

**FILED**

DEC 06 2017

COURT OF APPEALS  
DIVISION III  
STATE OF WASHINGTON  
By \_\_\_\_\_

Court of Appeals No. 352960

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COURT OF APPEALS,  
DIVISION III OF THE STATE OF WASHINGTON

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STATE OF WASHINGTON, RESPONDENT  
V.  
JEFFREY J. POOL, APPELLANT

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BRIEF OF APPELLANT

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## **I. INTRODUCTION**

The Defendant, Mr. Pool, was charged with two counts of First Degree Robbery, four counts of First Degree Kidnapping and four counts of Second Degree Assault. These charges arose out of two separate events. The first Burglary occurred at the Dollar Tree in Cheney, Washington on May 30, 2015. The second Burglary occurred at the same store on July 9, 2016. This matter went to trial, and Mr. Pool was found guilty on March 28, 2017. Mr. Pool appeals the conviction based upon the assignments of error set forth herein.

## **II. ASSIGNMENTS OF ERROR**

1. The trial court erred by not allowing defense to introduce evidence of the nature of prior convictions of two “suspects” at the scene of the May 30, 2015 robbery.
2. The trial court erred when it overruled defense objections regarding the State’s mischaracterization of DNA evidence during closing arguments.

## **III. ISSUES PERTAINING TO ASSIGNMENTS OF ERROR**

1. Did the trial court err when it ruled the Defense was prohibited from bringing into evidence the nature of prior convictions of two “suspects” at the scene of the May 30, 2015 robbery? (Assignment of Error 1)
2. Did the trial court err when it overruled defense objections regarding the State’s mischaracterization of DNA evidence during closing arguments, constituting misconduct? (Assignment of Error 2)

## **IV. STATEMENT OF THE CASE**

On May 30, 2015, Cheney Police were dispatched to a report of an armed robbery at the Dollar Tree, located at 2424 First Street, Cheney, Washington. *Affidavit of Facts* at 3. Two employees of Dollar Tree were working at the time of the incident: Store Manager, Tom Busby, and co-worker Mikaela Norrish. *Id.* After closing, and after doors were locked, Mr. Busby heard a noise, opened the office door and encountered a masked

robber with a weapon. *Id.* After placing the money into a bag, the suspect led both Mr. Busby and Ms. Norrish to the front of the store and had Mr. Busby unlock the door. *Id.* After which, the suspect left. *Id.* The suspect was believed to be a white male, about 5-7, 170 pounds, with possibly blond hair. R.P. at 375.

In addition to the Cheney Police Department, a K-9 Deputy along with officers from Eastern Washington University and Airway Heights responded to the incident. R.P. 292-293. The K-9 was a track dog that started at the front doors of the Dollar Tree building and went North, but then lost the scent. R.P. at 293. Directly north of the Dollar Tree was a Napa Auto store. R.P. 292.

Two males were located in the Napa parking lot with a truck that was said to have been broken down in the cordon area. R.P. 372, 387-388. These two individuals were asked to move outside the cordon area. R.P. 385. The officers did not run the license or identification of either of these two individuals the night of the robbery. R.P. 387. It was later discovered that at least one of these individuals had a warrant. R.P. 387. This warrant was out of King County from a 1992 Kidnapping and robbery case. R.P. 9.

The next day, a call came into the Cheney police department regarding a suspicious item on the side of the road along State Route 904. R.P. 277. The item turned out to be a black knit ski cap that had been cut. R.P. 277. Based upon the appearance, this seemed to match the description of the mask used in the robbery the night before. R.P. 278

The mask was sent to the lab with a lab request for DNA on June 3, 2015. R.P. 561. On this request, the two individuals who were in the Napa parking lot, Mr. Matthew Smith and Mr. Frank Wolf were listed in the "suspect" column of the request. R.P. 562.

In that request, the suspect robber is described to be 5-7 to 5-9, with blond hair. R.P. 562. Both of these individuals had prior convictions and one had two outstanding warrants out of King County. R.P. 563. At least one of these individuals had a prior conviction for Robbery and Kidnapping. R.P. 564-565. It was suspected at the time, that one of these two individuals could have used the mask. R.P. 569. At that time, these individuals were the only “viable suspects” and the state was seeking to gain evidence. R.P. 569.

The testimony regarding the background of the two individuals was the subject of the State’s motion in limine. R.P. 8-19. At that time, the trial court found that 404 and 609 do not apply, and that the line of questioning may be relevant to show how the investigation was conducted. R.P. 18. The only questions that could be asked is what law enforcement knew at that time. R.P. 18-19. This ruling was reinforced after opening statements and prior to the state calling its first witness. R.P. 98. When Captain Beghtol submitted a request for DNA, he included information from Mr. Wolf and Mr. Smith regarding their criminal histories. R.P. 563. While these individuals were listed in the suspect column, Captain Beghtol was stating that they were merely subjects, not suspects. R.P. 563. As Defense started to inquire about specific references in the request form, which mentions the nature of the underlying charges, the State objected stated that allowing testimony of the underlying crimes, was improper and absolutely prejudicial to the State. R.P. 565. After a recess, the court ruled that due to the prejudicial effect, the exact nature of the prior criminal charges could not be discussed. R.P. 567.

At the lab, DNA was extracted from the knit cap and a profile was developed, containing a mixture of at least three individuals, with two major contributors. R.P. 663. However, the DNA sample was not eligible for upload into CODIS. R.P. 664. Even

though Mr. Wolf's DNA was in CCODIS, a keyboard search of the profile was not conducted for Mr. Wolf or Mr. Smith. R.P. 673, 675. The DNA analyst requested a reference sample from the two suspects from the Police Department. 671-672. The Police Department did not provide the lab with any additional information regarding the two suspects. R.P. 573-574.

Over a year later, on Saturday, July 9, 2016, Cheney Police Department again responded to a just occurred robbery at the Dollar Tree. Affidavit of Facts at 4. Mr. Busby was again working, this time with co-worker Sarah Cousins. *Id.* At about closing time, Mr. Busby was checking the bathrooms, when he encountered a suspect wearing a motorcycle helmet behind the door of the bathroom. *Id.* A scuffle ensued until suspect pulled a gun; at which point Mr. Busby complied with the suspect's requests. *Id.*

The suspect flex-cuffed Mr. Busby, but then removed the flex cuffs when Ms. Cousins made contact and mentioned there was still a customer at the front. *Id.* at 5. Mr. Busby handled the customer and then locked the front door. *Id.* The suspect then took the money, placing it in a bag, and ran out the front door. *Id.* The suspect was described as a male in his mid-20's, 5-10, 175 to 185 pounds, wearing a motorcycle helmet, visor, a grey EWU sweatshirt with white lettering, dark military style pants, security gun belt, black shoes, black gloves, carrying a red bag. R.P. 429-430.

Mr. Blazenkovic, who was another store employee, told authorities that earlier that evening, he saw the defendant, Mr. Pool, walking in the store with a black motorcycle helmet in hand. R.P. 299. It was believed that Mr. Pool worked at a correctional facility. R.P. 530-531. Officers did not go looking for Mr. Pool on that

night. R.P. 529. It was decided that it would be better to wait until Monday morning to start doing follow-up investigation. R.P. 529-530.

On Tuesday, Officers arrested Mr. Pool as he showed up for work at the Airway Heights Correctional Facility. R.P. 532. Following his arrest, officers executed a warrant for his house, his car, and his DNA. R.P. 533-554. When arrested, Mr. Pool was wearing dark blue uniform pants and black leather work boots. R.P. 454. During the search of the home, officers recovered a handgun, ammo magazines and ammo. R.P. 464. Additionally, officers recovered two motorcycle helmets, one with visor, one without. R.P. 466 – 467.

Mr. Pool's DNA was subsequently compared to the DNA profile taken from the ski hat with a finding that it is 140 times more likely that the observed DNA typing profile occurred as a result of a mixture of Jeffrey Pool and an unknown individual than having originated from two unrelated individuals. R.P. 667. A likelihood ratio is the ratio of two hypotheses weighted against each other. R.P. 679. Analysts use a scale that helps weigh the likelihood ration. R.P. 684. The lower the likelihood ratio, the less strength there is in the hypothesis. R.P. 684-685. Likelihood rations can go into the tens-of-thousands and millions. R.P. 683-684. During opening statements, the prosecutor conceded that the DNA is somewhat nebulous. R.P. 84. When asked if a likelihood ratio between 83 and 146 is referred to as a nebulous result, the DNA analyst answers in the affirmative, stating that it would fall on the weight chart between moderate and moderately strong, which is the second lowest level used by the state for statistical purposes. R.P. 685. During closing arguments, over Defense objections, the State used

an analogy stating that if you flip a coin 140 times, 139, it's Mr. Pool in combination with another individual. R.P. 863.

The Jury convicted Mr. Pool on all charges. R.P. 906-907.

## V. STANDARD OF REVIEW

“The court reviews the correct interpretation of an evidentiary rule de novo as a question of law.” *State v. DeV incentis*, 150 Wn.2d 11,17, 74 p.3d 119,123 (2003). “Once the rule is correctly interpreted, the trial court’s decision to admit or exclude evidence is reviewed for an abuse of discretion.” *Id.*

## VI. ARGUMENT

### A. **Did the trial court err when it ruled the Defense was prohibited from bringing into evidence the nature of prior convictions of two “suspects” at the scene of the May 30, 2015 robbery?**

The trial court erred when it ruled that the Defense would be prohibited from bringing into evidence the nature of the prior convictions of the two “suspects” from the May 30, 2015 scene would not be allowed into testimony.

Washington evidence rules state that “all relevant evidence is admissible, except as limited by constitutional requirements or as otherwise provided by statutes, by these rules, or by other rules or regulations applicable in the court of this state.” ER 402.

“Relevant evidence” is “evidence having a tendency to make the existence of any fact consequential to the resolution of a lawsuit more or less probable than it would be without the evidence.” ER 401. ER 404(b) states that “evidence of other crimes, wrongs, or acts is not admissible to prove the character of a person in order to show action in conformity therewith. It may, however, be admissible for other purposes, such as proof of

motive, opportunity, intent, preparation, plan, knowledge, identity, or absence of mistake or accident.”

The standard for relevance of other suspect evidence is whether there is evidence “tending to connect” someone other than the defendant with the crime. *State v. Downs*, 168 Wash. 664 at 667, 13 P.2d 1 (1932). The *Franklin* court reinforced this standard by stating “some combination of facts or circumstances must point to a nonspeculative link between the other suspect and the charged crime.” *State v. Franklin*, 180 Wn.2d 371 at 381, 325 P.3d 159, (2014). In *Franklin*, the Court held that “the trial court’s error in that case to exclude evidence showing that another person had both the motive and opportunity to commit the crime directly affected Franklin’s state and federal constitutional right to present witnesses on his own behalf.” *Id* at 382, 325 P.3d at 164. This "constitutional error is presumed to be prejudicial and the State bears the burden of proving that the error was harmless. A constitutional error is harmless if the appellate court is convinced beyond a reasonable doubt that any reasonable jury would have reached the same result in the absence of the error." *Id.* (referencing *State v. Watt*, 160 Wn.2d 626, 635, 160 P.3d 640 (2007) (citing *State v. Guloy*, 104 Wn.2d 412, 425, 705 P.2d 1182 (1985) (citing *State v. Stephens*, 93 Wn.2d 186, 190-91, 607 P.2d 304 (1980))))).

In *Donald*, the Court went on further to explain that “character evidence might be considered relevant on four theories:

1. As circumstantial evidence that a person acted on a particular occasion consistently with his character (propensity evidence)
2. To prove an essential element of a crime, claim, or defense
3. To show the effect that information about one person had on another person’s state of mind
4. Other purposes, such as identity or lack of accident.”

*State v. Donald*, 178 Wn.App. 250,255, 316 P.3d 1081, 1083 (Div. 1 2013). The Court affirmed “that prior bad acts are generally not considered proof of any person's likelihood to commit bad acts in the future and that such evidence should demonstrate something more than propensity.” *Id.* at 260, 316 P.3d at 1086.

The Supreme court weighed in on the issue when considering the balancing of this type of evidence. *See Holmes v. South Carolina*, U.S. 319 (2006). “Well-established rules of evidence permit trial judges to exclude evidence if its probative value is outweighed by certain other factors such as unfair prejudice, confusion of the issues, or potential to mislead the jury.” *Id.* at 320. However, “whether rooted directly in the Due Process Clause of the Fourteenth Amendment or in the Compulsory Process or Confrontation clauses of the Sixth Amendment, the Constitution guarantees criminal defendants 'a meaningful opportunity to present a complete defense.' ” *Id.* at 320, citing *Crane v. Kentucky*, 476 U.S. 683, at 690 (1986).

“The United States Constitution bars the trial court from considering the strength or weakness of the State's case in deciding whether to exclude defense-proffered other suspect evidence.” *Franklin*, at 373, 325 P.3d at 160. “Evaluating the strength of only one party's evidence, no logical conclusion can be reached regarding the strength of contrary evidence offered by the other side to rebut or cast doubt. *Holmes*. at 320. “We have never adopted a per se rule against admitting circumstantial evidence of another person's motive, ability, or opportunity. Instead, our cases hold that if there is an adequate nexus between the alleged other suspect and the crime, such evidence should be admitted. *Franklin*, at 373, 325 P.3d at 160.

In the present case, it is clear that the underlying conviction of the two individual found at the scene of a robbery and kidnapping is relevant. They just “happen” to be in the area, north of the Dollar Tree, in the vicinity of where a K-9 search was conducted. This is a non-speculative link.

However, the defense was attempting to introduce this evidence for a “different purpose.” Captain Beghtol made issue that the two individuals were not “suspects,” but merely “subjects.” Yet in filling out the DNA request, Captain Beghtol expounded on the criminal history as a basis for comparing the DNA to the “subjects.”

The strength or weakness of the state’s case should not have been considered in the trial court’s order. Because the court erred when denying the Defense opportunity to introduce evidence of the prior convictions of the suspects, even for other purposes, Mr. Pool was denied a right to present a fair defense.

**B. Did the trial court err when it overruled defense objections regarding the State’s mischaracterization of DNA evidence during closing arguments, and did those mischaracterizations constitute misconduct?**

The trial court erred when it overruled Defense objections regarding the States mischaracterization of DNA evidence during closing arguments, which constituted Prosecutorial misconduct.

“To show misconduct, the defendant must show that the prosecutor did not act in good faith and the prosecutor's conduct was both improper and prejudicial.” *State v. Jones*, 163 Wn.App. 354, 363 266 P.3d 886, 891 (Div. 2 2011). “The burden rests on the defendant to show the prosecuting attorney's conduct was both improper and prejudicial...Once proved, prosecutorial misconduct is grounds for reversal where there

is a substantial likelihood the improper conduct affected the jury.” *State v. Fisher*, 165 Wn.2d 727, 747, 202 P.3d 937 (2009).

In order to prevail, the defense must establish “that the prosecutor's conduct was both improper and prejudicial in the context of the entire record and the circumstances at trial.” *State v. Thorgerson*, 172 Wn.2d 438, 258 P.3d 43, (2011), citing *State v. Magers*, 164 Wash.2d 174, 191, 189 P.3d 126 (2008). The burden to establish prejudice requires the defendant to prove that “there is a substantial likelihood [that] the instances of misconduct affected the jury's verdict.” *Thorgerson* at 442-443, 258 P.3d at 46 “When reviewing a claim that prosecutorial misconduct requires reversal, the court should review the statements in the context of the entire case.” *Thorgerson* at 443, 258 P.3d at 47.

“As a quasi-judicial officer representing the people of the State, a prosecutor has a duty to act impartially in the interest only of justice.” *State v. Warren*, 165 Wn.2d 17, 27, 195 P.3d 940 (2008). “A prosecuting attorney represents the people and presumptively acts with impartiality in the interest of justice . . . a prosecutor must subdue courtroom zeal for the sake of fairness to the defendant.” *Thorgerson* at 443 258 P.3d at 47.

The Court has held “that it is error to submit evidence to the jury that has not been admitted at trial. The ‘long-standing rule’ is that ‘consideration of any material by a jury not properly admitted as evidence vitiates a verdict when there is a reasonable ground to believe that the defendant may have been prejudiced.’ ” *In re Personal Restraint of Glasmann*, 175 Wn.2d 696, 705, 286 P.3d 673 (2012). citing *State v. Rinkes*, 70 Wn.2d 854, 862, 425 P.2d 658 (1967).

Researchers have discussed the issue of the legal fallacy of misstating or misrepresenting the likelihood ratio of DNA hypothesis. See, Jane Moira Taupin *Introduction to Forensic DNA Evidence for Criminal Justice Professionals*, 71-73 (CRC Press, 2014). “This logic problem can be avoided by using the LR strictly as quoted in the forensic report . . . [it] should not be translated to the probability of the hypothesis itself.” *Id.* at 73. By making probability statements, the statement becomes logically incorrect. See, I.W. Evett, *Avoiding the Transposed Conditional*, *Science & Justice*, Vol 35, Iss 2, April 1995, pp 127-131. The error in shifting the language is illustrated as follows:

*“The probability that an animal has four legs if it is a cow is one*

Does not mean the same thing as:

*The probability that an animal is a cow if it has four legs is one”*

*Id.* at 129.

In the present case, the prosecutor clearly mischaracterized the DNA results of the defendant. The DNA analyst confirmed that a range of 83-146 LR was on the second to the bottom ladder of in the strength chart. The DNA analyst did not convert the Likelihood ratio to a percentage.

When the prosecutor used the analogy of the coin flip, he essentially introduced facts which were not in evidence. Whether this was intentional, or due to a misunderstanding of DNA evidence is not at issue. Further, the effect of prejudice is great when the jury is presented with the idea that 139 out of 140 times is the defendant.

Because the conduct of the state was improper and prejudicial, Mr. Pool’s constitutional rights were violated.

**VII. CONCLUSION**

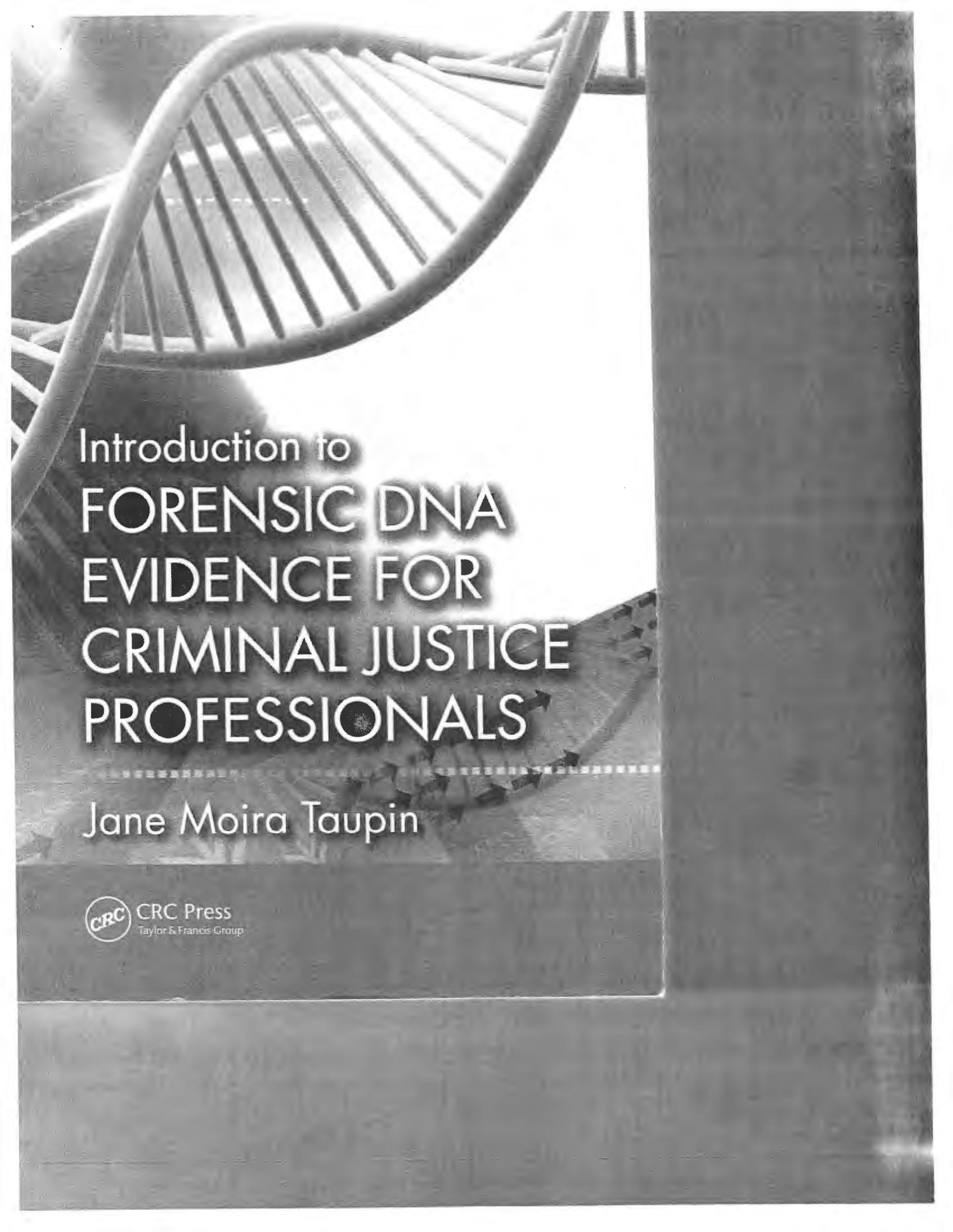
For the foregoing reasons, the trial court erred when it denied defense the ability to introduce evidence of the nature of prior convictions of two “suspects” at the scene of the May 30, 2015 robbery, as well as when it overruled defense objections regarding the State’s mischaracterization of DNA evidence during closing arguments. Therefore, this Court should reverse the trial verdict and grant a new trial.

DATED this 6 day of December 2017.

Respectfully submitted,

  
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# **APPENDIX 1**



Introduction to  
**FORENSIC DNA  
EVIDENCE FOR  
CRIMINAL JUSTICE  
PROFESSIONALS**

Jane Moira Taupin

 CRC Press  
Taylor & Francis Group

The Court of Criminal Appeal dismissed the appeal and special leave was granted to appeal to the High Court that then held that the appellant did not demonstrate that the probative value was outweighed by the danger of unfair prejudice.

It should be noted that mitochondrial DNA typing and Y-STR profiling use different techniques from autosomal STR DNA profiling, and the derivation of the statistical significance is different. The techniques are less discriminatory than autosomal STR DNA profiling due to the method of inheritance of haplotypes—either from the maternal line (mitochondrial) or from the paternal line (Y-STR). The considerations of haplotype frequencies and the way they are reported necessitate the “counting” approach (see Chapters 6 and 7). The strength of the evidence depends on the sizes of the databases.

The probability of exclusion, or random man not excluded (RMNE), or the complementary probability of inclusion entails a binary view of alleles, meaning that alleles are only present or absent. Furthermore, if they are present, they are observed. If alleles are found where there is a possibility of stochastic effects, laboratories may omit the inconvenient loci from their calculations (Gill et al., 2006). Such a calculation incorrectly implies that among the “random men” considered for comparison, only the same loci as those considered for the suspect in question would be used for inclusion or exclusion (see Chapter 5 for low level DNA techniques).

Two methods of statistical significance were presented in the O.J. Simpson case in California (Weir, 1995). The prosecution wished to use the LR and the defense wanted to use the RMNE. The final result was that the court heard both methods and ruled that the LR method was preferable. Also see Chapter 1 for a discussion of this case.

Clayton and Buckleton (2005) summarized the advantages and disadvantages of each approach. Full discussions of the various methods of interpreting evidence can be found in comprehensive texts (Buckleton, 2005; Balding, 2005). According to the DNA Commission of the International Society of Forensic Genetics (Gill et al., 2006), the scientific community has a responsibility to support improvement of standards of scientific reasoning in the courtroom. This implies that concepts such as likelihood ratios, whether difficult to convey or not, are the methods of choice for the statistical evaluation of DNA profiles.

Computer software is available to forensic laboratories for calculating statistics such as likelihood ratios. Some laboratories may perform manual calculations to check their results, although the calculations may be very demanding. Each particular laboratory must have validated the population databases and genotype frequencies it uses in forensic calculations.

#### 4.3.4 Identity and rarity

It is important to note that statistical analyses can never lead to absolute conclusions. DNA evidence is essentially probabilistic as shown above and an expert witness should never denote an individual as the donor of a genetic material from which DNA was produced. There is a growing realization that all forensic science evidence is probabilistic and no current forensic technology supports the unique identification of an individual. Other forensic science disciplines follow binary match or no-match systems and this transparency deficit is being addressed (National Research Council, 2009; Fingerprint Inquiry, 2011).

Two authors (Saks and Koehler, 2005) described the genetics-based model of DNA profiling as highlighting the deficiencies in other forensic disciplines in which “untested assumptions and semi-informed guesswork are replaced by a sound scientific framework and justifiable protocols.”

The statistics quoted in forensic reports for DNA profiles are often rarer than “1 in 1 trillion,” a number that is greater than the population in the world (currently 6 billion). These statistics appear incredulous to many people and their method of derivation difficult to understand. It is hoped that this text explains that the statistics in most criminal cases are derived according to assumptions made both in the *comparison* of DNA profiles, and the *quality* of the profile itself (complete or partial/low level/mixture). It is also the probability of the DNA profile occurring in a particular population, not the probability of the case hypothesis (see Section 4.4 for legal fallacies).

An interesting example of how statistics can be readily misinterpreted is the famous (at least in statistical circles) “birthday problem.” This particular problem has been used to illustrate misconceptions in DNA database matches (Weir, 2007; Kaye, 2009). Assume that equal numbers of people are born every day of the year. Then the random match probability for a particular birthday is 1/365. However, there is over a 50% probability that two people in a group of 23 or more share a birthday. How could this be? This is because there are 253 pairs of people in a group of 23 and the particular birthday is not specified. When translated to DNA issues, the birthday problem has to do with multiple occurrences of any profile, not one particular profile (Weir, 2007).

#### 4.4 Legal fallacies

Using unfamiliar terminology plus difficulties in statistical interpretation may lead a legal professional to translate results to a wider perspective that may not be valid. Two well-known fallacies are common in the legal community and sometimes even in the news media. The *prosecutor’s fallacy* is also called the “fallacy of the transposed conditional.” This fallacy

translates the chance probability of a crime stain match to the probability of innocence. For example, say there is a 1 in 100,000 chance probability of a match in a city of 1 million people. The prosecution fallacy is to say there is a probability of innocence of 1 in 100,000. The defense fallacy in this particular situation is to say the probability of guilt is 1 in 10.

Suppose a crime is committed in London (population about 7 million) and a crime scene profile has a likelihood ratio (LR) of 1 in 1 million. The prosecutor might say that the odds are a million to one in favor of the defendant being guilty. However, based on population size, about seven people in the city are expected to match the profile so it can be argued that the odds are actually 7 to 1 in favor of innocence. The defense fallacy unrealistically assumes that each of the 7 people has equal probability of guilt.

An often-quoted case from England (*R. v Deen*, 1994; Puch-Solis et al., 2012) illustrates the prosecutor's fallacy. *Deen* was an early DNA case in which the random match probability was quoted as 1 in 3 million.

*Prosecutor:* So the likelihood of this being any other man but Andrew Deen is 1 in 3 million?

*Expert:* In 3 million, yes.

*Prosecutor:* You are a scientist ... doing this research. At the end of this appeal a jury are going to be asked whether they are sure that it is Andrew Deen who committed this particular rape in relation to Miss W. On the figure which you have established according to your research, the possibility of it being anybody else being 1 in 3 million, what is your conclusion?

*Expert:* My conclusion is that the semen originated from Andrew Deen.

*Prosecutor:* Are you sure of that?

*Expert:* Yes.

The basic fallacy is contained in the first question when the attorney asks the probability of the accused being the source of the DNA profile; the attorney should have asked about the probability of the evidence. It is the jury's responsibility to decide whether factual propositions have been established by the evidence, not the expert.

Having been asked the wrong question, the expert in *Deen* confounded the fallacy, even to the extent of pronouncing himself "sure" that Deen was the source of the stain. In fact, a random match probability of 1 in 3 million implies that about 20 people in the UK would be expected to share the same profile.

The prosecution fallacy (transposing the conditional) may be described by two simple statements (Aitken et al., 2010):

1. If I am a monkey, I have two arms and legs.
2. If I have two arms and legs, I am a monkey.

This logic problem can be avoided by using the LR strictly as quoted in the forensic report. The probability of the evidence based on the hypothesis should not be translated to the probability of the hypothesis itself. It is also helpful to remember that DNA profiling evidence provides only the probability of a match of DNA profiles in the relevant population, not the probability that a particular person committed the crime. As will be repeated throughout this book, DNA is only one piece of evidence in a crime.

Limitations of the evidence must be described. The question of how the DNA was transferred is one for the jury to consider. The scientist's main role is to outline the various modes of transfer that exist and advise on the relative risks associated with the modes (Gill and Buckleton, 2010). The uncertainties about the mode of transfer increase with touch DNA evidence—evidence that cannot be associated with a particular body fluid (Buckleton, 2009).

## 4.5 Understanding reports: Common phrases and their meanings

Identifying the strengths and limitations of facts and opinions is a cornerstone of forensic science. Any forensic report or testimony should convey the limitations of all tests and all the evidence. All conclusions, assumptions made, and inferences should be enunciated and clearly explained. Differences or similarities between evidence and reference samples should be explained as actual differences or similarities inherent in the evidence or as consequences caused by imprecision of the test system—limitations. All alternative explanations (such as different hypotheses proposed) should also be conveyed in the report or testimony.

### 4.5.1 Inclusion and exclusion

Scientific statements should clearly support or refute a finding or state that the result is not possible due to the limitations of the hypotheses proposed. Case 2 from Western Australia (Merritt, 2010) shows how misconceptions may arise from the wording of forensic statements.

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#### Case 2

Sixteen-year-old Patrick Waring was accused of rape, spent a year in detention, and was exonerated in 2007. The forensic report stated that the accused "could not be excluded" from the DNA profile taken from the victim's underwear.

# **APPENDIX 2**

# Avoiding the transposed conditional

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*Science & Justice 1995; 35: 127–131*

*Received 8 June 1994; accepted 4 January 1995*

This note is a discussion of the problem which the forensic scientist faces, particularly when at court, of avoiding making probability statements which are logically incorrect. The particular error under consideration is known as 'transposing the conditional'. The meaning of this phrase is first explained through a discussion of the concept of conditional probabilities and it is then illustrated by a series of examples. The final section touches on the philosophy of identification and on the need to maintain a sense of perspective.

Sachverständige müssen, vor allem vor Gericht, vermeiden Wahrscheinlichkeitsaussagen zu machen, die logisch nicht korrekt sind. Ursache für solche unlogischen Aussagen ist häufig das Verwechseln von abhängigen und unabhängigen Merkmalen bzw. Ereignissen. In dem Beitrag wird deshalb zunächst der Begriff der bedingten Wahrscheinlichkeit erklärt und an Beispielen verdeutlicht. Abschließend wird eine Art Identifizierungsphilosophie vorgestellt und auf die Notwendigkeit hingewiesen ein Gefühl dafür zu bekommen, die Dinge unter dem richtigen Blickwinkel zu betrachten.

Cette note est une discussion du problème rencontré par l'expert forensique, particulièrement au tribunal, pour éviter de faire état de probabilités qui sont logiquement incorrectes. L'erreur particulière discutée est connue comme la transposition du conditionnel. La signification de cette phrase est d'abord expliquée par une discussion du concept des probabilités conditionnelles puis est illustrée par une série d'exemples. La section finale aborde la philosophie de l'identification et le besoin de maintenir un sens de perspective.

En esta nota se discute el problema con que se encuentra el científico forense, especialmente cuando está ante un tribunal, de evitar pronunciarse en términos de probabilidad que lógicamente no son correctos. El error en consideración se conoce con el término de transponer el condicional. El significado de esta frase se explica a través de una discusión del concepto de probabilidad condicionada y se ilustra con una serie de ejemplos. La sección final trata de la filosofía de la identificación y de la necesidad de mantener el sentido de perspectiva.

*Key Words:* Statistics; Probability; Bayesian; Interpretation; Likelihood ratio.

## Introduction

Recent articles [1, 2] have publicized a common error of inference in legal proceedings that has been called the 'prosecutor's fallacy'. The term was first used by Thompson and Schumann [3] but the error is well known to statisticians as something that can occur quite generally where probability statements are made, and it was given the name 'the fallacy of the transposed conditional' in the more general context by Diaconis and Freedman [4]. The error occurs in the following way.

A probability statement has little meaning unless it includes at least some indication of the information, knowledge and assumptions upon which it is based. In shorthand, a probability is often represented in the form  $P(A | I)$  where  $A$  denotes the event or proposition which is uncertain and  $I$  denotes the information which has been taken into account. In this way the vertical line can be seen to be shorthand for the word 'given' or the phrase 'conditioned on'. Whereas some readers may consider it unnecessary to labour such basic issues, it is the author's experience that the education of the majority of scientists fails to achieve an appreciation of the nature of probability. The subject appears in general to be taught poorly, and the notion of conditional probability receives scant attention: when it is presented, it tends to be as a special kind of probability. The reality is that there is no such thing as an *unconditional* probability; it is meaningless to state a probability without an indication of the circumstances in which it is assessed. For brevity, when there is little scope for misunderstanding about the nature of the conditioning information it is frequent practice to abbreviate the symbols to  $P(A)$ ; but the conditioning, although tacit, is still there.

For the interpretation of forensic transfer evidence there is considerable support for the Bayesian view which demonstrates that it is necessary to consider the probability of the evidence given whatever alternative propositions or hypotheses which are relevant to the deliberation of the court [5]. If there are two alternatives, then the ratio of the two probabilities—the likelihood ratio—provides the means for placing the scientific evidence in the context of the other evidence in the following way. The other evidence will have led to some state of belief in relation to the two alternatives (normally one defence and one prosecution) and it is useful to visualize these as odds—called the prior odds—in favour of the prosecution alternative. If the likelihood ratio has as its numerator the probability of the scientific evidence given the

prosecution alternative and as its denominator the probability of the same evidence given the defence alternative, then the ratio provides a factor to multiply the prior odds. The new odds—the posterior odds—are now based on all of the evidence, including the scientific evidence.

Conventionally, however, it is still widespread practice to confine attention to the denominator of the likelihood ratio. In the simplest of cases, where the numerator can realistically be taken as one, this is not necessarily a bad way to proceed but it can become misleading when things become more complicated. To illustrate the problem of the transposed conditional, however, this paper is confined mainly to the simplest kind of transfer case, i.e., one in which the evidence consists solely of a body fluid stain left at the scene of a crime, which is found to match a sample taken from a suspect, who is of some hypothetical type  $X$ .

Let  $E$  be used to summarize the evidence that the body fluid stain found at the scene of the crime is type  $X$ . Let  $C$  denote the hypothesis that the suspect left the stain and let  $\bar{C}$  denote the alternative hypothesis that some other unknown person from a specified population left the stain. If the case later comes to court, these can be seen to be respectively the prosecution and defence alternatives. Assume that the body fluid types are determined without error and also that data exist to estimate the proportion of people in that population who are type  $X$ . Following the conventional approach to the interpretation of such cases, a statement of the following form would typically be made:

*The probability that the stain would be type  $X$  if it had come from some other person is 1 in 1000.*

It is useful to write this symbolically:

$$P(E | \bar{C}) = 1/1000$$

Note that the shorthand here has itself been abbreviated; strictly speaking, the probability should be written in the form  $P(E | \bar{C}, I)$  where  $I$  denotes all of the relevant information, in particular that which has led to the choice of database from which the frequency has been estimated. Note also that the word 'if' is being used to mean 'given that'. The error that is commonly made amounts to reversing the symbols around the vertical line as follows:

$$P(\bar{C} | E) = 1/1000$$

This is equivalent to saying:

*The probability that the stain has come from some other person if it is type  $X$  is 1 in 1000*

There may be unusual circumstances in which such an assertion is justified but the crucial point is that it does not follow from the first sentence. The rearrangement is clear in the algebra; the  $E$  and  $\bar{C}$  terms have changed places around the vertical, or 'conditioning', line. This is what led to the expression 'transposing the conditional'.

The illogicality of the fallacy can be illustrated by means of trivial examples. For example:

*The probability that an animal has four legs if it is a cow is one*

does not mean the same thing as:

*The probability that an animal is a cow if it has four legs is one.*

Whereas it may be comparatively easy to spot correct and incorrect sentences when they are written out, it becomes more difficult with the spoken word and experience at court shows that questions from lawyers and judges are often wrongly framed. In that environment it can be difficult to decide whether or not a particular sentence is correctly framed.

Under the assumption that the body fluid type can be determined without error and given that the suspect is type X then it is certain that the crime stain would be found to be type X, if it came from him. Therefore, the probability of  $E$  given  $C$  is one, and if the evidence in the example were presented in the form of a likelihood ratio then the numerator would be one, the denominator 1/1000 and the ratio consequently 1000. Then the interpretation may be expressed as follows:

*The evidence is 1000 times more likely if the blood came from the suspect than if it came from someone else*

which may be incorrectly transposed as:

*The blood is 1000 times more likely to have come from the suspect than from someone else*

or:

*The odds are 1000 to 1 on that the blood came from the suspect.*

A statement of the odds in favour of a hypothesis can only validly be made if prior odds have been assigned. If the non-scientific evidence suggested prior odds of one then the posterior odds would indeed be 1000 to one on and the last sentence would be correct. However, the consideration of prior odds is rightly considered the function of the jury and, in general, the transposed form of the statement will be incorrect.

It follows that the Bayesian approach does not necessarily protect the scientist from the possibility of transposing the conditional. The difference is that the error will be made as an odds statement rather than as a probability statement.

### **Suggestions for avoiding the transposed conditional**

Avoiding the problem in written reports is not difficult, provided that the writer has time to reflect, but avoiding the problem in court and in discussions with lawyers is much more difficult. It is the author's experience that questions from counsel are often framed as transposed conditionals. The following suggestions are offered as a guide.

*It is inadvisable to speculate on the truth of a hypothesis without considering at least one other alternative hypothesis*

This is a rather philosophical point which could, no doubt, be discussed at length but, as a general principle, the forensic scientist should be prepared to consider at least two explanations for any evidence that has been found.

*Clearly state the alternative hypotheses that are being considered*

This should be seen as an important element of report writing, recognizing that the alternatives to be addressed are provisional and might change with changing circumstances.

*If a statement is to be made of probability or odds then it is good practice to use 'if' or 'given' explicitly to clarify the conditioning information*

The examples following these suggestions illustrate this point.

*Do not offer a probability for the truth of a hypothesis*

Forensic scientists can state the probability of the evidence that has been found, given various hypotheses. To state the probability of a hypothesis given the evidence requires a prior probability or odds which may not be within the scientist's domain. The scientist is most likely to attract criticism when the hypothesis relates directly to the issue of whether or not the defendant can be connected with a particular feature of an incident. However, when the hypothesis does not directly relate to the involvement of the defendant it will be seen as permissible for the scientist to use his own experience to provide a prior probability. For example, if a scientist says 'In my opinion, this pattern of blood stains was probably

caused by the victim having been beaten about the head with a blunt instrument', he is taking into account not just the observations on the staining but also other factors such as experience and the circumstances surrounding the observations.

### Examples

The following examples are not given in any particular order. Some are clearly correct, some are clearly wrong, but there are several which require careful reading before their validity can be determined. Note that words such as 'likelihood' and 'chance' tend to be used in court as synonyms for probability; this is unlikely to cause confusion, though statisticians make distinctions between the meanings of these words.

*The probability of finding this blood type if the stain had come from someone other than Smith is 1 in 1000*

This statement is correct. The event is 'finding this blood type' and the conditioning information is that it came from some other person. The condition is made clear by the use of 'if'.

*The probability that someone other than Smith would have this blood type is 1 in 1000*

This statement is also correct but it is not as clear as the first because the distinction between the event and the conditioning is not made explicit. If a lawyer at court inadvertently inverts it then it may be difficult to explain where he has gone wrong.

*The probability that the blood came from someone other than Smith is 1 in 1000*

This is clearly wrong. It is the most common form of the transposed conditional. It is the spoken equivalent of  $P(\bar{C} | E) = 1/1000$ ; the probability of a hypothesis given the evidence rather than the other way around.

*The evidence is 1000 times more probable given the first alternative rather than the second*

It is good practice for the scientist first to explain the alternative hypotheses that have been considered and the framework of circumstances within which they have been addressed. If, in the context of the simple example, the first alternative is the prosecution alternative then this is a correct statement, in the form of a likelihood ratio.

*The first alternative is 1000 times more probable than the second*

This is an incorrectly transposed version of the previous example. It is a statement about the odds in favour of a hypothesis, rather than a likelihood ratio

for the evidence.

*The odds are 1000 to 1 in favour of the first alternative*

This also is incorrect. It is similar to the previous example and also to the last example in the introduction.

*There is only a 1000 to 1 chance that Smith is not the donor of the bloodstain*

This is another version of the transposed conditional, again given in the form of odds: it is an odds statement about the truth of a hypothesis. As in several of these examples, the failure to state any of the conditioning information contributes to the confusion.

*The chance of a man other than Smith leaving blood of this type is 1 in 1000*

The problem with this sentence is that it can be read in two different ways:

*The chance that a man other than Smith would leave blood of this type is 1 in 1000*

or

*The chance that a man other than Smith left blood of this type is 1 in 1000.*

Readers may differ in their opinions as to which of these interpretations of the wording is more obvious. The first is an acceptable statement whereas the second embodies a transposed conditional.

*It is very unlikely that the stain came from someone other than Smith*

Although this is not quantitative, it implies a transposed conditional because, once again, it relates to the probability of a hypothesis given the evidence, rather than the other way around.

*The evidence strongly supports the hypothesis that the stain came from Smith*

The use of the word 'supports' in this context was proposed by an eminent statistician, H. Jeffreys [6], and this kind of formulation is, in the author's opinion, the best available. This is the method which is recommended to scientists within the Forensic Science Service. Although it successfully conveys the impression that the evidence favours one hypothesis over the other it is not a probability statement. The strength of the support is based on the likelihood ratio but the overall probability (or odds) in favour of the hypothesis depends also on the other evidence.

*There is very strong evidence that the stain came from Smith*

This may be a familiar style of presentation to forensic scientists but it is difficult to determine whether or not a transposed conditional is inferred. Problems may well arise at court because subtle wording changes by counsel could inadvertently change it into a clear transposed conditional. It would be preferable to specify clearly which alternatives have been considered and the extent to which the evidence supports one of them.

*The chance of selecting a man other than Smith having the same blood type is 1 in 1000*

The most natural way of reading this is as: 'If a man other than Smith is selected then the chance that he will have the same blood type is 1 in 1000'. Whereas this is correct, the sentence is not as clearly worded as it might be. It would be clearer if it were rearranged to include explicitly a conditioning word or phrase.

### **Keeping the problem in perspective**

If avoidance of the transposed conditional were taken to extremes, things could become rather ludicrous. For example, if a scientist enters a room where the walls are smoke-blackened then it would be entirely natural for him to conclude that there had probably been a fire of some sort. If he were to say 'the evidence supports the hypothesis that there has been a fire' then non-scientists could be forgiven for regarding him as eccentric and/or pedantic. Unless the hypothesis relates directly to the ultimate issue of the defendant's involvement, courts will consider it acceptable, even desirable, for the expert to introduce a prior probability based on his experience and thus legitimately express an opinion about a hypothesis.

But the expert should, at least, be aware of the logical steps he is following.

Furthermore, if the Bayesian view were taken to its logical conclusion then experts would never give an opinion of identification. It is not possible for a scientist, following the Bayesian paradigm, to say 'I am satisfied that this tool made this mark' unless he assumes a prior probability, quantifies the evidence and assumes a threshold posterior probability at which he becomes virtually certain about a hypothesis. In reality, of course, none of these three is done explicitly. Although the process of subjective identification is recognized by courts everywhere as an invaluable element of forensic science, it cannot be rationalized by the simple Bayesian view, though BW Robertson and GA Vignaux (personal communication) have demonstrated an indirect method which treats the expert's opinion itself as an item of evidence for the court to consider. In practice, the reconciliation is a matter of pragmatism and sound common sense.

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