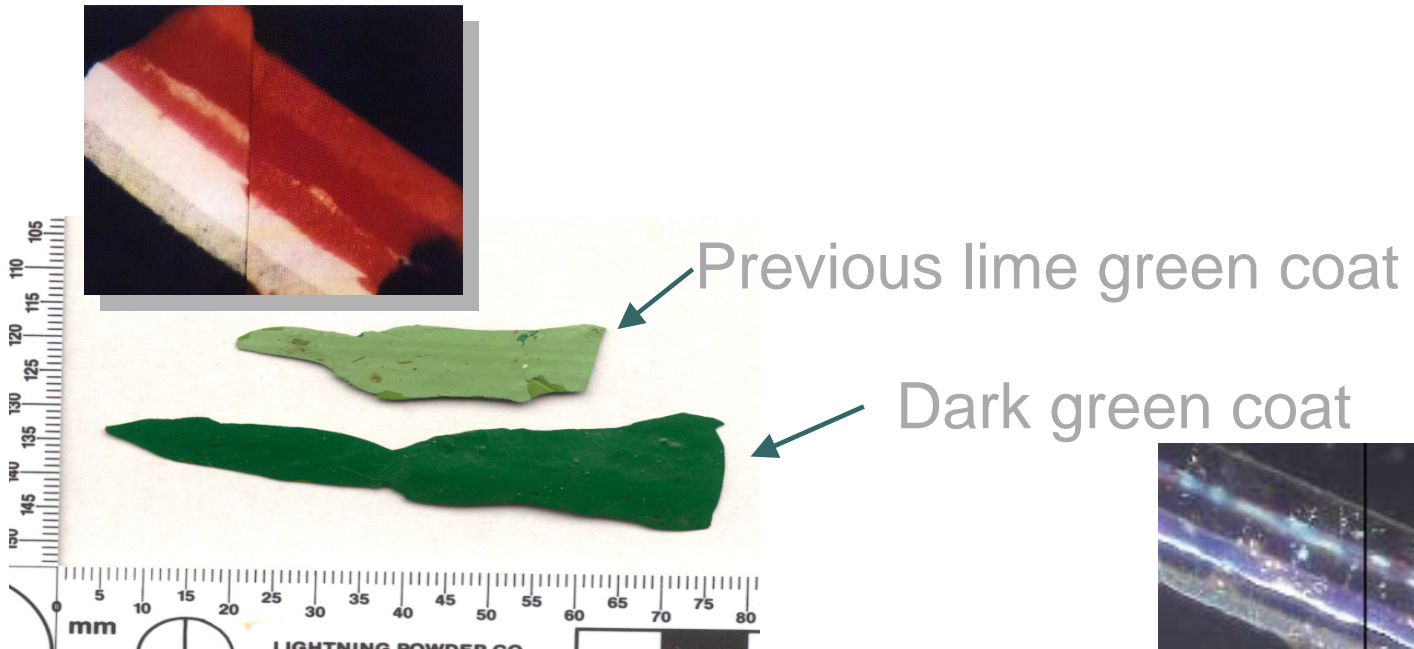
Legislation in Irl.



2010

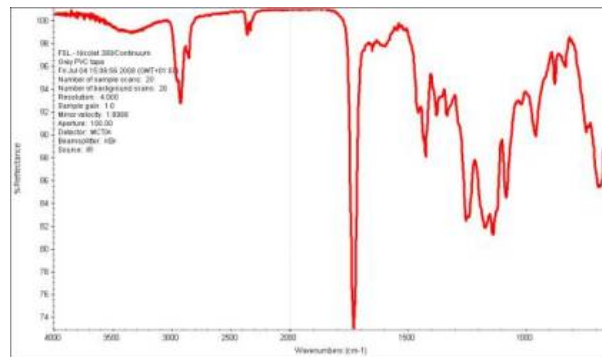
So what

- Early days factual reporting
- Examples – fibres paint



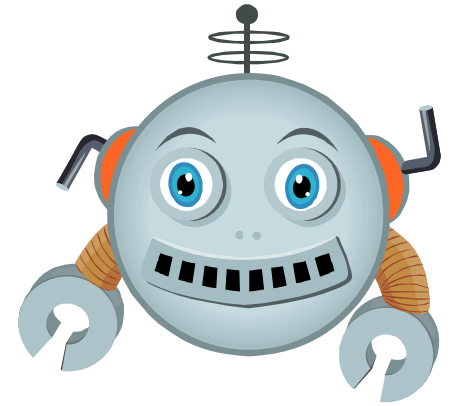
Typical questions

- Reliability
- Statistics
- Discriminating power
- Don't always address the issues at the heart of interpretation



Role of science

- Add to prior information
- Findings of themselves are neutral but to be useful need to support one side over the other
- Not stand alone
- Need to be used to discriminate



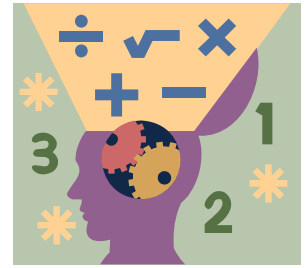
National Academy of Sciences

Very critical of traditional forensic science

- Question underlying science and validity
- Consider DNA to be gold standard because figures available to assist in assessment
- Made no mention of reporting and this is seen as a major flaw by some of the thought leaders in forensic science



Figures misleading



- 1 in 10,000,000 chance that you get this profile if it originated from another person
- Sounds definitive
- Real question not addressed
- How did profile arise
- What are expectations?



Risk assessment - Crime scene to court



Scene	Difficult to control	Implications for mistakes high
Transport	Easy to control	Implications for mistakes high
Prioritisation/ pre-assessment	Inter-dependence needed for control	Mistakes reversible
Testing	Controls easily put in place	Implications for mistakes high
Report writing/ Interpretation	High inter-dependence for control	Mistakes reversible if detected – serious if not
Court	Difficult to control	Implications for mistakes high

AFSP standards



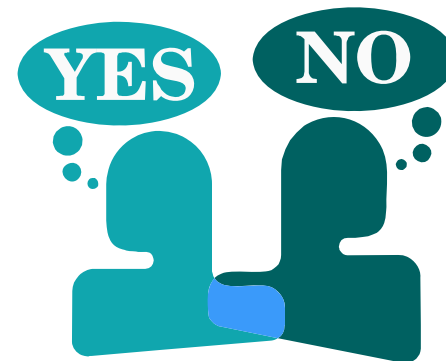
- Due to be adapted by ENFSI
- Based on four principles – logic, balance, robustness transparency
- Testing needs to meet international norms
- Innovative aspect that interpretation should be standard



What is Evaluative Forensic expert Opinion?

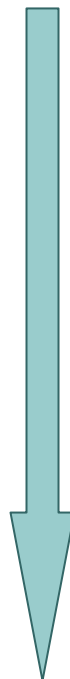


Observations



Jurors'
'common sense'

Jurors' appreciation
of the expert opinion



Expert Opinion

Judicial Guidance

Issues that the jury must consider

Some principles of evaluative forensic expert opinion

Balance

The expert will address at least one pair of propositions

Not true if evidence confined to that supporting prosecution
Not possible if we don't have the case details;



Some principles of evaluative forensic expert opinion

Logic

The expert will assess
the probability of the evidence
given the proposition

**Not true if scientist offers opinion on likelihood of an event
Result is a ratio rather than an absolute number**



Some principles of evaluative forensic expert opinion

Robustness

Opinion given will be capable of scrutiny

- Based upon sound knowledge of the evidence types and verifiable databases
- Results of examinations are robust

Not true if science used is not valid

or

if insufficient background data





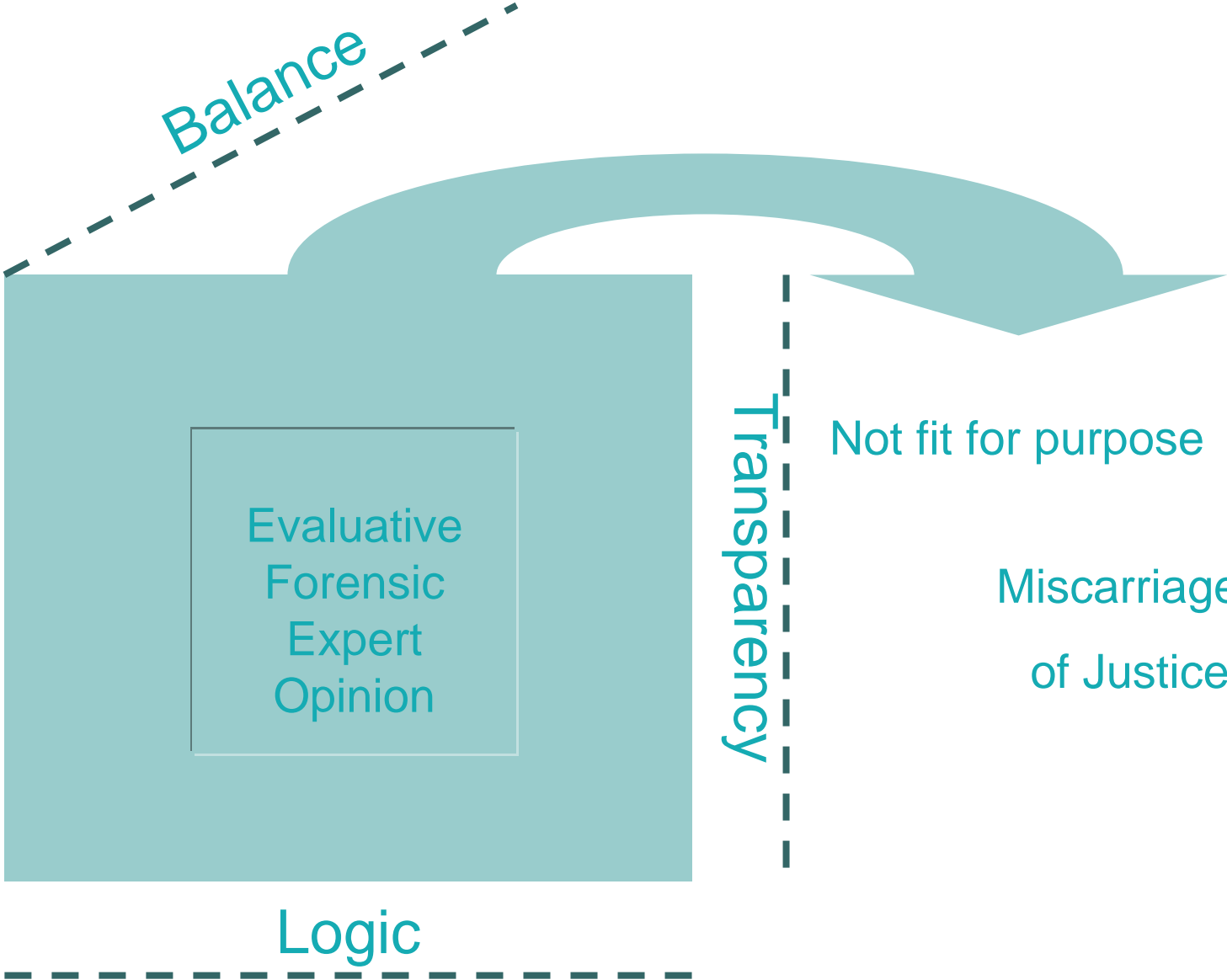
Some principles of evaluative forensic expert opinion

Transparency

The expert can demonstrate basis of opinion

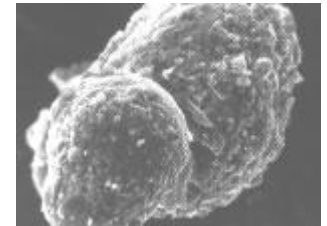
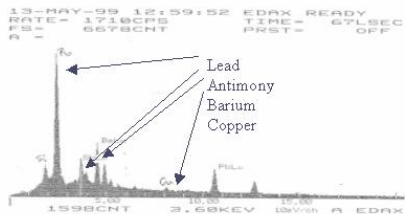
- Propositions addressed
- Examination results
- Background information
- Date used and its provenance

Not true if reports confined to factual findings



Examples from other countries

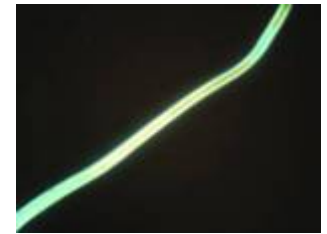
- Barry George appeal
- Firearm residue – single particle – appeal judgements lots of probing of technicalities of finding but real questions never arose
- Probability of 1 particle of FR if Barry George shot Jill Dando
- Probability of 1 particle of FR if Barry George didn't shoot Jill Dando



Belgium case



- Large number of 11 types of matching fibres between the garments of assaulted girls and M. Ait Oud
- Lot of technical work – emphasis highlighted the effort to ensure that analytical work was robust
- Support prosecution case
- Evidence equally likely if defence proposition was correct ie that suspect played with the young girls
- Source not relevant but activity that led to the transfer should be considered;



Sexual assault cases

- If consent is the issue in the case much of the work of the laboratory is neutral;
- Quite different if the examinations are carried out to check for support for either victim or suspects version of events;
- Another case from outside Ireland, lot of emphasis on DNA , real assistance when fibre work supported that sex occurred on a bed rather than in a lane way;
- Highlights the need to identify issue early on;



Some realities

- Irish system rarely have defence proposition until court case
- If defence proposition changes ratio of probability of evidence in two scenarios will also change
- Scientist will not necessarily be in a position to address this without some reflection;



Factual reports

- This material is Cannabis resin;
- The liquid contained approximately 40 % ethanol;
- The spray contained CS gas;
- Semen was detected;
- The material was identified as PETN;



Investigative interpretation

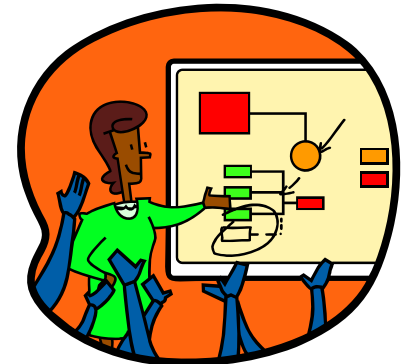


- There is an innocent explanation for the start of the fire;
- The paint originated from a Renault 21 manufactured since 2003;
- The blood pattern suggests that the assault began in the bedroom before the deceased moved into the kitchen;



Reports will include

- Background information used in assessment/interpretation
- Propositions addressed
- Relevant items received
- Items examined
- Significant finding(s)
- Conclusion(s)



Bayesian approach

- Method of updating probabilities
- Science should add to the other information in the case
- Posterior odds(Court result) = Prior odds(information other than science) x likelihood ratio (contribution from science)

$$LR = \frac{\text{Probability of evidence if } C \text{ is True}}{\text{Probability of evidence if } \bar{C} \text{ is True}} = \frac{P(F / C_i)}{P(F / \bar{C}_i)}$$

Conclusions for evaluative opinion

- Will be related to the propositions addressed and the estimated likelihood ratio
- The strength of evidence will be expressed either by a value of the likelihood ratio or using a verbal scale related to the value of the likelihood ratio.



Evaluative opinion

- The exchange of paints provide support for this vehicle colliding with the wall rather than another vehicle;
- My findings are far more likely if the victim's version of events are true rather than the suspect's version;
- My findings support the proposition that Mr. X broke the window rather than he passed by later;
- My findings are equally likely whether Ms X was sexually assaulted or had consensual sexual intercourse with Mr.Y;



Science is not about absolutes

- Governed by probabilities
- Yet useful – more verifiable than eyewitness or other circumstantial
- Clear reporting the key to ensuring that it is well used;
- Bayesian approach more likely to give clearer values for and against than less systematic approach



Hope for future

- Eolaíocht Fhóiréinseach Éireann
- Continue to produce high quality science
- Science used to address realistic issues
- Expressed in a manner that identifies its potential and limitations;
- Avoid the use of science as belt and braces which can actually be misleading

