The Yale Law Journal

Articles

Route Analysis of Credibility and Hearsay*

Richard D. Friedman†

This Article applies a simple graphic technique, which I call route analysis,[1] to problems of credibility and hearsay. Route analysis facilitates the examination of the role that a given piece of evidence plays in the proof of an uncertain factual proposition. The focus of this Article is on a particularly important type of evidence—a person's declaration or other conduct that tends to prove the truth of a proposition because the person asserts the proposition or his conduct otherwise indicates he believes it to be true. This Article assumes, as a working premise, that such declarations or other conduct, whether in court or out of court, can be analyzed by the same technique used for other types of evidence. I hope to demonstrate that this premise is correct by reaching intuitively appealing yet nontrivial results; some of these results are quite general, while others concern specific recurrent issues of evidence law, such as the *Hillmon* doctrine.

---

1. I presented the technique in a previous article, Friedman, *A Diagrammatic Approach to Evidence*, 66 B.U.L. REV. 571 (1986) [hereinafter *A Diagrammatic Approach*].

A simple illustration will help clarify the working premise. Donald is accused of murdering Victor. After presenting other evidence, the prosecution offers indisputable proof that a smoking pistol bearing Donald's fingerprints was found near Victor's still warm body. A juror can evaluate the probability that Donald is the murderer by asking three questions: (1) "How probable did I think it was, before I heard this evidence, that Donald was the murderer?" (2) "How probable is it that the gun and fingerprints would show up if Donald were the murderer?" (3) "How probable is it that the gun and fingerprints would show up if Donald were *not* the murderer?"[2] Now suppose that instead of the smoking pistol the prosecution offers the testimony of Wendy that she saw Donald plug Victor. I will show in this Article that the juror's analysis of a case like this one is similar to that of the smoking pistol case. The juror's first question is identical to that in the pistol case, and the other two are very similar: "How probable is it that this evidence—Wendy's testimony—would arise if Donald were the murderer?" and "How probable is it that the testimony would arise if Donald were *not* the murderer?"

Answering those two questions is the essence of evaluating the credibility of an in-court witness or of an out-of-court declarant. The last question—asking the probability that a given declaration would be made notwithstanding its falsity—is particularly difficult and complex. The perceived difficulty of answering that question without having heard the declaration made and subjected to cross-examination is the principal source of the rule against hearsay.

Route analysis aids examination of these questions by setting out chains of circumstances that might have led to a given declaration. This makes possible a comprehensive and rigorous analysis of credibility, enabling an observer to avoid mistakes like those of such acute observers as Professor John Kaplan[3] and Professors Lea Brilmayer and Lewis Kornhauser.[4] Furthermore, with a simple extension, route analysis provides a far more powerful and flexible tool for analyzing hearsay than the celebrated testimonial triangle first presented in the legal literature by Professor Laurence Tribe.[5]

---

2. *See id.* at 582-84.

3. Kaplan, *Decision Theory and the Factfinding Process*, 20 STAN. L. REV. 1065, 1086-91 (1968); *see infra* Appendix B.

4. Brilmayer & Kornhauser, *Review: Quantitative Methods and Legal Decisions*, 46 U. CHI. L. REV. 116 (1978); *see infra* text accompanying notes 42-43 and Appendix D.

5. *See* Tribe, *Triangulating Hearsay*, 87 HARV. L. REV. 957 (1974). Professor Tribe's comment is quoted at length in R. CARLSON, E. IMWINKELREID & E. KIONKA, MATERIALS FOR THE STUDY OF EVIDENCE 427-29 (1983); E. GREEN & C. NESSON, PROBLEMS CASES AND MATERIALS ON EVIDENCE 279-82 (1983); J. KAPLAN & J. WALTZ, CASES AND MATERIALS ON EVIDENCE 87-89 (5th ed. 1984); J. WEINSTEIN, J. MANSFIELD, N. ABRAMS & M. BERGER, CASES AND MATERIALS ON EVIDENCE 550-51 (7th ed. 1983). Others present the testimonial triangle in somewhat modified

Section I of this Article reviews some of the basics of route analysis and the measurement of probative value.[6] Section II applies route analysis to credibility evaluations and Section III extends the analysis to hearsay. I have attempted to make the text as nontechnical as possible. Some more formal mathematical analysis does lurk at the bottoms of a few pages and in the Appendices. I believe that this analysis is significant and instructive; if, as I contend, assessing the credibility of a witness or an out-of-court declarant involves consideration of probabilistic questions, then the mathematical theory of probability can aid the analysis. I have put the mathematical discussions to the side, however, so that they do not clutter the way for readers less technically inclined.

I. ELEMENTS OF ROUTE ANALYSIS AND THE MEASUREMENT OF PROBATIVE VALUE

The basic method of route analysis is to represent both known and unknown propositions as nodes, with arrows between them indicating probability assessments. By examining the routes going through all known propositions, we can determine the probability of an unknown proposition.

Figure 1 is a simple route diagram, representing a simple situation. Mornings in the city of Omphalos are either cloudy or not cloudy, and afternoons are either rainy or not rainy. In the diagram, o represents our base of information;[7] CLOUDY represents the proposition that a given morning is cloudy in Omphalos; RAINY represents the proposition that the afternoon is rainy. The prefix NOT- represents the negation of a proposition; thus, NOT-CLOUDY is the proposition that the morning is not cloudy and NOT-RAINY the proposition that the afternoon is not rainy.

Now suppose that we know the probability of a cloudy morning, which we represent by $P(\text{CLOUDY})$. From this, we know what $P(\text{NOT-CLOUDY})$

---

form. *E.g.*, M. GRAHAM, EVIDENCE 79-83 (1983); R. LEMPERT & S. SALTZBURG, A MODERN APPROACH TO EVIDENCE 350-64 (2d ed. 1982); Graham, *"Stickperson Hearsay": A Simplified Approach to Understanding the Rule Against Hearsay*, 1982 U. ILL. L. REV. 887. Professor Ronald Allen has pointed out to me that the testimonial triangle bears a familial resemblance to the "Triangle of Reference" presented in the classic work, C. OGDEN & I. RICHARDS, THE MEANING OF MEANING 10-12 (8th ed. 1946 & supplementary essays 1956); Malinowski, *The Problem of Meaning in Primitive Languages*, in C. OGDEN & I. RICHARDS, *supra*, at 323-25 Supp. As compared to Ogden and Richards, Tribe gives the triangle, especially its base, a somewhat different meaning, and puts it to an altogether different purpose.

6. Those who have read *A Diagrammatic Approach*, *supra* note 1, or a second article, Friedman, *A Close Look at Probative Value*, 66 B.U.L. REV. 733 (1986) [hereinafter *A Close Look*] may find it unnecessary to work through this Section. This Section's review is concededly sketchy; those who find that it leaves questions unanswered may wish to consult the previous articles.

7. In other words, o represents the "origin" of the problem, or everything we know about the world other than the propositions separately identified.
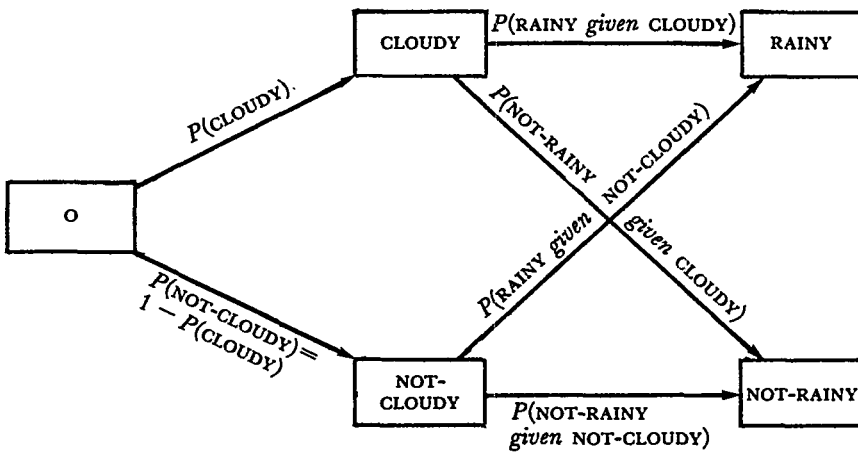
FIGURE 1

is, because $P(\text{CLOUDY}) + P(\text{NOT-CLOUDY})$ equals one: the morning is either cloudy or not cloudy, but not both. Similarly, suppose we know the probability, given the assumption that the morning is cloudy, that the afternoon will be rainy. This we represent as $P(\text{RAINY given CLOUDY})$. And by definition $P(\text{NOT-RAINY given CLOUDY})$ equals $1 - P(\text{RAINY given CLOUDY})$. Finally, suppose we know the probability, given the assumption that the morning is *not* cloudy, that the afternoon will be rainy. This is $P(\text{RAINY given NOT-CLOUDY})$, and by definition $P(\text{NOT-RAINY given NOT-CLOUDY})$ equals $1 - P(\text{RAINY given NOT-CLOUDY})$.[8]

Given all this information, we may wish to determine $P(\text{RAINY})$, the probability of afternoon rain as determined before knowing anything about the weather on the particular morning. There are two routes to RAINY, one through CLOUDY and one through NOT-CLOUDY, and so the probability that events will reach RAINY by one route or the other is the sum of the probabilities for each of the two routes. The probability for the first route is $P(\text{CLOUDY}) \times P(\text{RAINY given CLOUDY})$, and the probability

---

8. More formal notations substitute a vertical line to represent "given," a character or symbol (e.g., N or ~) to represent the negation of a proposition, and single letters, rather than words, as proposition names. The notation used here is designed to ease the path for readers who are not conversant with formal probability work, without, of course, affecting the validity of the analysis. The mathematically inclined are invited to read "$P(\text{R} \mid \text{NC})$" for "$P(\text{RAINY given NOT-CLOUDY})$." In the appendices, the more compact notation is used.
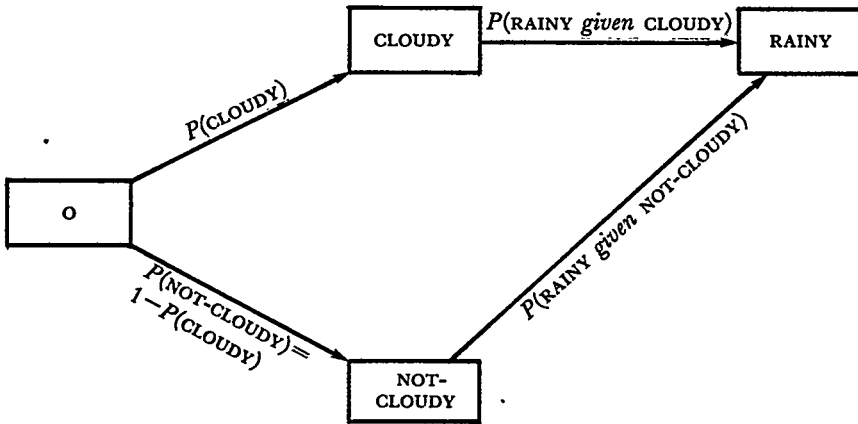
FIGURE 2

for the second route is $[1 - P(\text{CLOUDY})] \times P(\text{RAINY } given \text{ NOT-CLOUDY}).$[9] Thus,

$$P(\text{RAINY}) = P(\text{CLOUDY}) \times P(\text{RAINY } given \text{ CLOUDY}) \qquad (1)$$
$$+ [1 - P(\text{CLOUDY})] \times P(\text{RAINY } given \text{ NOT-CLOUDY}).$$

This is what I call a prospective problem—determining the probability, from the perspective of one point on a route diagram, that a proposition represented farther to the right[10] is true. To learn that the morning is cloudy is to receive prospective evidence in determining the likelihood of afternoon rain, because RAINY is represented farther to the right of CLOUDY on this diagram.

Prospective evidence is important in many adjudicative situations.[11] More important, however, and the focus of this Article, is what I call retrospective evidence. Suppose, for example, that we arrive in Omphalos on a rainy afternoon. Given the afternoon rain, what is the probability that the morning was cloudy; that is, what is $P(\text{CLOUDY } given \text{ RAINY})$?

To analyze this proposition, we can use a diagram that dispenses with one of the nodes of, and so is even simpler than, Figure 1; we already know that RAINY is true, so we need not worry about NOT-RAINY or the

---

9. Recall that $1 - P(\text{CLOUDY})$ equals $P(\text{NOT-CLOUDY})$.
10. One proposition may be represented farther to the right of another if it is later in time or logical sequence. For a discussion of such sequences and the placement of the nodes, see *A Diagrammatic Approach, supra* note 1, at 588-91.
11. For example, in a personal injury case, the jury may have to determine how great the plaintiff's earnings will be given her injury, and also how much she would earn if she were not injured.

671

routes leading to NOT-RAINY. In Figure 2, we should imagine ourselves at RAINY. We know that events began at O and have reached RAINY. The question is, "How did we get here from there?" As the prospective analysis has shown, there are two routes by which events could go from O to RAINY, the first through CLOUDY and the second through NOT-CLOUDY. Suppose that, from the vantage point of O, it seemed that events would more likely travel the first route than the second to RAINY; then if we know that events have in fact reached RAINY, it is more likely that they came via the first route, through CLOUDY, than through NOT-CLOUDY. We can express this in more formal terms by saying that the probability of CLOUDY, given that RAINY is true, is the probability of the route from O through CLOUDY to RAINY divided by the total probability of both routes from O to RAINY. In the notation we have adopted,

$$P(\text{CLOUDY } given \text{ RAINY}) = \frac{P(\text{CLOUDY}) \times P(\text{RAINY } given \text{ CLOUDY})}{P(\text{RAINY})}. \quad (2)$$

This equation is one form of what is known as Bayes' Theorem.[12] It is crucial because it lets us express the retrospective probability that we seek in terms of the prospective probabilities with which we began.

In an adjudication, the factfinder must determine the probability of a disputed material proposition given all the evidence. In deciding whether to admit proffered evidence, the judge must assess whether the evidence appears to have probative value. The probative value of evidence may be defined as its "tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."[13] A simple formal definition of probative value essentially restates the verbal one.[14] Let $PV(\text{Y } w.r.t. \text{ X})$

---

12. The theorem was first presented by an English cleric, Thomas Bayes, in *An Essay Toward Solving a Problem in the Doctrine of Chances*, 53 PHIL. TRANSACTIONS ROYAL SOC'Y 370 (1763), *reprinted in* U.S. DEP'T OF AGRIC., FACSIMILES OF TWO PAPERS OF BAYES (1940). For an informal proof of the theorem and a fuller discussion of it in route analysis terms, see *A Diagrammatic Approach, supra* note 1, at 586-88 & n.32. For more general discussions of the theorem, see M. BIZLEY, PROBABILITY 88 (1957); Cullison, *Probability Analysis of Judicial Fact-Finding: A Preliminary Outline of the Subjective Approach*, 1969 U. TOL. L. REV. 538, 545.

13. FED. R. EVID. 401.

14. *See A Close Look, supra* note 6, at 738. *But see* Kaye, *Quantifying Probative Value*, 66 B.U.L. REV. 761 (1986) (criticizing this method of measuring probative value); Friedman, *Postscript: On Quantifying Probative Value*, 66 B.U.L. REV. 767 (1986) (replying to Kaye).

mean the probative value of evidentiary proposition Y with respect to material proposition X. Then

$$PV(\text{Y } w.r.t. \text{ X}) = P(\text{X } given \text{ Y}) - P(\text{X}), \tag{3}$$

where $P(\text{X } given \text{ Y})$ is the probability of X evaluated after introduction of Y and $P(\text{X})$ is the probability of X evaluated beforehand.

If $P(\text{X } given \text{ Y})$ is greater than $P(\text{X})$—that is, if knowledge of Y makes the truth of X more likely than it would be absent knowledge of Y—then Y has positive probative value. If Y makes X less probable, it has negative probative value. Finally, Y has no probative value[15] if it leaves the probability of X unaltered. Because $P(\text{X } given \text{ Y})$ lies between 0 and 1, the maximum positive probative value of Y is equal to $1 - P(\text{X})$, indicating that Y proves X to a certainty, and the maximum possible negative probative value of Y equals $- P(\text{X})$, indicating that Y absolutely disproves X.[16]

II. ROUTE ANALYSIS OF CREDIBILITY

A. *The Basic Credibility Model*

Section I treated evidentiary propositions, such as Y in the immediately preceding discussion, as if proven to a certainty; only the inferences that could be drawn from such propositions were left uncertain. In the retrospective Omphalos weather problem, for example, we assumed that, although we could not determine conclusively whether the morning had been cloudy, our evidence—proof of whether the afternoon was rainy or not—was certain. But of course in adjudication external facts are generally not proven with certainty. Most often, the jury (or other factfinder) receives evidence of a proposition through a witness, who may or may not be speaking the truth. Sometimes, the jury must rely on, in addition to or instead of a human witness, an instrument such as a thermometer or a radar speed gun that may or may not be reporting accurately.

Route analysis can take into account the uncertainties created by the fallibilities of human and non-human witnesses, and in so doing can help us understand the nature of problems of credibility and reliability.[17]

---

15. That is, $PV(\text{Y } w.r.t. \text{ X}) = 0$.

16. Substituting into Equation 3, if $P(\text{X } given \text{ Y}) = 0$, the minimum possible value, then $PV(\text{Y } w.r.t. \text{ X}) = - P(\text{X})$; if $P(\text{X } given \text{ Y}) = 1$, the maximum possible value, then $PV(\text{Y } w.r.t. \text{ X}) = 1 - P(\text{X})$.

17. I use "reliability" with reference to non-human "witnesses" that make and report observations, including instruments like radar guns and thermometers, *cf.* McCORMICK ON EVIDENCE § 204, at 610-14 (E. Cleary 3d ed. 1984) (admissibility of speed measurement by various devices), and bloodhounds, *see, e.g.*, State v. Loucks, 98 Wash. 2d 563, 656 P.2d 480 (1983); State v. Porter, 303 N.C. 680, 690, 281 S.E.2d 377, 384 (1981); Annotation, *Evidence of Trailing by Dogs in Criminal*

These problems may be analyzed along the same lines as other retrospective problems of relevance. The question is "How did we get here, TESTIMONY(X), from there, O?" where TESTIMONY(X) represents the testimony by a given witness of fact X, O represents the facts that we know apart from the testimony, and there are one or more routes from O to TESTIMONY(X) through X and one or more through NOT-X. We wish to find $P(X$ *given* TESTIMONY(X)).[18]

A traditional model treats a witness' credibility as if one could summarize it by simply stating a probability that a statement by the witness is accurate. In other words, one could determine for a witness Wilma a constant, C, which equals $P(X$ *given* TESTIMONY(X)) for any factual proposition X, without reference to the probability of X assessed apart from the witness' statement.[19] Even as a simplification, this model is grossly inadequate. For one thing, as Appendix A shows, it is mathematically incoherent. For another, it leads to the bizarre result that, if X previously appeared to have a probability greater than C, Wilma's testimony of X would necessarily *lower* that probability. Perhaps most significantly, the model provides no basis for treating differently testimony of the truth of the proposition EMPIRE, "The Empire State Building is standing," and of CHEESE, "The moon is made of green cheese." Of course we do treat those testimonial statements differently, even if made by the same witness. In assessing the accuracy of Wilma's statement as to any proposition X, we take into account not only her propensity to report accurately but also

---

Cases, 18 A.L.R.3d 1221, §§ 3, 4 (1968 & Supp. 1984). For the most part, the following discussion will refer only to credibility of human witnesses. Reliability of non-human witnesses can usually be analyzed by means similar to those used for examining the credibility of human witnesses, but without some of the complexities. For example, the reports of a mechanical observer may present problems of perception and articulateness, but ordinarily not problems of sincerity or (putting computers aside) memory; if a thermometer indicates that the temperature is 75°, we may be concerned that the mechanism is malfunctioning (misperception) or that the gauge is miscalibrated (inarticulateness), but not that the thermometer is lying or forgetting. Potential incapacities of human witnesses are represented *infra* in Figure 6 and listed *infra* at text accompanying notes 46-48.

18. TESTIMONY(X) is used throughout this Article to represent testimony of a particular witness to a particular fact X. Thus, in the discussion of Knapp v. State, 168 Ind. 153, 79 N.E. 1076 (1907), TESTIMONY(HEARD) represents the proposition that a witness (Knapp) testifies that he heard a report that a marshal clubbed an old man to death. *See infra* text accompanying notes 32-34.

19. This is the traditional Bernoulli-Boole model adopted in Ball, *The Moment of Truth: Probability Theory and Standards of Proof*, 14 VAND. L. REV. 807, 827 (1961), and criticized at great length in L. COHEN, THE PROBABLE AND THE PROVABLE 95-107 (1977). A variation assigns to $P(X$ *given* TESTIMONY(X)) a value $C(X)$ that depends not only on the witness' credibility but on the prior probability of the particular proposition X. This appears to be the model adopted in Cullison, *supra* note 12, at 592-95, although Cullison is unclear, and may be taking the traditional Bernoulli-Boole approach. This variation avoids the incoherence and lack of realism that plague the more rigid model, *see infra* Appendix A, but it does so at an intolerable price of question-begging: Because we seek to determine $P(X$ *given* TESTIMONY(X)), a value for it should not be assumed at the outset. Of equal importance, the variation does not truly measure the witness' credibility, but only the credibility of his statement—the probability that X is true given his assertion of it. *See infra* text following note 30.

$P(x)$, the likelihood, as assessed apart from the statement, that x is true. We do this even when the witness is not human. Suppose we have determined, by measuring against an instrument of known reliability,[20] that 95% of a particular thermometer's readings are accurate. Can we then say, if the thermometer reads 110°F, that it is 95% certain that this is indeed the temperature? Not if it is February in Minnesota.

Nor does it solve our problem to turn this model inside out and treat Wilma's credibility as the probability that, given the truth of x, she will testify accurately—that is, to assign to the witness an index Q equal to $P(\text{TESTIMONY}(x) \text{ given } x)$.[21] For one thing, it is obvious that any human witness is more likely to state certain facts accurately than certain other facts.[22] If MAIL is the proposition that Wilma has mailed a long-awaited check, and CHOP is the proposition that she chopped down her father's favorite cherry tree, it takes no great insight to see that MAIL is more likely than CHOP to produce truthful testimony by Wilma—that is, $P(\text{TESTIMONY}(\text{MAIL}) \text{ given } \text{MAIL})$ is greater than $P(\text{TESTIMONY}(\text{CHOP}) \text{ given } \text{CHOP})$. Thus, we cannot speak simply of Q, the probability that the witness will state any fact accurately; rather, we must speak of $Q(x)$—the probability that the witness will state a *particular* fact x accurately.

We can assume comfortably that $Q(\text{MAIL})$ substantially exceeds $Q(\text{CHOP})$. And yet, even if CHOP is, a priori, no more likely than MAIL, we are inclined to give far more credence to the confession, "Father, I chopped down your cherry tree," than to the declaration, "The check is in the mail." This apparent paradox is not difficult to resolve.

Consider $P(\text{TESTIMONY}(x) \text{ given } \text{NOT-x})$, the probability that a witness would testify that a proposition is true although in fact it is false. We may call this probability $R(x)$. Even if Wilma has not mailed the check, she may have a substantial incentive to say that she has. Thus, it is entirely plausible that $R(\text{MAIL})$ is quite large, perhaps (if Wilma appears somewhat shifty) nearly as large as $Q(\text{MAIL})$.[23] On the other hand, unless

---

20. And how, the technical-minded might ask, is this other instrument *known* to be reliable? It should suffice if the instrument is a platinum resistance thermometer, calibrated by and tested against the fixed points of the current International Practical Temperature Scale. *See Thermometry*, 18 EN-CYCLOPAEDIA BRITANNICA: MACROPAEDIA 321, 324–25 (1978). Even then, if we wanted to be absolutely precise (for present purposes, thankfully, we do not need to be), we would have to recognize a possibility that the thermometer might be in error.

21. Note that $P(\text{TESTIMONY}(x) \text{ given } x)$ is not identical to $P(x \text{ given } \text{TESTIMONY}(x))$. Indeed, as Appendix B demonstrates, if the two are equal in a given case, it is only a matter of coincidence. That Appendix also shows that failure to distinguish between $P(\text{TESTIMONY}(x) \text{ given } x)$ and $P(x \text{ given } \text{TESTIMONY}(x))$ seriously impairs the model of credibility offered by Professor Kaplan.

22. This factor need not hold in the same way for non-human witnesses. One can easily imagine an instrument that accurately measures a condition 95% of the time, the remaining observations being erroneous because of a malfunction that occurs randomly with respect to the condition being measured.

23. In other words, a dishonest Wilma may be very likely to say she has mailed the check whether she has done so or not; that saying so would be lying may deter her little or not at all.

Wilma is a martyr or a masochist, R(CHOP) is almost certainly far smaller than Q(CHOP), and indeed close to zero: If Wilma is blameless she has little or no reason to take the rap. Thus, although she is less likely to testify to CHOP than to MAIL if both facts are true, *if* Wilma testifies to both facts, then CHOP is more likely than MAIL to be true.

We see, then, that in determining the probable accuracy of a witness' statement that x is true, we must take into account: (1) P(x), the probability of x as judged apart from the witness' statement of it; (2) Q(x)—that is, P(TESTIMONY(x) *given* x), or the probability that the witness would testify to x if x were accurate; and (3) R(x)—that is, P(TESTIMONY(x) *given* NOT-x), or the probability that the witness would testify to x if x were *not* accurate.[24]

Figure 3 shows how these factors must be combined. This map, showing that events may proceed from O to TESTIMONY(x) either via x or via NOT-x, is a simple and perfectly general route diagram; indeed, it is identical to Figure 2, except for the names of the nodes. Thus, ordinary principles of relevance for retrospective evidence apply to testimonial evidence. In a prior article,[25] I have explored these principles in some depth. I emphasize here two principles that highlight and sharpen points made in the preceding discussion.

First, other things being equal, the greater the probability of the disputed proposition before considering the evidence, the greater its probability after. As applied to testimony, this means that the greater the prior assessment P(x), the greater is the posterior evaluation of P(x *given* TESTIMONY(x)).[26] Thus, one factor in determining the probability that a witness is testifying accurately has nothing to do with the witness' personal credibility.

The second factor does focus on the witness' credibility per se. To examine it requires introduction of another term, often used in probabilistic analysis of evidence: the likelihood ratio of evidentiary proposition y with respect to material proposition x.[27] Defined as the quotient P(y *given* x) $\div$ P(y *given* NOT-x), this ratio tells us whether the truth of y is more or less likely (and by how great a factor) given the truth of x as opposed to the falsity of x. If the probability of the evidentiary proposition y is greater given x than given NOT-x—that is, if the likelihood ratio is greater than one—then the evidence has positive probative value; if the ratio equals one, the evidence has no probative value; and if the ratio is

---

24. *See supra* text following note 2.
25. *A Close Look, supra* note 6.
26. *See id.* at 753.
27. *See, e.g.*, Lempert, *Modeling Relevance*, 75 MICH. L. REV. 1021 (1977).
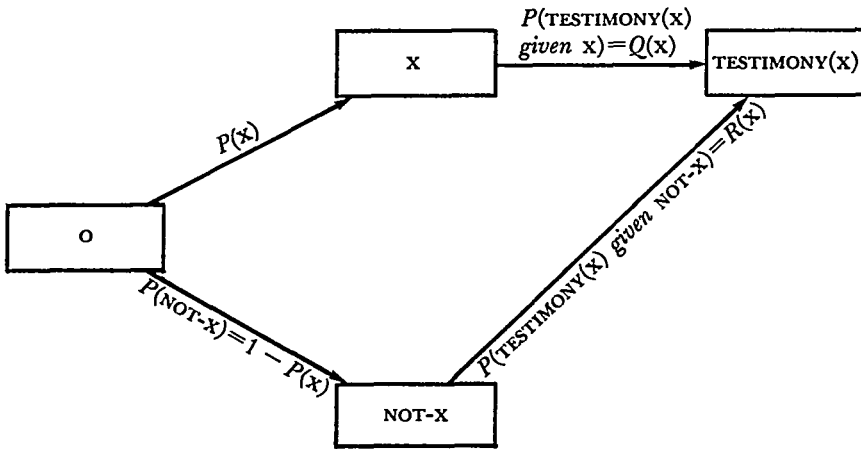
FIGURE 3

less than one the evidence has negative probative value.[28] For a given prior probability $P(x)$, the posterior probability $P(x \text{ given } y)$ is greater if the likelihood ratio of the evidence is greater; consequently, as the likelihood ratio increases from less than one to greater than one, the probative value of the evidence increases from a negative to a positive number.[29]

The consequence of this for our credibility model is that both the probability of x given the testimony and the probative value of the testimony vary with the likelihood ratio of the testimony—that is, with the ratio of (1) $P(\text{TESTIMONY}(x) \text{ given } x)$, the probability that the testimony would be made given the truth of x, to (2) $P(\text{TESTIMONY}(x) \text{ given NOT-} x)$, the probability that the testimony would be made given that x is false. In the simpler notation we have used, this ratio is $Q(x) \div R(x)$.

We can now give this ratio a special name, $C(x)$, meaning the credibility ratio of a particular witness in testifying to x. $C(x)$ is an ordinary likelihood ratio, but it obeys one limitation that does not confine most likelihood ratios. The witness should be at least as likely to testify to x if it is true as she would be if it is false; indeed, we may well call the witness a pathological liar if the falsity of x makes her *more* likely to assert x. Thus, for most witnesses, $Q(x)$ is at least as great as $R(x)$, and so $C(x)$ is at least one. A virtually certain consequence of this is that the jury should be at least somewhat more likely to believe x after hearing the

28. *See A Close Look, supra* note 6, at 739.
29. *See id.* at 748-49.

witness' testimony than it was beforehand;[30] one possible exception, based on the witness' demeanor in giving her testimony, is analyzed in Appendix C.

The witness' credibility in making a statement, denoted by the $C(x)$ ratio, should be carefully distinguished from what may more loosely be termed the credibility of her statement. In speaking of the credibility of the witness' statement of x, I mean nothing more than $P(x$ *given* TESTIMONY$(x))$—the probability that x is true given that the witness has testified to it. But as we have seen, the credibility of a witness' statement as to x depends not only on the witness' personal credibility, $C(x)$, but also on the prior probability of x, $P(x)$; the more probable x appears before hearing the witness' statement of it, the more probable it appears afterwards.

We can use this general background to give a somewhat more precise analysis of the four illustrative declarations discussed above. In the Empire State Building case, the prior probability, $P($EMPIRE$)$, is already so close to one that the testimony as to EMPIRE cannot have much probative value: There is hardly any room to increase the probability of EMPIRE, and, unless Wilma is not only a pathological liar on the status of skyscrapers, but a severe one at that, her testimony cannot decrease that probability significantly. Wilma's declaration has insignificant value in the green-cheese-moon case as well, but for the opposite reason. The prior probability of CHEESE is so minuscule that even if Wilma's credibility, $C($CHEESE$)$, is quite high, $P($CHEESE *given* TESTIMONY$($CHEESE$))$ will still be tiny. We are far more likely to conclude that Wilma has made a mistake, or is joking or lying, than that she has accurately stated the composition of the lunar landscape.

In the check-in-the-mail case, the probative value of the evidence may be very slight, but for a reason of a different nature. Unlike the first two cases, the prior probability of MAIL may well be far from either extreme, but if $C($MAIL$)$ is barely larger than one—because Wilma is very likely to say that the check is in the mail even if it is not—the question may re-

---

30. The relationship of the credibility ratio and the prior probability of proposition x to the posterior probability of x and to the probative value of the testimony may be expressed formally by adapting two general equations for retrospective evidence presented in *A Close Look*, *supra* note 6, at 747-48, and stated there in terms of ordinary likelihood ratios:

$$P(x \text{ given TESTIMONY}(x)) = \frac{C(x)}{C(x) + \dfrac{1 - P(x)}{P(x)}} \tag{N1}$$

and

$$PV(\text{TESTIMONY}(x) \ w.r.t. \ x) = \frac{P(x) \times [1 - P(x)] \times [C(x) - 1]}{[P(x) \times C(x)] + [1 - P(x)]} \tag{N2}$$

main a close one after the declaration. In the cherry tree case, by contrast, Wilma's confession will virtually settle the issue of her culpability, even if previously her guilt seemed unlikely. With $R(\text{CHOP})$ near zero, $C(\text{CHOP})$ is extremely high, so that $P(\text{CHOP } given \text{ TESTIMONY}(\text{CHOP}))$ is near one—or put another way, $PV(\text{TESTIMONY}(\text{CHOP}) \ w.r.t. \ \text{CHOP})$ approaches the maximum of $1 - P(\text{CHOP}).$[31]

B. *An Illustration and Application: The* Knapp *Case*

The principles discussed above help in understanding the celebrated case of *Knapp v. State.*[32] Accused of murdering a marshal, Knapp pleaded self-defense. To bolster his case, he testified that before the killing he had heard a report that the marshal had clubbed an old man to death. When the prosecution offered proof that the old man died of senility and alcoholism, Knapp objected on grounds of relevance.

Figure 4 shows why this objection was properly overruled. Here, CLUB represents the proposition that the marshal clubbed the old man to death and HEARD the proposition that Knapp heard a report of CLUB. TESTI-MONY(HEARD) represents Knapp's testimony that he heard a report that the marshal killed the old man; there is no NOT-TESTIMONY(HEARD) node because the jury knows that Knapp has given this testimony. This diagram introduces a new technique that will be used occasionally in this Article: a very light arrow indicates a particularly low probability and a very heavy arrow indicates a particularly high probability.[33] Thus, the arrow from O to CLUB is light and that from O to NOT-CLUB heavy, because absent evidence on point it appears improbable that the marshal clubbed the old man to death. Similarly, the arrow from NOT-CLUB to HEARD is light, and that from NOT-CLUB to NOT-HEARD heavy, because most situations in which no clubbing has occurred do not give rise to a rumor of clubbing. The arrow from HEARD to TESTIMONY(HEARD) is heavy, because if Knapp did hear a report of clubbing he would have every reason to give truthful testimony of the report; the arrow from NOT-HEARD to TESTIMONY(HEARD) is not particularly light because Knapp would have a substantial incentive to claim HEARD even if HEARD were untrue. Thus, $C(\text{HEARD})$, although greater than one, is relatively low.

---

31. *See supra* text accompanying notes 15–16.

32. 168 Ind. 153, 79 N.E. 1076 (1907). I analyzed this problem in part in *A Diagrammatic Approach, supra* note 1, at 591–92, but now it is possible to take a fuller view.

33. Principally because of the static nature of print, which does not allow the same efficiency in presenting variations as does, say, a blackboard, this technique will not be applied uniformly here. Accordingly, no inference should be drawn as to a particular probability from the fact that it is *not* indicated by a very light or very heavy arrow.
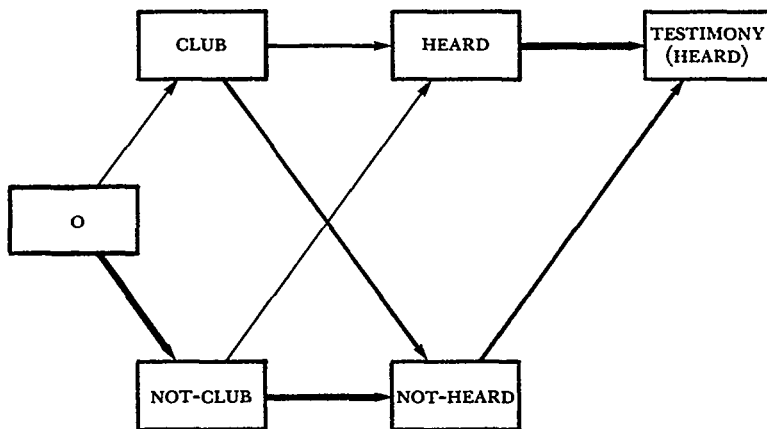
FIGURE 4

The ultimate question is how events proceeded between the two points known by the jury, from O to TESTIMONY(HEARD). They could have gone through CLUB and HEARD (indicating that Knapp did in fact hear a report, and it was true), NOT-CLUB and HEARD (Knapp heard an untrue report), NOT-CLUB and NOT-HEARD (Knapp fabricated the report, which would have been untrue), or—least likely of all—CLUB and NOT-HEARD (Knapp fabricated a report of the truth).

The prosecution's proof that CLUB is in fact untrue eliminates the first of these routes (as well as the unlikely fourth), and so "show[s] that somewhere between the fact [NOT-CLUB] and the testimony [TESTI-MONY(HEARD)] there was a person who was not a truth speaker."[34] True, the falsehood may not have been Knapp's—it may have been that Knapp heard a report of a clubbing (HEARD), notwithstanding the fact of NOT-CLUB. Proof of NOT-CLUB has, however, eliminated a route that previously appeared to be a significant conduit for "traffic" from O to HEARD, whereas of the routes inconsistent with HEARD only a relatively unimportant one has been eliminated. It therefore appears substantially more probable than before that NOT-HEARD is true, so that Knapp's testimony of HEARD conflicted with the facts.

If Knapp's testimony gained some credence before proof of NOT-CLUB, so that the HEARD versus NOT-HEARD issue was considered in doubt, the proof of NOT-CLUB will probably shift the balance substantially toward

---

34. 168 Ind. at 157, 79 N.E. at 1077.

NOT-HEARD. The probability that a witness' statement is true depends not only on the witness' credibility ratio for that statement but also on the probability, as judged apart from his testimony, that the statement is true. Here, the jury may be expected to begin with an understanding that Knapp's self-interest makes his credibility ratio for this testimony quite low. And the prosecution's proof as to the actual cause of the old man's death significantly lowers the probability, as judged apart from his testimony, that Knapp heard the report. Together these factors support the inference that by far the most probable path is one leading through NOT-HEARD, indicating that Knapp lied on the stand.

C. *Reports of Unusual Events and the Multiple Possibilities of Falsehood*

In the credibility problems we have previously considered, we have implicitly assumed that a witness has two options in each case, to speak accurately or to speak inaccurately. This is essentially true if the witness is presented a yes-or-no question. But often the question is more open-ended. We must take into account that, although there may be only one truth, there are many ways of speaking falsely.

Consider the well-known case of *Bridges v. State*,[35] in which defendant Bridges was accused of molesting a very young girl, Sharon, in his apartment. A material issue was whether Sharon had ever been in the apartment. The prosecution offered the child's declaration[36] describing the appearance and arrangement of various objects in the apartment, together with apparently incontrovertible evidence confirming the accuracy of her description.

Figure 5 suggests why Sharon's declaration was so compelling. Here O represents the underlying evidence apart from Sharon's declaration, including the other proof describing Bridges' apartment. PRESENT represents the proposition that Sharon was present in the apartment, and DESCRIBE represents the proposition that she accurately describes the apartment. Assume that Sharon is asked for a description of Bridges' apartment only after answering affirmatively to a query as to whether she was in the apartment. This affirmative answer is represented in Figure 5 by the two-section node YES. The YES node is in two sections because the probability of DESCRIBE given both YES and PRESENT is different from the

---

35. 247 Wis. 350, 19 N.W.2d 529 (1945).

36. In the actual case, Sharon's testimony was supported by that of other witnesses who repeated out-of-court declarations that she had made. The principal issue in the case was thus one of hearsay. *See* 247 Wis. at 355-57, 19 N.W.2d at 531-32. The discussion in the text puts this factor aside and concentrates on the probative value of Sharon's own declaration. Understanding of that issue casts light on the hearsay question as well. *See infra* note 40.

probability of DESCRIBE given YES and NOT-PRESENT; on the other hand, YES is represented as a single node rather than as separate nodes because in learning YES the jury does not learn whether PRESENT is true or not. In other words, the jurors know that events have reached the YES node, but they do not know which section of that node events have reached.[37]
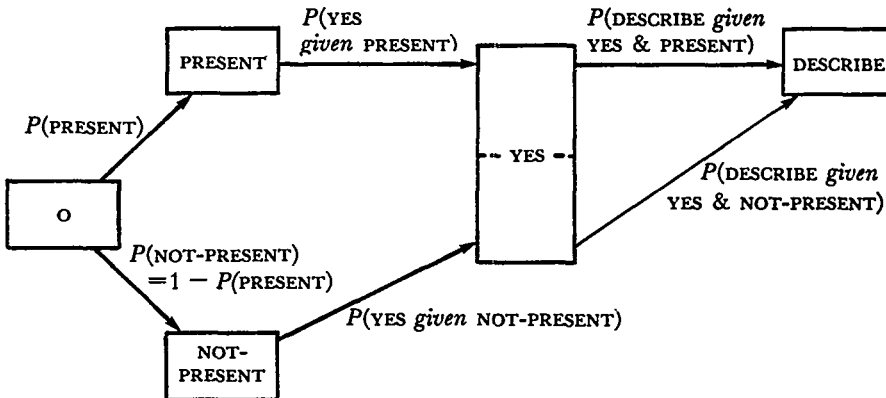

FIGURE 5

There are two routes to DESCRIBE, one through PRESENT and the other through NOT-PRESENT. But, as indicated by the very light arrow from the NOT-PRESENT section of YES to DESCRIBE, that linkage is so weak—it is so unlikely that Sharon would give this particular description, among all the others possible, if she had not actually been in the apartment[38]—that the second route appears improbable. If, apart from Sharon's testimony, other evidence established that there was a substantial probability she had been in the apartment,[39] the conclusion is virtually compelled that the first

---

37. For a fuller discussion of two-section nodes, see *A Diagrammatic Approach, supra* note 1, at 612–15. In this diagram there is no need to show the NOT-YES and NOT-DESCRIBE nodes, because we know that YES and DESCRIBE are true.

38. I assume, as did the court, that the circumstances and other evidence made it essentially impossible for Sharon to know of the apartment's appearance without having been there. *See* McCOR-MICK ON EVIDENCE, *supra* note 17, § 250, at 742. There is of course the possibility that Sharon could come up with an accurate description of the apartment even without actual knowledge of its appearance, simply by making a lucky guess. If her description were bland and spare—"blue walls, big radio"—this possibility would have to be reckoned substantial. In fact, although the information provided by Sharon was mundane, it was sufficiently detailed in aggregate to make the lucky guess hypothesis unlikely. *See* 247 Wis. at 355–56, 19 N.W.2d at 531.

39. This factor distinguishes Sharon's case from that of the lottery discussed below, *see infra* text accompanying notes 42–43 and Appendix D, where the prior probability—that is, the probability as assessed before the selector's declaration—that the chosen ticket bears a given number is very small. In such a case, we can have strong confidence that the selector's announcement is correct only if we regard the selector as highly credible.

route was the actual one. And this proposition holds true even if Sharon is regarded as rather unreliable and therefore likely to report inaccurately.[40] The essential point here is that often, if a witness testifies inaccurately, there is only a small probability that he or she will come up with a particular false story. We must take this factor into account, especially when the witness testifies to events that, judged apart from the testimony, seem improbable. In such a case, the two low probabilities may be nearly in balance—that is, the low probability assessment, apart from the testimony, that the particular story is true, and the low probability, assuming it is not true, that a falsifying witness would come up with *this* false story.[41]

This factor helps us understand a classic problem that has created some

---

40. Sharon would be unreliable, for example, if $P(\text{YES given NOT-PRESENT})$ were high or $P(\text{DESCRIBE given [PRESENT \& YES]})$ were low. Even if she were unreliable on both counts, $P(\text{DESCRIBE given PRESENT})$, which equals $P(\text{YES given PRESENT}) \times P(\text{DESCRIBE given [PRESENT \& YES]})$, is probably far greater than $P(\text{DESCRIBE given NOT-PRESENT})$, which equals $P(\text{YES given NOT-PRESENT}) \times P(\text{DESCRIBE given [NOT-PRESENT \& YES]})$, because $P(\text{DESCRIBE given [NOT-PRESENT \& YES]})$ is minuscule. The essential point—that $P(\text{DESCRIBE given NOT-PRESENT})$ is so small, compared to $P(\text{DESCRIBE given PRESENT})$, that $P(\text{PRESENT given DESCRIBE})$ is probably near one—would apply even if Sharon's description of the apartment were not in response to a request for a description, or indeed even if she gave it in circumstances unrelated to the crime. If, for example, while in a trance Sharon spontaneously gave a description that fit Bridges' apartment exactly, that would constitute strong evidence, even though she did not identify the apartment or link it to the crime. Sharon's personal credibility thus has little bearing on the probative value of her statement with respect to the proposition that she was present in the apartment. Therefore, the court properly held untenable a hearsay objection to a second-hand report of Sharon's description.

The result should probably be different if Sharon's description were of the spare "blue walls, big radio" type, for then a jury could not have confidence, absent examination of Sharon, that $P(\text{DESCRIBE given NOT-PRESENT})$ is negligible. Note also that if Sharon's description had been used to prove not her presence in the apartment but the proposition that the molestor's apartment fit the description, it would clearly, as the court recognized, have been hearsay. 247 Wis. at 366, 19 N.W.2d at 536.

For a carefully considered but somewhat less favorable view of *Bridges*, see Park, McCormick on Evidence *and the Concept of Hearsay: A Critical Analysis Followed by Suggestions to Law Teachers*, 65 MINN. L. REV. 423, 437-41, 439 n.50 (1981).

41. Bayes' Theorem helps express this idea more rigorously. According to the Theorem,

$$P(\text{X given TESTIMONY(X)}) = \tag{N3}$$

$$\frac{P(\text{X}) \times P(\text{TESTIMONY(X) given X})}{[P(\text{X}) \times P(\text{TESTIMONY(X) given X})] + [(1 - P(\text{X})) \times P(\text{TESTIMONY(X) given NOT-X})]}.$$

Dividing both numerator and denominator by $P(\text{X}) \times P(\text{TESTIMONY(X) given X})$ transforms this equation to

$$P(\text{X given TESTIMONY(X)}) = \frac{1}{1 + \dfrac{1}{P(\text{TESTIMONY(X) given X})} \times \dfrac{P(\text{TESTIMONY(X) given NOT-X})}{O(\text{X})}}, \tag{N4}$$

where $O(\text{X})$ is the odds of X, or $P(\text{X}) \div [1 - P(\text{X})]$. From this equation it is clear that, for a given value of $P(\text{TESTIMONY(X) given X})$, the value of $P(\text{X given TESTIMONY(X)})$ depends on the ratio of two quantities likely to be very small; if $O(\text{X})$ is very small in comparison with $P(\text{TESTIMONY(X) given NOT-X})$, then $P(\text{X given TESTIMONY(X)})$ will be close to zero, whereas if $P(\text{TESTIMONY(X) given NOT-X})$ is very small in comparison with $O(\text{X})$, then $P(\text{X given TESTIMONY(X)})$ will be close to one.

confusion in the literature:[42] Suppose that each of the numbers from 1 to 10,000 is placed on a separate lottery ticket and that Whitney, whom we believe to be trustworthy, selects one of the tickets at random. Whitney declares that she has picked ticket 297. $P(x_{297})$, representing the probability gauged before Whitney's declaration that ticket 297 would be chosen, equals 0.0001 (or 1 in 10,000). Given such a tiny prior probability, do we have confidence, or even perceive a substantial probability, that Whitney is telling the truth? Can we really say that the probability that Whitney would announce an incorrect ticket, whether by design or mistake, is very small? What if there were a million tickets? Professors Brilmayer and Kornhauser contend that, if the prior probability of selecting a given ticket is taken into account, as Bayesian logic demands, "the probability of the witness' veracity becomes exceedingly small as the number of tickets in the lottery is increased."[43] This conclusion, of course, is intuitively incorrect; if we have confidence in the selector beforehand, we generally rely on her veracity and assume that the ticket she announces is the one she picked. Accordingly, the Bayesian perspective appears flawed.

The solution to this apparent conundrum is really quite straightforward, and perfectly consistent with Bayesian analysis; it depends on the realization that, *if* the selector makes an inaccurate announcement, there are many possibilities as to what announcement she will make, and the probability that she will make an inaccurate announcement of ticket 297 is very small. Furthermore, this small probability is virtually identical to, and so essentially balances out, the small prior probability that ticket 297 was in fact the one chosen. This balance leaves as the crucial factor the probability that, if ticket 297 is chosen, Whitney will accurately report that fact. And assuming that Whitney has no reason to deny the truth, the latter probability is very high. I present a fuller analysis of this problem in Appendix D.

---

42. The problem is taken from I. TODHUNTER, A HISTORY OF THE MATHEMATICAL THEORY OF PROBABILITY FROM THE TIME OF PASCAL TO THAT OF LAPLACE 400 (1865), *quoted in* Brilmayer & Kornhauser, *supra* note 4, at 148 n.114.

43. Brilmayer & Kornhauser, *supra* note 4, at 148 n.114. As the number of lottery tickets increases, the probability that any one of them will be chosen decreases; hence, if x is the proposition that ticket 297 is chosen, $P(x)$ decreases as the number of tickets increases. Accordingly, by Bayes' Theorem, which provides that

$$P(\text{x given TESTIMONY(x)}) = \frac{P(\text{x}) \times P(\text{TESTIMONY(x) } given \text{ x})}{P(\text{TESTIMONY(x)})} , \qquad (N5)$$

it may appear that "the probability of the witness' veracity"—represented by $P(\text{x } given \text{ TESTIMONY(x)})$—"becomes exceedingly small as the number of tickets in the lottery is increased." But this argument overlooks a crucial point made in the following paragraph of text and in Appendix D—that as the number of tickets is increased $P(\text{TESTIMONY(x)})$ also becomes very small.

The lottery situation is similar to the one posed in the deathbed warning of one of Damon Runyon's gamblers:

> [S]ome day you will come upon a man who will lay down in front of you a new deck of cards with the seal unbroken and offer to bet he can make the jack of spades jump out of the deck and squirt cider in your ear. Son . . . do not bet him because just as sure as you do, you are going to get an earful of cider.[44]

The old gambler, who presumably understood both probabilities and human nature, may have exaggerated somewhat, but he had a point. First, he understood the temptation of the bet: The prior probability, assessed before the stranger's statement, of an acrobatic and expectorant jack of spades must be very low. Further, the old man understood the danger: Also low—and in his view lower by far than the first probability—is the probability that, if indeed the jack could not perform the particular trick promised, the stranger would come up with such a claim and put money on it.[45] And if that probability is low enough, then a statement of what appeared beforehand to be a bizarre proposition may be quite persuasive evidence.

D. *The Elements of Testimonial Failure*

We have seen that often there are many inaccurate statements that a witness may make. Now let us focus on *how* it may happen that the witness fails to testify accurately.

It is customary to speak of four testimonial capacities, generally referred to by such labels as perception, memory, sincerity, and articulateness.[46] Accurate testimony depends on the satisfactory operation of all four capacities. In route analysis terms, this means that for events to go from a fact x to accurate testimony of x by a witness, they must first go from x to PERCEIVE(x) (the witness perceived x), then to BELIEVE(x) (the witness

---

44. This advice, perhaps most familiar from the musical *Guys and Dolls*, was recently repeated in I. BERKOW, RED: A BIOGRAPHY OF RED SMITH 33 (1986).

45. In the lottery case, the probability that the witness would assert the proposition notwithstanding its falsity is low because she is unlikely to select the particular number, even assuming that she made an inaccurate announcement. In the gambler's case, the corresponding probability is low because the stranger is unlikely to concoct the particular bizarre phenomenon, and unlikely to make a bluff that costs him money if called and gains him nothing if not called.

46. The exact terminology differs from one catalogue to another. *Compare* Park, *supra* note 40, at 425 n.7 *with* Maguire, *The Hearsay System: Around and Through the Thicket*, 14 VAND. L. REV. 741, 744–45 (1961) *and* Morgan, *Hearsay Dangers and the Application of the Hearsay Concept*, 62 HARV. L. REV. 177, 178–79, 185–88 (1948). I prefer "articulateness" or "communication," to the more commonly used "narration," *see* 2 J. WIGMORE, EVIDENCE § 478, at 636–37 & n.1 (J. Chadbourn rev. 1979), which is too narrow a term. *See* Maguire, *supra*, at 745 n.10 (also rejecting "narration").

remembered, and so now believes, X), then to INTEND(X) (the witness sincerely intends to declare X), and only then to TESTIMONY(X) (the witness testifies articulately to X). At any point events might depart from this main route, which we will call the "truth path" to TESTIMONY(X). The witness might, for example, sincerely intend to testify to X, but because of his inability to use the language, articulate a conflicting proposition instead.

Our main concern now, though, is not with how events might depart from the truth path to TESTIMONY(X) if X is true. If we hear a witness' testimony of X, we do *not* know that X is true, but we do know that events *have* reached TESTIMONY(X). Our concern, therefore, is to determine by which paths, in addition to the truth path leading through X, events might have proceeded from O to TESTIMONY(X).

Figure 6 displays the problem, showing the truth path and other paths to the TESTIMONY node. This diagram can be used in a wide variety of cases by letting X stand for the material proposition to which a witness has testified. Suppose that, as in the classic case of *Wright v. Tatham*,[47] the will of one Marsden is challenged. The material proposition in dispute, MARSOUND, is that Marsden was mentally sound when he wrote the will, and TESTIMONY(MARSOUND) represents the undisputed proposition that a Mr. Ellershaw has made an assertion understood to be of MAR-SOUND. How did events proceed to that declaration? If we let X stand for MARSOUND in Figure 6, that diagram indicates five possible routes. One, the truth path, passes through MARSOUND: Marsden is indeed of sound mind, a fact that Ellershaw has perceived and remembered, wishes to communicate, and does communicate articulately. The other paths pass through NOT-MARSOUND—indicating that Marsden is not of sound mind—and then join the truth path at one point or another.

In one of these paths (from NOT-MARSOUND through PER-CEIVE(MARSOUND) to TESTIMONY(MARSOUND)), Ellershaw has misperceived Marsden's mental condition. In another (from NOT-MARSOUND via the NOT-PERCEIVE(MARSOUND)-BELIEVE(MARSOUND) link to TESTI-MONY(MARSOUND)), Ellershaw has correctly perceived the defect, but has forgotten it by the time of his declaration.[48] In a third (the route

---

47. 7 Eng. Rep. 559 (H.L. 1838), *aff'g* Wright v. Doe d. Tatham, 112 Eng. Rep. 448 (Ex. Ch. 1837). The hypothetical facts presented here differ from those of the actual case, in which Ellershaw did not testify, and had not made any explicit assertion regarding Marsden's mental state. *See infra* Section III.B.3. (variations on *Wright*).

48. References to a mental defect may be oversimplifications, made here because Figure 6 indicates only two possibilities at each step of the testimonial process. The negation of mental soundness need not be regarded as monolithic; there are many varieties and degrees of mental defect. On this view, the statement in the text should be rephrased: Whether Ellershaw has correctly perceived the defect or not, he has not made the particular misperception of *perceiving* mental soundness, but he has made the particular error of *remembering* mental soundness, thus joining the truth path leading from
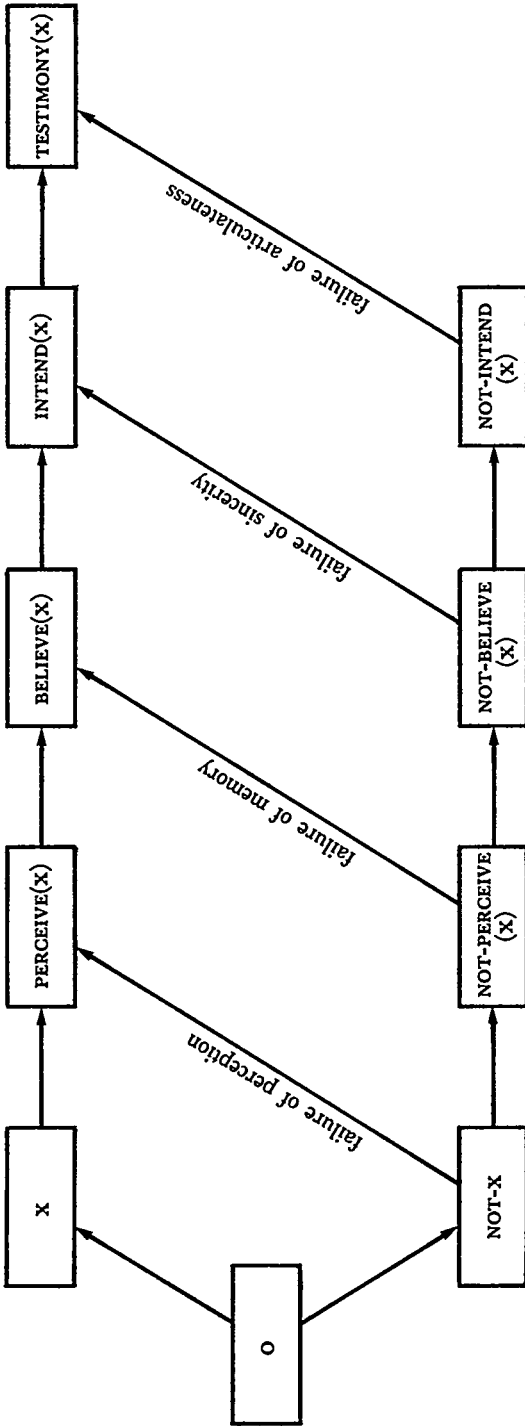
FIGURE 6

through the NOT-BELIEVE(MARSOUND)-INTEND(MARSOUND) link), Eller-
shaw correctly remembers Marsden's mental unsoundness but lies about
it. In the fourth (from NOT-MARSOUND through all the lower nodes and
finally from NOT-INTEND(MARSOUND) to TESTIMONY(MARSOUND)), El-
lershaw does not wish to speak inaccurately, but does so because of his
own inability with the language. He might, for instance, have wanted to
convey the information that Marsden has a vivid imagination and vocabu-
lary—a fact certainly consistent with Marsden's (hypothetically) unsound
mind—but confused "lurid" with "lucid."

Figure 6 is a generalized and broadly applicable diagram. A diagram
this simple does not, however, represent all the routes to a declaration; to
do so would render it too complex to be useful. The simplifications are of
two sorts: Some important linkages are not shown at all, and others are
presented in the aggregate.

(1) *Linkages not shown.* Figure 6 does not present certain linkages that
are so unlikely that they may be ignored. In particular, it does not portray
the possibility of compensating error. It is conceivable, for example, where
the question is how many balls there were in an urn and William testifies
that there were 10, that there were indeed 10 and that William perceived
20 but now remembers 10. Conceivable but, in the elegant phrasing of
Eliza Doolittle, "[n]ot bloody likely";[49] it would be rather flukish, in a
question involving quantification, for the two errors to cancel each other
out exactly. At least with respect to such a question, we generally may
"[n]eglect[] the very small possibility of compensating error."[50]

In other circumstances, however, compensating error may be a more
substantial possibility. Suppose, for example, that William identifies Den-
nis, whose aquiline nose he says he recognizes, as the man he saw fleeing
a bank after robbing it. It is perfectly plausible that Dennis was indeed
the robber, that William had such a fleeting view of him that he did not
in fact notice the nose, but that he now believes—after the subtle sugges-
tivity of police interrogation, a view of mugshots, and a lineup—that he
did. In other words, his declaration could be the product of compensating
errors of perception and memory. For a route diagram of such a case to be
most useful, it should indicate the possibility of a path leading through x,
then down to NOT-PERCEIVE(x), and then back up through BELIEVE(x).

(2) *Aggregated linkages.* Figure 6 not only ignores some linkages; it
also merges some that are conceptually distinct. Consider, for example, the

---

MARSOUND to TESTIMONY(MARSOUND). In this case, however, we are primarily interested in the
simple binary issue of soundness versus unsoundness, so the simplification probably does not distort
our analysis. *See generally infra* text accompanying note 51.

49. G. SHAW, *Pygmalion,* in BERNARD SHAW: SELECTED PLAYS 561 (1981).

50. Kaplan, *supra* note 3, at 1088.

possibility of failed memory. This might have occurred at any time be-tween the perception and the declaration. The declarant's state of mind at any time in that interval may be represented as a point on the PER-CEIVE(X)–BELIEVE(X) link or the NOT-PERCEIVE(X)–NOT-BELIEVE(X) link. The various possibilities of failed memory could then be represented by an infinite series of arrows leading from points on the NOT-PERCEIVE(X)–NOT-BELIEVE(X) link to points farther right on the PER-CEIVE(X)–BELIEVE(X) link. Unless it is important to focus on the precise time of a possible memory failure, it will suffice to summarize all these possibilities by the single arrow from NOT-PERCEIVE(X) to BELIEVE(X).

Perhaps more significantly, Figure 6 does not fully reflect the point made in the last subsection, that the possibilities of testimonial error are often multiple. That multiplicity applies not only to the testimony as a whole, but also to each of the testimonial capacities. For example, if there are 10 balls in an urn, it is a simplification to say that a witness may either perceive 10 balls or perceive that there are not exactly 10 balls; obviously, the second alternative compounds an infinite number of incor-rect perceptions. Of necessity, Figure 6 adopts this simplification, using each NOT node to represent myriad possibilities. Because of this com-pounding, the link from one NOT node to another does not always re-present merely the probability that a given testimonial capacity operates correctly, albeit on an incorrect premise. The case of memory is again a good illustration. The link between NOT-PERCEIVE(X) and NOT-BELIEVE(X) represents the probability that the witness will avoid the par-ticular error of remembering X even though he has not perceived X. That is, the link represents the probability, given the witness' perception, of an accurate memory *or* of all possible inaccuracies but that one. Because Fig-ure 6 focuses on proposition X, it does not distinguish the witness who perceives and remembers Y from another witness who perceives Y but re-members Z.

Thus, Figure 6 simplifies reality by failing to show that an erroneous statement may be the product of compound failure of more than one testi-monial capacity. The witness may perceive 20 balls, remember 40 balls, intend to testify to 60 balls, but mistakenly communicate that there were 80 balls. The occurrence of such non-compensating multiple errors is en-tirely possible, and where necessary could be indicated by adding extra nodes. It may, however, often be put aside, especially when the question confronting the witness is conceived in yes-or-no terms.

Figure 6, in short, is a model of a credibility problem. Like all models, it simplifies reality, making the problem more tractable at the price of obscuring some complexity. But, like good models, it also is flexible, al-

lowing the presentation of more complexity when satisfactory analysis requires it.

However complex a particular diagram may be, the key point is that there are numerous paths, in addition to the truth path, leading to a testimonial statement. Once these paths are discerned, it is a straightforward matter to determine the probability, given the statement, that the proposition the statement asserts is true. That determination requires a comparison of (1) the a priori probability that events would lead to the statement via the truth path (or, if compensating errors are plausible, any other path leading through both the proposition and the statement) with (2) the a priori probability, summed for *all* possible routes, that events would produce the statement.[51]

The prior probability of the proposition's truth is critical to this determination, as are the individual probabilities that a given testimonial failure would lead events to the statement notwithstanding its falsehood. A route diagram can set out the principal possibilities and enable us to determine their likelihoods. As those who have previously considered the dubious mental health of Mr. Marsden might guess, and as Section III will show, this method can be extended usefully to analyze problems of hearsay.

III. ROUTE ANALYSIS OF HEARSAY

This Section applies route analysis to some basic issues of hearsay doctrine. The standard approach, entrenched by the Federal Rules of Evidence, defines and presumptively excludes a category of evidence as hearsay; it then defines and excepts from this exclusionary rule various subcategories of evidence, against which the concerns underlying the basic rule are thought not usually to apply in full force. The following pages will take up this doctrine on its own terms, using route analysis to show ways in which the definitional approach achieves its purpose and other ways in which it falls short.

My aim here is principally methodological; I do not seek to demonstrate

---

51. Thus, by Bayesian logic a fraction may represent the probability, given the statement, that the proposition it asserts is true. For the simple general case represented by Figure 6, the numerator of this fraction is the a priori probability that events would lead to the statement via the truth path, or

$$P(x) \times P(\text{PERCEIVE}(x) \text{ given } x) \times P(\text{BELIEVE}(x) \text{ given } \text{PERCEIVE}(x)) \times$$
$$P(\text{INTEND}(x) \text{ given } \text{BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{INTEND}(x)). \tag{N6}$$

The denominator of this fraction is the a priori probability that events would lead to the statement via *any* path. In addition to the truth path, there are four paths to the statement—one for each of the testimonial incapacities—in the simple general case represented by Figure 6. Thus, the denominator is:

that, as others have argued,[52] the doctrine should be abolished, replaced, or drastically reformed. Having disclaimed this motive, I must add that I hope the analysis presented here lends force to some of these arguments, simply by fostering a better understanding of hearsay—for to understand traditional hearsay doctrine is to appreciate the legal insight of Mr. Bumble.[53] The rigid definitional approach does not work well; it bars many items of evidence that do not raise substantial hearsay concerns and admits others that do. Under a more sensitive approach, the judge would decide whether the particular item of evidence has enough probative value to justify admissibility, notwithstanding the hearsay concerns that it raises and any possibility that excluding it would induce the production of other evidence not raising those concerns. This approach depends on case-by-case analysis rather than on broad categorizations.[54] Thus, although this

---

$P(x) \times P(\text{PERCEIVE}(x) \text{ given } x) \times P(\text{BELIEVE}(x) \text{ given } \text{PERCEIVE}(x)) \times$
$P(\text{INTEND}(x) \text{ given } \text{BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{INTEND}(x))$

[truth path]

plus

$P(\text{NOT-}x) \times P(\text{PERCEIVE}(x) \text{ given } \text{NOT-}x) \times P(\text{BELIEVE}(x) \text{ given } \text{PERCEIVE}(x)) \times$
$P(\text{INTEND}(x) \text{ given } \text{BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{INTEND}(x))$

[path of failure of perception]

plus

$P(\text{NOT-}x) \times P(\text{NOT-PERCEIVE}(x) \text{ given } \text{NOT-}x) \times P(\text{BELIEVE}(x) \text{ given } \text{NOT-PERCEIVE}(x)) \times P(\text{INTEND}(x) \text{ given } \text{BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{INTEND}(x))$

[path of failure of memory]

plus

$P(\text{NOT-}x) \times P(\text{NOT-PERCEIVE}(x) \text{ given } \text{NOT-}x) \times P(\text{NOT-BELIEVE}(x) \text{ given } \text{NOT-PERCEIVE}(x)) \times P(\text{INTEND}(x) \text{ given } \text{NOT-BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{INTEND}(x))$

[path of failure of sincerity]

plus

$P(\text{NOT-}x) \times P(\text{NOT-PERCEIVE}(x) \text{ given } \text{NOT-}x) \times P(\text{NOT-BELIEVE}(x) \text{ given } \text{NOT-PERCEIVE}(x)) \times P(\text{NOT-INTEND}(x) \text{ given } \text{NOT-BELIEVE}(x)) \times P(\text{TESTIMONY}(x) \text{ given } \text{NOT-INTEND}(x)).$

[path of failure of articulateness]

(N7)

---

52. *See* MODEL CODE OF EVIDENCE Rules 501–531 (1942); Weinstein, *Probative Force of Hearsay*, 46 IOWA L. REV. 331 (1961); Note, *The Theoretical Foundation of the Hearsay Rules*, 93 HARV. L. REV. 1786 (1980); Comment, *Abolish the Rule Against Hearsay*, 35 U. PITT. L. REV. 609 (1974); *see also* English Civil Evidence Act, 1968, ch. 64 (relaxing barriers to admitting hearsay evidence).

53. " 'If the law supposes that,' said Mr. Bumble . . . 'the law is a ass, a idiot.' " C. DICKENS, OLIVER TWIST ch. 51 (1837–38).

54. Such a flexible approach may not appear to give sure enough protection to a criminal defendant's constitutional right to confrontation under the Sixth Amendment. But I believe that confronta-

Section contends that particular types of evidence should or should not be considered hearsay, these comments are made only in the context of the prevailing definitional approach, which I regard as wholly unsatisfactory.

A. *A Basic Hearsay Question: Is the Assertion Offered for Its Truth?*

When a hearsay declaration is offered into evidence, the jury must rely on testimony to determine that the declaration was made by the person and under the circumstances claimed. Even if the jury sees a written hearsay statement, ordinarily it still must depend on a witness' testimony that the writing is what the proponent of the evidence claims it to be. In this respect, however, hearsay is no different from other types of evidence. Juries must rely on testimony, rather than, or in addition to, their own sense impressions, to determine all sorts of facts; there is no reason why they cannot conclude, on the basis of testimony, that a statement was made, who made it, and under what circumstances.

Hearsay is perceived as troublesome for a different reason: Because the declaration was made out of court rather than before the jury and subject to cross-examination,[55] the jury may have inadequate means of determining whether that declaration was true. Thus, the basic definition of hearsay includes not all out-of-court declarations, but only those offered to prove the truth of the matter asserted.[56]

Figure 7 illustrates this point. TESTIMONY(DECLARATION(X)) represents the fact, known to the jury through its own senses, that a witness has testified to the proposition DECLARATION(X)—that an out-of-court declarant has made a declaration of proposition X. The jury does *not* know from its own senses whether that testimony is accurate; hence, the diagram shows both the DECLARATION(X) and the NOT-DECLARATION(X) nodes. In turn, the jury does not know how, if DECLARATION(X) is true, events proceeded to that point—by the truth path through X or through NOT-X. The perceived difficulty in making that determination without observing the declaration and cross-examination of it underlies the hearsay

---

tion is a matter very distinct from hearsay. Whereas the hearsay rules are intended to guarantee the truth-finding capacity of the system, confrontation doctrine should protect the system's sense and appearance of fairness. Somewhat tentatively, I suggest that the confrontation clause be construed to give a criminal defendant an absolute right against admissibility of an accusation unless the defendant has an opportunity to cross-examine the accuser. By comparison to the hearsay rule, which is very extensive—potentially applying to virtually any assertion—but riddled with exceptions, the confrontation right should be far narrower—applying only to accusations—but far more intensive. I am currently engaged in revision of the hearsay portion of the Wigmore treatise, in which I hope to develop this approach to hearsay and confrontation.

55. In some cases, an out-of-court declaration will be admitted notwithstanding the hearsay rule because the declarant is a witness subject to cross-examination. *See* FED. R. EVID. 801(d)(1). The extent to which such later availability alleviates the hearsay concern continues to be a matter of dispute. *See, e.g.,* R. CARLSON, E. IMWINKELREID & E. KIONKA, *supra* note 5, at 432-35.

56. FED. R. EVID. 801(c).

rule. But this difficulty does not arise if the material issue is simply whether the declaration was made or not—i.e., if the issue is *whether* events have proceeded through DECLARATION(X) and not *how*.
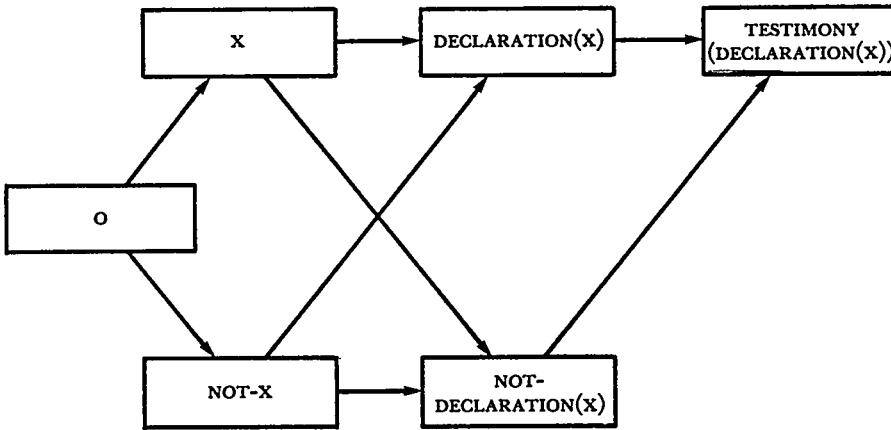

FIGURE 7

Take the case in which a woman sues a grocery store for injuries allegedly suffered in a fall caused by the store's negligently leaving spilled ketchup spread over the floor.[57] Let SPILL represent the proposition that there was indeed ketchup on the floor, and suppose the plaintiff offers the testimony of another shopper that a third one told a fourth at the checkout counter, "A ketchup bottle spilled all over the floor." Here the testimony is being offered to prove that SPILL is true. In order to conclude that, the jury must decide not only that DECLARATION(SPILL) is true—that the witness before it, Shopper Two, is telling the truth about what he heard—but also that events reached that point via SPILL rather than through NOT-SPILL.

As we already know from Section II.D., there may be more than one path leading through NOT-SPILL to the node representing a declaration of SPILL. To show these paths, we need a map more detailed than Figure 7. Figure 8, which has the same format as Figure 6 but with an extra column of nodes, is such a map. Figure 8 shows in detail the route between

---

57. This hypothetical is an altered version of Safeway Stores v. Combs, 273 F.2d 295 (5th Cir. 1960). The variation later in the text, *see infra* text following note 58, is closer to the actual facts of *Safeway*, which properly held the evidence at issue admissible.
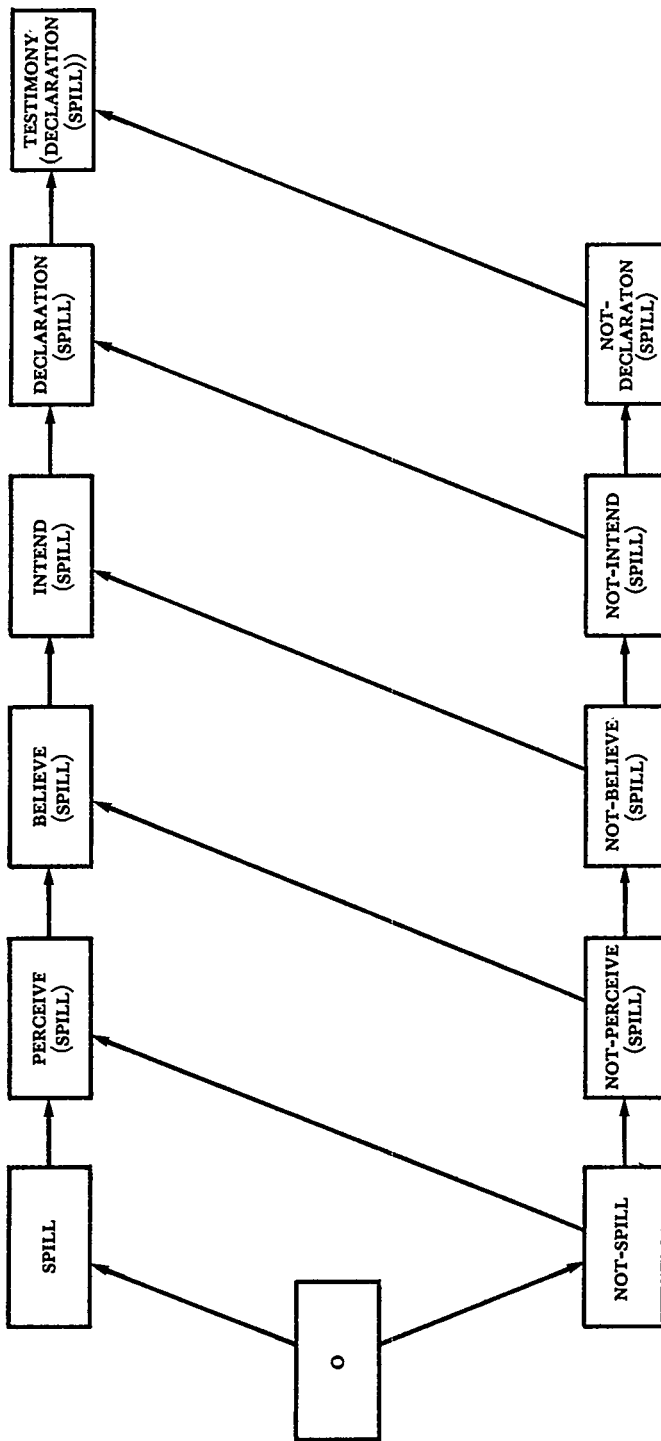
FIGURE 8

SPILL and DECLARATION(SPILL) and also shows each of the principal routes through NOT-SPILL to DECLARATION(SPILL).[58] The diagram also shows that the evidence before the jury is not Shopper Three's declaration of SPILL but Shopper Two's testimony of that declaration. We could, if we wished, show a whole set of nodes between the DECLARATION(SPILL) column and TESTIMONY(DECLARATION(SPILL))—nodes representing PER-CEIVE(DECLARATION(SPILL)), BELIEVE(DECLARATION(SPILL)), INTEND (DECLARATION(SPILL)), and their negations—similar to those diagrammed in Figure 8, to emphasize the problems in inferring from testimony that a given out-of-court declaration was made. That is not our principal concern in analyzing hearsay, however, so the full array of linkages and nodes is not shown. Indeed, to sharpen the focus on the hearsay issue, suppose that the jury completely trusts Shopper Two, and so concludes that DECLARATION(SPILL) is true. To be confident, however, that events reached DECLARATION(SPILL) via SPILL rather than through NOT-SPILL, the jury must be sure that events could not have passed through NOT-SPILL and then joined the truth path by taking one of the routes indicating a failed testimonial capacity of Shopper Three. Hearsay doctrine holds that the jury cannot be sufficiently sure of this, because Shopper Three's statement was not made in court and subject to cross-examination.

But now suppose that the intended recipient of Shopper Three's warning was not a fourth shopper but the plaintiff herself, and that it is the defendant who offers the evidence. Plainly, the store has no desire to prove SPILL, and it may even deny that proposition. But here DECLARA-TION(SPILL)—the proposition that the declaration was made—is itself relevant. It tends to prove that, whether or not SPILL was actually true, the plaintiff was on notice that it might be true. To conclude DECLARA-TION(SPILL) does not require the jury to follow the route diagram all the way back to SPILL or NOT-SPILL. So far as this use of the testimony is concerned, there is no need for the jury to distinguish among the routes leading to DECLARATION(SPILL). Even if that point was reached through a failure of Shopper Three's perception or memory, the fact remains that she made the declaration. The hearsay doctrine will not bar use of Shop-

---

58. Diagrams drawn especially for specific cases may be more or less complex than the general one. In some contexts, certain nodes shown by Figure 8 may be extraneous. Indeed, if we can put aside doubts as to whether the declaration was in fact made, a simpler diagram, in the form of Figure 6, can often be used. *See, e.g., infra* Figure 15; *see also infra* note 77 and accompanying text, text accompanying notes 99-100 & note 100 (congruence of nodes).

On the other hand, Figure 8 does not show any of the paths linking SPILL and NOT-DECLARATION(SPILL), because ordinarily we may disregard as de minimis the probability that (1) SPILL is true, (2) the declarant for some reason did not declare SPILL, and yet (3) the in-court witness testifies that he did so declare. This is not always true, however. Where necessary, these paths, each of which includes a link leading from the truth path to the lower row of nodes, may be diagrammed.

per Two's testimony to prove the fact of, as opposed to the truth of, that declaration.

Thus, the route diagram helps explain why hearsay doctrine bars proof of an out-of-court declaration only when it is offered for its truth, and not when it has some other relevance, such as proving notice. To be precise, we must recognize that proving that a declaration such as DECLARA-TION(SPILL) was made is not equivalent to proving that the plaintiff was on notice. It may be that she failed to hear or understand the warning. Figure 9 helps show this, for a slightly altered case. Here Shopper Three's testimony is that Shopper Two declared BROKE, the proposition that a ketchup bottle broke on the shelf. WARNED represents the proposi-tion that the plaintiff received and understood the message as a warning. Figure 9 is what I call a two-excursion map. It indicates no direct rela-tionship between TESTIMONY(DECLARATION(BROKE)) and WARNED; cer-tainly, later testimony of a declaration of BROKE could not cause a warn-ing to be received at the time of the alleged spillage, and we may posit that neither does receipt of the warning make the later testimony more probable. Thus, Figure 9 shows no direct links between TESTI-MONY(DECLARATION(BROKE)) or its negation and WARNED or its nega-tion. This does not mean that the two issues are irrelevant to each other, however. Both are related to the issue of whether DECLARATION(BROKE) is true. First, the truth of DECLARATION(BROKE) makes it more likely that Shopper Two will later testify that the declaration was made. This rela-tion is indicated by a set of single arrows similar to those in Figure 8. Second, if DECLARATION(BROKE) is true, the probability that the shopper who fell had received a warning increases as well. A set of double arrows portrays this second relation.[59]

TESTIMONY(DECLARATION(BROKE)) may therefore help prove WARNED by increasing the probability of DECLARATION(BROKE), which in turn in-creases the probability of WARNED. As Figure 9 shows, this logic does not require tracing the routes back to BROKE or NOT-BROKE; the jury need look no farther left than DECLARATION(BROKE). But the testimony does require the jury to determine whether events in fact proceeded from DEC-LARATION(BROKE) to WARNED. Such a determination may be largely speculative, for it requires the jury to assess the plaintiff's perceptive abil-ity and how well that ability operated in the particular case. Nevertheless, a court would almost certainly allow the jury to infer WARNED from TES-TIMONY(DECLARATION(BROKE)) even absent testimony by the plaintiff as to whether she received and understood the warning. The danger in draw-

---

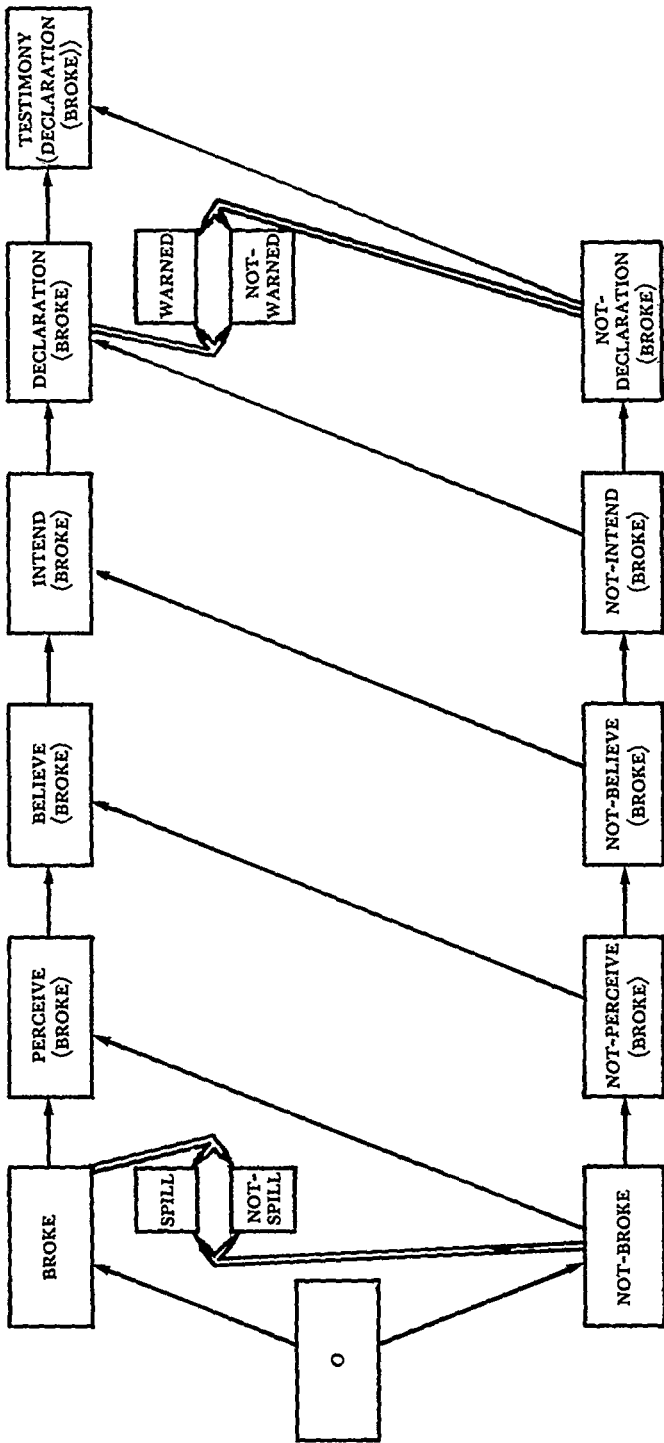59. For a further discussion of two-excursion maps, see *A Diagrammatic Approach, supra* note 1, at 605–11.

FIGURE 9

ing such an inference may be substantial, and it is similar to the hearsay danger in that the jury is making a determination of the capacity and mental performance of someone not before it. But, because the jury is not called on to trace the links back from DECLARATION(BROKE) to BROKE or NOT-BROKE, the hearsay rule—anomalously, perhaps—never comes into play.

Figure 9 can also represent a case in which, although the material issue and the proposition asserted in the declaration are not the same, one party does in effect ask the jury to trace links back to the nodes representing the assertion's truth, and on from there to the material proposition. Suppose now that Shopper Two is prepared to testify that Shopper Three declared BROKE to him out of the plaintiff's earshot, and that the plaintiff offers this to prove SPILL. In arguing for admissibility of the evidence, plaintiff's counsel may contend (though probably in different phrasing): "The issue here is not BROKE or NOT-BROKE. The issue is SPILL or NOT-SPILL, where SPILL represents the proposition that ketchup was spilled on the floor. Proof of DECLARATION(BROKE) is good circumstantial evidence because SPILL is more probably true given that Shopper Three declared BROKE." The judge should sustain the hearsay objection, ruling in essence: "The only reason that DECLARATION(BROKE) increases the probability of SPILL is that it increases the probability of BROKE, and P(SPILL *given* BROKE) is greater than P(SPILL *given* NOT-BROKE). But the jury cannot infer BROKE from DECLARATION(BROKE), whether as an intermediate or ultimate objective, without making the forbidden hearsay determination of whether events could plausibly have reached DECLARATION(BROKE) from NOT-BROKE." So in this case, the fact that the material issue is the truth of SPILL, rather than of the asserted proposition BROKE, will not avail against a hearsay objection.[60]

It is possible at this point to discern several advantages that route diagrams offer over the so-called testimonial triangle. The triangle has three nodes: one in the lower left representing the out-of-court declaration or conduct, one at the apex representing the declarant's belief, and one in the lower right representing the proposition for which the declaration is offered.[61] The value of the triangle appears undeniable, for many scholars find it helpful in understanding hearsay doctrine. Nevertheless, as compared to the triangle, route analysis offers several significant benefits. For example:

(1) A route diagram, unlike the triangle, can show that the evidence before the jury is not an out-of-court declaration (DECLARATION(X)) but

---

60. *See* McCORMICK ON EVIDENCE, *supra* note 17, § 246, at 729-30; Park, *supra* note 40, at 429.

61. *See* Tribe, *supra* note 5, at 959.

testimony that the declaration was made (TESTIMONY(DECLARATION(X))). Thus, a route diagram such as Figures 7, 8, or 9 can, where appropriate, indicate doubt as to whether the declaration was made; TESTIMONY(DECLARATION(X)) might have been reached through NOT-DECLARATION(X) as well as through DECLARATION(X).

(2) A route diagram represents as separate points a declaration, DECLARATION(X), and the material proposition X that the declaration asserts. Whether TESTIMONY(DECLARATION(X)) is hearsay generally depends on which proposition it is offered to prove; to conclude DECLARATION(X), the factfinder must reject the possible routes leading through NOT-DECLARATION(X), whereas to conclude X, which is more distant from the testimony node, the factfinder must additionally reject the routes that lead from NOT-X to DECLARATION(X) and so raise hearsay problems.

In contrast, no matter what the relationship between the declaration and the conclusion for which it is offered, the triangle represents them across the base from each other. This suggests that the difference between a hearsay inference and a nonhearsay inference is that the latter represents a shortcut to the same point—along the base of the triangle rather than by the long route up to the apex (representing belief) and then down again. The better explanation, as shown by route diagrams, is that DECLARATION(X) is more closely related to TESTIMONY(DECLARATION(X)) than is X, and is in fact a stepping stone between the two.

(3) Route analysis is flexible. For a simple case, a simple diagram such as Figure 7 may suffice. When it is necessary to separate out more precisely the possible paths to a declaration, a somewhat more detailed map such as Figure 8 can be developed. And if the relation between the declaration and the material proposition is like that of DECLARATION(BROKE) to WARNED, or like the much more attenuated relation of DECLARATION(BROKE) to SPILL, it may be shown in a diagram like Figure 9. Thus, a route diagram may be custom-made to fit the particulars of the case at hand. We shall see further examples of such tailoring, an adaptability that the triangle does not offer.

(4) A route diagram shows not only routes indicating that the material proposition is true but also routes indicating that it is not. Thus, the diagram presents each testimonial incapacity as a separate link; in determining the possible routes that might have led to a declaration, we can assess whether there is a significant probability that the declaration was reached via the link representing a particular incapacity.

In part, this determination depends on empirical observation. For example, the hearsay exception under Rule 803(2) of the Federal Rules of Evidence for excited utterances is based on the hypothesis that, because the startling condition leaves little opportunity for conscious fabrication,

the NOT-BELIEVE(X)–INTEND(X) link is weak.[62] Closer analysis, with the
help of Figure 8, suggests that this premise is rather dubious. (Although
this diagram is drawn with respect to a particular proposition, SPILL, it
may be made applicable to any propositon X simply by substituting X for
SPILL throughout.) True, stress may increase the probability that the de-
clarant will blurt out the truth. But that does not decrease the probability
of the NOT-BELIEVE(X)–INTEND(X) link; rather, it increases the
probability of the BELIEVE(X)–INTEND(X) link. In all likelihood stress will
also increase the probability of the NOT-BELIEVE(X)–INTEND(X) link, be-
cause it will increase the probability that the declarant will blurt out
something, whether true or false. It may very well be, as Appendix E
discusses, that the net effect of stress is to decrease the probability that the
declarant was sincere. Moreover, even assuming that stress does improve
sincerity, the same condition might also strengthen the NOT-
X–PERCEIVE(X), NOT-PERCEIVE(X)–BELIEVE(X), and NOT-
INTEND(X)–DECLARATION(X) links—representing misperception, failed
memory, and inarticulateness—and so increase the probability that DEC-
LARATION(X) was reached via NOT-X.

The testimonial triangle is once again limited in comparison to route
analysis, for it does not foster as precise an analysis of the individual inca-
pacities. For one thing, the triangle represents misperception and failed
memory together on the same leg of the triangle, and insincerity and inar-
ticulateness together on another leg. This structure does not encourage
separate treatment of each incapacity. The triangle does not, for example,
make it as readily apparent as does a route diagram that the same stress
that arguably diminishes sincerity problems may also increase articulate-
ness problems. Second, the triangle does not support close analysis of the
nature of any given hearsay incapacity in the same way that a route dia-
gram does; whereas the triangle represents the sincerity issue simply by
placing it on the right leg, a route diagram forces us to think about the
probability that a declarant would attempt to articulate proposition X if he
believed X to be true *and* the probability that he would do so even if he
did not believe X to be true.

Route analysis, then, helps us identify and think more clearly about
empirical issues in the law of hearsay, such as whether the assumptions
underlying the excited utterances exception are justified. But, like any
other non-empirical form of analysis, it cannot resolve such matters with-
out the aid of empirical data. There is, however, another type of hearsay
issue that is not so dependent. Sometimes we can say, as a matter of logic
rather than of experience, that because of the relationships between an

---

62. FED. R. EVID. 803(2) advisory committee's notes.

out-of-court declaration and the proposition for which it is offered, one or more of the hearsay dangers is not present. Route diagrams help show why this is so. Suppose that the link representing an incapacity is on a path leading *to* the node representing the material proposition (or another proposition from which the material proposition can readily be inferred), rather than on a path leading *from* the node representing falsity of that proposition to the declaration. In such a case, the incapacity does not offer a possible explanation of how the declaration could be made notwithstanding the falsity of the proposition;[63] accordingly, the incapacity does not raise a hearsay problem.

The remainder of this Section will concentrate on such logically oriented problems. Some of these will concern the definition of hearsay, and some will concern exceptions to the rule against hearsay. For the most part, this distinction may be ignored; whether a given statement falls within an exception or outside the hearsay definition itself is, as we shall see, often unclear, and it is almost always unimportant.

B. *Material Intermediate Points*

In the previous subsection, we saw that TESTIMONY(DECLARATION(X)) is regarded as hearsay if offered to prove X, but not if offered to prove DECLARATION(X). The former case presents all four of the hearsay dangers, and the latter case none of them. But what if the material fact is one of the points between X and DECLARATION(X)? Then a more discriminating analysis is necessary, because some, but not all, of the hearsay dangers may arise.

1. *Proof of Belief Concurrent with the Statement and Inferences from That Belief*

BELIEVE(X) is the intermediate point for which TESTIMONY(DECLARATION(X)) is most commonly offered. That point represents

---

63. Indeed, in such a situation, the existence of a path leading through the incapacity link will tend to increase rather than diminish the probability of the material proposition, because it provides another course of events, in addition to the one indicating truthful reporting by the declarant, that includes both the declaration and the material proposition.

For example, suppose a party seeks to prove that Delia believed proposition x by introducing testimony that Delia made an out-of-court declaration of x. It is of course possible that x is true and Delia believed x and intended to assert x. But it is also possible that Delia's belief in x is based only on her faulty perception or memory. Thus, the probability that Delia believed x is (1) the probability that x is true, and she accurately perceived and remembered it (i.e., the probability of the truth path), *plus* (2) the probability that x is not true, but she inaccurately perceived it to be true, and then remembered it, *plus* (3) the probability that x is not true, and she did not perceive it to be true, but she did remember it as being true. In this case, misperception and misremembering—which we normally think of as hearsay *dangers*—increase the probability that the proposition being supported (Delia's belief) is true. *See infra* note 67 and accompanying text.

the proposition that the out-of-court declarant believed X at the time of his declaration—that is, his memory told him at the time of his statement that X is true, whether X or NOT-X was in fact true, and whether he perceived X or not.

Take as an example testimony that, shortly before killing the marshal, Knapp[64] asserted proposition CLUB, "The marshal clubbed an old man to death." If offered to prove the clubbing, the testimony is plainly hearsay—perhaps, indeed, hearsay within hearsay.[65] But the defense can offer the testimony for a more limited purpose, to show BELIEVE(CLUB)—that when Knapp made the declaration he believed it to be true. From BE-LIEVE(CLUB) the jury might infer the proposition represented in Figure 10 as FEAR, that Knapp feared the marshal.

If the hearsay rule does not block use of testimony of DECLARA-TION(CLUB) to prove BELIEVE(CLUB), then it will not prevent the jury from making the further inference of FEAR from BELIEVE(CLUB). This is analogous to the principle that hearsay doctrine, having allowed the jury to infer DECLARATION(BROKE) from testimony of the declaration, also allows an inference of WARNED from DECLARATION(BROKE).[66] The question thus is whether the doctrine allows use of the testimony to prove BELIEVE(CLUB).

Events might have reached BELIEVE(CLUB) through CLUB and PER-CEIVE(CLUB) (the truth path), through NOT-CLUB and PERCEIVE(CLUB) (misperception), or through NOT-CLUB and NOT-PERCEIVE(CLUB) (bad memory). Since BELIEVE(CLUB) rather than CLUB is the factual proposition at issue, it does not matter if BELIEVE(CLUB) has been reached

---

64. *See supra* Section II.B.

65. The general rule is that testimony of a hearsay declaration can be admitted only if it fits within an exception to the hearsay rule *and* if the declaration itself would be admissible if delivered as in-court testimony. *See, e.g.,* FED. R. EVID. 402 (evidence not admissible if not relevant); FED. R. EVID. 805 (hearsay within hearsay not excluded as hearsay if each statement fits within an exception); McCORMICK ON EVIDENCE, *supra* note 17, §§ 285, 300, 310 (application of usual rules of evidence to various hearsay declarations). *But see id.* § 263 (majority of decisions hold requirement of first-hand knowledge not applicable to admissions). Because in this variation Knapp asserted that the clubbing had occurred, and not merely that he had learned of it from another source, it might not be technically correct to bar that assertion, if offered by him from the witness stand, as hearsay; rather, because Knapp did not witness the clubbing, and so lacked personal knowledge of it, the better objection to such testimony would be that it was incompetent. *Id.* § 247; *see id.* § 300, at 865 ("[t]he usual requirement for witnesses and also for hearsay declarants since they in reality are witnesses, [is] that they must have had firsthand knowledge of the facts . . . ." (footnotes omitted)).

I shall not further discuss problems of hearsay within hearsay. They can be diagrammed in a straightforward manner by replacing TESTIMONY(DECLARATION(X)) by a node labeled DECLARA-TION(DECLARATION(X)), under which is a node labeled NOT-DECLARATION(DECLARATION(X)). A series of nodes similar to that with which we are now familiar leads to the node representing the actual in-court testimony, TESTIMONY(DECLARATION(DECLARATION(X))).
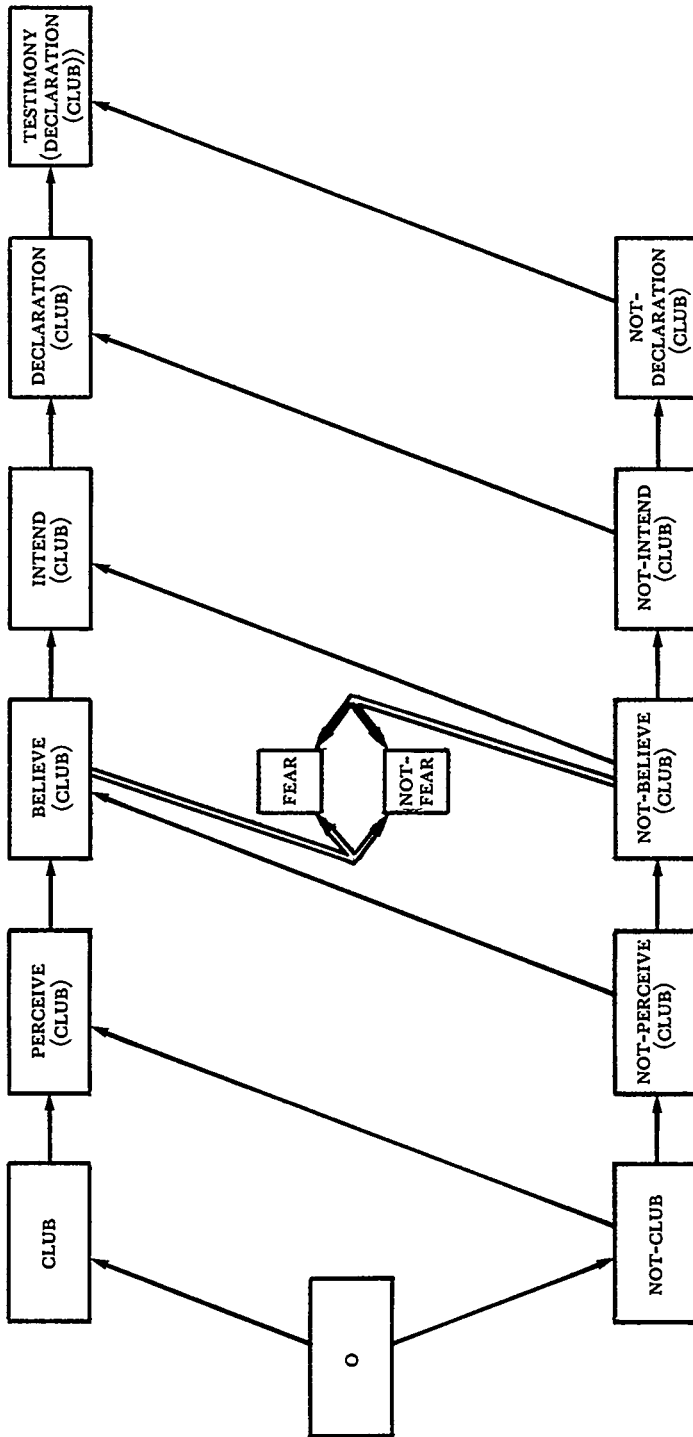
66. *See supra* Figure 9 and accompanying text.

FIGURE 10

through misperception or faulty memory, and so those possible incapacities pose no hearsay danger.[67]

The same cannot be said for the incapacities represented to the right of BELIEVE(CLUB). Even if the jurors are confident from the in-court testimony that Knapp made the declaration, they cannot conclude that he believed in it unless they regard as improbable the possibilities that he was insincere or inarticulate.[68] It cannot, however, be said a priori that those possibilities are insubstantial—Knapp may have spoken figuratively, or with crafty self-interest in anticipation of a murder and a plea of self-defense. Nevertheless, a court would almost certainly hold that, because the testimony of Knapp's declaration is being offered to show his belief rather than the truth of his assertion, the hearsay bar does not apply. In effect, elimination of two of the hearsay dangers, misperception and faulty memory, is enough to remove the bar.

Suppose now that Knapp began his statement with an assertion of belief: "I believe that the marshal clubbed an old man to death." If the statement is offered, as before, to prove Knapp's belief, should it be excluded as hearsay because it is quite literally being offered to prove the truth of the matter asserted? Our intuition tells us that it should not, because virtually every declaration of fact could be considered implicitly to assert a belief, and making the assertion of belief explicit does not alter the substance of the factual declaration. We can make this intuition more precise with the help of Figure 11. This diagram is similar to Figure 10, but without the FEAR and NOT-FEAR nodes, and with two other differences. For simplicity, it reflects the assumption that Knapp did indeed make the out-of-court declaration; because DECLARATION(CLUB) is assumed to be true, there is no need to show the TESTIMONY(DECLARATION(CLUB)) and NOT-DECLARATION(CLUB) nodes. More significantly, because Knapp's declaration was of his belief rather than of the underlying facts—i.e., of BELIEVE(CLUB) rather than of CLUB—in this

---

67. This does not mean that there would be no advantage to examining Knapp to determine $P(\text{PERCEIVE(CLUB)}$ given $\text{NOT-CLUB})$ or $P(\text{BELIEVE(CLUB)}$ given NOT-CLUB & $\text{NOT-PERCEIVE(CLUB)})$. Knowing them would help determine the probability of the material proposition BELIEVE(CLUB). But these possibilities pose no hearsay danger because they add to, rather than subtract from, the total probability of BELIEVE(CLUB), by providing additional paths by which events may have passed through BELIEVE(CLUB); when the declarant's belief, rather than the underlying fact, is at issue, the possibility that he misperceived or misremembered the fact increases, not decreases, the probability that his belief was in accordance with his declaration. *See supra* note 63.

68. It is not coincidental that, when the question is one of belief, a route diagram, like the testimonial triangle, treats the capacities in two groups of two. The triangle, like route diagrams, reflects the fact that perception and memory are links between an occurrence and a person's later belief about it, and that the questions of sincerity and articulateness arise between his belief and his statement. But even in this context—probably the one in which the triangle is most useful—it is not entirely satisfactory, in part because it does not show how the capacities may have failed.
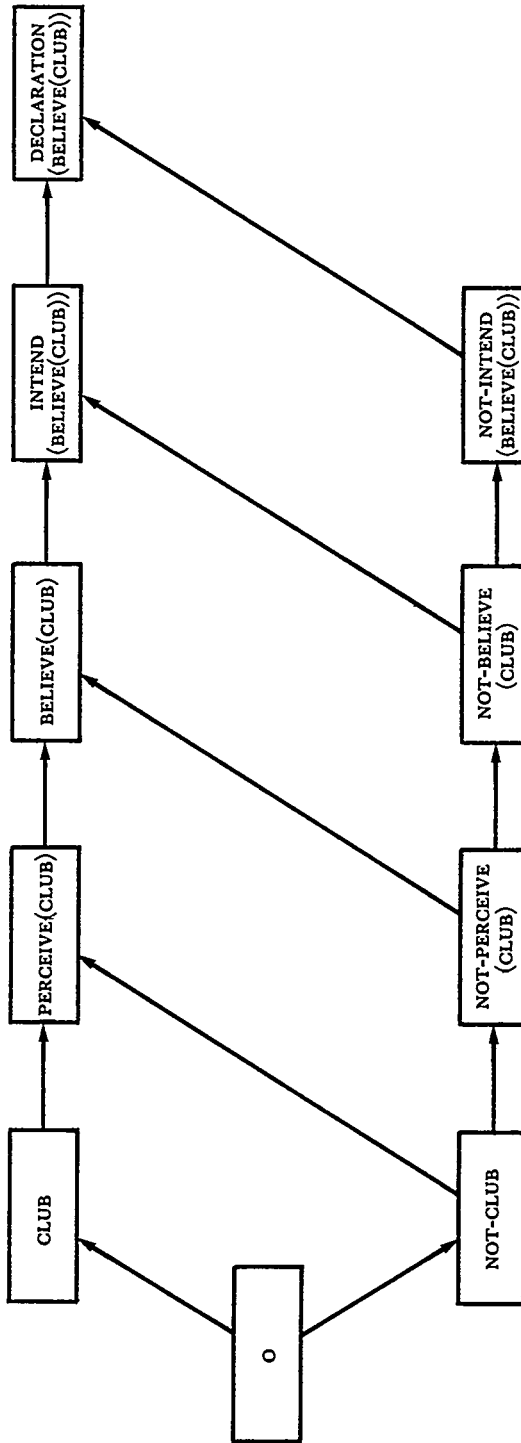
FIGURE 11

diagram BELIEVE(CLUB) replaces CLUB in the nodes to the right of the BELIEVE and NOT-BELIEVE nodes.

To conclude from this declaration that BELIEVE(CLUB) is true, the jury must, precisely as before, assign low probabilities to the propositions that Knapp was insincere (now represented by the NOT-BELIEVE (CLUB)-INTEND(BELIEVE(CLUB)) link) or inarticulate (now represented by the NOT-INTEND(BELIEVE(CLUB))-DECLARATION(BELIEVE(CLUB)) link). But also as before, the jury need not trace the routes to the left of BELIEVE(CLUB) to assess the likelihood that Knapp's perception or memory was faulty. Tacking on "I believe . . ." at the beginning of the declaration thus should not alter the hearsay analysis. If as amended the declaration is nevertheless to be considered hearsay when offered to prove the asserted belief, then to prevent the elevation of form over substance it must be placed within an exception to the rule. And this is what Federal Rule of Evidence 803(3) does.[69] The exception avoids an anomaly created by the definition of hearsay; as the route diagrams of the CLUB case show, there is no difference, so far as the policies underlying the hearsay rule are concerned, between proving BELIEVE(X) with an out-of-court declaration of BELIEVE(X) or with one of X, even though the first assertion is offered for its truth and the second is not.

Now let us look at the other side of the coin. Does the assertion of belief make the declaration *less* vulnerable to a hearsay objection when it is offered to prove not Knapp's belief but the truth of the underlying factual proposition? In other words, could Knapp's lawyer successfully argue: "As we already know, the jury can use Knapp's declaration of belief to conclude that he did believe in the clubbing, and that is good circumstantial evidence that the clubbing in fact occurred"? Quite plainly, as Figure 11 indicates, the answer should be no. To use proof of DECLARATION(BELIEVE(CLUB)) to prove CLUB requires the same inferential process as in any ordinary hearsay case. We have already conceded, as Knapp's lawyer says, that the jury may use testimony of DECLARATION(BELIEVE(CLUB)) to prove BELIEVE(CLUB), notwithstanding the dangers of insincerity and inarticulateness. But to reason from BELIEVE(CLUB)

---

69. Under that rule, a "statement of the declarant's then existing state of mind" is not excluded as hearsay so long as it is not "a statement of memory or belief [offered] to prove the fact remembered or believed." FED. R. EVID. 803(3). (There is an exception to this qualifying statement. *See infra* note 74.) Here Knapp's statement is offered to prove his belief, and not the fact believed. Courts usually find it unnecessary to distinguish between (1) statements of fact that are not hearsay because offered to prove the declarant's belief rather than the matter asserted, and (2) statements of belief that fit within the Rule 803(3) exception to the hearsay rule. *See, e.g.,* McCORMICK ON EVIDENCE, *supra* note 17, § 294, at 843 & n.4; 4 J. WEINSTEIN & M. BERGER, WEINSTEIN'S EVIDENCE ¶ 803(3)[02] (1985).

back to CLUB requires the jury to minimize possibilities of the remaining two testimonial incapacities—misperception and faulty memory—for they provide routes by which events might have reached BELIEVE(CLUB) from NOT-CLUB. The inferential chain suggested by Knapp's lawyer thus involves all four testimonial incapacities. Using BELIEVE(CLUB) as a stepping stone merely divides, but does not shorten or render more certain, the route linking CLUB and the declaration. Thus, although the matter asserted by Knapp—his belief—and the proposition for which it is offered are not the same, route analysis helps show that the concerns underlying the hearsay rule are in full force.

An argument similar to the one posed by Knapp's hypothetical counsel was properly rejected by the United States Supreme Court in the famous case of *Shepard v. United States*,[70] albeit in the lumbering style of Justice Cardozo rather than in the felicitious phrasing of route analysis. The Court held that it was error to admit as a declaration of state of mind the assertion by the murder victim, the defendant's wife, that "Dr. Shepard has poisoned me." This assertion, wrote Justice Cardozo, was a "declaration[] of memory, pointing backwards to the past."[71] Thus, even assuming BELIEVE(SHEPPOISON)—that Mrs. Shepard believed what she said—that point might have been reached through NOT-SHEPPOISON and NOT-PERCEIVE(SHEPPOISON), representing a failure of memory. "What is even more important," added Cardozo, "it spoke to . . . an act by some one not the speaker."[72] Thus, too, BELIEVE(SHEPPOISON) might have been reached through NOT-SHEPPOISON and PERCEIVE(SHEPPOISON), a route representing misperception. If such a statement were not considered hearsay, "[t]here would be an end, or nearly that, to the rule against hearsay."[73] Indeed, to guard against such a result, Federal Rule of Evidence 803(3) provides—except in one narrow context in which the hearsay rule is essentially nullified—that a statement of memory or belief may not be offered to prove the fact remembered or believed.[74]

In noting that Mrs. Shepard's statement "faced backward and not forward,"[75] Cardozo was distinguishing an even more famous case, *Mutual Life Insurance Co. v. Hillmon*.[76] To examine the distinction, we shall first consider that case in simplified and significantly altered form. Mrs. Hillmon, claiming that her husband's body was found at Crooked Creek,

---

70. 290 U.S. 96 (1933).
71. *Id.* at 106.
72. *Id.*
73. *Id.*
74. *See supra* note 69. The exception is for a statement that "relates to the execution, revocation, identification, or terms of declarant's will." FED. R. EVID. 803(3).
75. 290 U.S. at 106.
76. 145 U.S. 285 (1892).

sues the insurer of his life. The insurer cries fraud and contends that the body actually belongs to one Walters. A material proposition, which may be represented by CROOKCREEK in Figure 12, is that Walters went to Crooked Creek. The insurer offers testimony proving that at an earlier time Walters made a declaration of PLAN, the proposition that he planned to go to Crooked Creek; again, we will assume there is no doubt that the declaration was made.
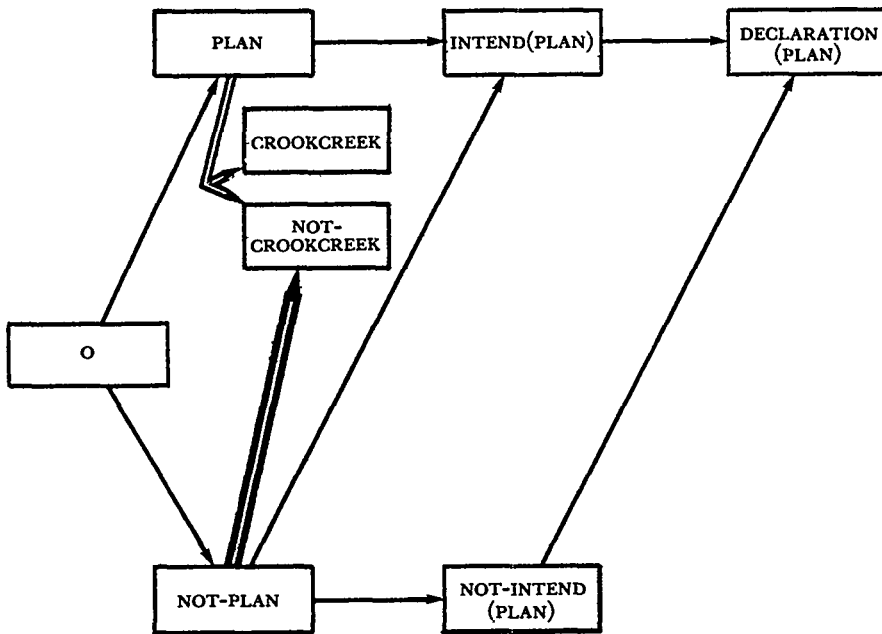

FIGURE 12

Because PLAN is itself a proposition about the state of Walters' own mind at the time of his declaration, BELIEVE(PLAN) is—in contrast to the *Shepard* case—equivalent to PLAN; accordingly, there is no need to show nodes representing PERCEIVE(PLAN), BELIEVE(PLAN), or their negations.[77] PLAN could be false notwithstanding Walters' declaration if Walters lied or was inarticulate, but, as we already know, these possibilities will not alone invoke the hearsay bar.[78] Proof of PLAN clearly increases the

---

77. In other words, because there are no possibilities of faulty perception or memory, there is no link from NOT-PLAN to PERCEIVE(PLAN), or from NOT-PERCEIVE(PLAN) to BELIEVE(PLAN). If events have reached BELIEVE(PLAN), therefore, they must have come through PLAN and PERCEIVE(PLAN); PLAN, PERCEIVE(PLAN), and BELIEVE(PLAN) can thus be thought of as one node.

78. *See supra* text accompanying note 68.

probability of CROOKCREEK; indeed, in the simple case posited by Figure 12, CROOKCREEK cannot be true unless PLAN is true. Even if PLAN is true, however, it does not necessarily follow that CROOKCREEK is true. P(CROOKCREEK *given* PLAN) is less than certain because after making his declaration Walters may have changed his mind, or other circumstances may have intervened.[79] These are substantial possibilities; conceivably they are more substantial than other possibilities—such as the possibility that Mrs. Shepard's belief was mistaken—that in other contexts cause evidence to be excluded as hearsay. And certainly a jury's ability to evaluate these possibilities is hampered by the absence of Walters' own testimony regarding them—especially about Walters' later state of mind. Nevertheless, as with the inference of FEAR in Figure 10, these possibilities do not fit within the standard hearsay mold; they do not represent flaws in the two capacities, perception and memory, that led to Walters' belief, but rather contingencies arising after his declaration.[80] Accordingly, they do not invoke the rule against hearsay.

This result would not change if Walters said he was going to Crooked Creek with his saddlebags, or with his horse. But in the actual case, Walters wrote that he expected to travel "with a certain Mr. Hillmon . . . for Colorado or parts unknown to me."[81] The Supreme Court held that this evidence "made it more probable both that [Walters] did go and that he went with Hillmon, than if there had been no proof of such intention."[82] There is a difficulty, however: To conclude that Hillmon and Walters traveled together, the jury must conclude that each of them had, and carried out, intentions to travel with the other. By the logic of the preceding paragraph, this poses no hearsay problem so far as Walters' intention is concerned. But Hillmon's intention is not a matter of Walters' state of mind. For the jurors to believe that Walters accurately reported Hillmon's intention, they must conclude not only that Walters was sincere and unambiguous, but also that he accurately perceived and remembered the state of Hillmon's mind.

Figures 13 through 17 represent the problem. In these diagrams,

---

79. Tribe, *supra* note 5, at 971.

80. The testimonial triangle offers no visually appealing way of distinguishing between proof of a *Shepard*-type statement such as CLUB in Figure 10 and proof of a proposition such as CROOKCREEK in Figure 12. Professor Tribe does offer the concept of "time's arrow," running along the right leg of the triangle in one direction in *Shepard* and in the other direction in *Hillmon*. Tribe, *supra* note 5, at 971. But that leg is itself an arrow, leading from point B (belief of the actor) to C (the conclusion to which B points). It is unclear whether Tribe means to give the arrow a new meaning or to add a second set of arrows to the triangle. In any event, a simple triangle cannot simultaneously represent, and distinguish, the variety of conclusions that might be inferred from the actor's belief in a given proposition (e.g., truth of the proposition, and conduct by the actor pursuant to his belief).

81. 145 U.S. at 288.

82. *Id.* at 296.

WALTPLAN signifies the proposition that Walters intended to travel with
Hillmon, HILLPLAN the proposition that Hillmon intended to travel with
Walters, and JOINTTRIP the material proposition that they in fact jour-
neyed together. As Figure 13 indicates, only if HILLPLAN and WALTPLAN
are true, and even then not with certainty, can JOINTTRIP be true.[83]
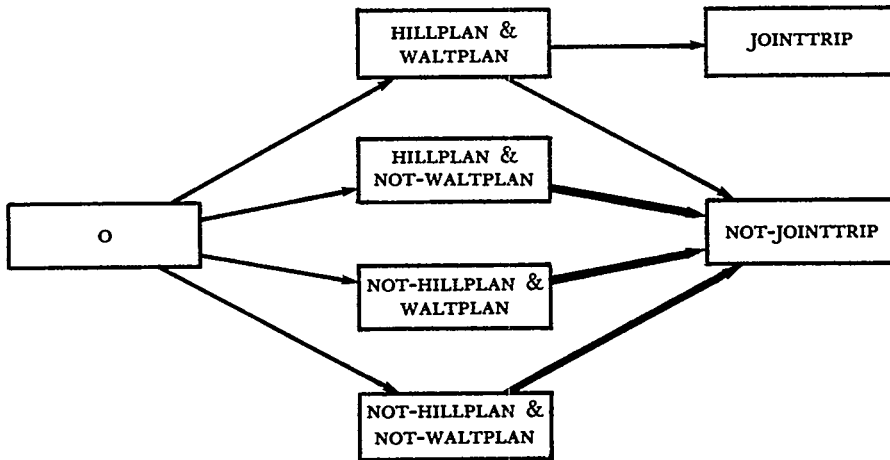

FIGURE 13

Read generously, Walters' letters declared both WALTPLAN and HILL-
PLAN. Accordingly, Figure 14 shows how WALTPLAN may be inferred
from DECLARATION(WALTPLAN), and Figure 15 shows how HILLPLAN
may be inferred from DECLARATION(HILLPLAN). (Because it is undisputed
that Walters wrote the letters, these diagrams, like Figure 12, take the
DECLARATION nodes as given and do not show the TESTIMONY nodes.)
The hearsay rule will not forbid the jury to conclude WALTPLAN from
DECLARATION(WALTPLAN), because that inference, in contrast to the in-
ference of HILLPLAN from DECLARATION(HILLPLAN), does not involve
perception or memory. Concluding HILLPLAN from Walters' declaration
of HILLPLAN, by comparison, is a classic instance of forbidden hearsay, as
indicated by the resemblance of Figure 15 to Figure 11.

---

83. This assumption is something of a simplification. It ignores the possibility that either Hillmon
or Walters may have acted under the duress of the other, although it is broad enough to account for
the more moderate and common case in which the intent of one is heavily dependent on that of the
other. *See infra* note 84 and accompanying text. Furthermore, the propositions are defined broadly
enough to put aside the time element. For example, the definitions leave unexplored the possibility
that each man temporarily wished to travel with the other, but that they never both had the wish at
the same time. Rhett and Scarlett loved each other passionately, but their timing was off. *See also
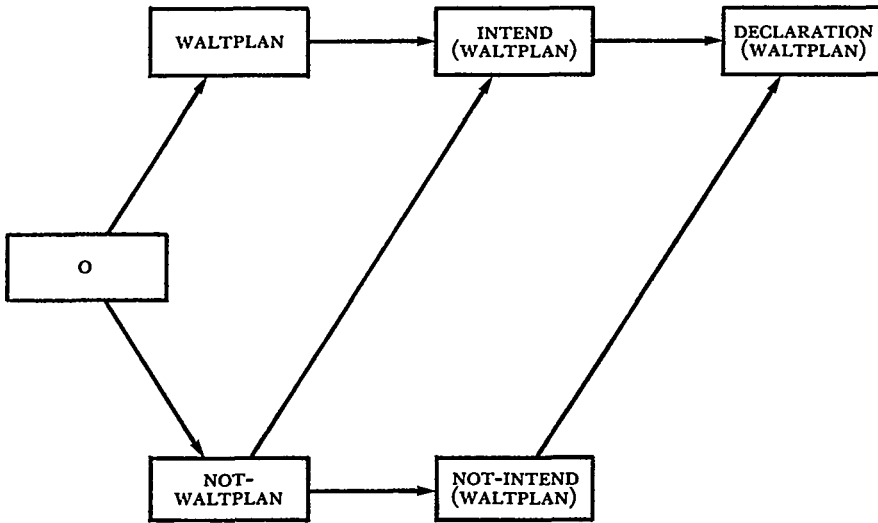infra* note 86.

FIGURE 14

Yet the matter does not end there. It is possible that DECLARA-
TION(WALTPLAN), by helping to prove WALTPLAN, can significantly sup-
port JOINTTRIP even without reliance on DECLARATION(HILLPLAN). Wal-
ters' intention to travel with Hillmon reflected his perception and memory
that Hillmon intended to travel with him. To take an extreme case, sup-
pose that, as indicated by Figure 16, WALTPLAN could not be true unless
BELIEVE(HILLPLAN) is true—that is, for some reason (coyness, an inferi-
ority complex, a judge-like desire not to decide unnecessary questions,
etc.), Walters would not develop the intention of traveling with Hillmon
unless he believed that Hillmon wanted to travel with him. This diagram
shows that DECLARATION(WALTPLAN) offered to prove HILLPLAN, al-
though not hearsay in its purest form, raises all four hearsay dangers;
Walters may have misperceived or misremembered HILLPLAN, and may
have been insincere or inarticulate in declaring WALTPLAN. Thus, the in-
ference of HILLPLAN suggested by Figure 16 should not provide a means
of avoiding the hearsay rule.

In a converse variation, however, proof of WALTPLAN makes HILLPLAN
more likely, not because WALTPLAN reflects Walters' perception and
memory of HILLPLAN, but because something in the relationship of Wal-
ters and Hillmon suggests that Hillmon's intention depends on Walters'
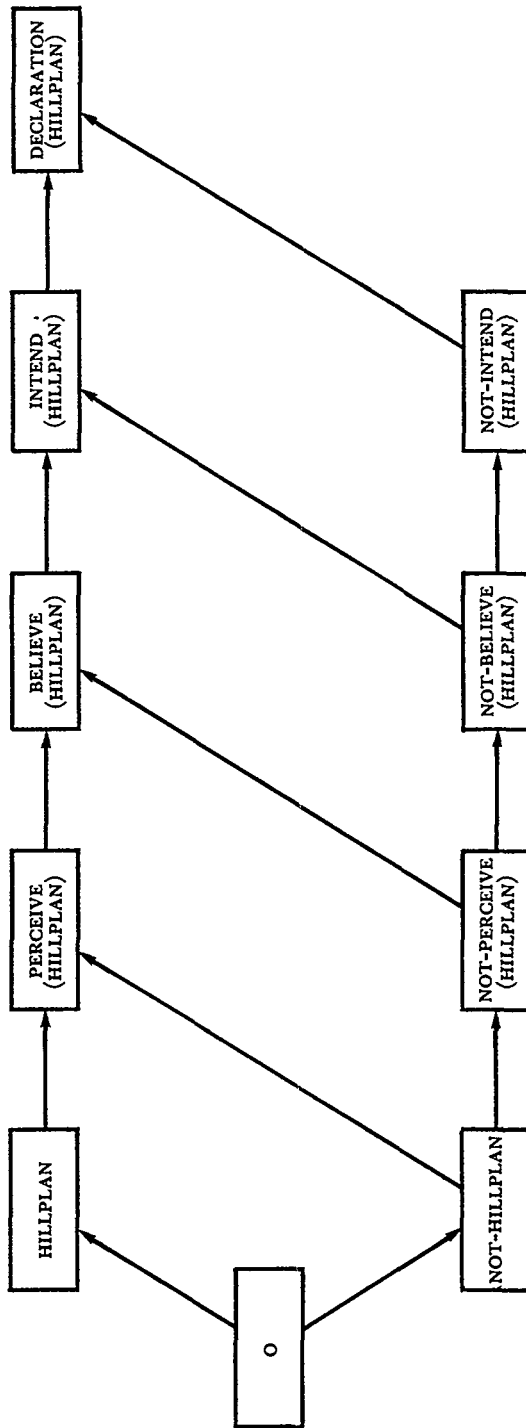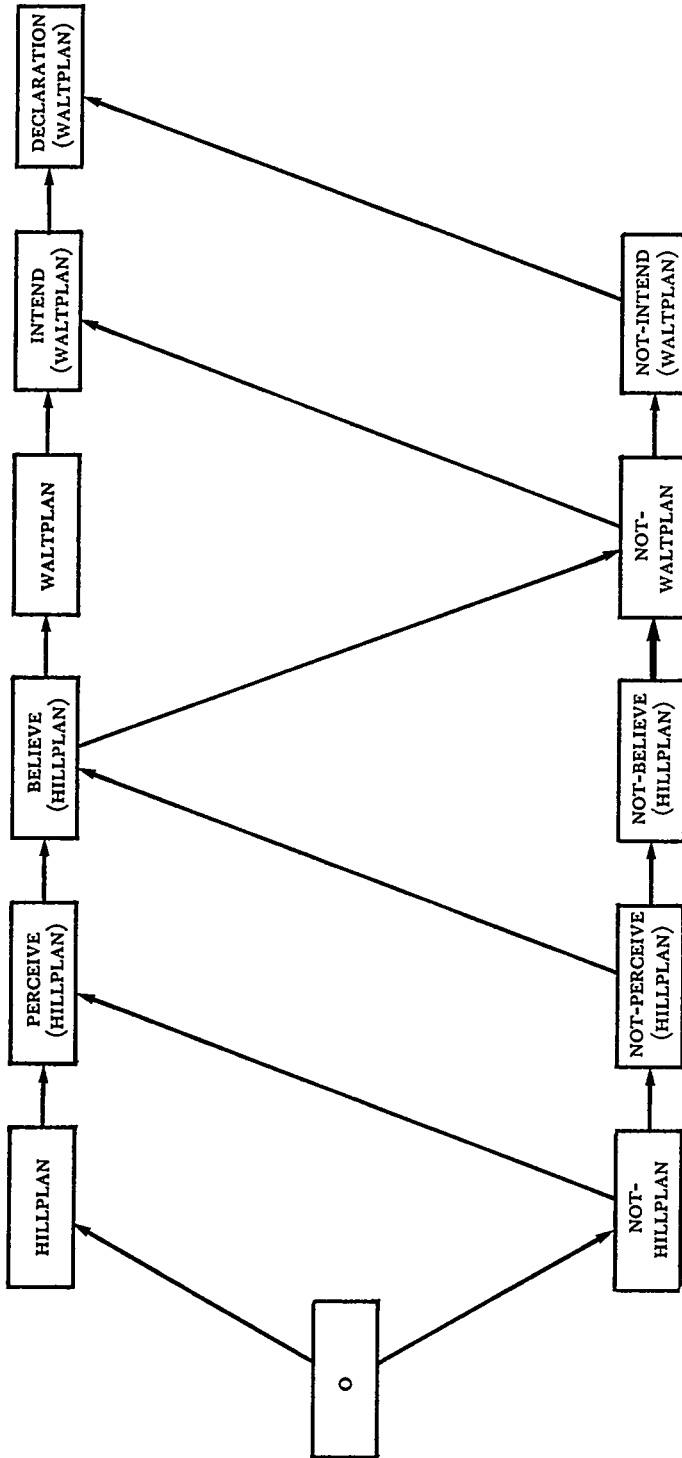intention. Suppose, for example, that Hillmon was Walters' faithful man-

FIGURE 15

FIGURE 16

713

servant, or that Walters was a high-paying expedition leader whose invitation to join him would almost certainly be accepted gladly by Hillmon.[84] Figure 17 diagrams such a case. Here, Hillmon could not form an intention to go with Walters unless Walters formed the reciprocal intention, and the relative thickness of the arrows suggests that proof of WALTPLAN is tantamount to proof of HILLPLAN. Together (as we know from Figure 13), the two propositions increase the probability of JOINTTRIP.
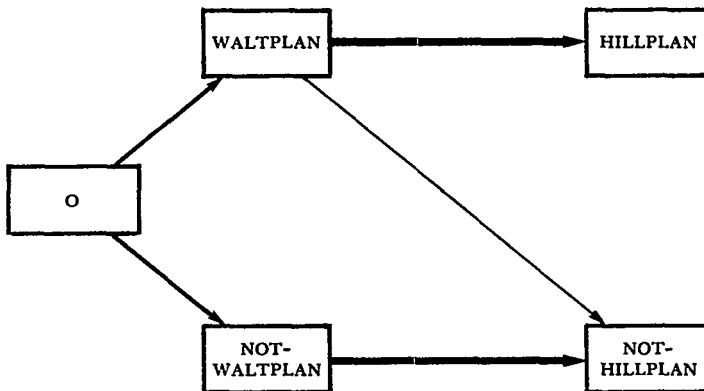

FIGURE 17

But the actual case more resembled that of Figure 16: Hillmon was the generous leader—or so it appeared to Walters[85]—and Walters was the more dependent party. Let us therefore make the assumption, a harsh one from the viewpoint of the proponent of the evidence, that proof of Walters' intention does not alter the probability that Hillmon intended to travel with him.[86]

---

84. Or suppose, to move matters from Crooked Creek towards Palm Beach, that Walters was a major league baseball manager who expressed his intention of traveling north from spring training with Hillmon, a rookie, still on the squad. Surely it would be reasonable to conclude that if Walters intended to travel with Hillmon then Hillmon intended to travel with Walters.

85. Walters, in essence, wrote his fiancee that Hillmon had made him a munificent employment offer that he could not refuse. 145 U.S. at 288-89.

86. Mathematically, this expression means that $P(\text{HILLPLAN})$ equals $P(\text{HILLPLAN } given \text{ WALTPLAN})$. Some readers may note an apparent paradox: if this assumption is true, then, because $P(\text{HILLPLAN}) \times P(\text{WALTPLAN } given \text{ HILLPLAN}) = P(\text{HILLPLAN \& WALTPLAN}) = P(\text{WALTPLAN}) \times P(\text{HILLPLAN } given \text{ WALTPLAN})$, it follows that $P(\text{WALTPLAN}) = P(\text{WALTPLAN } given \text{ HILLPLAN})$. This last equation appears to preclude the possibility that Walters' intention was dependent on Hillmon's. Recall, however, that WALTPLAN and HILLPLAN have been defined broadly, disregarding the time element. *See supra* note 83. If the propositions were defined more precisely—for example, WALTPREPLAN to represent Walters' intention before Hillmon stated his intention, and WALTPOSTPLAN to represent Walters' intention afterwards—the apparent paradox would disappear. For present purposes, using the more precise definitions would add an unnecessary complexity.

If the material proposition at issue were HILLPLAN, this would settle the matter. But here the material proposition is JOINTTRIP, and we have posited that JOINTTRIP cannot be true if WALTPLAN is not. Proof that WALTPLAN is true therefore eliminates one of the contingencies that could prevent JOINTTRIP from being true, and so necessarily increases the probability of JOINTTRIP.[87] Or, as Figure 13 shows, proof of WALTPLAN eliminates two nodes—HILLPLAN & NOT-WALTPLAN and NOT-HILLPLAN & NOT-WALTPLAN—that are compatible only with NOT-JOINTTRIP, and so necessarily increases the probability of JOINTTRIP. Proof of WALTPLAN therefore has probative value with respect to JOINTTRIP, even assuming that WALTPLAN has no bearing on the probability of HILLPLAN. Thus, even disregarding Walters' perception and memory of external facts, the Supreme Court was justified in concluding that proof of Walters' intention "made it more probable both that he did go and that he went with Hillmon, than if there had been no proof of such intention."[88]

But even if the evidence has nonhearsay relevance, it is not necessarily admissible. That decision also requires a judgment as to whether the probative value of the evidence is outweighed by potential harmful effects, such as prejudice and confusion.[89] The probative value is greatest if (1) WALTPLAN was not a foregone conclusion, and (2) apart from proof of WALTPLAN, there is a substantial probability that JOINTTRIP is true.[90] In

---

87. That is, because P(JOINTTRIP *given* NOT-WALTPLAN) is zero, P(JOINTTRIP *given* WALTPLAN) must be greater than P(JOINTTRIP). This is readily demonstrated. P(JOINTTRIP) = [P(WALTPLAN) $\times$ P(JOINTTRIP *given* WALTPLAN)] + [P(NOT-WALTPLAN) $\times$ P(JOINTTRIP *given* NOT-WALTPLAN)]. But because the last probability, P(JOINTTRIP *given* NOT-WALTPLAN), equals zero, this equation simplifies to P(JOINTTRIP) = P(WALTPLAN) $\times$ P(JOINTTRIP *given* WALTPLAN). P(WALTPLAN), the prior probability of WALTPLAN, is less than one, and so P(JOINTTRIP) must be less than P(JOINTTRIP *given* WALTPLAN). If we could say only that P(JOINTTRIP *given* NOT-WALTPLAN) is very small, and not that it is definitely zero—if, for example, Hillmon conceivably could have drugged Walters and taken him along—the same inference, albeit somewhat weakened, would still apply.

Thus, Walters' intention, WALTPLAN, has probative value because the probability of the material proposition, JOINTTRIP, depends in part on whether Walters was a willing participant. If the probability of JOINTTRIP were solely dependent on Hillmon's intention, HILLPLAN, or if HILLPLAN itself were the material proposition at issue, this analysis would not apply.

88. 145 U.S. at 296; *see supra* text accompanying note 82.

89. *See* FED. R. EVID. 403.

90. By definition, *see supra* text accompanying notes 14-16, PV(WALTPLAN *w.r.t.* JOINTTRIP) equals P(JOINTTRIP *given* WALTPLAN) − P(JOINTTRIP). Because P(JOINTTRIP) = P(JOINTTRIP *given* WALTPLAN) $\times$ P(WALTPLAN), *see supra* note 87,

$$PV(\text{WALTPLAN } w.r.t. \text{ JOINTTRIP}) = P(\text{JOINTTRIP } given \text{ WALTPLAN}) - [P(\text{JOINTTRIP} \\ given \text{ WALTPLAN}) \times P(\text{WALTPLAN})]$$

$$= P(\text{JOINTTRIP } given \text{ WALTPLAN})(1 - P(\text{WALTPLAN})).$$

$$(N8)$$

Using the fact that P(JOINTTRIP *given* WALTPLAN) = P(JOINTTRIP) ÷ P(WALTPLAN) (from the expression for P(JOINTTRIP), *see supra*), this transforms to

Hillmon these criteria appear to have been met.[91]

Nevertheless, there is a serious danger of prejudice. For decades, the *Hillmon* doctrine has befuddled courts,[92] rulemakers,[93] and academics,[94]

$$PV(\text{WALTPLAN } w.r.t. \text{ JOINTTRIP}) = P(\text{JOINTTRIP}) \times \frac{1 - P(\text{WALTPLAN})}{P(\text{WALTPLAN})}$$

$$= \frac{P(\text{JOINTTRIP})}{O(\text{WALTPLAN})}, \qquad (N9)$$

where $O(\text{WALTPLAN})$ is the odds of WALTPLAN. Thus, the probative value of WALTPLAN with respect to JOINTTRIP is greatest if the prior likelihood of JOINTTRIP was substantial and the prior likelihood of WALTPLAN was small.

Alternatively, because

$$P(\text{JOINTTRIP}) = P(\text{WALTPLAN}) \times P(\text{HILLPLAN } given \text{ WALTPLAN}) \times P(\text{JOINTTRIP}$$
$$given \text{ HILLPLAN \& WALTPLAN}),$$
$$(N10)$$

we can express Equation N9 as

$$PV(\text{WALTPLAN } w.r.t. \text{ JOINTTRIP}) =$$

$$\left(\frac{1 - P(\text{WALTPLAN})}{P(\text{WALTPLAN})} \right) \left(P(\text{WALTPLAN}) \times P(\text{HILLPLAN } given \text{ WALTPLAN}) \times \right.$$
$$\left. P(\text{JOINTTRIP } given \text{ HILLPLAN \& WALTPLAN}) \right)$$

$$= [1 - P(\text{WALTPLAN})] \times P(\text{HILLPLAN } given \text{ WALTPLAN}) \times$$
$$P(\text{JOINTTRIP } given \text{ HILLPLAN \& WALTPLAN}).$$
$$(N11)$$

And because by hypothesis $P(\text{HILLPLAN})$ equals $P(\text{HILLPLAN } given \text{ WALTPLAN})$, see *supra* note 86, this becomes

$$PV(\text{WALTPLAN } w.r.t \text{ JOINTTRIP}) = [1 - P(\text{WALTPLAN})] \times P(\text{HILLPLAN}) \times$$
$$P(\text{JOINTTRIP } given \text{ HILLPLAN \& WALTPLAN}).$$
$$(N12)$$

Thus, a manager's statement of intent to travel north with a rookie, see *supra* note 84, is strongly probative of joint travel, because the rookie's intent was a foregone conclusion but the manager's was far less likely. For similar reasons, the rookie's statement of intent to travel north with the manager has low probative value.

91.   As to WALTPLAN, it appears clear from the case that, apart from his letters, there was no direct indication of Walters' intention. Although less clear, the essense of the Court's logic seems to be that there was a substantial prior probability of JOINTTRIP that the letters could augment: "In view of the mass of conflicting testimony introduced upon the question whether it was the body of Walters that was found in Hillmon's camp, this evidence might properly influence the jury in determining that question." 145 U.S. at 296.

92.   *See, e.g.*, People v. Alcalde, 24 Cal. 2d 177, 148 P.2d 627 (1944) (holding, over Justice Traynor's dissent, that murder victim's statement, earlier in day of murder, that she intended to be with defendant that night could be used to show the two did meet). *Compare* United States v. Pheaster, 544 F.2d 353, 379-80 (9th Cir. 1976) (declarant's assertion of state of mind allowed to prove the actions of another person) *with* Gual Morales v. Hernandez Vega, 579 F.2d 677, 681 (1st Cir. 1978) (disallowing same type of proof). *See generally* Note, *One Person's Thoughts, Another Person's Acts: How the Federal Circuit Courts Interpret the* Hillmon *Doctrine*, 33 CATH. U.L. REV. 699, 704-05, 715 &

and with good reason: As suggested by the above discussion and the array of Figures 13 through 17—each itself something of a simplification—this type of case poses extremely subtle problems.[95] It may be asking too much to expect a jury to consider WALTPLAN for the light it casts on JOINTTRIP but to exclude from that consideration the natural inference that if WALT-PLAN is true the declarant probably perceived and remembered HILLPLAN to be true.

The distinction suggested here, however, is more comprehensible than the dichotomy suggested by other analyses of the problem,[96] under which the statement would be admissible for its bearing on the acts of the declarant but not on those of the other person. That distinction, even if coherent, is far too subtle to be workable, at least when the essence of the declaration, and of the proposition for which it is offered, is that the two persons engaged in the asserted act together. The analysis described here acknowledges that the declarant's intention to engage in the common activity was one of the preconditions to occurrence of the activity. Thus, proof of the intention necessarily makes the occurrence, which by definition required the participation of both persons, more likely; the jury is barred only from reevaluating the probability of a second precondition—the intention of the other person—by relying on the declarant's perception and memory of that intention.

Several cross-cutting points have emerged from this route analysis of *Hillmon*-type problems. A brief summary might be helpful:

(1) DECLARATION(WALTPLAN) *as proof of* WALTPLAN. A declaration of intention is not hearsay under the traditional approach when offered to prove that the declarant in fact had that intention. Such a declaration may be the product of insincerity or of inarticulateness, but not of failed perception or memory. Even when the intention is material only because of

---

n.108 (1984) ("federal courts have split" on the doctrine).

93. *Compare* FED. R. EVID. 803(3) advisory committee's note (rule leaves *Hillmon* doctrine "undisturbed") *with* the House Committee on the Judiciary's report on Fed. R. Evid. 803(3), H.R. REP. No. 650, 93d Cong., 1st Sess. 13-14 (1973) (intending "that the Rule be construed to limit the . . . [*Hillmon* doctrine] so as to render statements of intent of a declarant admissible only to prove his future conduct, not the future conduct of another person."). The author of Note, *supra* note 92, concluded that "instead of silencing critics and settling the matter, Federal Rule of Evidence 803(3) and the various reports accompanying the rules failed to clarify the scope of the *Hillmon* doctrine." *Id.* at 704-05 (footnote omitted).

94. *See* Note, *supra* note 92, at 714-15 (noting academic split and confusion). The classic treatment of *Hillmon* remains Maguire, *The* Hillmon *Case—Thirty-Three years After*, 38 HARV. L. REV. 709 (1925). For a helpful survey of the topic, see McFarland, *Dead Men Tell Tales: Thirty Times Three Years of the Judicial Process After* Hillmon, 30 VILL. L. REV. 1 (1985).

95. A unified diagram, intended to represent in a single map the variation discussed in connection with Figure 16 is presented in Appendix F. This diagram can cause sturdy minds to boggle—but so can the *Hillmon* problem itself.

96. *E.g.*, People v. Alcalde, 24 Cal. 2d 177, 189-90, 148 P.2d 627, 633 (1944) (Traynor, J., dissenting); Note, *Federal Rule of Evidence 803(3) and the Criminal Defendant: The Limits of the* Hillmon *Doctrine*, 35 VAND. L. REV. 659, 703-05 (1982).

the possible inference that the declarant acted in accordance with the in-
tention (as when PLAN in Figure 12 is proven to support a contention of
CROOKCREEK), the declaration should not be considered hearsay.

(2) DECLARATION(HILLPLAN) *as proof of* HILLPLAN. A declaration,
whether implicit or explicit, of someone else's intention should be consid-
ered hearsay under the traditional approach when offered to prove that
the other person had, or acted in accordance with, that intention. Thus,
DECLARATION(HILLPLAN) in Figure 15 should be considered hearsay
when offered to prove HILLPLAN, because the declaration of Hillmon's
intention is made by Walters and so raises all four dangers.

(3) DECLARATION(WALTPLAN) *as proof of* HILLPLAN. The assertion of
the declarant's own intention may, however, have some probative value in
determining the other person's intention and conduct.

(a) If, as in Figure 16, the assertion is offered because the declar-
ant's intention reflects his belief in the other person's intention, it should
be considered hearsay because it involves all four hearsay dangers: the
dangers that the declarant misperceived and misremembered the other
person's intention, and the dangers that he was insincere and inarticulate
regarding his own intention.

(b) If the assertion of the declarant's intention is offered because the
other person's intention was dependent on the declarant's, as in Figure 17,
then it should not be considered hearsay; as with (1), the assertion raises
the dangers of insincerity and inarticulateness, but not those of failed per-
ception or memory.

(4) DECLARATION(WALTPLAN) *as proof of* JOINTTRIP. If the material
question is whether the declarant and the other person engaged in conduct
jointly, then each person's willingness to engage in the conduct is a predi-
cate to the proposition that they did so. Under the logic summarized in
paragraph 3(b), the declarant's assertion of his own intention may allow
the non-hearsay inference that the other person is willing, and if so, it also
makes the joint conduct more probable. But even if this logic is not appli-
cable, because the other person's intention is not dependent on the declar-
ant's, the declaration helps establish the other predicate to the joint con-
duct—the declarant's own willingness—and so may make the joint
conduct more probable. Thus, if, as in Figure 13, JOINTTRIP is more
probable when WALTPLAN is known to be true than when WALTPLAN is
in doubt, DECLARATION(WALTPLAN) makes JOINTTRIP more probable by
helping to prove WALTPLAN. The relevance of the declaration for this the-
ory is greatest if, as assessed apart from the declaration, (a) there is a
substantial probability that the two people engaged in the joint conduct,
and (b) the declarant's willingness to engage in the conduct is not a fore-
gone conclusion. There may, however, be a substantial problem of

prejudice in offering the declarant's assertion on this ground, because the jury may well take it as an assertion of the other person's intention as well as of the declarant's. As with all evidence, if the potential prejudice of the declaration outweighs its probative value, the declaration should not be admitted.

2. *Other Problems Concerning Intermediate Points*

We have seen that, if BELIEVE(X) is a material proposition, standard hearsay doctrine will allow it to be proved by an out-of-court declaration of either X or BELIEVE(X). A fortiori, proof of an out-of-court declaration of X or of INTEND(X) may be used to prove INTEND(X), that the declarant intended to assert X.[97] INTEND(X) is closer to DECLARATION(X) than is BELIEVE(X), and a diagram in the form of Figure 8 shows only one route—indicating inarticulateness—by which events might have reached DECLARATION(X) without passing through INTEND(X).

Now let us look to the left of BELIEVE(X). We have seen that the reason that standard hearsay doctrine allows evidence of DECLARATION(X) to prove BELIEVE(X) is that this does not raise dangers of misperception or faulty memory.[98] But prevailing doctrine does not demand, as a prerequisite to admissibility, that both dangers to the left of BELIEVE(X) be eliminated. Under Federal Rule of Evidence 803(1), an out-of-court declaration of X may be used to prove X itself if it is one "describing or explaining an event or condition" and it was "made while the declarant was perceiving the event or condition, or immediately thereafter." The first requirement allows the possibility of misperception, so long as that possibility fits within the broad category of a mistaken "sense impression," but the second eliminates the chance of failed memory. This second condition could be represented on Figure 8, for example, if Shopper Two's declaration of the spill was made while observing it, by merging the PERCEIVE(SPILL) and BELIEVE(SPILL) nodes (and likewise the NOT-PERCEIVE(SPILL) and NOT-BELIEVE(SPILL) nodes). Because the declaration was made at the time of the perception, the propositions ordinarily represented by two nodes—the declarant's state of mind at the time of the perception and at the time of declaration, respectively—are identical. There is thus no link between the NOT-PERCEIVE(SPILL) and BELIEVE(SPILL)

---

97. For example, where an out-of-court declaration of X is allegedly fraudulent, the plaintiff offers proof of the declaration to show not only that the statement was made (DECLARATION(X)), but also that the declarant intended the message conveyed (INTEND(X)). The plaintiff does *not* offer the evidence to prove BELIEVE(X); in fact, it is part of his case to prove NOT-BELIEVE(X). This analysis would not change if, for some strange reason, the declarant asserted not X but INTEND(X): "I want to tell you . . . ."

98. *See supra* Section III.B.1.

nodes, for there was no opportunity for a failure of memory. Significant
dangers of failed perception, sincerity,[99] and articulateness remain, but the
statement may be admitted.

Hearsay doctrine tends to take a less generous attitude when the situa-
tion is reversed—that is, when there is a danger of faulty memory (be-
cause the declaration was made after the perception, so that the PER-
CEIVE(X) and BELIEVE(X) nodes are not identical) but not of
misperception. That danger might be eliminated in either of two ways.

First, it might be that X is the material proposition but there is substan-
tially no probability that the declarant misperceived X. This is so when X
concerns facts of the declarant's own condition, bodily or mental, that a
person ordinarily perceives accurately.[100] If we conclude that the declarant
did indeed perceive the condition, we will conclude, virtually inevitably,
that the condition existed; it does not matter whether the statement is in
the form of DECLARATION(X)—such as "my nose was congested"—or of
DECLARATION(PERCEIVE(X))—such as "I felt chest pains." The X and
PERCEIVE(X) nodes are essentially identical. But if the condition assertedly
existed in the past, these nodes are not identical to BELIEVE(X), and a
memory problem remains.

Second, it may be that although there is a real possibility that the de-
clarant could have falsely perceived X, PERCEIVE(X) rather than X itself is
the material proposition. For example, in *Garford Trucking Co. v.
Mann*,[101] the principal issue was whether the defendant's truck driver,
one Glogowski, was acting within the scope of his employment at the time
of an accident. It was therefore a material question what his state of mind

---

99. Note, however, that according to the advisory committee, the underlying theory of the excep-
tion "is that substantial contemporaneity of event and statement negative the likelihood of deliberate
or conscious misrepresentation." FED. R. EVID. 803(1) advisory committee's note. This is an optimis-
tic overgeneralization. True, there may be circumstances in which contemporaneity provides some
assurance of sincerity—as when the recipient of the declaration is in a position to make the same
observations as the declarant. But it hardly seems true that self-interest is so slow to affect one's
conduct that it can be presumed to have no effect on a statement commenting on current happenings;
ordinary experience suggests that in simple situations people tend to recognize, and if necessary act
upon, their self-interest immediately. And yet Rule 803(1) makes no special provision for self-serving
statements. *See* McCORMICK ON EVIDENCE, *supra* note 17, § 290.

100. We have already seen, *see supra* note 77 and accompanying text, that when X is a statement
about the declarant's state of mind at the time of the declaration it is equivalent to BELIEVE(X). There
is not the same identity when X concerns a bodily sensation, but still applicable is the general proposi-
tion that because "what one perceives as his physical or mental sensations *are* his sensations, there is
ordinarily no possibility of erroneous perception." Tribe, *supra* note 5, at 965. Not all statements of
bodily condition fit within this logic, however; whereas "I have a sore throat" speaks only of sensa-
tions and so presents no perception problem, the same cannot be said for "I have cancer of the pan-
creas." Indeed, there may be some mental feelings, such as love, that are so complex that they raise
perception problems because the declarant may be unable to identify them with certainty. *Id.; see* S.
CAHN, WALKING HAPPY ("I don't think I'm in love"); L. HART, THE BOYS FROM SYRACUSE ("This
can't be love"). *But see* F. LOESSER, GUYS AND DOLLS ("I'll know when my love comes along").

101. 163 F.2d 71 (1st Cir.), *cert. denied*, 332 U.S. 810 (1947).

was in choosing to take one route rather than another between two points on his journey. The plaintiff offered proof that, some days after the accident, Glogowski stated that he had taken Route 126 because it was quicker to travel, albeit longer in distance, than Route 9.[102] If that proposition is represented as 126QUICKER, the declaration was offered to prove PERCEIVE(126QUICKER), Glogowski's perception at the time of his travel. Admissibility of Glogowski's statement probably should not depend on whether it was in the form DECLARATION(126QUICKER) ("Route 126 is quicker"), DECLARATION(PERCEIVE(126QUICKER)) ("I thought Route 126 is quicker"), or DECLARATION(BELIEVE(126QUICKER)) ("I think Route 126 is quicker").[103] In any event there is no hearsay danger of misperception—although Glogowski's perception of 126QUICKER certainly might have been mistaken, it is PERCEIVE(126QUICKER), not 126QUICKER, that is the proposition at issue.

But both in the *Garford*-type case and with statements of past bodily condition, the other three dangers remain. As indicated by Figure 8, events might have proceeded from NOT-PERCEIVE(X) to the declaration via any of three routes: (1) through the BELIEVE(X) node (representing failure of memory); (2) through NOT-BELIEVE(X) and then the INTEND(X) node (insincerity); and (3) through NOT-BELIEVE(X) and then the NOT-INTEND(X) node (inarticulateness). The traditional rule in such cases is reflected in Federal Rule of Evidence 803(3), which in general permits admission of "[a] statement of the declarant's *then existing* state of mind, emotion, sensation, or physical condition."[104] As the rule suggests, state-

---

102. *Id.* at 72.

103. A fine distinction is possible, however. To infer PERCEIVE(X) from DECLARA-TION(PERCEIVE(X)) requires confidence in Glogowski's memory of his own prior state of mind, which is arguably less of a problem than his memory of an external fact. *But cf.* Mutual Life Ins. Co. v. Hillmon, 145 U.S. 285, 295 (1892) (declarant's "own memory of his state of mind at a former time is no more likely to be clear and true than a bystander's recollection of what he then said"). If, however, one is to conclude PERCEIVE(X) from DECLARATION(X) or DECLARATION(BELIEVE(X)), it is his memory of a perceived external fact—that Route 126 was quicker—that must be accurate.

Sometimes such questions of form have a more substantial bearing on admissibility. Suppose the material proposition is that Popeye liked olives some years ago. His recent out-of-court statement, "I liked olives back then," like Glogowski's, raises all the hearsay dangers except misperception. If, however, what Popeye said recently is "I like olives," inference of the material proposition depends not on the accuracy of his memory but on the constancy of his tastebuds. That is, this statement proves the material proposition if it is sincere and articulate and if we have confidence that Popeye responded in prior years as he did recently to the stimulus of olives on his tongue. Perhaps cross-examination is not necessary to gain that confidence. The literary-minded reader may have anticipated a related problem: Suppose the material proposition is that Popeye liked Olive back then, and his recent out-of-court statement is "I like Olive." Again, failure of memory as such seems not to be a problem. Here, though, the stimuli—including Olive's actions and attitude towards Popeye—are more likely to have changed over time. In itself, that is a problem of relevance, not of hearsay. But it is also true that Popeye's response—even if the stimuli have remained the same and especially if they have not—may very well have altered over the years. That is a possibility that may be difficult to assess without examining Popeye.

104. FED. R. EVID. 803(3) (emphasis added); *see also* 4 J. WEINSTEIN & M. BERGER, *supra*

ments expressing the declarant's prior state of mind or bodily condition are usually considered inadmissible.[105] Under this limitation, declarations of mental or bodily condition cannot be admitted unless they satisfy the second requirement of Rule 803(1), contemporaneity. Such declarations also satisfy the first requirement of that rule, for by definition they state sense impressions, and of a particular sort. Thus, the Rule 803(3) exception is "essentially a specialized application of [Rule 803(1)],"[106] one with especially strong justification because the danger of misperception, as well as that of failed memory, is eliminated.

The Rules' lack of symmetry—admitting a declaration when the only danger eliminated is failed memory but not when it is misperception—may not be sensible, but in practice there appears to be more flexibility than the Rules indicate. Possibly recognizing that declarations of past states of mind present no perception problems, some courts do admit such declarations so long as the danger of failed memory is small.[107] Indeed, *Garford* approved admission of Glogowski's statement; that case, however, is regarded as stretching hearsay doctrine to the limit or beyond.[108]

---

note 69, ¶ 803(3)[03], at 803-114 ("Rule 803(3) restates the traditional requirement that the statement must relate to a then existing state of mind.").

105. *See, e.g.,* R. CARLSON, E. IMWINKELREID & E. KIONKA, *supra* note 5, at 475 (noting also that California admits statements of prior states of mind under some conditions); E. MORGAN, BASIC PROBLEMS OF EVIDENCE 296 (J. Weinstein 5th ed. 1976); 6 J. WIGMORE, EVIDENCE § 1722, at 122 (J. Chadbourn rev. 1976).

106. FED. R. EVID. 803(3) advisory committee's note.

107. *See* 4 J. WEINSTEIN & M. BERGER, *supra* note 69, ¶ 803(3)[03], at 803-114 to -115 & sources cited nn.13-15. The "notion of the continuity in time of states of mind," MCCORMICK ON EVIDENCE, *supra* note 17, at 844, has been offered in support of the broad proposition that "[a] statement of the declarant's present state of mind is admissible to prove a past state of mind in issue." Edwards & Hanley v. Wells Fargo Sec. Clearance Corp., 458 F. Supp. 1110, 1118 n.2 (S.D.N.Y. 1978), *rev'd on other grounds,* 602 F.2d 478 (2d Cir. 1979), *cert. denied,* 444 U.S. 1045 (1980); *accord* Slough, *Spontaneous Statements and State of Mind,* 46 IOWA L. REV. 224, 231-32 (1961) (because of permissible assumption that "given state of mind will continue over a reasonable period of time," "[w]hen mental condition is directly in issue, [it] should be subject to proof by declarations both prior and subsequent"). This proposition seems justifiable in some cases but not in others, depending on whether the presumed continuity in state of mind is based on an assumed constancy of memory or of response to an external stimulus. *See supra* note 103. In the one case, the jury reasons that, given the declarant's later belief in x (e.g., "Route 126 is quicker"), he probably remembered it from, and so believed in it at, the prior time. To permit that inference without cross-examining the declarant is essentially to abandon memory as a hearsay concern. But where the jury reasons that, given the declarant's recent response to an external stimulus, he probably reacted the same way at a prior time, memory questions never come into play.

108. E. MORGAN, *supra* note 105, at 297; 4 J. WEINSTEIN & M. BERGER, *supra* note 69, ¶ 803(3)[03], at 803-115 n.15; Recent Case, 27 NEB. L. REV. 450, 452 (1948).

3. Out-of-Court Conduct Offered To Prove the Truth of an Apparently Implicit Belief

As the *Shepard* case[109] indicated, the inference from a declaration to its truth may be broken down into parts: from the declaration to the declarant's belief in the truth of the matter asserted, and from that belief to the truth itself. A declaration is just one form of conduct, however, and there are other types of out-of-court conduct that may be relevant by an apparently similar two-step inference, from the conduct to the actor's belief in the truth of a material proposition, and from that belief to the truth of the proposition.[110] Such conduct may take various forms. Consider again variations on *Wright v. Tatham*,[111] where conduct of Ellershaw was offered to show that he believed Marsden had sufficient mental capacity to make his will, and therefore that Marsden did have the capacity. Ellershaw's conduct might be noncommunicative[112]—if, for example, he attended a lecture by Marsden, one might possibly infer that he believed Marsden to have at least some remaining mental capacity. Or the conduct might be communicative but not assertive—the inference of Ellershaw's belief could be drawn from letters he wrote to Marsden asking sophisticated questions but not asserting any facts. Or the conduct might even be assertive, but of a proposition different from the one that it is used to prove—the material inference might be drawn from the fact that Ellershaw found it worthwhile to pass on to Marsden complex information concerning Marsden's business affairs. In each of these cases, the conduct does not assert the material proposition, but apparently indicates that the actor believed in that proposition. When used to prove the proposition, the conduct may raise significant hearsay problems.

Figure 18 can be used to represent any of the illustrations just given. MARSOUND represents the proposition at issue—in each case, that Marsden is of sound mind. CONDUCT represents the out-of-court conduct of Ellershaw that is offered to prove that proposition. (Figure 18 assumes that CONDUCT is undisputed; there is thus no need to show the TESTIMONY nodes.) As in the case of ordinary hearsay, the inference from CON-

---

109. *See supra* notes 70–74 and accompanying text.

110. *See generally* Falknor, *The "Hear-Say" Rule as a "See-Do" Rule: Evidence of Conduct*, 33 ROCKY MTN. L. REV. 133 (1961). As the accompanying text paragraph suggests, the label "nonassertive conduct," sometimes applied to such behavior, *e.g., id.* at 137; R. LEMPERT & S. SALTZBURG, *supra* note 5, at 366, does not sufficiently describe it in all its forms.

111. 7 Eng. Rep. 559 (H.L. 1838), *aff'g* Wright v. Doe d. Tatham, 112 Eng. Rep. 488 (Ex. Ch. 1837); *see supra* text accompanying notes 47–48.

112. That some conduct is not intended, either consciously or subconsciously, to convey a message, was perhaps suggested by Freud: "Sometimes a cigar is just a cigar." *Attributed in* J. BARTLETT, FAMILAR QUOTATIONS 679 (E. Beck 15th ed. 1980).
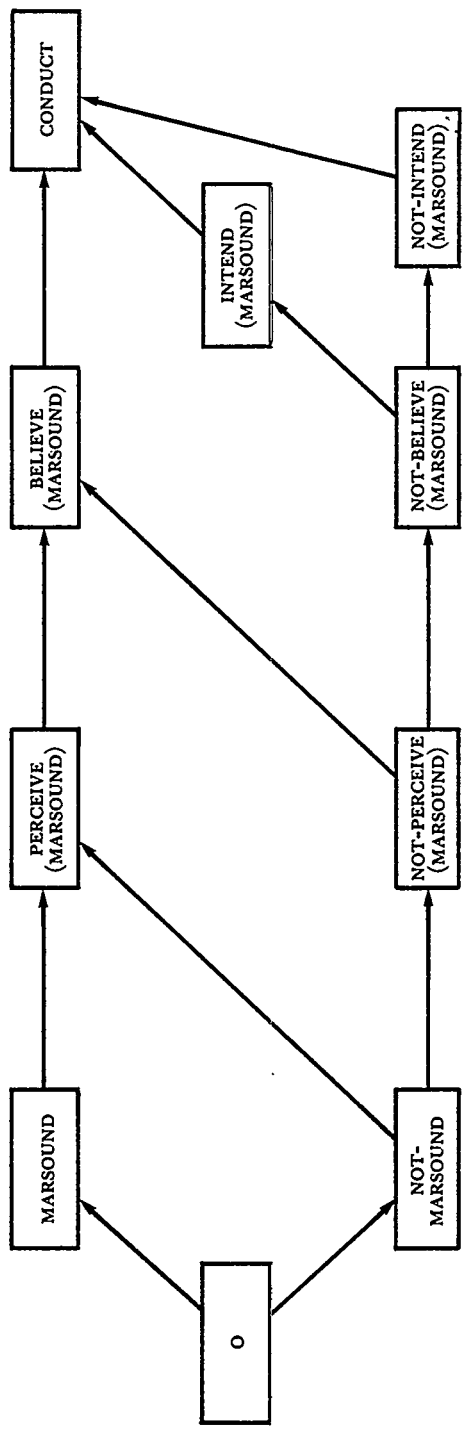
FIGURE 18

DUCT back to MARSOUND uses BELIEVE(MARSOUND) as a stepping stone. And the inference of MARSOUND from BELIEVE(MARSOUND) is the same as in the case of ordinary hearsay; from O to BELIEVE(MARSOUND) and NOT-BELIEVE(MARSOUND) the route diagram is identical (except for the names of the nodes) to the pertinent parts of Figure 8, the diagram for an ordinary hearsay assertion.

Put another way, a factfinder could logically conclude that Ellershaw believed that Marsden was sane, either because Ellershaw made an assertion to that effect or because the belief appeared to be implicit in his conduct. In either case, once Ellershaw's belief is discerned the factfinder can—if permitted by the hearsay rule—draw the further inference that Marsden was indeed sane. When the factfinder is asked to draw that inference, the first case, Ellershaw's assertion, will clearly be considered hearsay, while the second, which characterizes the *Wright* situation, generally will not be under modern law. This is so notwithstanding the fact that the first two hearsay dangers are present in the two cases: However the factfinder has determined Ellershaw's belief, the inference that Marsden was in fact sane depends on a conclusion that Ellershaw's capacities of perception and memory have not failed—i.e., that Ellershaw has not failed to perceive a mental defect of Marsden's or forgotten it since their last contact.

The Advisory Committee for the Federal Rules of Evidence, however, contended that the dangers of failed perception and memory "are minimal in the absence of an intent to assert."[113] This claim is, at the very least, a great overgeneralization. True, often the very fact that an actor has engaged in conduct for a purpose other than communication suggests that he relied with care on his perception and memory, for if they were faulty his conduct could affect him adversely. But communicative conduct, of course, also can often have significant consequences for the actor.[114] And it is undeniable that even noncommunicative conduct is often based on inaccurate beliefs, produced by errors of either perception or memory. The perception and memory concerns underlying the hearsay rule would be better addressed by ascertaining whether the conduct is of the type in which the actor would probably engage only if he were confident of the disputed fact, rather than by determining whether or not he asserted that fact.

Although Figures 8 and 18 are identical in format from O to the BE-LIEVE column, from there to the right they are significantly different. Assume that Ellershaw's conduct is no more than what it appears to be on

---

113. FED. R. EVID. 801(a) advisory committee's note.

114. *See* Park, *supra* note 40, at 453 n.100. For example, making an accusation about one's co-worker may well cause very unpleasant repercussions if the accusation is false; the accusation is nevertheless considered hearsay.

its face. If events passed through BELIEVE(MARSOUND) on their way to
CONDUCT they need not have passed through INTEND(MARSOUND), for by
hypothesis Ellershaw did not intend to communicate MARSOUND, and a
fortiori did not do so articulately. Thus, assessing P(CONDUCT *given* BE-
LIEVE(MARSOUND)) does not require a jury to rely on Ellershaw's capaci-
ties of sincerity and articulateness—the jury need not determine how well
these capacities operated, because if Ellershaw's conduct is taken at face
value, as the proponent of the evidence contends it should be, they never
came into play at all. Rather, the jury need only determine how likely it is
that Ellershaw, believing Marsden to be of sound mind, would have writ-
ten the letter. To make that determination, the jury might have to con-
sider many factors—the relationship of the two men, Ellershaw's willing-
ness to communicate the information by letter, and so forth—but not
Ellershaw's sincerity and articulateness in communicating an assertion of
Marsden's sanity.

But P(BELIEVE(MARSOUND) *given* CONDUCT), not P(CONDUCT *given*
BELIEVE(MARSOUND)), is what the jury is really after. Granted, under
Bayesian reasoning P(BELIEVE(MARSOUND) *given* CONDUCT) depends in
part on P(CONDUCT *given* BELIEVE(MARSOUND)); that is, for the jurors to
determine from Ellershaw's conduct how likely it is that he believed in
Marsden's sanity, they should assess how likely it is that he would have
acted that way if he so believed. But the jury might be able to determine
what it needs to know about P(CONDUCT *given* BELIEVE(MARSOUND))
reasonably well even without hearing the cross-examination of Eller-
shaw.[115] It is far more critical for the jury to have a good estimate of
P(CONDUCT *given* NOT-BELIEVE(MARSOUND))—the probability that El-
lershaw would have acted the way he did if he did not so believe. We
must therefore examine the routes by which events might have reached
CONDUCT from NOT-BELIEVE(MARSOUND).

On one such path, as indicated by Figure 18, Ellershaw did after all
intend to convey a message concerning the state of Marsden's mind. It
could be, for example, that Ellershaw knew Marsden to be insane but
intended the letter to persuade Marsden both of Marsden's sanity and of
Ellershaw's belief in Marsden's sanity—all so that Ellershaw could take
control of Marsden's affairs for his own benefit. Thus, one cannot infer

---

115. To be more precise, what the jury may be able to determine with some confidence, even
absent cross-examination, is that there are no factors that substantially diminish the probability of
CONDUCT given BELIEVE(MARSOUND) without similarly affecting the probability of CONDUCT given
NOT-BELIEVE(MARSOUND). The jury probably cannot evaluate the probability of contingencies that
diminish the probability of CONDUCT equally given BELIEVE(MARSOUND) or NOT-
BELIEVE(MARSOUND)—but it does not need to, because these "screens," which have no effect on the
likelihood ratio of the evidence, do not alter the probability of BELIEVE(MARSOUND) given CONDUCT.
See A Diagrammatic Approach, supra note 1, at 615 & n.67.

BELIEVE(MARSOUND) from CONDUCT without relying on Ellershaw's sincerity—not in the sense that sincere communication is necessary to make a path from BELIEVE(MARSOUND) to CONDUCT, but because an insincere communication is one possible explanation of how events might have proceeded from NOT-BELIEVE(MARSOUND) to CONDUCT.

It also may be conceivable that Ellershaw's conduct was intended to communicate a message, but one other than Marsden's sanity, and that it was inarticulate in doing so. This possibility would mean both that conduct noncommunicative on its face was in fact communicative and that Ellershaw performed the communication poorly; thus, it is probably rather insignificant.

But this possibility of inarticulateness is part of a more general possibility that may be highly significant. It could be, for any of various reasons, that Ellershaw acted the way he did notwithstanding a belief in Marsden's insanity but without any intention to convey an inaccurate message. Perhaps, for example, Ellershaw sent the letter to enjoy a rather cruel private joke. Or perhaps Ellershaw knew that Marsden's steward secretly took care of Marsden's business affairs but would only answer correspondence if it preserved form by addressing Marsden himself.[116]

Even if Ellershaw's conduct was almost certainly not produced by inarticulateness, therefore, the proffered evidence suffers from a broader inherent problem of ambiguity. Figure 18 represents this problem by the route leading to CONDUCT through NOT-BELIEVE(MARSOUND) and NOT-INTEND(MARSOUND).[117]

The ordinary problem of inarticulateness, as presented by an out-of-court assertion, DECLARATION(X), is narrow; if it is known that the declarant intended an assertion, the problem is simply that the message he conveyed may not have been the message he intended. But that is not the situation in a case like *Wright*. There, the out-of-court conduct may not even have been assertive (hence, it is labeled, more generally, CONDUCT), and in fact it appeared on its face to be nonassertive. Thus, the conduct could have many explanations consistent with NOT-BELIEVE(MARSOUND) and NOT-INTEND(MARSOUND) but having nothing to do with a failure to articulate. Probably more than the narrow problem of inarticulateness,

---

116. *See* Park, *supra* note 40, at 452–53 n.100.

117. The path from BELIEVE(MARSOUND) to CONDUCT could also be pictured as leading through NOT-INTEND(MARSOUND), or even as being composed of two branches, the principal one through NOT-INTEND(MARSOUND) and a less important one through INTEND(MARSOUND). Such detail is unnecessary, however. A direct arrow from BELIEVE(MARSOUND) to CONDUCT adequately conveys, with greater pictorial simplicity, the assumption that if BELIEVE(MARSOUND) is true then the conduct was probably neither intended as an assertion of MARSOUND nor an inarticulate assertion of another proposition. Where that assumption is open to question, *see, e.g., infra* note 120, the extra complexity is necessary.

this problem of ambiguity is made more difficult to resolve by Ellershaw's absence from the courtroom; if he were to testify, subject to cross-examination, the jury could better judge whether he might have acted the way he did even if he believed that Marsden had lost his mind.

In sum, route analysis demonstrates visually that conduct offered to prove the truth of an apparently implicit belief is beset by two problems—the possibilities of failed perception and memory—in the same manner as is ordinary hearsay evidence. A third potential problem, insincerity, is present as well, albeit in mitigated form; the relevance of the evidence does not depend upon the actor's having communicated sincerely, but may be undercut by the possibility that he was attempting to communicate insincerely. And although there may be no serious problem of inarticulateness per se, there is a broader problem of ambiguity, because there may be one or more plausible explanations for the actor's conduct, apart from the possibility of an insincere communication, that do not depend on the actor's having believed the material proposition.

In the actual case, these problems prompted the House of Lords to affirm the trial court's exclusion of the evidence as hearsay.[118] But the rule of *Wright* has proven unpopular, and the Federal Rules of Evidence decline to classify conduct similar to Ellershaw's as hearsay. Instead, the rules treat such conduct as if "not intended as an assertion," and so not a Rule 801(a) "statement" capable of being treated as hearsay, or as if assertive yet "offered as a basis for inferring something other than the matter asserted, [and therefore] excluded from the definition of hearsay by the language of [Rule 801(c)]."[119] In terms of our diagrams, the hearsay rules do not apply because the route from BELIEVE(X) to CONDUCT does not lead through INTEND(X).

As a generalization, however, this is insufficient. In some cases, as we have seen, there may be a significant path from NOT-BELIEVE(X) to CONDUCT through INTEND(X); it is therefore begging the question of whether BELIEVE(X) or NOT-BELIEVE(X) is true to admit the evidence on the ground that the conduct is nonassertive.[120] True, the danger of an insin-

---

118. For an interesting discussion of the background of and issues in this celebrated case, see Maguire, *supra* note 46, at 749-60.

119. FED. R. EVID. 801(a) advisory committee's note.

120. The draftsmen of the Federal Rules acknowledged that their approach often requires a difficult preliminary determination of whether an assertion was intended. *Id.* The problem is not only that the path to CONDUCT may have passed from NOT-BELIEVE(X) through INTEND(X)—i.e., that the conduct may actually be a dishonest communication of x. It may also be unclear whether the path from BELIEVE(X) to CONDUCT goes through INTEND(X)—in other words, whether the conduct might have been a sincere attempt to communicate x. Suppose that in our slip-and-fall case, *see supra* note 57 and accompanying text, the plaintiff, to prove that there was ketchup on the floor, offers proof that a few minutes before the accident another shopper out of her earshot told his child, "Don't step in the ketchup!" That communication could have been intended to include an assertion ("There is ketchup there. Don't step in it!") or merely as a nonassertive imperative ("Don't step in the ketchup that we

cere communication is less when it is uncertain, and indeed unlikely, that the conduct was assertive. But even if this is so, that very uncertainty often converts the narrow problem of inarticulateness into the broader one of ambiguity. In some cases, there may be no real ambiguity; the conduct may be consistent only with the actor's belief in the truth of the material proposition. It seems difficult to make any valid generalization, however. Wholesale rejection of the *Wright* rule represents a pragmatic hostility to, rather than a consistent application of, hearsay doctrine.

IV. CONCLUSION

Route analysis offers a method for displaying visually how a jury should consider the effect of retrospective evidence—the most important type of evidence in judicial proceedings—on the probability of a disputed proposition. The jury should ask: "How probable did the disputed proposition appear prior to the new evidence? How probable is it that the evidence would arise if the disputed proposition were true? How probable is it that the evidence would arise if the disputed proposition were not true?" The same general technique applies when the evidence supporting a proposition x is a witness' testimony of x, proof of an out-of-court declaration of x, or proof that a person acted in a way apparently reflecting a belief that x is true. The technique also applies when the material proposition in dispute is not x, but, for example, another proposition inferable from x, or the proposition that a person believed x, or the proposition that a person declared x.

This congruence is perhaps the most significant advantage of route analysis in considering credibility and hearsay, for the analysis shows how much problems in these areas have in common with other problems of factual inference.[121] To say that the same technique applies is not, of course, to say that it should be applied uniformly. On the contrary, a complementary advantage of route analysis is its flexibility: The diagram for a particular case is drawn to suit the needs of that case. By demanding an assessment of the prior probability of the material proposition—for that is the first of the three questions set forth above—route analysis ap-

---

both recognize is there [so that I needn't tell you about it and can refer to it with the definite article]!"). This type of uncertainty raises interesting issues for transformational grammarians. *See, e.g.,* R. HUDDLESTON, AN INTRODUCTION TO ENGLISH TRANSFORMATIONAL SYNTAX 6, 127–45 (1976). It is doubtful, though, that an evidentiary ruling should depend on their resolution.

121. A provocative piece suggests that the admissibility of an item of evidence should be determined in the same manner for "all types of evidence," including hearsay, "by balancing its value against the residual gap (i.e., the disparity at the end of the trial) between expected jury perception and absolute reliability." Note, *supra* note 52, at 1791; *see also id.* at 1787–90 (outlining general decision rule); *cf. id.* at 1804–07 (exclusion of hearsay is inconsistent with usual rules governing roles of judge and jury).

propriately places the evidentiary problem in the context of the rest of the case. The second and third questions require close examination of the relation between the specific proposition at issue and the evidence of it. A properly-drawn route diagram aids this examination, enabling an analyst to consider the possible hypotheses of how the material proposition could be false notwithstanding the evidence, and to determine which of these hypotheses could adequately be considered only with cross-examination.

Route analysis, in short, is a comprehensive method for diagramming problems of factual inference, with ready application to problems of credibility and hearsay. Any analysis made with the diagrams could also be made without them, on the basis of clear, logical thought. But it is difficult enough to think clearly about intricate problems, and we should readily accept any available aid. Route diagrams offer assistance to those who, when required to understand a complex situation, are prone to ask, "Can you draw me a picture?"

APPENDIX A

Section II.A. criticizes a simple credibility model under which a number representing credibility is assigned to each witness. That number is the probability of a proposition given the witness' testimony to the proposition, and it is assessed without reference to the probability of the proposition before the testimony. This Appendix demonstrates the mathematical incoherence in this model.

Assume the simple case in which witness W must admit or deny proposition x; he has the choice of testifying to x or nx.[122] Assuming the simplified model of credibility is coherent, there is a number C that represents both the probability that x is true given W's testimony of x and the probability that nx is true given W's testimony of nx. That is,

$$P(x \mid T(x)) = P(NX \mid T(NX)) = C. \tag{A1}$$

A lengthy proof, however, shows that, whatever the value of C, there are propositions for which this relationship cannot hold. More precisely, the model breaks down if *either* (i) $C + P(x) > 1$ and $P(x) > C$, *or* (ii) $C + P(x) < 1$ and $P(x) < C$.[123] For example, if $C = 0.8$, there is no proper solution to these equations if $P(x) < 0.2$ or $P(x) > 0.8$; thus, if our prior estimate of the probability of x is 0.9, we cannot rationally conclude—as the simplified credibility model demands we should—both that the probability of x, given W's testimony of x, is 0.8 and that the probability of nx, given W's testimony of nx, is 0.8. This impossibility is not disturbing if we are not bound to the simplified model, for

---

122. In the appendices, a notation more compact than that in the main text will be used. NX is equivalent to NOT-X, a vertical line I means *"given"*; and T(X) means TESTIMONY(X).

123. Applying Bayes' Theorem to Equation A1, we can write:

$$\frac{P(x) \times P(T(x) \mid x)}{P(T(x))} = C \tag{A2}$$

and

$$\frac{P(NX) \times P(T(NX) \mid NX)}{P(T(NX))} = C. \tag{A3}$$

And, because $P(x) + P(NX) = P(T(x)) + P(T(NX)) = P(T(x) \mid NX) + P(T(NX) \mid NX) = 1$, we can express Equation A3 as

$$\frac{[1 - P(x)] \times [1 - P(T(x) \mid NX)]}{1 - P(T(x))} = C. \tag{A4}$$

We also know that

$$P(T(x)) = [P(x) \times P(T(x) \mid x)] + ([1 - P(x)] \times [P(T(x) \mid NX)]). \tag{A5}$$

If the simple credibility model is coherent, there should be values of $P(T(x))$, $P(T(x) \mid x)$, and $P(T(x) \mid NX)$ that satisfy Equations A2, A4, and A5 for any proper values of C and $P(x)$—that is, however credible the witness is and however probable the proposition is absent the testimony—or at least for any reasonable values of C and $P(x)$.

To solve this trio of equations, first restate Equation A2 as

$$P(x) \times P(T(x) \mid x) = C \times P(T(x)). \tag{A6}$$

Substituting the right side of this equation into Equation A5 and rearranging yields

such a pair of conclusions would be highly surprising, if not irrational; it would mean that W's testimony as to a proposition that previously appeared extremely probable *lowers* the probability of that proposition to *C*.

APPENDIX B

This Appendix demonstrates that Professor Kaplan's failure to distinguish between $P(x \mid T(x))$ and $P(T(x) \mid x)$ severely undercuts his model of credibility.[124] It should be noted at the outset that $P(T(x) \mid x)$ and $P(x \mid T(x))$ are not in fact identical. For example, suppose that $P(x) = 0.6$, $P(T(x) \mid x) = 0.8$, and $P(T(x) \mid Nx) = 0.4$. Then by Bayes' Theorem,

$$P(T(x)) = \frac{(1 - P(x)) \times P(T(x) \mid Nx)}{1 - C}.$$

(A7)

Substituting this expression for $P(T(x))$ into Equation A4 and rearranging then gives

$$P(T(x) \mid Nx) = \frac{(1 - P(x) - C)(1 - C)}{(1 - P(x))(1 - 2C)}.$$

(A8)

Using the relationship between $P(T(x))$ and $P(T(x) \mid Nx)$ shown in Equation A7, Equation A8 leads to

$$P(T(x)) = \frac{1 - P(x) - C}{1 - 2C}.$$

(A9)

And then using the relationship between $P(T(x))$ and $P(T(x) \mid x)$ shown in Equation A6, Equation A9 gives

$$P(T(x) \mid x) = \frac{C \times (1 - P(x) - C)}{P(x) \times (1 - 2C)}.$$

(A10)

If $C + P(x) > 1$ and $P(x) > C$, there is no satisfactory solution of Equation A8: if $C < \frac{1}{2}$, the numerator of the fraction is negative and the denominator positive; if $C = \frac{1}{2}$, the fraction is undefined; and if $C > \frac{1}{2}$, both numerator and denominator are negative, but the numerator is larger in absolute value. Similarly, if $C + P(x) < 1$ and $P(x) < C$, there is no satisfactory solution of Equation A10.

124. *See* Kaplan, *supra* note 3, at 1086-91.

$$P(x \mid \text{T}(x)) \quad = \quad \frac{P(x) \times P(\text{T}(x) \mid x)}{P(x) \times P(\text{T}(x) \mid x) + [1 - P(x)] \times P(\text{T}(x) \mid \text{N}x)} \qquad \text{(B1)}$$

$$= \quad \frac{0.6 \times 0.8}{(0.6 \times 0.8) + (1 - 0.6) \times 0.4}$$

$$= \quad \frac{0.48}{0.64} = 0.75.$$

And this, of course, is not equal to $P(\text{T}(x) \mid x)$, which by hypothesis equals 0.8. $P(x \mid \text{T}(x))$ would equal $P(\text{T}(x) \mid x)$ in this case if $P(\text{T}(x) \mid \text{N}x)$ were 0.3 instead of 0.4, but that would be a mere coincidence.

Professor Kaplan does not distinguish between $P(x \mid \text{T}(x))$ and $P(\text{T}(x) \mid x)$. Professor Kaplan discusses his approach to credibility in the context of a case in which a witness declares that the defendant left town after the crime. Kaplan then seeks to determine "the ultimate L" for this evidence, which is "the ratio of the probability of finding this piece of evidence if the defendant were guilty to the probability of finding it if he were inno-cent."[125] The numerator of this ratio is "the probability that the witness would state that he saw the defendant leaving town if the defendant were in fact guilty." We may call this probability $P(\text{T}(\text{R}) \mid \text{G})$. Kaplan expresses it as $[P(\text{R} \mid \text{G}) \times A] + [(1 - P(\text{R} \mid \text{G})) \times (1 - A)]$, where $P(\text{R} \mid \text{G})$ is the probability that the defendant would run if guilty and A is a measure of the witness' accuracy.[126] This expression correctly recognizes that there are two paths by which events might proceed from the defendant's guilt to testimony of his flight—it may be that the defendant did run and the witness testified accurately, or that the defendant did not run and the witness testified inaccurately. To give the expression its intended meaning, A must signify $P(\text{T}(\text{R}) \mid \text{R})$, the probability that the witness would testify to flight given the fact of flight. But there is no reason to suppose that the probability that the witness would testify to flight given that the defendant did not flee must be equal to 1 $- A$: there is no logical relation between $P(\text{T}(\text{R}) \mid \text{R})$ and $P(\text{T}(\text{R}) \mid \text{NR})$.

Kaplan apparently makes the oversimplifying assumption because he misunderstands the meaning of A. Instead of treating A as a prospective probability, $P(\text{T}(\text{R}) \mid \text{R})$, he seems to regard it as a retrospective probability, $P(\text{R} \mid \text{T}(\text{R}))$; for example, he defines A as "the probability that the witness testified accurately."[127] It is true that if this did equal A, then $P(\text{NR} \mid \text{T}(\text{R}))$—the probability that the witness testified inaccurately in asserting the defend-ant's flight—must equal 1 $- A$, because the witness was either accurate or not but not both. The difficulty is that the retrospective probabilities $P(\text{R} \mid \text{T}(\text{R}))$ and $P(\text{NR} \mid \text{T}(\text{R}))$ have no place in the above stated expression for $P(\text{T}(\text{R}) \mid \text{G})$. A cannot mean what Kaplan seems to think it means.

This confusion extends into Kaplan's attempts to break A down into components. Kaplan states that "A may be expressed as the product of the probabilities: (1) that the witness was not mistaken in what he saw; (2) that he has remembered what he thinks he saw; (3) that he has meant to tell us what he remembered; (4) that he has actually been

---

125. *Id.* at 1087.

126. *Id.* Similarly, he expresses the denominator of the ratio as $P(\text{R} \mid \text{NG}) \times A + [1 - P(\text{R} \mid \text{NG})] \times (1 - A)$. Kaplan actually uses a slightly different notation, but the difference is inconsequential.

127. *Id.*

able to communicate what he intends to tell us; and (5) that we have correctly understood what he has communicated."[128]

Kaplan's suggestion of breaking the credibility measure down by the individual testimonial capacities is a useful one,[129] and he is correct that, if we put aside the very small possibility of two compensating errors, A may be expressed as a product.[130] But he has misstated the components. If, as I have suggested, $A = P(\text{T(R)}|\text{R})$, Kaplan should have stated the components in the subjunctive mood rather than in the indicative past tense. They should be the probabilities that: (1) if the defendant ran the witness would correctly perceive this; (2) if the witness perceived it he would remember it; (3) if he remembered it he would intend to communicate it; (4) if he so intended he would in fact communicate it; and (5) if he communicated it we would understand it.[131]

Although assessing the prospective probability $P(\text{T(R)}|\text{R})$ may be helpful to the jury by Bayesian reasoning, it is the retrospective probability $P(\text{R}|\text{T(R)})$ that the jury really must determine. Because that probability looks backwards, it may be divided into components that describe an inferential chain from T(R) back to R. They are the probabilities that: (1) given what we understood the witness to testify, it is what he communicated; (2) given what the witness communicated, it is what he intended to communicate; (3) given that he intended to communicate this message, it was in fact what he remembered; (4) given what he remembered, it was what he actually perceived; and (5) given what he perceived, it was what actually occurred.[132]

APPENDIX C

Section II.A. suggests that $C(\text{x})$, the credibility ratio for a given witness W, is greater than 1 if the witness is not a pathological liar. This suggests that W's declaration of x should make x appear more probable than it was without the statement, although not necessarily by very much. If all we know is that W has declared x, this is probably true. But if a jury sees and hears W make the declaration, it may conclude that x is less probable than it was before the testimony. Is such a conclusion irrational?[133] No, because the

---

128. *Id.* at 1088.

129. *See supra* Section II.D.

130. Kaplan, *supra* note 3, at 1088.

131. To adhere to Kaplan's format, A here describes five links, rather than four as elsewhere in this Article. The fifth link, understanding by the listener, may—especially as judged by the listener—be considered part of the fourth link, proper communication by the witness.

132. In United States v. Myers, 550 F.2d 1036, 1049 (5th Cir. 1977), the court described another backwards-looking chain of inference, this one beginning essentially where the one described in the text leaves off, with proof of behavior suggesting flight:

Its probative value as circumstantial evidence of guilt depends upon the degree of confidence with which four inferences can be drawn: (1) from the defendant's behavior to flight; (2) from flight to consciousness of guilt; (3) from consciousness of guilt to consciousness of guilt concerning the crime charged; and (4) from consciousness of guilt concerning the crime charged to actual guilt of the crime charged.

133. Apart from the matter of demeanor, discussed in this Appendix, there is at least one other explanation of why the jury would lower its estimate of the probability of x after learning of W's declaration of x. It is possible that the jury assumes, because the issue is being litigated and because one attorney has asserted x in her opening statement, that there is credible evidence of x. This assumption is an improper one, because the jury is instructed not to treat the pleadings or the attorneys' assertions as evidence, 1 E. DEVITT & C. BLACKMAR, FEDERAL JURY PRACTICE AND INSTRUCTIONS §§ 11.11, 11.13 (3d ed. 1977) (assertions); 2 *id.* §§ 70.03, 71.10 (pleadings); that is, it should not make the probability that it assigns to x depend on those advocacy statements. But suppose that, as must often be the case, the jury makes the forbidden assumption. If W's testimony is disappointing—that is, $C(\text{x})$ is lower than the jury anticipated—the jury may then lower its prior estimate

manner in which W gives his testimony may in itself be a significant indication of whether his statement is accurate.[134]
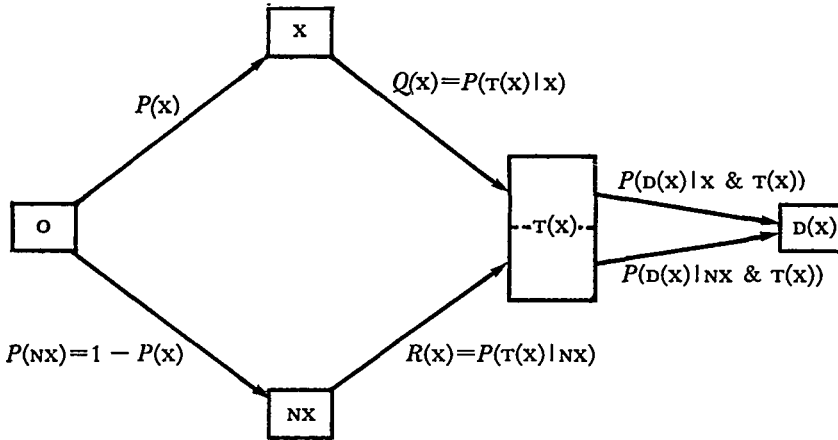

FIGURE C1

Figure C1 shows how this can be. $D(x)$ represents W's demeanor in testifying to x. Thus, $P(D(x) | [x \ \& \ T(x)])$ represents the probability that W would display this demeanor given that he testifies to x *and* that x is accurate, and $P(D(x) | [NX \ \& \ T(x)])$ represents the probability that he would do so given that he testifies to x *and* that x is inaccurate. We can then define a new term, the sweat factor S:

$$S(x, D(x)) \ = \ \frac{P(D(x) \ | \ [NX \ \& \ T(x)])}{P(D(x) \ | \ [x \ \& \ T(x)])}. \tag{C1}$$

S indicates whether W's demeanor in testifying to x is more suggestive of falsification ($S > 1$, reflecting lowered eyes and profuse perspiration) or of truthtelling ($S < 1$, reflecting cool calm and a stationary polygraph needle).

---

of the probability of x; the jury may reason that, if better evidence of x were available, the proponent would present it in addition to, or in lieu of, W's shaky testimony.

134.   Indeed, it may be that in some cases a factfinder may find a proposition to be true solely on the basis of a witness' demeanor in testifying to the contrary of that proposition. *See* Dyer v. Mac-Dougall, 201 F.2d 265, 270 (2d Cir. 1952) (Frank, J., concurring and construing majority opinion, by L. Hand, J., so to hold where judge is factfinder); *In re* Bebar, 315 F. Supp. 841, 844 (E.D.N.Y. 1970) (relying on *Dyer* to uphold referee's finding that fact was contrary to unrefuted testimony). *But see, e.g.,* United States v. Cisneros, 448 F.2d 298, 306 n.10 (9th Cir. 1971) (burden of proof cannot be satisfied solely by demeanor evidence); Janigan v. Taylor, 344 F.2d 781, 784-85 (1st Cir.), *cert. denied*, 382 U.S. 879 (1965) (if court could use "disbelief [of testimony] alone to support a finding that the opposite was the fact . . . a case could be made for any proposition in the world by the simple process of calling one's adversary and arguing to the jury that he was not to be believed" (citation omitted)). The *Janigan* argument appears specious, or at least exaggerated. A court could establish a rule allowing demeanor evidence to support a finding of some propositions but not others: The more unlikely a proposition appears, apart from a witness' denial of it, the more suspicious the witness must be to render the proposition probable.

Looking at Figure C1, we can see how to define $C'(x,D(x))$, a measure of credibility that takes into account $S(x,D(x))$ as well as the factors that determine $C(x)$:

$$C'(x,D(x)) \; = \; \frac{Q(x) \times P(D(x) \mid [x \; \& \; T(x)])}{R(x) \times P(D(x) \mid [Nx \; \& \; T(x)])} \qquad = \; \frac{C(x)}{S(x,D(x))}. \quad (C2)$$

We may also rewrite an equation used earlier[135] to take this additional factor into account. Equation N2 expresses $PV(T(x) \; w.r.t. \; x)$ in terms of $P(x)$ and $C(x)$. After substitution of $C'(x,D(x))$ for $C(x)$, the equation gives an expression for $PV([T(x) \; \& \; D(x)] \; w.r.t. \; x)$:[136]

$$PV([T(x) \; \& \; D(x)] \; w.r.t. \; x) \; = \; \frac{P(x) \times [1 - P(x)] \times [C'(x, D(x)) - 1]}{[P(x) \times C'(x, D(x))] + [1 - P(x)]}. \qquad (C3)$$

Equation C2 shows that, if the S factor is greater than the C factor, $C'(x,D(x))$ is less than one. Equation C3 shows that when this is so the substance and manner of the testimony, taken together, lower the probability that the declaration is true. There may be occasions when a witness' testimony is negatively persuasive.[137] But such a situation is probably not very common, because the S factor is not often far above one: even the beaded brow and the quavering voice may be the products of nervousness, illness, or heat rather than of a guilty conscience.

APPENDIX D

This Appendix analyzes the lottery problem presented in Section II.C.[138] It shows that the route analysis model, properly applied, does jibe with our intuition: If Whitney, a selector of apparent veracity, picks a lottery ticket at random and announces the result, it is highly probable that her announcement is accurate, no matter how many tickets are in the lottery.

The key consideration in understanding the problem is this: In determining the probability that Whitney's announcement of ticket 297 is accurate, we must be able to assess, inter alia, $R(x_{297})$—the probability that Whitney would announce ticket 297 even though she had chosen another of the 10,000 tickets. The R factor is not the probability that W would make an inaccurate statement of the ticket number, but rather the much smaller probability that she would make this *particular* inaccurate statement, announcing ticket 297 rather than any other.

---

135. *See supra* note 30.

136. Making a similar substitution into Equation N1, *see supra* note 30, yields an expression for $P(x \mid [T(x) \; \& \; D(x)])$:

$$P(x \mid [T(x) \; \& \; D(x)]) \; = \; \frac{C'(x,D(x))}{C'(x,D(x)) + \dfrac{1 - P(x)}{P(x)}}. \qquad (CN1)$$

137. *See, e.g.,* Dyer v. MacDougall, 201 F.2d 265, 269 (2d Cir. 1952).
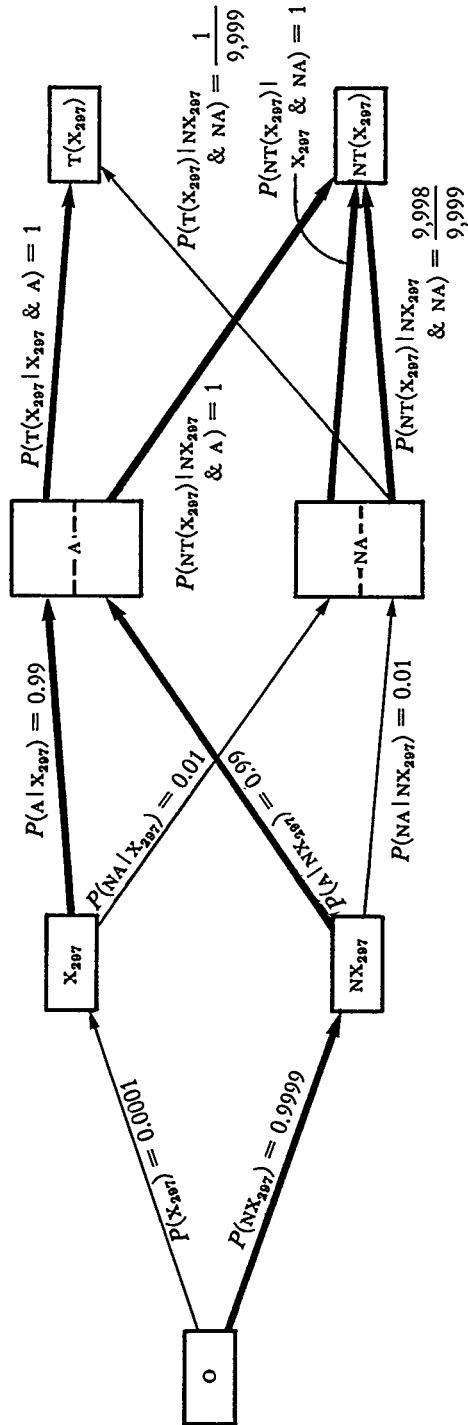
138. *See supra* text accompanying notes 42–44.

FIGURE D1

Figure D1 helps us to explore and understand the significance of this consideration. Here, x_{297} represents the proposition that the ticket with number 297 has been selected (the diagram could easily be relabelled for a ticket bearing any number i), and A represents the proposition that Whitney has stated accurately the number of the selected ticket. Suppose we can assign a probability A' to represent the proportion of times that Whitney will state the number of the ticket accurately, whatever the number,[139] and that in this case $A' = 0.99$.

Thus, $P(A \mid x_{297}) = P(A \mid NX_{297}) = A' = 0.99$, and consequently $P(NA \mid x_{297}) = P(NA \mid NX_{297}) = 1 - A' = 0.01$. If the ticket is 297 and Whitney speaks accurately she will definitely announce 297. Similarly, if the ticket is 297 and she speaks inaccurately, or if it is not 297 and she speaks accurately, she will definitely *not* announce 297. Thus, $P(T(x_{297}) \mid [x_{297} \ \& \ A]), = P(NT(x_{297}) \mid [x_{297} \ \& \ NA]) = P(NT(x_{297}) \mid [NX_{297} \ \& \ A]) = 1$. But if the ticket is not 297 and she speaks inaccurately, there is only one chance in 9999 that she will announce 297. There are 9999 possible wrong announcements that Whitney could make, and selecting 297 is just one of them, so $P(T(x_{297}) \mid [NX_{297} \ \& \ NA])$ equals 1/9999.

With the help of Figure D1, we can distinguish between two routes to the announcement of a particular numbered ticket. Along one, the substance of the statement is correct, and the witness testifies accurately. If x_i is true, the probability that Whitney will declare it—that is, $P(T(x_i) \mid x_i)$—is simply $P(A \mid x_i)$, because if she testifies accurately she will necessarily testify to x_i. Along the other route, the statement is incorrect and the witness not only testifies inaccurately but makes the particular misstatement at issue. $P(T(x_i) \mid NX_i)$ therefore equals $P(NA \mid NX_i) \times P(T(x_i) \mid [NX_i \ \& \ NA])$. By definition, the credibility ratio $C(x_i)$ equals the quotient $P(T(x_i) \mid x_i) \div P(T(x_i) \mid NX_i)$. Accordingly, it may be expressed as

$$C(x_i) \quad = \quad \frac{P(T(x_i) \mid x_i)}{P(T(x_i) \mid NX_i)}$$

$$= \quad \frac{P(A \mid x_i)}{P(NA \mid NX_i) \times P(T(x_i) \mid [NX_i \ \& \ NA])}$$

$$= \quad A''(x_i) \quad \times \quad \frac{1}{P(T(x) \mid [NX_i \ \& \ NA])}, \qquad \text{(D1)}$$

where A'' equals $P(A \mid x_i) \div P(NA \mid NX_i)$ and so, on the assumption that a probability A' can be assigned, also equals $A' \div (1 - A')$.[140] In this particular case, $A''(x_{297})$ equals $0.99 \div 0.01$, or 99, and $P(T(x_{297}) \mid [NX_{297} \ \& \ NA])$ equals 1/999?, so $C(x_{297})$ is very large,

---

139. This assumption of equality is made here for simplicity. In this case it is perfectly plausible. Unless Whitney has an interest in announcing, or in not announcing, a given number, or unless the chance that she will innocently misread the ticket is greater or less for one number than for others, there is no reason to suppose that the assumption in the text does not hold. In some cases, however, the assumption is not accurate (for example, if Whitney is dyslexic, she might be especially susceptible to misreading a 6 for a 9), and the analysis would be more complex numerically, but not conceptually.

140. This follows immediately from the definition of A'. By simple algebraic manipulations, we can also write

$$A' = \frac{A''}{A'' + 1} \qquad \text{(DN1)}$$

(9999)(99) or 989,901. Plugging this number and the value of $P(x_{297})$, 0.0001, into Equation N1,[141] we have

$$P(x_{297} | T(x_{297})) = \frac{(9999)(99)}{(9999)(99) + \dfrac{0.9999}{0.0001}}$$

$$= \frac{(9999)(99)}{(9999)(99) + 9999} = 99\%. \qquad (D2)$$

This is just what we expect intuitively. In fact, this probability would remain substantially the same no matter how many lottery tickets there are.[142] In effect, though the event—selection of a particular ticket—is unexpected, so too would be inaccurate testimony that this particular ticket was the one chosen. The two low probabilities cancel each other out, and our assessment of Whitney's propensity to tell the truth in this situation determines how probable we are to regard her statement to be accurate.[143]

---

141. *See supra* note 30.

142. Assume that there are n lottery tickets, each equally likely to be chosen, one of them numbered 297. Thus, $P(x_{297}) = 1/n$ and $P(T(x_{297}) | [NX_{297} \ \& \ NA]) = 1/(n - 1)$. From Equation D1, $C(x_{297}) = A'' \div [1/(n - 1)] = (n - 1)A''$. Inserting this value and the value for $P(x_{297})$ into Equation N1, *supra* note 30, we have:

$$P(x_{297} | T(x_{297})) = \frac{(n - 1)A''}{(n - 1)A'' + \dfrac{1 - 1/n}{1/n}}$$

$$= \frac{(n - 1)A''}{(n - 1)A'' + (n - 1)}$$

$$= \frac{A''}{A'' + 1}. \qquad (DN2)$$

Moreover, we know, *see supra* note 140, that this equals A', which in our particular case equals 99%.

We have assumed that A' remains constant no matter how many lottery tickets there are. In the main, this assumption should hold true: If a ticket reads 297, Whitney's chance of stating the number accurately should not ordinarily be affected by how many other numbers the ticket might have borne. It is conceivable, though, that Whitney is somewhat more likely to get confused if she knows the ticket is one of a very large number. And if the ticket bears a number containing many digits rather than a three-digit number like 297, she may be slightly more prone to error.

143. Informally, we may note that the route through x_{297} to $T(x_{297})$ has two heavy links and one light one, whereas the route through NX_{297} to $T(x_{297})$ has only one heavy link and two lights ones. Thus, the former is far more probable.

Appendix E

This Appendix examines, in a non-empirical way, whether stress increases the sincerity of a declarant. The excited utterance exception to the hearsay rule is justified on the theory that the startling condition leaves the declarant little opportunity for conscious fabrication. Assuming that this is true—and it may well be—the excitement increases $P(\text{I}(x)\,|\,\text{B}(x))$, the probability that if the declarant believes proposition x he will attempt to articulate it.[144] That, however, is not the ultimate question; we know that he has made a statement, and the question is whether what he has articulated is what he believes. In a shorthand form of notation, we will assume that the stress increases $P(\text{I}(x)\,|\,\text{B}(x))$, where I(x) represents the declarant's intention to articulate x and B(x) represents his belief in x. To improve our assessment that the declarant is sincere, however, it is $P(\text{B}(x)\,|\,\text{I}(x))$ that must increase.

An increase in $P(\text{I}(x)\,|\,\text{B}(x))$ is not sufficient to meet this condition, for the stress may also increase $P(\text{I}(x)\,|\,\text{NB}(x))$—the probability that the declarant will attempt to assert a fabrication, perhaps self-serving. In other words, the principal effect of the stress could well be to loosen the declarant's tongue, causing him to blurt out *something*. Thus, the tongue-loosening effect does not necessarily increase the probability, given the fact that the declarant *has* blurted out something, that what he says is what he believes. That depends on whether the stress has a greater proportionate impact on the probability of blurting out the truth or on the probability of blurting out a falsehood.

To see this, note first that under Bayes' Theorem, as expressed in the form of Equation 2 *supra*,

$$P(\text{B}(x)\,|\,\text{I}(x)) \;=\; \frac{P(\text{B}(x)) \times P(\text{I}(x)\,|\,\text{B}(x))}{P(\text{I}(x))}. \tag{E1}$$

This can be reformulated by expanding the expression for $P(\text{I}(x))$ in accordance with Equation 1 *supra*:

$$P(\text{B}(x)\,|\,\text{I}(x)) = \frac{P(\text{B}(x)) \times P(\text{I}(x)\,|\,\text{B}(x))}{P(\text{B}(x)) \times P(\text{I}(x)\,|\,\text{B}(x)) + [1 - P(\text{B}(x))] \times P(\text{I}(x)\,|\,\text{NB}(x))}. \tag{E2}$$

Then divide both numerator and denominator of the right-hand side by $P(\text{I}(x)\,|\,\text{NB}(x))$, yielding

$$P(\text{B}(x)\,|\,\text{I}(x)) \;=\; \frac{P(\text{B}(x)) \times L(\text{I}(x)\,w.r.t.\;\text{B}(x))}{P(\text{B}(x)) \times L(\text{I}(x)\,w.r.t.\;\text{B}(x)) + [1 - P(\text{B}(x))]}. \tag{E3}$$

where $L(\text{I}(x)\,w.r.t.\;\text{B}(x))$, which is the likelihood ratio of I(x) with respect to B(x),[145] equals the quotient $P(\text{I}(x)\,|\,\text{B}(x)) \div P(\text{I}(x)\,|\,\text{NB}(x))$. From this equation, it can be seen that, for a given prior probability of B(x), the greater the likelihood ratio is the greater the posterior probability, $P(\text{B}(x)\,|\,\text{I}(x))$, will be.

Thus, stress causes $P(\text{B}(x)\,|\,\text{I}(x))$ to be greater than it would be otherwise only if the

---

144. In the longer notation of the main text, this probability would be denoted $P(\text{INTEND}(x)$ *given* $\text{BELIEVE}(x))$.

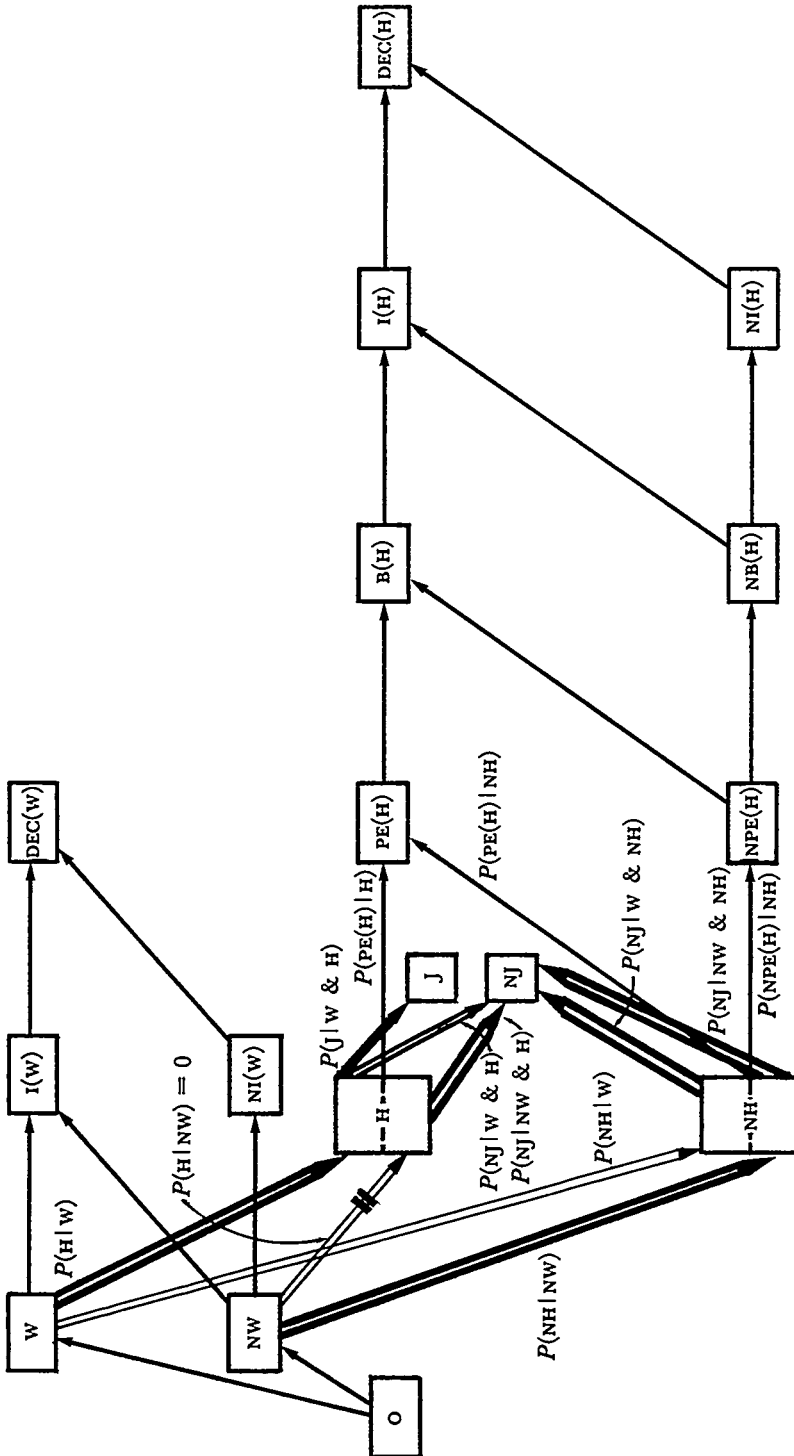145. *See supra* text accompanying note 27.

FIGURE F1

stress causes $P(\text{I}(x)\mid \text{B}(x))$ to increase proportionally more than $P(\text{I}(x)\mid \text{NB}(x))$. It is by no means clear that this is usually true.

APPENDIX F

Section III.B.1. of the text used several route diagrams to present variations of the *Hillmon* problem. This Appendix shows that even a complex variation of the problem can be presented in a single diagram. Figure F1 presents essentially the same information as Figures 13, 14, 15, and 17. This diagram uses double arrows, as do Figures 9, 10, and 12 and two-section nodes, as do Figures 5, C1, and D1. The variation mapped here is the same one for which Figure 17 was used, in which Hillmon's intent is heavily dependent on Walters'. A different diagram would be necessary to present the variation for which Figure 16 was used, in which this assumption need not hold.

As in the text, Walters' statement is construed to be a declaration of two propositions, W and H.[146] As in Figure 13, J,[147] the material proposition at issue, can be true only if W and H are both true, and not necessarily even then. As in Figures 14 and 15, an inference of W is less troublesome than a direct inference of H, because it does not involve the hearsay dangers of misperception and failed memory. But, as in the situation represented in Figure 17, H can be inferred from W, without relying on the declaration of H, because $P(\text{H}\mid\text{W})$ is so much greater than $P(\text{NH}\mid\text{W})$. (Also, as in Figure 17, H cannot be true unless W is also true, as indicated by bars across the NW–H link.) Accordingly, a juror might trace the links from DEC(W) back to W, then to H and from there to J.[148]

Thus, this diagram, although obviously less digestible than the series of diagrams presented in the text, has some advantages in that it gives an overview of the problem, and shows in one map how the jury may make the desired inferences while bypassing the forbidden hearsay route. It also demonstrates the adaptability of route analysis, showing that a route diagram may be drawn even for an extraordinarily complicated problem.

---

146. Referred to in the text as WALTPLAN and HILLPLAN, respectively.
147. Referred to in the text as JOINTTRIP.
148. DEC(X) is a shorthand way of stating what is referred to in the text as DECLARATION(X). Similarly, PE(X), B(X), and I(X) are here used to represent the propositions that the declarant, respectively, perceived, believed, and intended to declare proposition X.