



## Understanding forensic evidence: Do lawyers and the judiciary understand forensic evidence and the Bayesian approach?

By Jocelyn Ledward, QEB Hollis Whiteman

Do lawyers and the judiciary understand forensic evidence and the Bayesian approach. From the point of view of the Junior Bar, the answer to the question is probably 'no', although they think they do. The use of Bayes' Theorem has received very little judicial attention, and that some years ago now. This current lack of proper understanding is dangerous, from the point of view of the integrity of the criminal justice system. The privilege of being able to confer with expert witnesses is, in the vast majority of cases, underused. This can lead to misunderstanding and ineffective presentation of scientific evidence to tribunals of fact. The community of forensic scientists and the legal professions must work together to ensure a proper understanding of forensic evidence, both generally and on a case by case basis.

### Do Lawyers and the Judiciary understand the Bayesian method?

When I saw that in the programme for today's conference, I was rather worried – what is the Bayesian approach to the evaluation of forensic evidence? Thinking I must be a very badly informed barrister, I asked around – something of a straw poll of the Junior (and not so Junior) Bar. The overwhelming response was 'the what approach?'.

For the uninitiated, the internet offers some assistance, but I was no further enlightened when I discovered that Bayes's theorem had its origin in 1763, and could be expressed as:

$$P(h/e \& k) = \frac{P(e/h \& k) P(h/k)}{P(e/k)}$$

My maths 'A' Level suddenly seemed most inadequate. A little further digging seemed to reveal the gist of it – a method for evaluating the probability that a certain hypothesis is correct, given certain evidence. That is a concept which is more readily understandable for both the barrister and the lay tribunal of fact – I felt somewhat relieved, though not entirely – perhaps I did understand it after all, I just didn't know what it was called.

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So I turned to the question of judicial consideration of Bayes' Theorem, and discovered the reason why many of the Junior Bar may have little knowledge of the theory behind the Bayesian approach.

There are three principle authorities on this topic: *R v Doheny & Adams*<sup>1</sup>; *R v Adams (No 1)*<sup>2</sup>; *R v Adams (No 2)*<sup>3</sup>. Only *R v Doheny & Adams* deals with the question of the use of Bayes' Theorem in relation to scientific evidence (albeit previously considered in *R v Dee*) – the *Adams* cases centre primarily on the question of the use of Bayes' Theorem in relation to the evaluation by juries of non-scientific evidence, about which Rose L.J. had this to say in *Adams (No 1)*:

'...to introduce Bayes Theorem, or any similar method, into a criminal trial plunges the jury into inappropriate and unnecessary realms of theory and complexity deflecting them from their proper task.'

Anyone who has read the *Adams* cases will readily understand that criticism – how a jury is supposed to evaluate mathematically (in percentage terms) the probability that a crime was committed by a local man (using only their common sense and the surrounding circumstances of the crime) is beyond my comprehension.

This history perhaps explains why all the junior respondents to my straw poll didn't know what I was talking about:

- (1) the Bayesian approach has (by judicial authority) been confined to consideration of forensic and other scientific evidence where mathematical evaluations of probabilities can be carried out by experts armed with the appropriate statistical data and expertise (the most obvious example of which is in relation to DNA); and
- (2) judicial consideration of Bayes' Theorem has been relatively limited, and took place before large numbers of the Junior Bar had embarked upon their legal education, let alone been called or read their first forensic statement.

Further discussion with the straw poll revealed that the vast majority did understand the idea, and had some familiarity with it, but didn't know the terminology. This is hardly surprising. Anyone practising at the Criminal Bar cannot be unfamiliar with the approach of all statements of forensic scientists:

'I have considered the possibility that (the crime stain) was created by the defendant and the possibility that (the crime stain) was created by someone other than and unrelated to the defendant (and then the magic figure all prosecutors like to hear 1 in a billion, hopefully, or whatever it might be!).'

But, as the old adage goes, familiarity breeds contempt. Most criminal barristers will instinctively

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1 The Times Law Reports August 14, 1996, [1997] 1 Cr.App.R. 369

2 [1996] 2 Cr.App.R. 467

3 [1998] 1 Cr.App.R. 377

(and I am one of them), fast forward through the statement of a forensic scientist to 'the important bit' – but the real meaning of the scientific evidence is sometimes overlooked.

And the 'prosecutor's fallacy'<sup>4</sup> is still committed – perhaps not frequently, but it still happens<sup>5</sup>. A reality of the criminal justice system is that, as a category of expert witnesses, forensic scientists are rarely called – because their evidence is rarely disputed. The combination of this and misunderstandings (albeit slight) of the forensic evidence can lead to difficulties in two particular situations:

- when advising a defendant on plea,
- when summarising evidence to a jury.

When advising, the forensic evidence (by its very nature 'independent') can often be the determinant factor in a decision to plead guilty – the 'straw that breaks the camel's back' – unless the barrister (from the most junior to the most senior) understands properly the significance of the forensic evidence (which inevitably means understanding the Bayesian approach), there is a danger of a defendant being misled as to the strength of the evidence against him.

The summarising of forensic evidence to tribunals of fact, particularly juries, often takes place where (as in the majority of cases) the forensic scientist is not called. The reason – statements are (quite properly) long and set out a lot of detail (all of it necessary in the statement) which is not necessarily needed, particularly when dealing with a jury – and so (in the interests of justice and the easy comprehension of evidence which is beyond the common experience of the jury) it is summarised or reduced to admissions. The danger, if the barristers do not understand properly the meaning of that evidence, is that it will be summarised incorrectly.

There is a further drawback, but one which, it seems to me cannot be avoided – most barristers (who deal with this approach to evidence on a daily basis), let alone defendants or jurors do not readily understand the distinction between a 1 in a billion random occurrence ratio (1 in a billion people have a DNA profile that matches the crime stain) and a billion to 1 probability that the defendant left the crime stain and is therefore guilty – even if the random occurrence ratio is set out correctly to a jury, unless its significance is made explicit, they may well fall into the 'Prosecutor's fallacy' themselves.

In the days of *Doheny & Adams*, the 'best' random occurrence ratio to be found was one in 1 million – with a UK male population of 26 million, this meant that the defendant was 1 of perhaps 26 men in the UK with matching DNA. Against that background, the case emphasised the need to consider

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4 An error of statistical reasoning, such as the confusion of two conditional probabilities:

- (1) The probability that a DNA sample taken from an innocent person matches that found at the murder scene GIVEN THAT the person is innocent.
  - (2) The probability that a person is innocent GIVEN THAT their DNA sample matches that found at the scene of the crime.
- These two probabilities are NOT the same

5 Anecdote – recently, clearly committed by an experienced Judge – evident from his questioning of the forensic scientist who was called at the trial, and who was able to put the Judge, and so the jury, right, in the most clear and understandable terms.

the DNA evidence in the context of the 'other evidence' in the case (e.g. the whereabouts of the defendant at the time the crime was committed – what is the likelihood of two men with matching DNA being in the vicinity of the crime scene at the relevant time?).

Phillips L.J., in considering the prosecutor's fallacy in *Doheny & Adams* said:

'as the art of analysis progresses, [DNA evidence] is likely to become more [probative], and the stage may be reached when a match will be so comprehensive that it will be possible to construct a DNA profile that is unique and which proves the guilt of the defendant without any other evidence'.

We now frequently have random occurrence ratios of 1 in a billion, and they are not infrequently used as the sole basis for a prosecution, most commonly in cases of burglary. With a UK population hovering around 60 million (male and female), this would seem to indicate there is likely to be only one (unrelated) person in the UK with a DNA profile that matches the crime stain (and only about 6 people in the whole world).

These types of cases result in charge many months or even years later (after analysis, comparison with the national database, issue of warrant, and finding of the defendant, usually through some unrelated matter), when no defendant or prosecutor could be expected to produce other evidence (e.g. the rough whereabouts of the defendant on that particular day).

Is this correct? Or should there be any safeguards? Have we reached the point predicted by Phillips L.J. or not?

And what about fingerprints – 'I have never seen fingerprints of two different people match' – that is an illusory database – how many studies have actually been done? How should we be cautioning juries, without unnecessarily undermining our own evidence?

All of the above situations are detrimental to the interests of justice, and the integrity of the criminal justice system, and must be avoided at all costs. I don't suggest such misunderstanding is widespread, nor that the scientists are to blame – there is only so much simplification that can be done in relation to complex areas of evidence.

But this issue is not perceived as an 'issue' or a problem by the vast majority of the Bar – and it is perhaps time that we were refreshed.

### **The needs of the criminal justice system**

The above is a feature of a broader conundrum when it comes to adducing forensic and other scientific evidence of all kinds before a lay tribunal (most commonly criminal trials) – how to present complex evidence in an accurate way that can be readily understood by a lay tribunal, without detracting from the necessary detail or subtleties of that evidence – that is the primary concern of the Bar when dealing with forensic evidence.

That is an area where both scientists and lawyers are perhaps 'to blame'. The privilege of being able to confer with an expert witness is underused, particularly where that witness is not to be called 'live'.

I have often spent many hours wrestling with a complex written statement describing a particular blood-stain pattern, or ballistics evidence, trying to get a picture in my head, that I can then readily convey to a court or jury.

For example, a few years ago I prosecuted a case of a serious assault on an elderly woman by two younger companion alcoholics. The victim had very little clear recollection of the events (because of a combination of her state of intoxication and the injuries she sustained). The two defendants admitted presence, but each blamed the other for inflicting the injuries, claiming various bloodstains were on their clothes because they had walked through pools of blood or tried to help the bleeding victim after the event. The forensic evidence of (1) blood spatters and (2) deeply embedded blood in the seam of a particular shoe (consistent with creation of the stain with a vigorous kick, rather than walking through the blood after the event) suggested otherwise.

It was a complex crime scene, and there were a number of elements to that forensic evidence. The forensic scientist was to be called, and attended court early for a conference with me and defence counsel on the second day of the trial, mainly because defence counsel wanted to see his notes. We discovered in a bulging FSS file (which had been reduced to a 10-page statement) a mass of very useful diagrams and photographs – which made the points in the statements so much more readily understandable than the statement ever could, no matter how clear the language.

Greater use is being made in the courts of 'visual aids' to presentation of evidence, many courts are now equipped with a vast array of electronic presentation equipment – but it isn't used as often as it might be – in my view it should be used in every case which has that potential, not just the more serious and complex cases where a great deal of time and effort is spent on achieving the best presentation – but not for the sake of it.

### **How is this to be achieved?**

**Firstly**, better education of the Bar as to the work of forensic scientists – it is something we deal with every day, but really have very little understanding. CPD points are all the rage – nothing like the prospect of losing your practising certificate to stimulate interest in all sorts of different topics – so the Bar makes a receptive audience to almost any topic. Courses on forensic evidence should (like forensic accountancy and training on the ECHR) be compulsory aspects of a pupil's training.

For example, I had very little knowledge of one area of forensic science – firearms & ballistics. This is a complex area in which we are dependent on the experts, because of the legislative categorisations. We cannot assume that all baby barristers know the difference between a shotgun, an air rifle and a pistol, or how they operate, or what a casing or a bullet actually is (it took me some time to work it out, and I'm still not 100% sure). A John Wayne film is not the best source for understanding precise scientific terms. Online courses, and reference material (with pictures!) would be of great assistance. It is only by understanding the way forensic scientists work, the

scope of their work, and what they can and can't say, that the Bar can begin to present that evidence most effectively. We are there partly to paint a picture, to reconstruct a series of events from disparate pieces of evidence, and unless we can see the picture ourselves, we are never going to be able to present it to a jury.

**Secondly**, better communication between expert forensic witnesses, and lawyers involved in particular cases, even the more minor or less complex, so as to achieve the best presentation of the particular evidence in the case. I know it is something that can be easily achieved – it doesn't have to be fancy, a clear photograph or a handmade drawing, but a visual presentation almost always works better, and conveys instantaneously what a thousand words cannot.

I would personally welcome more direct access to expert witnesses (and by that I mean a telephone number or email address in the brief sent to me by the CPS, so that I can email or telephone the expert without having to get hold of the CPS – CJU – OIC, which can take days, if not weeks). We are shy of using up each other's valuable time, but a quick telephone (conference) call at a convenient moment, or a short email is all it needs to be – there don't have to be great meetings in chambers after court hours with the whole prosecution team. This 'short-cut' to discussion of presentation and understanding would be most beneficial.

For example, when out-sourcing for graphical presentations is done, usually via the officer in the case, this often results in to-ing and fro-ing of various drafts which are incorrect / inadequate. This can lead to confusion and errors being made before the jury. Could we be doing more between us? A graphics department within the FSS, which has the advantage of being in the same building as the scientist, so consultation can take place more easily (rather than the absurd situation of the police officers running around all over London with multiple drafts, that are going between the graphics company, the expert and counsel)? There are implications in terms of time and financial resources – but it has to be grappled with, and in the long run, may be cheaper and more efficient than spending thousands per case on outside agencies.

### **Conclusion**

The above are all just ideas – and imperfect ones at that, because they stem from limited discussion with other barristers. Better communication between us will lead to greater efficiency, accuracy and a fairer criminal justice system – we can't afford not to.

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