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Murder, Extramarital Affairs, and the Issue of Probative Value

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A paper previously published in Law and Human Behavior *by D. Davis and W. C. Follette (2002) argued that certain "profiling" characteristics commonly admitted into court have little or no probative value. They argued that this is especially likely to be true when the characteristic used as evidence (e.g., having an extramarital affair) is rather common in the population whereas the act in question (e.g., a man murdering his wife) is rare. Their analysis has prompted a strong response by Friedman and Park and by Kaye and Koehler with a rejoinder by Davis and Follette (all three follow this paper in this issue of* Law and Human Behavior*). This paper describes some of the nature of this controversy.*

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A husband is considered a suspect in the murder of his wife. How informative would it be to you to learn that the husband was having an extramarital affair? Many Americans experienced a version of this problem recently when a pregnant Laci Peterson, of Modesto, California, went missing on Christmas Eve of 2002. Later, it was learned that her husband, Scott Peterson, was having an extramarital affair, which seemed to dramatically focus attention on Scott Peterson. Scott Peterson was later charged with murder in the death of his wife and the death of their unborn son after they were washed ashore in the San Francisco Bay area. As of this writing, the trial of Scott Peterson has not yet been concluded. What role should the extramarital affair of Scott Peterson play in the evidence against him?

According to a paper published in this journal by Davis and Follette (2002) many months before Laci Peterson went missing, his extramarital affair per se has little or no probative value. Davis and Follette's reasoning stems largely from their observation that uxoricide (a man murdering his wife) is a relatively rare event whereas having an extramarital affair is relatively common event. For example, they used data from the FBI uniform crime statistics showing that the uxoricide rate is approximately four per million married men. They then estimated that the infidelity rate is approximately 250,000 per million married men. That means that 249,996

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unfaithful husbands out of 250,000 unfaithful husbands do not murder their wives. Using these types of numbers and various assumptions about the distribution of uxoricide among faithful and unfaithful husbands, Davis and Follette argued that the probative value of infidelity is very small and that the prejudicial value of permitting such evidence at trial is most likely to exceed it probative value.

Two new papers, published in the current issue of this journal, seek to strongly refute the Davis and Follette (2002) conclusion. Both papers largely accept the base rate information used by Davis and Follette regarding the rate of infidelity among married men and the rate of uxoricide. However, they raise several arguments about the appropriate way to calculate probative value. For example, Davis and Follette calculate probative value as the difference between the probability of the hypothesis (uxoricide) given the evidence of infidelity minus the probability of the hypothesis given evidence of fidelity. Kaye and Koehler (2003), however, calculate probative value as a likelihood ratio of the probability of the evidence (infidelity) given the hypothesis (uxoricide) is true divided by the probability of the evidence (infidelity) given the hypothesis is false (no uxoricide).

The difference between the Davis and Follette (2002) approach and the approaches of Kaye and Koehler (2003) and Friedman and Park (2003) is dramatic. Consider, for instance, a situation in which the probability of uxoricide among unfaithful husbands is three times that of the probability of uxoricide among faithful husbands (a likelihood ratio of 3.0).[2] Suppose now that the other evidence in the case is so weak that, considering the other evidence alone, there is only a 1% chance that the husband committed uxoricide. In this case, the probability of uxoricide given infidelity rises to a less than 3% chance. Suppose, however, other evidence in the case points to a 50% chance that the husband committed uxoricide. Under these conditions, adding the infidelity information increases the chances to 75%. Or, if the other evidence indicates a 90% chance that the husband committed uxoricide, adding the infidelity information increases the chances to nearly 97%. The latter might cross the decision criterion that people hold for reasonable doubt. Readers should not be confused by these probabilities, which are readily understood and easily calculated using Bayes' Theorem.

It is important to recognize that the impact of evidence has a nonlinear relation to posterior probabilities of guilt when taken across the spectrum of levels of corroborating evidence. At very low levels of corroborating evidence and at very high levels of corroborating evidence, infidelity evidence produces small changes to the probability of uxoricide whereas at more moderate levels of corroborating evidence infidelity evidence has a larger impact. A visual look at this nonlinear relation is depicted in Fig. 1 using the likelihood ratio of 3.0. Notice that the maximum increase in the probability of uxoricide from knowing about infidelity peaks at the point where the other evidence indicates a .36 probability of uxoricide, at which point the infidelity evidence raises the probability of uxoricide by 26.8%. Both the steepness of

[2]This is not to say that the correct likelihood ratio is 3.0 for infidelity evidence. Davis and Follette (2002) have proposed smaller likelihood ratios under some assumptions and both Friedman and Park (2003) and Kay and Koehler (2003) have suggested higher ratios under other assumptions. The point is that a likelihood ratio could be said to have considerable probative value or very little probative value depending on other considerations.

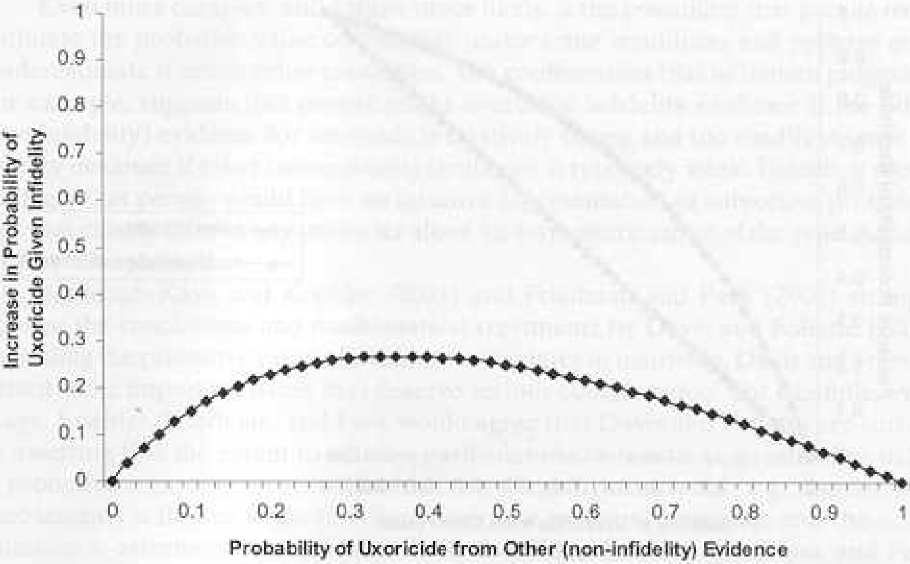

Fig. 1. Change in the probability of uxoricide given evidence of infidelity as a function of other evidence.

the curve and the point at which it peaks is determined by the likelihood ratio. Unlike the common wisdom of those who have only cursory familiarity with Bayesian statistics, the maximum change in the probability does not automatically occur when the other evidence indicates a .50 probability, but instead varies as a function of the likelihood ratio.

Davis and Follette's analysis (Davis & Follette, 2002) of the probative value of infidelity tended to focus on forms of data of the type shown in Fig. 1. In the absence of other evidence indicating uxoricide (the lower left values on the *X* axis of Fig. 1), it might be easy for people to overestimate the probative value of infidelity. Notice, for example, that if the other evidence indicates only a 2% chance of uxoricide, the infidelity information increases the probability by less than four additional percentage points. Similarly, when the other evidence indicating uxoricide is strong, the infidelity information adds very little. For example, when the other evidence indicates a .96 probability of uxoricide, the infidelity information increases the probability by less than three additional percentage points. Notice how probative value, if defined as the change measure as in Fig. 1, varies as a function of the other evidence in the case. This relates to Friedman and Park's arguments (Friedman & Park, 2003) that motive evidence interacts with other evidence in a way that can prove to be probative.

Another way to look at these same data is to examine the posterior probabilities themselves rather than the change in probabilities. Figure 2 is a plot of the same data as those in Fig. 1 except that the *Y* axis in Fig. 2 is the posterior probability of uxoricide (rather than the *change* in probability that was shown in Fig. 1). Again, keep in mind that these are exactly the same data graphed in a different way. The straight diagonal line in Fig. 2 is commonly called the "identity line," and represents the posterior probability if no evidence of infidelity was known. The curve above the identity line

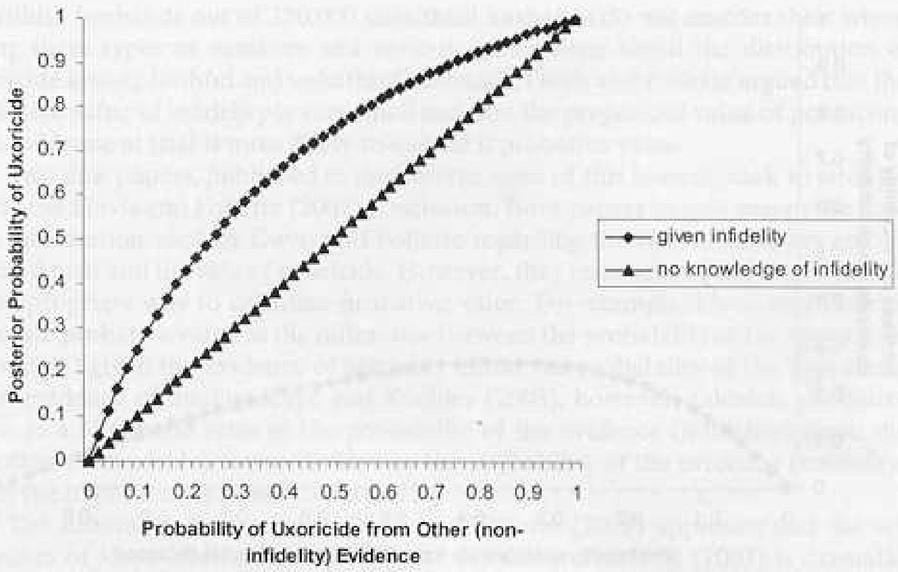

Fig. 2. Posterior probability of uxoricide given evidence of infidelity as a function of other evidence.

represents the posterior probability of uxoricide given all evidence, including the evidence of infidelity. This depiction of the probability data shows that the posterior probability (after considering all evidence) could exceed some decision criterion with the inclusion of infidelity evidence that it could not exceed without the infidelity evidence. For example, suppose that one needed to be 95% certain to vote guilty. The 95% criterion could be achieved if the other evidence indicated only an 85% probability and the infidelity evidence were then added to it. Or, if one needed to be 99% certain to vote guilty, then this level of certainty could be achieved if the other evidence indicated a 97% probability and the infidelity evidence were then added to it. This relates more closely to Kaye and Koehler's analysis (Kaye & Koehler, 2003) and their distinction between *sufficiency* and *support*.

The debate between these authors is an important one. But, the debate will remain incomplete to the extent that it is restricted to the question of what weight should properly be placed on motive evidence of this type. In particular, we need to know what weight people actually place on motive evidence of this type. Suppose, for example, the proper likelihood ratio describing the probative value of infidelity as it relates to uxoricide is 3.0. Suppose further that people estimate the probability of uxoricide based on other evidence (without evidence of infidelity) to be 60% and then after learning of infidelity revise their probabilities to be 95%. If this were to happen, then we would be inclined to conclude that the prejudicial value of the infidelity evidence would exceed it probative value because the revised probability should only be about 82%. Kaye and Koehler (2003) and Friedman and Park (2003) could be correct to assert that there is reasonable probative value in the infidelity evidence, but Davis and Follette (2002) could also be correct that people overestimate the probative value.

Even more complex, and I think more likely, is the possibility that people overestimate the probative value of infidelity under some conditions and perhaps even underestimate it under other conditions. The confirmation bias in human judgment, for example, suggests that people might overvalue infidelity evidence if the other (noninfidelity) evidence for uxoricide is relatively strong and too readily dismiss infidelity evidence if other (noninfidelity) evidence is relatively weak. Indeed, it seems unlikely that people would have an intuitive representation of subjective probabilities that closely follows any curve, let alone an asymmetric curve of the type dictated by Bayesian statistics.

Although Kaye and Koehler (2003) and Friedman and Park (2003) strongly contest the conclusions and mathematical treatments by Davis and Follette (2002) regarding the probative value of infidelity as it relates to uxoricide, Davis and Follette raised some important issues that deserve serious consideration. For example, even Kaye, Koehlèr, Friedman, and Park would agree that Davis and Follette are correct in asserting that the extent to which a particular characteristic (e.g., infidelity, debt) is probative regarding an act with which it is allegedly associated (e.g., murder, embezzlement) is limited when the characteristic is extremely common and the act in question is extremely rare. It is also likely that Kaye, Koehler, Friedman, and Park would agree that there is merit in obtaining better estimates of the true likelihood ratios associated with motive evidence so as to assess whether or not or under what conditions people overvalue that evidence.

It would be unfortunate if *Law and Human Behavior* readers avoided a detailed reading of the articles by Davis and Follette (2002), Kaye and Koehler (2003), and Freidman and Park (2003). Yes, the mathematics in these papers requires effort to process, but the math is actually rather simple, involving only rudimentary elements of probability. And the payoff can be quite large because of the ways in which these papers can sharpen our understanding of the probative value of evidence.

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