Case No: 95/1169/Z5

Neutral Citation Number: [1996] EWCA Crim 222

IN THE COURT OF APPEAL
CRIMINAL DIVISION

Royal Courts of Justice
The Strand
London WC2

Date; Friday 26th April 1996

B E F O R E :

LORD JUSTICE ROSE

MR JUSTICE HIDDEN

and

MR JUSTICE BUXTON

- - - - - - - - - - - -

R E G I N A

- v -

DENNIS JOHN ADAMS

- - - - - - - - - - - -

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MR R THWAITES QC appeared on behalf of the Appellant
MISS S TAPPING appeared on behalf of the Crown

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JUDGMENT

LORD JUSTICE ROSE: Mr Thwaites, for a reason at present unknown the appellant is not yet here. We are minded to deliver the judgment. In any event there will be a transcript for the appellant to peruse if he wishes. We will not, however, hear any argument in relation to retrial until he is here.

MR THWAITES: I am grateful and I consent to that course.

LORD JUSTICE ROSE: On 24th January 1995, at the Central Criminal Court before His Honour Judge Gordon, this appellant was convicted of rape and was sentenced to seven years' imprisonment. He appeals against that conviction by leave of the single judge.

The victim of the offence was a Miss M who was walking home after an evening out on 6th April 1991. Her attacker was a stranger. He approached and asked her the time. She saw his face for a matter of seconds before looking at her watch. He raped her from behind. She reported the attack to the police and a DNA profile was obtained from semen on a high vaginal swab. In October 1993 she attended an identification parade but did not pick out the appellant or anyone else. At committal proceedings she said the appellant did not look like the man who had attacked her. The appellant was 37 and the complainant said at one stage in her evidence that he looked 40 to 42. The description which she had given was of a white, clean shaven, man with a local accent aged 20 to 25. The prosecution case rested entirely upon expert evidence in relation to the DNA sample which was challenged by the defence. In evidence, the defendant gave an alibi for the night of the attack which he said he had spent with his girlfriend who also gave evidence before the jury.

Submissions were made by the defence on the voire dire which resulted in STR evidence being excluded by the judge from the jury's consideration. This was on the basis that there was no proper expert evidence to be placed before the jury to enable them to know how to treat the material in conjunction with the single line probe evidence which was admitted.

Doctor Harris for the Crown said that DNA profiles from the appellant and the crime's scene sample were compared and a visual match within one percent declared. Computer calculation indicated that the chance of a randomly chosen unrelated man matching the DNA profile was 1 in 297 million rounded down in the interests of

"conservatism" to 200,000,000. That calculation was based on nine bands of DNA identified in the profile. Professor Donnelly for the defence gave evidence, by agreement, before the prosecution case was closed. He said it was logical and consistent for the jury to deal with the rest of the evidence in the case in statistical terms and for the jury to do this using the Bayes theorem. He identified four types of evidence which could be evaluated in this way, namely the probability that the offence was committed by a local man (which the appellant was), the non identification evidence, the appellant's evidence and the alibi evidence. The Crown accepted that the Bayes theorem was a valid method for looking at non statistical matters in statistical terms and the judge directed the jury in relation to the Bayes theorem in terms to which we shall shortly return. In cross-examination and by its own expert evidence, the defence criticised the methodology of the Crown's experts in a number of respects which it is for present purposes unnecessary to rehearse. The jury convicted unanimously after a retirement of some five hours.

For the appellant, Mr Thwaites QC submits, first, that the judge should have excluded the DNA evidence because it was no more than a rough estimate, inconclusive in itself and inadequate to found the prosecution case. The judge should have excluded it in the exercise of his common law discretion, because its prejudicial effect exceeded its probative value and he should have excluded it under section 78 of the Police and Criminal Evidence Act because of its inappropriate impact on the fairness of the trial. It is apparent from the judge's ruling that he bore in mind that this was the first case in which the Crown had relied exclusively upon DNA evidence. He took into account the technical and complex nature of the evidence. He rejected the proposition that such material could only be used in confirmation of other evidence. He took into account that, as it was the only evidence, it would need to be scrutinised with the greatest possible care. He took into account that the evidence was criticised. He considered the provisions of section 78 and his common law powers and concluded that it would be wrong to preclude the jury from considering the evidence. In the judgment of this court that approach was unimpeachable. No flaw in the exercise of the judge's discretion is demonstrated. There is no principle of law that DNA evidence is in itself incapable of establishing guilt.

Mr Thwaites drew our attention to a number of authorities including In re J-S [1981] Family Division 22, R v Gordon [1995] 1 Cr App R 290 and R v Adekunle (unreported) transcript 26th January 1993, a decision of Judge Smedley QC. None of these provides any support for Mr Thwaites' proposition that DNA evidence alone is incapable

of proving guilt. That is unsurprising. In every case, the probative effect of a particular piece of evidence depends on its quality individually and in relation to all the other evidence. It is, in our view, wrong to describe DNA evidence generally, or the DNA evidence that was presented in this case, as no more than a rough estimate of that which it seeks to establish. Mr Thwaites' contention to that effect appeared to be based on the practice of statisticians, in presenting DNA evidence, of rounding down very large figures of probability in order to produce a figure or concept more easily handled by the jury. In the present case, the prosecution evidence was that the chance of a randomly chosen man matching the DNA profile taken from the semen found in the victim was one in 200,000,000, that figure having been rounded down from that of one in 297 million yielded by the actual calculations. We were also told that it is the practice of the Metropolitan Police to express any result giving a probability of greater than one in ten million in terms of one in ten million. There is nothing in that practice that make the results either rough or an estimate. Any of the figures mentioned, taken on their own, are plainly very cogent evidence. However, whether the evidence of those figures is reliable in itself depends on scrutiny of the assumptions and methodology of the original calculations, which can be the subject of enquiry at trial. The extent to which such evidence survives such scrutiny sufficiently to establish guilt is, as we have said, a separate question to be assessed in the light of all the evidence in the case. There is, however, nothing inherent in the nature of DNA evidence which makes it inadmissible in itself or which justifies a special, unique rule, that evidence falling into such a category cannot found a conviction in the absence of other evidence.

Mr Thwaites contended, somewhat faintly, that, as the appellant has a brother of the full blood and as there was evidence that the chance of a full brother having the same nine DNA bands is one in 220, this weakened the DNA evidence against the appellant. But, as there was no evidence as to the brother's actual DNA profile nor any suggestion that he might have committed the offence, the point leads nowhere and we disregard it. The first ground fails.

Mr Thwaites' second submission is that the judge should have withdrawn the case from the jury, either at the close of the prosecution case or (although no submission to this effect was made at the time) after all the evidence had been heard. In our judgment this is an impossible contention. The prosecution evidence, in particular from Dr Harris, was that to which we have already referred. If this was accepted by the jury the probability was that the chance of an

innocent man matching the DNA profile of the sample from the complainant was one in 200,000,000. Professor Donnelly for the defence, having made various criticisms of the prosecution case, said "I don't accept that the figure of 200,000,000 necessarily does err in the direction of the defendant. It is not clear to me what the right answer is or how far it might be wrong, but certainly I think it is quite plausible that the right answer might be in the range of 2 million rather than 200,000,000 because of the sorts of concerns I have raised." It follows in our judgment that there was material for the jury to consider both on the prosecution evidence, as the judge correctly ruled and taking into account the defence evidence also. This submission fails.

Mr Thwaites' final submission is that the judge misdirected the jury as to the evidence in relation to the Bayes theorem and left the jury unguided as to how that theorem could be used in properly assessing the statistical and non-statistical evidence in the case. For the Crown, Miss Tapping submits that there was no misdirection as to the evidence and that if the judge had gone further than he did in guiding the jury as to the use of the theorem he would have improperly usurped their function.

In order to assess these rival submissions it is necessary to examine and compare the evidence which was given and the summing-up.

The material part of Professor Donnelly's evidence-in-chief starts at Volume 2, page 32D to 33C:

> "Q. Now is it possible for the jury in this case to approach the evidence along statistical lines?
>
> A. You mean the entirety of the evidence, or the DNA portions of it?
>
> Q. The DNA evidence has been reduced to statistical estimates, so that we have got to deal with that, that is how it is expressed. Can they attempt if they want to do so, subject to the directions they will be given by the Judge in due course, can they attempt to deal with the whole of this case in statistical terms?
>
> A. That is possible, yes.
>
> Q. Is it a logically sound approach?
>
> A. It is and in fact more than that is true, it is the only logically sound and consistent approach to considering situations such as this.
>
> Q. In your view is it, or may it be, a practical proposition for them to attempt that exercise?
>
> A. I think it is practical, yes.
>
> Q. So far as you are concerned if it is the only logical approach is that the approach, so far as you are

qualified to do so, you would recommend them to take?

A. I think my position would be that if one wanted to be logical and consistent there is no choice but to do it in the way that is recognised for these situations.

Q. What does that involve by way of mathematical or statistical theory?

A. There is a theory called Bayes theorem, that is the name given to it, which explains how one should use different pieces of evidence -- the DNA evidence is one example, there may be other pieces of evidence -- to change one's assessment in the light of uncertainty.

Q. If the jury wanted to work through to such a position, could they do it simply?

A. I think relatively simply, yes.

Q. How many questions would they have to ask themselves in relation to each piece of non-DNA evidence in the case?

A. Broadly for each piece of similar type of evidence they have to ask two questions.

Q. We have identified the following areas of evidence in the case. The probability that it was a local man who committed the offence: point number one. The non-identification evidence of the victim: point number two. The evidence of the defendant in due course himself: point number three. And the alibi evidence to be called on his behalf is point number four. Those are the four areas of evidence. Does it follow they would have eight questions?

A. Effectively yes, maybe only seven because the first one is a starting point..."

At page 34 the evidence continued:

"Q. So they would have seven questions, seven answers, and they could then be told how to deal with those answers?

A. Yes.

Q. And carry them forward to whatever their view was of the statistical estimate that was appropriate to apply in the context of the DNA evidence itself?

A. Yes.

Q. That would be logically consistent?

A. Yes, in fact as I said that is the only logically consistent way.

Q. The alternative is what, that they try in some way balance non-statistical evidence against statistical evidence? Is there any formula, a simply formula that can be applied to that, or not?

A. It is clear as I understand it that the problem in a case such as this is to compare the evidence which is not obviously statistical with the evidence that is statistical. There is one recognised and accepted way of doing that which avoids being inconsistent. I do not know of others, well, more than that is true, it has been shown

that there is exactly one way of doing it that avoids inconsistency. Of course people reach decisions in the presence of uncertainty by other methods.

Q. Without reference to any statistics at all?

A. Yes.

Q. But there is no formula that can combine the two if one remains in numerical quantities and the other remains in general expressions of evidence?

A. That is right.

Q. May we attempt to suggest the workings of this method hypothetically for the jurors' later consideration, subject to the direction they receive?

A. I am happy to try and help.

Q. Let us take our starting question, and if any member of the jury wish to take it down this might be an appropriate moment for them to do it. What is the starting question, question number one that you would pose if you were approaching this on the Bayes theorem basis?

A. The first thing that I think one should ask is what is the chance, having heard nothing about this particular case, what is the chance that the real attacker, the rapist, comes from within the local area?

Q. Have you got a figure, a working figure for us of the area we are concerned with in this case of eligible men between the age of 15 and 60.

A. Yes, my understanding from Hertfordshire County Council is that in an area within 15 kilometres, that is their definition, that is about 10 miles, of Hemel Hempstead there are just over 150,000, I think 153,000 men between the age of 18 and 60.

JUDGE GORDON: That comes from some form of census, does it?

A. I think so, my Lord, yes. That local area does not include either Luton, which is to the north of the area where the offence occurred, or London, which is to the south. In asking about the chance it is a local man local would mean not including Luton or London or any of the other areas outside that range of 15 kilometres or possibly just outside, from London, or possibly a long way away.

MR THWAITES: Would we as statisticians round that figure down to 150,000 for convenience of doing the sum, or does it not matter?

A. I do not think the difference between 150,000 and 153,000 is going to be significant.

Q. So we have got that figure, do we now have to nominate the probability of it being a local man?

A. One does, yes.

Q. If I suggested it was a 75 percent chance of being a local man.

JUDGE GORDON: That is the decision that the jury are going to have to make, is it not?

A. Absolutely.

Q. This is an illustration.

MR THWAITES: It is only for illustrative purposes, unless we have a probability we cannot make sense of it.

JUDGE GORDON: No I follow that but the jury are to put a question mark if they are writing down.

MR THWAITES: Oh, yes, they do not nominate my figures because they are picked out of the air.

JUDGE GORDON: You are just showing us what happens on certain figures?

MR THWAITES: Yes. Mr Lambert, I think, suggested 50 percent. I pick the figure 75 percent.

JUDGE GORDON: 75 percent chance that it is a local man?

MR THWAITES: Yes. How do we translate that into our 153,000 to give us a figure to carry forward to the next part of the sum?

A. Let me tell you the mechanics and then explain the rationale. The mechanics are that if one thought it was 75 percent, 75 percent is 75 over 100, you take the 150,000 and you multiply by what we call the inverse, you multiply 150,000 by 100 over 75. The effect of that would be to increase it by about a third. The reason for that is that the rationale is that if we were certain it was a local man and there are 153,000 relevant local men, the fact that it is a particular one, Mr Adams, we would assess as 1 over 150,000. If we are not certain it is a local man our assessment for a particular local man will be decreased a bit. The way that changes is that you take your 150,000 which are the odds, 150,000 to 1 are the odds on innocence, and you increase that by 100 divided by the percentage, 75 percent. In this case, I think it was his Lordship yesterday took 50 percent for the local man as a working example that would double the figure of 150,000 to 300,000, as Mr Lambert said.

Q. So when we have got this figure 150,000 times 100 over 75, do we do that little sum now or do we leave it until later?

A. Either is fine.

Q. Well, let us do it now and carry it forward?

A. May I use a calculator?

JUDGE GORDON: I do not mind you using a calculator.

A. That gives us £200,000.

Q. You take 150,000 as being the 75 percent?

A. Exactly.

Q. So you then add another 25 percent on to bring it up to 100?

A. You probably add a third on.

Q. Yes, 25 percent is a third of 75.

A. Yes.

MR THWAITES: So, what are we left with after this part of the calculation? How do we express what we have got?

A. We have now changed to a situation where our odds on a particular local man, Mr Adams is the one of interest, but a particular local man being the true rapist is 200,000 to one now.

Q. Is that the same as 1 in 200,000.

A. One way of putting it is to say that the odds are 200,000 to 1, another way which is virtually identical is to say that the chance is 1 in 200,000."

The witness then dealt with the non identification evidence at 37G to 38G:

"Q. You are saying if he was innocent what is the chance that he would not match her description?

JUDGE GORDON: Is this in percentage terms or in any way you like?

A. It is probably easiest to express probabilities as percentages, my Lord, with zero percent representing completely impossible and 100 percent representing absolutely certain, and 50 percent is even odds, it is the chance of getting a head if we toss a fair coin, for example. That is the scale on which one should think about probability.

MR THWAITES: What is the chance that if he is innocent he would not match the description I might put that at 90 percent?

A. Very well.

JUDGE GORDON: Again I make clear this is a jury question. Can we just indicate each time which are the jury questions?

MR THWAITES: Whenever I give a figure that is a matter for them to decide, that simple rule of thumb, my figures are only hypothetical. That is the first part of question. What is the second part?

A. The second question sounds similar, it is what is the chance of that evidence if in fact Mr Adams is guilty.

Q. You mean that he would not match the description?

A. Yes, if Mr Adams were the true rapist the question the jury must ask is what is the chance that the victim would say his description is different from Mr Adams, that the victim would identify someone and then soon afterwards not identify Mr Adams and make the statement the Magistrates' Court.

Q. I would take the other percentage, my figure again, a matter for the jury, and I would say that there is only a 10 percent chance of that.

A. Very well.

Q. So you have got those two figures?

A. I have, yes.

Q. How do we deal with them because this is the first time we have dealt with the double figure, in the first point we did not have that?

A. What matters is the ratio of those two figures. What matters is how much more likely one thinks the evidence is if Mr Adams is guilty than if he is innocent, or how much less likely? In this case if we put it that way round if we put the probability of the evidence given guilt on the top line, we have 10 percent on the top line the hypothetical figure that has been suggested, and on the bottom line we have the probability of the evidence given innocence of 90 percent, so 10 over 90 which is 1 over 9. We multiply that number, 1/9th, by our starting figure of 1 on 200,000.

Q. If we could do the sum what answer would we get?

A. I think we would get, being brave without a calculator, 1 in 1.8 million.

Q. Is that the same as we had in the first question, does that represent the chance that Adams is guilty?

A. Yes."

The witness then dealt with the evidence of the defendant himself which Professor Donnelly assessed at 50 percent i.e. neutral. He was then asked to deal with the alibi evidence at just below 40D to 41C:

"MR THWAITES:...What is the question. What is the chance that he would have an alibi if he was guilty?

A. More specifically what is the chance that whichever witness gives the alibi evidence would give that kind of evidence.

Q. If he were guilty?

A. Yes, if he were guilty. How likely is whatever evidence on the alibi the jury hear if he is guilty: that is the first question. The second question is how likely is that sort of evidence if he is innocent?

Q. So let us just nominate the figure of 1 in 4, 25 percent in answer to the first question. And what is the chance that he would have an alibi if innocent let us say 50 percent. I am giving him a greater, on my figures, I am giving him had a greater probability of him having an alibi if he is an innocent man.

A. Yes, in fact your figures of 25 percent and 50 percent are saying that you think that particular alibi, or that sort of alibi evidence is twice as likely if he is innocent than if he is guilty. That piece of evidence you are saying points in favour of his innocence, you are saying is twice as likely if he is innocent than if he is guilty.

Q. Doing our little equation again we are going to put 25 over 50.

A. And get half.

Q. And we are going to multiply that by 1.8 million on the assumption- - -,

JUDGE GORDON: Is that not twice as likely, I think we have done the mathematics, have we not?

MR THWAITES: Some of us have, others may be slower. What is the figure that we come to?

A. We take the figure we were before this piece of evidence in which is 1 on 1,800,000 and we multiply it by evidence in which is 1 on 1,800,000 and we multiply it by 1 on 2, or 25 percent on 50 percent in your example, and the effect will be to change the 1 on 1,800,000, his Lordship will check my arithmetic, to 1 on 3,600,000.

Q. So on this entirely hypothetical basis we have got the figure of the probability of Adams being guilty from the non-DNA evidence as 1 in 3.6 million. I have done all the sums which the jury would do.

A. Yes, nothing hypothetical about the questions, they are the questions that need to be asked but the numbers to be put in to the formula are the jury's assessment and not mine."

He then dealt at 42C with the DNA evidence:

" Q. ... Now the 1 in 200,000,000 is the chance of the DNA evidence, you will hear that I disagree with figure, but if we accept that figure for the moment numerically, that is claimed to be the chance of the DNA evidence if Mr Adams is innocent. So we still ask the same two questions about the DNA. What is the chance of the DNA evidence if he is guilty? That is usually assumed that that is 100 percent that if Mr Adams were the rapist the rapist DNA would match his DNA. That is usually assumed that that is certain and I would not quarrel with that in this case. We ask the two questions and we have 100 percent on the top line as the chance of the DNA evidence if he is guilty and accepting for the moment the figure we would 1 on 200,000,000 on the bottom line. Now that ratio of effectively 1 divided by 1 divided by 200,000,000 gives you 200,000,000. So we do the same thing as before we take our odds of 1 in 3,600,000 and we multiply them by the relevant figure for the DNA, which for the moment we will take to be 200,000,000. So we have 1 on 3,600,000 multiplied by 200,000,000 and we get about my calculation tells me about 55.

Q. What is that 55,000,000?

A. No, it is saying that the odds, it is much easier I think to think in terms of odds, the odds of him being guilty before the DNA evidence were 1 to 3,600,000. The DNA evidence has changed those and it is now 55-1, on these figures, in favour of his guilt. So the final position we arrived at with this hypothetical scenario is to a view that he is 55 times more likely to be guilty than innocent.

Q. If the DNA figure in the jury view were to be reduced to 20,000,000 or 2,000,000 do we do a simple factoring exercise or do we have we to do a different exercise to find out the percentage possibility?

A. Taking that figure of 55 we have got to you just do a factoring exercise. So if the DNA number changed from 200,000,000 to 20,000,000 the 55-1 that he is guilty would change to 5-1.

Q. And the 2,000,000?

A. To 2,000,000 it would change to being just under two times more likely that he is innocent than guilty. So when the DNA number is 200,000,000 we think, accepting the rest of the hypothetical, we would think that

the chance that he is guilty is 55-1. If the DNA evidence were 20,000,000 we would think the chance he was guilty was about 5 and a half to one. If the DNA figure were about 2,000,000 we think that the chance of him being guilty is about 1-2, his almost twice as likely to be innocent than guilty on that assessment.

Q. So the jury can see on a statistical analysis crucial importance of trying to determine the correct starting figure for the DNA?

A. Yes, on that hypothetical assessment of the other evidence the changes of the sort you have suggested would actually make a big difference to the final outcome."
In summing-up the evidence in relation to the Bayes theorem the judge said this:

> "Professor Donnelly said that the right way indeed in his view the only logical way to assess other evidence against statistical and scientific evidence is Bayes theorem. Well, as a statistician I suppose he would say that and he may well be right, it is not for me to say. Whether you decide to use it and do your best to operate Bayes theorem or not is up to you. It is right to say that whatever method you use it involves at the heart of it your judgment of the evidence even if you are using Bayes theorem as you will remember ultimately you have to say how many times is it more likely one question is right than the other, that is at the heart of it."

At page 28F to G the judge said this:

> "We will now turn to look at what the defence say about the DNA evidence. What they say really falls into two parts. They say first of all although the random figure, in particular the 200,000,000 one, as a figure looks impressive if you look at the other evidence in this case statistically - that is to say using Bayes theorem - it rapidly becomes less so. They say whatever figures are used the illustration by Professor Donnelly were revealing in the effect that they had upon the prosecution's figure. They say the use of the Bayes theorem, or something like it, shows that the figure is nothing like as grand as it initially appears."

At 29E he continues:

> "...one has really got to look at both those and that means starting with Bayes theorem. Now as I say it is entirely up to you whether you want to use it or not. As a theorem it is agreed in principle between both sides that it is a way of looking at non-statistical matters in statistical terms. Whether it is a practical for you a jury to operate it is as I say something that you will decide for yourselves. You know that Professor Donnelly suggested that you might want to start with the male population of a 10 mile/15 kilometre area and a figure was produced from some local authority of 150,000. This is just giving you illustrations apart from these figures, I am not going to give you anymore you need not worry, it is just to show you how it works to remind you how it works since it was last week that we heard about it. If one says we think there is a 75 percent chance of the person who did it being a local man that would mean that 150,000 would be 75 percent of the relevant population we are talking about. That would mean as a matter of pure mathematics that the relevant population is 200,000 because 150 is 75 percent of 200,000. That is if you took three-quarters. Supposing you said in our view it is a 90 percent chance bearing in mind the hour of the day, where it was etcetera, then as a matter of mathematics - unless I have got them wrong which would not be surprising - you would have a relevant population of 166,666.6 recurring. That is a straight mathematical question depending, like all these things do, on your assessment of matters of fact, here the percentage of the population the percentage chance of it being a local man. No one can tell you that. You are the only ones who can decide that as your start off on the Bayes theorem route.

Then you have to look, do you not, at all the evidence to see the effect that that other evidence has upon the figure that you have now got and you ask yourselves to operate this theorem two questions, do you not? What are the chances of this bit of evidence being given if the defendant is guilty? Secondly, what are the chances of it being given if he is innocent? If the chances are even, is equally likely to be given either way, quite obviously that piece of evidence would be a neutral and would not assist you from one conclusion or another: the statistician and the rest of us would all come to the same obvious conclusion about that. If the answer to one question is more likely than the other you then ask yourselves how many times more likely? These are value judgments for you and you alone. How many times more likely? If guilt is more likely from a piece of evidence you divide, sorry, if guilt is more likely taking the figure that you started out with you divide. If it is three times more likely you divide by three. If innocent you multiply the figure. You see the mathematics you are getting at to produce from your analysis - and I go back to it being your analysis - of the likelihoods there."

At page 45C he said this:

"...while you are fresh and so am I just want to recap very briefly over two aspects of Bayes theorem that I do not think I was very clear about yesterday afternoon. Only those two, it will only take me a moment and then we will move on. Can I pick it up at that stage, and we are dealing with illustrations because the decisions are yours. Professor Donnelly's illustrations where he has taken the 150,000 has made an assumption that you may agree or disagree that there is a 75 percent chance of it being a local man which brings the figure up to fortunately to the round one of 200,000, it being a chance of one in 200,000 at that stage of Bayes theorem that the defendant is the rapist. We have got to that stage, alright. Then you take the other evidence the non-DNA evidence broken down as you find convenient and you ask about it the two questions that I dealt with yesterday: what are the chances of it if guilty? What are the chances if innocent? It is the conclusions you have come to having done that exercise, it is the first matter I want to deal with. If the evidence is more likely to have been given if the defendant is guilty that makes it more likely that he is the rapist. Nothing very complicated about it. Mathematically applying the theorem, this is an illustration. If it is twice as likely to have been given if guilty than if innocent that makes it twice as likely that he is the rapist. And on the figures you have at the moment that would mean that it would bring the figure, alter the figure of one in 200,000 to one in 100,000. You divide it by two and would make him twice as likely as before because of the conclusion you come to on that bit of evidence that it favours guilt. The opposite applies in exactly the same way. Supposing you come to the conclusion in respects of a piece of evidence that it is more likely to have been given if he is not guilty. Obviously that makes it less likely that he is the rapist. Again using the figure twice merely for convenience if you conclude that it is twice as likely to have been given if innocent than guilty then instead of one in 200,000 the chance is doubled, one in 400,000. I hope that is now clear. One in 400,000 because you double the figure which gives you half the chance.

Once you have completed your assessment taking all the different bits, however you choose to breakdown the other evidence - I dealt with all that yesterday - you end up, do you not, with two figures to compare. There is the one in 200,000,000 that it was a random person who was the rapist. That is the DNA figure and I putting to one side for the purposes of illustration all the criticisms of it that I dealt with yesterday. Let us take that as a figure because it is a neat round one for administrative purposes. You have got one in 20,000,000 that it is a random person. You have got a figure, and I do not know what your figure if you applied Bayes theorem would be, I have not the slightest idea. For a moment or two I am going to call it x as I did yesterday but we will look at two possibilities in just a moment. You have a one in x chance that the defendant was so. So you have got one in 200,000,000 of a random person, one in x Adams. You look to see then which of the two

> is the more likely and by how much. Let me give you two examples, one way one the other to see how you do. Supposing for the sake of argument that the Bayes theorem figure gave you a result of one in 400,000,000 that it was the defendant. So you would have one in 400,000,000 that it was the defendant but one in 200,000,000 that it was a random man. That would mean that a random man was twice as likely to have committed the offence than the defendant. For the obvious mathematical reason. If taking it the other way round, if the baize calculations and use of the theorem gave you a figure of one in 200,000 and that it was the defendant as against one in 200,000,000 that it was the random man then the defendant would be ten times more likely to have committed the offence than a random man. So there it is.
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> It all depends does that theorem opinion your being able to give accurate answers in respect of the parts of the evidence to the two questions. What are the chances of it being given if guilty? What are the chances of it being given if not guilty? If you do not feel able to give accurate answers in terms of percentages then the theorem does not work and you could go wrong because when you start multiplying inaccurate figures as Professor Donnelly says you increase the inaccuracy thereby. It is entirely for you, as I stress once again and finally, as to whether that is the best way for you to approach the evidence that you make your judgments about."

Mr Thwaites submits that the judge's summing-up at pages 28 to 31 was, as the judge himself realised, inadequate. In particular he appeared to have forgotten the answer given by Professor Donnelly expressing the probabilities as percentages. In the light of that answer, the passage at 30G to 31D of the summing-up amounted to a misdirection because, the witness having spoken in terms of percentages, the judge was directing the jury as to how many times it was more likely that something had occurred, yet he did not remind the jury of the formula given by Professor Donnelly in relation to the percentages of 10 and 90. In returning to the subject the following morning at 45 to 48 of the summing-up the judge gave the jury no explanation as to the sort of sums which they should do. In a nutshell, Mr Thwaites submits that the judge summed up only part of Professor Donnelly's exposition of the Bayes theorem. And, in speaking of multiplying and dividing at 31C he did not identify what should be multiplied and what should be divided.

For the Crown, Miss Tapping submits that the jury were well aware of the Crown evidence and of the criticisms of it put forward by the defence and they had listened for several days to the expert evidence including that of Professor Donnelly. She accepts that the judge did not put the figures to the jury, but to have done so would necessarily have resulted in suggesting a conclusion either more favourable to the prosecution or to the defence and this would have been to usurp the jury's function. The judge's summing up expressed in words what the defence were trying to say in relation to statistics. If the judge had suggested figures other than those advanced by the defendant this would have

strengthened the weight given to the DNA evidence. The judge rightly told the jury that they were not obliged to use Bayes theorem.

It seems to us that the difficulties which arise in the present case stem from the fact that, at trial, the defence were permitted to lead before the jury evidence of the Bayes theorem. No objection was taken by the prosecution. No argument on this point has been addressed to this court. It would therefore be inappropriate for us to express a concluded view on the matter. But we have very grave doubt as to whether that evidence was properly admissible, because it trespasses on an area peculiarly and exclusively within the province of the jury, namely the way in which they evaluate the relationship between one piece of evidence and another. The Bayes theorem may be an appropriate and useful tool for statisticians and other experts seeking to establish a mathematical assessment of probability. Even then, however, as the extracts from Professor Donnelly's evidence cited above demonstrate, the theorem can only operate by giving to each separate piece of evidence a numerical percentage representing the ratio between probability of circumstance A and the probability of circumstance B granted the existence of that evidence. The percentages chosen are matters of judgment: that is inevitable. But the apparently objective numerical figures used in the theorem may conceal the element of judgment on which it entirely depends. More importantly for present purposes, however, whatever the merits or demerits of the Bayes theorem in mathematical or statistical assessments of probability, it seems to us that it is not appropriate for use in jury trials, or as a means to assist the jury in their task. In the first place, the theorem's methodology requires, as we have described, that items of evidence be assessed separately according to their bearing on the accused's guilt, before being combined in the overall formula. That in our view is far too rigid an approach to evidence of the type that a jury characteristically has to assess, where the cogency of (for instance) identification evidence may have to be assessed, at least in part, in the light of the strength of the chain of evidence in which it forms part. More fundamentally, however, the attempt to determine guilt or innocence on the basis of a mathematical formula, applied to each separate piece of evidence, is simply inappropriate to the jury's task. Jurors evaluate evidence and reach a conclusion not by means of a formula, mathematical or otherwise, but by the joint application of their individual common sense and knowledge of the world to the evidence before them. It is common for them to have to evaluate scientific evidence, both as to its quality and as to its relationship with other evidence.

Scientific evidence tendered as proof of a particular fact may establish that fact to an extent which, in any particular case, may vary between slight possibility and virtual certainty. For example, different blood spots on an accused's clothing may, on testing, reveal a range of conclusions from 'human blood' via 'possibly the victim's blood' to 'highly likely to be the victim's blood'. Such evidence is susceptible to challenge as to methodology and otherwise, which may weaken or even, in some cases, strengthen the impact of the evidence. But we have never heard it suggested that a jury should consider the relationship between such scientific evidence and other evidence by reference to probability formulas. That such a course would in any event be impossible of sensible achievement by a jury, at least so far as the use of the Bayes theorem is concerned, is demonstrated by the practical application of the stage of that theorem's methodology that involves numerical assessment of the various items of evidence. Individual jurors might differ greatly not only according to how cogent they found a particular piece of evidence (which would be a matter for discussion and debate between the jury as a whole), but also on the question of what percentage figure for probability should be placed on that evidence. Since, as we have pointed out, the translation of an assessment of cogency into a percentage probability of guilt is entirely a matter of judgment and the conferring of a percentage probability of guilt upon one item of evidence taken in isolation is an essentially artificial operation, different jurors might well wish to select different numerical figures even when they were broadly agreed on the weight of the evidence in question. They could, presumably, only resolve any such difference by taking an average, which would truly reflect neither party's view; and this point leaves aside the even greater difficulty of how twelve jurors, applying Bayes as a single jury, are to reconcile, under the mathematics of that formula, differing individual views about the cogency of particular pieces of evidence. Quite apart from these general objections, as the present case graphically demonstrates, 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.

It is these considerations which lead us to the provisional conclusion, uninformed, as we have indicated, by argument, that evidence about the Bayes theorem ought not to have been admitted, without objection. The judge was led into error in that, no doubt, he felt obliged to seek to sum up the evidence to the jury.

That being so, it was, as it seems to us, incumbent upon him to direct the jury both as to the substance of that

evidence and as to the way it which it was open to them to use that evidence. It seems to us that, in a summing-up which was otherwise impeccable, he failed in these respects. Because of his conscientious desire to try to ensure that the jury grasped what was, it has to be remembered, the defence argument based on Bayes theorem, he concentrated his directions on that theorem, without indicating to the jury the more commonsense and basic ways in which it would have been open to them to weigh up the relative weight of the DNA evidence. The jury were not properly directed as to the meaning and implications for the prosecution case of an approach based on Bayes. If, as seems entirely possible, the jury abandoned the struggle to understand and apply Bayes, they were left by the summing-up with no other sufficient guidance as to how to evaluate the prosecution case (based as it was entirely on the DNA evidence), in the light of the other non-DNA evidence in the case. This means that their verdict cannot be regarded as safe.

Accordingly this appeal must be allowed and the conviction quashed. We will hear submissions as to whether or not there should be a retrial. Miss Tapping?

MISS TAPPING: My Lords, in dealing with the matter the evidence that the Crown would wish to put forward if there were to be a retrial of course would remain exactly the same, there having been no misdirection in law by the learned judge and dealing with your Lordships being able to see the exact evidence that would be placed before another jury on behalf of the Crown, the Crown would seek the leave of this court to be able to place that evidence before a jury on a second occasion. The only factual comment, if I may ask, my Lord, is that if your Lordships would be minded to order a retrial I would ask that it be back at the Central Criminal Court.

LORD JUSTICE ROSE: Thank you. Mr Thwaites?

MR THWAITES: My Lord, in my submission it can rarely, if ever, be appropriate for the court to sanction the retrial of issues arising from an offence that was committed five years ago unless the appellant himself was in some way responsible for the delay. We know in this case that there was an inbuilt delay because the prosecution did not become aware of his possible involvement in the offence until more than two years after it had taken place when he was arrested for an unconnected sexual offence which gave him the opportunity to run his DNA profile through the computer. Of course no one can be criticised for that delay and perhaps there will be other cases where, a considerable period after the offence, such material becomes available for the first time to the prosecution. That we know was in August 1993.

When the prosecution made the discovery that there was a possible match between this man's DNA and the crime sample they arrested him, in October 1993, for this matter and asked him for new blood, which he supplied and which they then tested leading to his arrest for this matter on 15th December 1993 when he was arrested and charged.

I am reciting this chronology for a purpose to your Lordships and it is this: by February of 1994 the defence solicitors, acting expeditiously, requested an opportunity from the prosecution to replicate the test which they carried out on the crime sample, and there is correspondence that was exhibited at the trial on my preliminary application on 12th September before His Honour Judge Machin sitting at the Central Criminal Court that established that this was the position. Between February and September 1994, when the trial was due to commence, the defence had no success in obtaining any materials which could be tested by experts instructed on our behalf. And so it was that on 12th September the defendant was ready to commence his trial and we embarked upon an application to exclude the DNA evidence, part of which included, and it is in the skeleton I provided to the prosecution and to the court following my own course, that because the DNA had all been consumed by tests carried out by the prosecution, it would be inappropriate to allow the case to proceed at all. That argument on the authorities is unanswerable. The result, however, of raising these arguments and arguing before the judge was that Dr Harris remembered that he had, in a refrigerator in a laboratory somewhere, some more DNA coming from a part of a body stocking. And so it was that the trial of this appellant in September 1994 was further delayed through no fault of his - his solicitors having taken all steps in an attempt to obtain material so that they could check it for themselves. Therefore, finally, the trial did not start, as your Lordships know, until January 1995. It is my submission that this appellant has been made to run the gauntlet to a very considerable extent so far.

The other complicating factor in a case as old as this -- and your Lordships need no rehearsal of the principle of justice delayed being justice denied, it is trite, it is perhaps the (inaudible) of the law, it is true, and of course it is important in cases where to some extent the outcome of the trial must depend upon the recollection of witnesses from that long ago. Miss M, the victim of the case, gave evidence more than two years ago at the committal proceedings for the first time. She gave evidence at the trial in January and she has followed the proceedings all the way to your Lordships' court today. She was present following her evidence at the trial at the Central Criminal Court, no complaint

can or is made about that. She was there until the end. She was here at the appeal. She is here again today and ultimately her impressions, her recollections of that man on that day and her account of the evidence she gave at the committal which qualified at the Central Criminal Court in a trial in one important respect, may inevitably be further weakened as a result both of the passage of time and the many sights and views she has had of this appellant throughout the proceedings up to today. The dangers of witnesses who have had subsequent opportunities to see people for long periods are well-known and are chronicled in other cases with which I need not weary your Lordships. It is our submission that there is already an injustice to be seen in the contemplation of this case being made to be tried again. We have, however, taken steps to discover the availability of Professor Donnelly. Whether ultimately I can call him on some, all or none of the issues that arise in this case I cannot predict today for I would need more time to consider the effects of your Lordships' judgment. But I can tell the court that Professor Donnelly will first be available at the end of June 1995 -- that is not a period so far ahead. He has availability in July and again in September when he would make arrangements to come from Chicago University (where your Lordships know he is based) for purposes of giving evidence in this case.

May I draw your attention to another matter connected with Professor Donnelly? By virtue of your Lordships' ruling and my initial reaction to it, the trial of this man, if it has to take place again, must inevitably take place on a different basis from that in which it was originally tried. Greater emphasis will therefore be placed on the eye witness testimony and on the memories and recollections of the appellant himself and his alibi witnesses. It means that the appellant, who I have derived from the only known case on the subject that is fully reported of retrials being ordered and which your Lordships will be familiar, the case of Saunders, has run the gauntlet on a particular basis, we have had all the scientific evidence, the statisticians and he has never been confronted, and your Lordships sanctioned this course, to a trial on a different basis of those events of five years ago. What has happened to him in the interim? Your Lordships know he has served almost the equivalent of a five year sentence in relation to an offence committed subsequent to this offence, for which he was sentenced on his own admission, and that he has in the course of that sentence, in which he is described as a model prisoner, sought to rehabilitate himself having been in the prison now for something approaching two years since August 1994 and becoming eligible for parole with effect from 16th June. His

rehabilitation has involved him addressing his problems through therapy, with the co-operation of doctors and others in the prison that is designed for that purpose, and that may be the factor that will operate on your Lordships' minds for it is possible that he will get parole on 16th June and, subject to consideration by your Lordships of the question of bail, which in the ordinary way perhaps would be granted, this man will be released to stand his trial in the late summer or early autumn at the Central Criminal Court, getting on for five-and-a-half years later. The problems that would there arise in the evidence of Miss M from what she said on many of the earlier occasions if she suddenly becomes convinced contrary to anything she said before that this was the man and she now realises it and such late returns of memory are not unknown and your Lordships may be faced with this case again, in a differently constituted form, 18 months from now.

My Lords, rape is a serious offence. There is no doubt that your Lordships have the power in a case of rape to order a retrial. In this case the conviction has been quashed in a way which does not affect the value of DNA evidence in criminal trials. There is no point of principle here to be retried and retested. Your Lordships have given guidance as to the future as to the use of technical theorems in situations like this. It is my submission that in all the circumstances of this case it would amount to an injustice to compel this man to be tried again. Those are my submissions.

LORD JUSTICE ROSE: Thank you. We shall order in this case that the defendant be retried. We shall direct that a new indictment be preferred in accordance with the rules. We shall direct that the Central Criminal Court shall be the place where he is to be retried.

MR THWAITES: Would your Lordship allow this defendant to have bail were he to be released in the ordinary course under the provisions of parole from the sentence he is currently serving?

LORD JUSTICE ROSE: Mr Thwaites, our view on that is that it is a little premature in the sense that it may be that this trial will take place before then. We know not. We think it would not be appropriate at the moment for us to deal with the question of bail.

MR THWAITES: My Lord, perhaps I will renew that application before the Central Criminal Court in the event that the parole authorities indicate that they are prepared to release him.

LORD JUSTICE ROSE: Certainly, that would be entirely proper and that is why we say nothing about it today Mr Thwaites. I dare say, Mr Thwaites, that you would like legal aid to be extended for the retrial, probably for two counsel?

MR THWAITES: Yes, please. My Lord, I found this case a burden doing it myself.

LORD JUSTICE ROSE: I had forgotten that. I just assumed that your junior was missing today.

MR THWAITES: My junior was not allowed in the appeal, but I had a junior at the trial.

LORD JUSTICE ROSE: You shall have a junior at the retrial.