Evidence that "cannot exclude" the accused[1]

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An application of Bayes' Theorem to the DNA test results in
R v Dougherty [1996] 3 NZLR 257, (1996) 14 CRNZ 145.

The limits of common sense

Some people might think that there seems to be a difference between (1) evidence which is merely consistent with guilt, and (2) evidence which tends to prove guilt. An example of evidence being merely consistent with guilt is evidence that the accused has the same blood group as blood found at the scene of a crime: it doesn't establish the accused was at the scene at the relevant time, it simply suggests that he belongs to the group of people in the population who could have left the blood at the scene. Because this evidence does not itself "establish" a link between the accused and the crime, people who think along these lines will be inclined to say that it adds nothing to the case against the accused. All it does is fail to exclude the accused from the group of potential suspects.

Again, people who think in this way will contrast that sort of consistency evidence with evidence that has a more definite link with the accused. For example, fingerprint evidence which proves that at some time the accused was at the scene of the crime. This evidence tends to prove guilt, but obviously it must be combined with other evidence before guilt is proved. If this distinction between evidence which is merely consistent with guilt, and evidence which tends to prove guilt, is correct, it would follow that evidence of the first type should not be included in the evidence against the accused. It does not advance the prosecution case.

Judges do not think in that way. Evidence that does not exclude the accused can have probative value in establishing the prosecution case. At the most a judge will simply suggest to the jury that, although it is entirely a matter for them, the weight they may attach to evidence which merely cannot exclude the accused as the offender will be slight, if indeed any weight at all is given to it. In *R v Dougherty* [1996] 3 NZLR 257, (1996) 14 CRNZ 145 (CA) the trial judge had directed the jury that on the scientific evidence, which at this trial was of limited

[1] To check for updates to this paper, go to www.nzcriminallaw.blogspot.com and follow the link on the left to "selected papers available here". Bayes Theorem is also discussed in other papers available here, concerning propensity evidence, and LCN DNA analysis evidence.

sensitivity, "there is nothing to implicate the accused or as I apprehend it even some person other than the accused, as being the offender. It seems to be completely negative in its entirety." This direction was not criticised by the Court of Appeal. In using the expression "completely negative" the judge seems to have meant that the scientific evidence was of no assistance to either side.[2]

Dougherty will be considered further because it illustrates the following points: (1) evidence which is merely consistent with guilt can increase the probability of guilt, so that the distinction between the two types of evidence mentioned above disappears; (2) the expression "the accused cannot be excluded as a contributor to the sample found at the scene" is likely to cause confusion; and (3) such confusion may be expressed as a quantified probability which can assist the defence in showing that a verdict may have been wrong. At trial the scientific evidence had simply been that traces of semen on the complainant and her clothing were insufficient for analysis, as were traces of seminal fluid found on clothing worn by the accused the morning after the offences. A few months after sentencing, further tests were carried out on the samples obtained in *Dougherty's* case, and a report from the scientist was used as grounds for appeal against conviction. However that report was interpreted as not conclusively excluding the accused and therefore as not taking the issue of identification significantly beyond that which had been left to the jury, and the appeal was dismissed. Subsequently the defence obtained affidavits from three other scientists which offered an interpretation of the test results which was, to put it at its lowest, favourable to the accused. Indeed, their conclusions were that the accused was excluded as a possible contributor. When the matter was referred to the Court of Appeal by the Governor-General in Council the convictions were quashed and a retrial ordered.

Consistent with, or proving, guilt: a game

Suppose there are four coins, identical in all respects except that three of them are counterfeits made for betting, having a "head" on each side. The fourth is a normal coin of the same denomination. The coins are placed in a box which is shaken and then a person is asked to draw one coin from the box. What is the chance of taking a counterfeit coin? Clearly, three out of four, or 75%, or, expressed as a probability, 0.75. This part of the game may be called the

[2] Here the Court of Appeal (considering the appeal a second time) quoted the direction given to the jury by the trial Judge. At that trial, where Mr Dougherty was convicted, the DNA evidence was not of much value because the available tests were, by later standards, crude. After further scientific evidence had been obtained using a more sensitive DNA test, the Governor-General referred the question of the conviction back to the Court of Appeal, and this Court ordered a new trial.

"choosing" part. Now suppose that this chosen coin is tossed. The result is "heads". What is the chance that it is counterfeit? This part of the game is the "tossing" part.

This game illustrates the "cannot be excluded" type of evidence. The result of the tossing part, "heads", means that the coin cannot be excluded from the counterfeit group. The evidence, the result "heads", is consistent with the coin being counterfeit.

The problem of determining the chance that the coin is counterfeit given the result "heads" may be answered differently, depending on whether a common sense, that is, intuitive, approach, or a mathematical approach is taken. Intuitively it might be thought that the chance of the coin being counterfeit had remained at 75%, or probability 0.75. After all, it is the same coin which has just been selected in the "choosing" part of the game, and all that has happened is that it hasn't been shown to be a genuine coin. So it still has the 75% chance of being counterfeit.

That may well be thought to be common sense, but mathematically the matter can be taken further. Using Bayes' Theorem - see Robertson and Vignaux, *Interpreting Evidence* (1996) - it can be shown that after one toss with the result "heads" the chance of it being counterfeit is approximately 86%, or the probability of it being counterfeit is 0.86. And after two tosses, each resulting in "heads", the probability increases to approximately 0.92. Thus the mathematical approach gives a counter-intuitive result.

Mathematically, and therefore, most people would say, in terms of objective truth or "in reality", results of the "tossing" which cannot exclude the possibility of the coin being counterfeit actually increase the probability that the coin is counterfeit.

The "cannot be excluded" evidence does have its own probative value in terms of tending to prove guilt, and there is no distinction between evidence which is merely consistent with guilt and evidence which tends to prove guilt. In *Dougherty* the trial judge was being, from a mathematical point of view, unduly favourable to the defence in describing the scientific evidence as being of no value.

The accused "cannot be excluded"

In *Dougherty*, some confusion arose from the original scientist's conclusion after conducting the newly-available tests that the accused "cannot be excluded" as a possible donor of chemical material in the complainant's clothing. This was because that expression suggests that if the test had been able to be carried out adequately it might have resulted in evidence which did implicate the accused. A DQA-1 analysis of DNA contained in stains on the complainant's clothing had revealed faint traces of "4 spot". This appeared to suggest that allele 4, which the accused had and the complainant did not have, was present but was only barely detectable because of the low level or degraded state of the DNA. Properly applied, the test would require spots below a certain intensity to be ignored, and these spots were below that intensity. The misleading nature of the scientist's conclusion that the accused could not be excluded as a contributor was intensified because the 4 spots may have diverted attention (here, the Court's attention when hearing the first appeal) from the fact that the tests also revealed the presence of a 3 allele, which could not have come from the complainant or from the accused. The presence of the 3 allele was also less capable of an innocent explanation than had appeared at the first appeal for reasons relating to evidence of the lack of durability of DNA in stains.

This illustrates the need for care on the part of scientists before evidence can be given that the results of tests are that the accused "cannot be excluded".

The totality of the evidence

Juries are always required to look at the totality of the admissible evidence in the case. What, then, would have been the significance in *Dougherty* of the fact that (ignoring the 3 allele now to keep the matter alive) the 4 allele was shared by approximately 5% of the population to which Dougherty belonged? The other evidence in the case was the complainant's eye-witness identification of the accused as the offender, and Dougherty's consistently maintained denial and his calling of alibi evidence from his partner, to the effect that he was in bed all the night of the offence. Suppose that a given juror weighed up all the non-scientific evidence and concluded that it overall indicated an 80% likelihood of guilt. Then, if he were to apply Bayes' Theorem to the scientific evidence concerning the 4 allele, he would conclude that the new overall likelihood of guilt was approximately 99%. In other words there would be a 1% likelihood of innocence on all the evidence. Whether this amounted to a reasonable doubt would be a matter for that individual juror to decide for himself.

The Baysean formula is applied as follows:

$$\frac{P(G)}{P(NG)} = \frac{P'(G)}{P'(NG)} \times \frac{P(E|G)}{P(E|NG)}$$

$$= \frac{0.8}{0.2} \times \frac{1}{0.05}$$

$$= \frac{80}{1}$$

So, $P(G) = 80/81 = 0.99$

The point here is that the defence could, on the second appeal, have taken advantage of the mathematical approach to quantify the damage which the misuse of the evidence concerning the 4 allele had caused in terms of the Court's assessment of the case at the first appeal. It could not be said that the evidence of the 4 allele was insignificant: it increased the likelihood of guilt from, say, 80% to 99%. Or, in Bayesian terms, it produced a likelihood ratio of 20 which, when applied to (multiplied by) the prior probability ratio (80% to 20% = 4), resulted in a ratio of probability of guilt to probability of "not guilt" of 80 to 1, compared with 4 to 1 without the evidence of the 4 allele.

Getting at scientific accuracy

The scientist's report, reproduced in the judgement in *Dougherty*, was in a form which indicated that the accused could have contributed to the staining on the complainant's clothing. Such reports are necessarily based on the scientific evidence and do not take into account the wider matters of fact considered by the jury. In *Dougherty* there seems to be no possibility that anyone other than the offender contributed to such of the chemicals staining the complainant's clothing as did not come from her. The scientist should, in these circumstances (where an allele is present which could not have come from the complainant or from the accused), be asked the following questions by counsel for the accused:

- Did the [3 allele] come from the complainant? [No]
- Did it come from the accused? [No]
- If the jury find as a fact that no one other than the rapist had any sexual contact with the complainant, do the scientific tests show that the accused was not the rapist? [Yes]

Remarkably, a similar situation has occurred before, and in relation to evidence given by the same scientist. In *R v Mairia* HC Auckland, T151/94, 25 October 1994, the accused was charged with rape. He was identified by the complainant

and by another person. DNA testing revealed an allele which could not have come from the complainant or from the accused. The complainant's boyfriend had the allele but had not had sexual intercourse with the complainant for 12 days, and the complainant and another scientist thought it highly unlikely any of the boyfriend's body fluids could have contributed to the relevant staining. The scientist eventually accepted defence counsel's proposition in the form of the last question stated above. The accused was acquitted. He had confessed, in spurious circumstances, and that had been ruled inadmissible on a pre-trial application: see *R v M* (1994) 12 CRNZ 268 (and as *R v Mairia* [1995] 1 NZLR 242).

So, what happened in the *Dougherty* proceedings?

After spending three and a half years in prison, Mr Dougherty was acquitted at a retrial, and four years later, after the government was advised that further, more advanced DNA testing had proved that he was not the offender, he was given compensation of more than $800,000.[3]

[3] For a news report, see http://tvnz.co.nz/view/news_national_story_skin/47392 .