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Relative Plausibility and its Critics

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Abstract

Within legal scholarship there is a tendency to use (perhaps overuse) "paradigm shift" in ways far removed from the process famously described by Thomas Kuhn. Within the field of evidence, however, a phenomenon very similar to a paradigm shift, in the Kuhnian sense, is occurring. Although not on the scale of the transformation from Newtonian to Einsteinian physics or other tectonic shifts in science, the best understanding of juridical proof is shifting from probabilism to explanationism. For literally hundreds of years, proof at trial was assumed to be probabilistic. This assumption was given sustained scholarly attention and support beginning with the 1968 publication of John Kaplan's path-breaking article that generated a rich literature explaining virtually all aspects of juridical proof as probabilistic, from the basic nature of relevancy through the processing of information to the final decision about the facts. Although probabilism quickly became the dominant paradigm, some analytical difficulties were detected quite early ("anomalies" or "irritants" in the words of Kuhn), beginning with L. Jonathan Cohen's demonstration of certain proof paradoxes. These were extended by Ronald Allen, who also demonstrated the incompatibility of Bayesian reasoning with trials and proposed an analytical alternative. Again a complex literature ensued with the defenders of the dominant paradigm attempting to explain away the anomalies or to shield the probabilistic paradigm from their potentially corrosive effects (in what in fact on a very small scale is precisely what Kuhn explained and predicted with respect to paradigm shifts in science). Over the last two decades, these anomalies have become too irritating to ignore, and the strengths of the competing paradigm involving explanatory inferences (referred to as the relative plausibility theory) have become too persuasive to dismiss. Thus the paradigm shift that the field is now experiencing.

We provide here a summary of the relative plausibility theory and its improvement on the probabilistic paradigm. As Kuhn noted, not everybody gets on board when paradigms shift; there are holdouts, dissenters, and objectors. Three major efforts to demonstrate the inadequacies of relative plausibility have recently been published. We analyze them here to demonstrate that their objections are either misplaced or unavailing, leaving relative plausibility as the best explanation of juridical proof. It is interesting to note that two of the three critiques

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that we discuss actually agree on the inadequacies of the probabilistic paradigm (they provide alternatives). The third concedes that explanationism may provide a better overall account of juridical proof but tries to resuscitate a probabilistic interpretation of burdens of proof in light of one particular analytical difficulty (i.e., the conjunction problem, which arises from the fact that proof burdens apply to the individual elements of crimes, civil claims, and defenses rather than a party's case as a whole). In analyzing the alternative positions proposed by our critics, we demonstrate that their accounts each fail to provide a better explanation than relative plausibility.

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Introduction

The "relative plausibility" explanation of the structure of proof at trial is the primary competitor to an explanation that is more robustly probabilistic.[1] Under both explanations, the primary objective in typical civil cases is to determine which party more likely deserves to win, within the confines of resource constraints and some evidentiary rules that pursue values other than truth.[2] In criminal cases and in atypical civil cases, the primary objective is also the same under both explanations: to skew errors away from defendants for policy reasons.[3] This is done by raising the standard of proof that must be achieved to "beyond a reasonable doubt" in criminal cases and "clear and convincing evidence" in atypical civil cases.[4] It is in this general sense that

[1] Throughout this article, we use "relative plausibility" and "explanatory account" interchangeably to refer to our theory of proof, which depends on the relative plausibility of explanations. See Michael S. Pardo & Ronald J. Allen, Juridical Proof and the Best Explanation, 27 Law & Philosophy 223 (2008). Explanations and explanatory reasoning (i.e., "abduction") provide the epistemological foundation to the theory first developed by Prof. Allen, which focused on the relative plausibility of stories. See Ronald J. Allen, Factual Ambiguity and a Theory of Evidence, 88 Nw. U. L. Rev. 604, 606 (1994); Ronald J. Allen, The Nature of Juridical Proof, 13 Cardozo L. Rev. 373 (1991).

[2] See, e.g., Fed. R. Evid. 407-11.

[3] In re Winship, 397 U.S. 358, 364 (1970); Addington v. Texas, 411 U.S. 418, 424 (1979)

[4] For a discussion of these policy goals and standards of proof, see Richard S. Bell, Decision Theory and Due Process: A Critique of the Supreme Court's Lawmaking for Burdens of Proof, 78 J. Crim. L. & Criminology 557 (1987).

some authors refer to probability as the generally accepted approach to proof.[5] The disagreement between the relative plausibility and the probabilistic explanations is not over whether the legal system is to some extent attempting to regulate errors; of course it is. Rather the disputes are about, first, the process through which the conclusion is reached that one party's case is good enough for a verdict, and second, the nature of that judgment.[6] The "relative plausibility" theory explains the process as involving reasoning put to the effort of deciding the relative plausibility of the parties' various explanations of the evidence and the contested events in civil cases; in criminal cases the analogue is determining whether the prosecution has a plausible case, and if so, whether the defendant does as well (even if less plausible than the prosecution's).[7] The more robustly probabilistic explanation, by contrast, sees trials as a process of serial updating probabilistic judgments on the question of whether one party's contentions are true or not.[8]

The primary disagreement, in other words, is empirical: what is the best explanation of juridical proof?[9] It is important to resolve this disagreement, if possible, because only with a

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[5] See, e.g., Lisa Kern Griffin, Narrative, Truth, and Trial, 101 Geo. L. Rev. 281, 304-05 (2013); William Twining, Rethinking Evidence: Exploratory Essays 72-73 (1990). See also Riordan v. Kempiners, 831 F.2d 690, 698 (7th Cir. 1987) ("All evidence is probabilistic"),

[6] For example, do such judgments rigorously follow the axioms of conventional probability so that all ambiguity counts against the person with the burden of persuasion (in other words, is the judgment about whether the plaintiff's case is more likely true or false?), or is the question instead whether the plaintiff's explanation is more plausible than the defendant's (with suitable modifications for other standards higher than a preponderance of the evidence)? Under the first interpretation, the issue is whether *X* or *not-X* is more probable (with *X* + *not-X* summing to 1.0); under the second, is it about whether *X* or *Y* is more plausible.

[7] Pardo & Allen, supra note 1. In general, explanations are evaluated based on criteria such as consistency, coverage, simplicity, coherence, consilience, and fit with background knowledge. Peter Lipton, Inference to the Best Explanation (2d ed. 2004); Gilbert Harman, Change in View: Principles of Reasoning 65-75 (1986); Tania Lombrozo, Explanation and Abductive Inference, in The Oxford Handbook of Thinking and Reasoning 260 (Keith J. Holyoak & Robert G. Morrison eds., 2012). We refer to this process throughout this article as "holistic," but all we mean by the use of that term is that explanatory considerations structure the process of proof as indicated in the text. In determining the existence and relative persuasiveness of plausible explanations, any cognitive tool at all may be employed, as indicated above, and employed from the very discrete level of analyzing the relationship between quite discrete evidentiary proffers and specific propositions to the appraisal of the overall explanation itself considered as a whole. We note this because some confusion has crept into the pertinent literature as to the significance of stories, as though story-telling were one explanation of trials, leading to the critique that a good story may still be false. However that may be, it has nothing to do with the relative plausibility theory, which deals with explanations, not stories. To be sure, a story such as a chronological narrative can provide an explanation, but the story does not persuade independent of the evidence at trial. It should be obvious that "telling a good story" at trial but failing to provide evidence of its truth is a recipe for disaster. For more on this, see the text at note 186, infra.

[8] See Part I for an overview of this explanation.

[9] It is important to note that the significance of this project extends well beyond the trial because the process of proof affects a wide array of issues throughout the systems of civil and criminal litigation. These issues include settlements and pleas; various discovery issues; which cases make it to trial in the first place and which are terminated pre-trial; and which verdicts are upheld or overturned. For an overview of the roles played by evidence and proof in non-trial issues, see Michael S. Pardo, Some

clear understanding of what the system is actually doing can the process be effectively critiqued. Once it is clear what the system is doing, one can decide whether and how it can be improved. But a complexity lurks here, which is that the American legal system is itself enormously complex. There are 51 or so separate "legal systems" in operation (actually many more than that) with millions of cases each year.[10] Moreover, the "American legal system" is not a static entity created with a single purpose in mind; it is to a large extent an organic, adaptive process, (or, in older but perhaps more familiar Hayekian terms, a grown rather than a made system).[11] This limits the ability to specify simple theories or explanations that will capture all the data. There will be outliers. The objective is thus not to identify a single explanation to which there are no exceptions, but instead to attempt to capture to the extent possible the essence of the object under inquiry.

From this perspective, our primary aim is to understand the general nature of juridical proof. We focus on burdens of proof, and how they structure the proof process, as a lens through which to observe the legal system, but burdens of proof are only a lens. What is being observed is the entire litigation process, which includes burdens of proof as one crucial component. This task is empirical: what is the best explanation of the data, where "the data" are observations of how the American legal system structures proof at trial? A second task is to then consider whether the empirically true is normatively appropriate, in light of the goals of the legal system. In the context of juridical proof, these goals include certain policy objectives regarding accuracy and the risk of error.[12] In addition to contrasting the two explanations of juridical proof on empirical grounds, we also compare the fit between these explanations and the legal system's goals.[13]

In previous work, we have argued that relative plausibility provides both a better empirical description than the probabilistic theory and a better fit with the legal system's normative goals.[14] Writing from different theoretical perspectives, a number of scholars have recently offered detailed critiques of our views. In this Article, we take a close look at these

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Remarks on the Importance of Evidence Outside of Trials, 36 Rev. Lit. 443 (2017). Perhaps most prominently, the standards of proof determine issues such as summary judgment and judgment as a matter of law in civil cases and the sufficiency of the evidence in criminal cases, each of which depends on what reasonable juries could find based on the evidence and the standards. See Fed. R. Civ. P 50, 56; Anderson v. Liberty Lobby, Inc. 477 U.S. 242, 248, 252 (1986); Reeves v. Sanderson Plumbing Prods., Inc., 530 U.S. 133, 149-50 (2000); Fed. R. Crim. P. 29; Jackson v. Virginia, 443 U.S. 307, 319 (1979).

[10] See, e.g,, National Center for State Courts, The Landscape of Civil Litigation in State Courts 6. N. 36 (2015), available at: http://www.ncsc.org ("In 2013, litigants filed approximately 16.9 million civil cases in state courts compared to 259,489 civil cases filed in U.S. District Courts."). The same report estimates over half a million trials (32,000 in a sample of five percent of the cases). Id. at 25.

[11] See Ronald J. Allen, Taming Complexity: Rationality, the Law of Evidence, and the Nature of the Legal System, 12 Law, Probability & Risk 99 (2013).

[12] See supra notes 3-4 and Part I infra.

[13] In other words, any normative claims we make are "conditional" ones in that they take the law's aims as a given and then assess possible conceptions in light of these aims. See Michael S. Pardo, The Law of Evidence and the Practice of Theory, 163 U. Penn. L. Rev. Online 1 (2015) (distinguishing conditional and unconditional normative claims).

[14] See supra note 1.

critiques and explain why they do not undermine our account. But we do more than respond to their various objections. In each case, the authors have put forth alternative explanations of various aspects of the evidentiary proof process. After defending our view, we critique each of their alternative views, clarifying why they each fail to provide a better descriptive explanation than relative plausibility. We also provide several reasons why each account is inconsistent with the law's normative goals.

Part I provides background on the process of proof and the previous academic debates. We outline the relevant doctrine and policy considerations; discuss the probabilistic account and our explanatory alternative (relative plausibility); review the various problems for the probabilistic account; and clarify why our alternative provides a better explanation. Part II responds to the objections to relative plausibility raised in recent works by David Schwartz & Elliott Sober,[15] Dale Nance,[16] and Kevin Clermont.[17] Collectively, they raise six different objections to our account—explaining why their objections fail will allow us the opportunity to further clarify and illustrate our theory. Even though relative plausibility provides a better explanation than the conventional probabilistic account, perhaps our critics have alternative accounts that provide an even better explanation? We consider (and reject) this possibility in Parts III-V. Among the critics, Schwartz & Sober hew most closely to the conventional probabilistic account and, in Part III, we evaluate their attempt to defend the probabilistic account from the so-called "conjunction problem."[18] Nance and Clermont each offer modified probabilistic theories that deviate in significant respects from the conventional account. In Part IV we critique Nance's theory, and in Part V we critique Clermont's theory. After considering our critics' objections and their alternative views, we end up where we began: relative plausibility provides the best explanation of juridical proof currently available.

I. Burdens and Standards of Proof: Probabilistic vs. Explanatory Accounts

This Part first discusses the basic features of, and policies underlying, burdens and standards of proof. It then outlines and contrasts two distinct accounts of the process of juridical proof focusing on, but not limited to, burdens and standards of proof within that process. The first account, the conventional probabilistic account, sees standards of proof as probabilistic thresholds. The second account, relative plausibility, sees standards of proof as explanatory

[15] David S. Schwartz & Elliott R. Sober, The Conjunction Problem and the Logic of Jury Findings, 59 William & Mary L. Rev. 619 (2017).

[16] Dale A. Nance, The Burdens of Proof: Discriminatory Power, Weight of Evidence, and the Tenacity of Belief (2016).

[17] Kevin M. Clermont, Common Sense on Standards of Proof, 48 Seton Hall Law Review 1057 (2018); Kevin M. Clermont, Trial by Traditional Probability, Relative Plausibility, or Belief Function?, 66 Case. W. Res. L. Rev. 353 (2015); Kevin M. Clermont, Standards of Decision in Law (2013); Kevin M. Clermont, Death of Paradox: The Killer Logic beneath the Standards of Proof, 88 Notre Dame L. Rev. 1061 (2013).

[18] The problem arises from the fact that, as matter of legal doctrine, standards of proof apply to individual elements of claims or crimes, and not to cases as a whole. Part III provides an in-depth discussion, but the problem is introduced and explained in Part I and also discussed when relevant in other Parts.

thresholds. We describe the general problems with the former and clarify why the latter provides a better explanation of the process of proof.

A. Burdens and Standards of Proof: Doctrine and Policy

The burden of proof provides an overarching structure to the evidentiary proof process. For the legal elements of crimes, civil causes of action, or affirmative defenses, one party or the other has the burden of proving each element.[19] Typically, the prosecution and civil plaintiffs bear the burden for each of the elements of crimes and civil claims, respectively. Defendants typically bear the burden of proof, in whole or in part, for most affirmative defenses. The burden of proof at trial consists of two components: a burden of *production* and a burden of *persuasion*. The burden of production, as its name suggests, requires the party with that burden to produce evidence. This raises the question: how much evidence is needed to meet the production burden? The answer is: enough to meet the persuasion burden as judged by a reasonable person.[20] The burden of persuasion is set by the applicable standard of proof.

Standards of proof specify when the party with the burden of proof has met its burden. In essence, these standards dictate when a disputed fact has been "proven" for legal purposes. In civil cases, the typical standard is "preponderance of the evidence."[21] In criminal cases, the higher standard of "beyond a reasonable doubt" applies to the elements of crimes.[22] A third, intermediate standard of proof of "clear and convincing evidence" sometimes applies to the elements of civil claims and affirmative defenses.[23] The standards play several important roles.[24] Most importantly, they instruct trial fact-finders on when to conclude that a disputed fact has been proven at trial. In addition, they guide a number of judicial assessments of the sufficiency of evidence—including, whether a party has sufficient evidence to proceed to trial in the first place, whether a case should go to the jury during a trial, and whether the evidence is sufficient to support a judgment.[25] Each of these determinations requires some assessment of whether an outcome is "reasonable" given the evidence and the standard of proof.[26]

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[19] For an introductory overview of burdens of proof, see Ronald J. Allen et al., An Analytical Approach to Evidence 804-13 (6th ed. 2016).

[20] John McNaughton, Burdens of Production of Evidence: A Function of the Burden of Persuasion, 68 Harv. L. Rev. 1382 (1955).

[21] Grogan v. Garner, 498 U.S. 279, 286 (1991); Herman & Maclean v. Huddleston, 459 U.S. 375, 391 (1983).

[22] In re Winship, 397 U.S. 358, 364 (1970).

[23] Addington v. Texas, 411 U.S. 418, 424 (1979).

[24] We focus on burdens of proof at trial, but there are additional burdens, such as probable cause and reasonable suspicion. See Kiel Brennan-Marquez, "Plausible Cause": Explanatory Standards in the Age of Powerful Machines, 70 Vand. L. Rev. 1249 (2017).

[25] See Fed. R. Civ. P. 56, 50; Fed. R. Crim. P. 29. The preponderance standard also plays an important role in admissibility determinations. Bourjaily v. United States, 483 U.S. 171, 175 (1987).

[26] See Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 252 (1986) (explaining that summary judgment depends on whether "reasonable jurors could find by a preponderance of the evidence that the plaintiff is entitled to a verdict); Reeves v. Sanderson Plumbing Prods., Inc. 530 U.S. 133, 150 (2000) (explaining that the standard for judgment as a matter of law "mirrors" the summary-judgment standard); Jackson v.

Standards of proof serve the function of resolving factual disputes in the face of *uncertainty*, and virtually all (probably all, actually) juridical fact finding is done under conditions of uncertainty. In modern litigation, the standards express policy choices about how to resolve uncertainty in light of two related, primary considerations: accuracy and allocating the risk of error between the parties.[27] The "preponderance of the evidence" standard, as is commonly assumed, attempts to divide the risk of error roughly evenly between the parties, in part because the two types of errors (i.e., false positives and false negatives) are thought to be similar in terms of social costs.[28] Under this standard, the law purports to favor whichever side the evidence appears to support, with "ties"—i.e., when the evidence is in equipoise—going against the party with the burden of persuasion.[29] Accordingly, each side bears the risk that, even though it might be the case that they ought to win, the evidence will appear to support the opposing party. Moreover, given certain assumptions, the preponderance standard is also thought to maximize overall accuracy (or minimize the total number of errors).[30] This is because the standard is thought to favor the outcome that is more likely true.[31] Finally, the preponderance standard embodies a notion of equality before the law for civil disputants.[32]

Rather than attempting to equalize the risk of error on an issue, higher standards of proof ("beyond a reasonable doubt" and "clear and convincing evidence") attempt to shift the risk of error away from one side (typically, defendants). The explicit policy behind this shift is the assumption that one type of error (a false positive) is, in general, more socially costly than the other type of error.[33] Thus, rather than attempting to maximize *total* accuracy, higher standards of proof function primarily to reduce one type of error (at the expense of the other). Thus, the beyond-a-reasonable-doubt standard is thought to require more proof than other standards, with

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Virginia, 443 U.S. 307, 318 (1979) (explaining the sufficiency standard for criminal convictions depends on whether "any rational trier of fact could find guilt beyond a reasonable doubt").

[27] Standards of proof were thought to serve other policies at common law, such as requiring the party to present evidence who is most likely to have evidence on an issue, but virtually all the common law justifications fade to insignificance in systems with highly developed discovery mechanisms such as exist in all American jurisdictions in civil cases. Because of limited discovery, burdens may have additional functions in criminal cases.

[28] See Grogan v. Garner, 498 U.S. 279, 286 (1991) ("preponderance-of-the-evidence standard results in a roughly equal allocation of the risk of error between litigants.").

[29] Alex Stein, Foundations of Evidence Law 144 (2005) (discussing the policies and assumptions underlying the preponderance standard).

[30] Some of the assumptions underlying this view include (1) the base rates of deserving parties on each side, (2) the evidence is a good indicator of what happened, and (3) fact-finders properly understand and interpret the evidence.

[31] Id. (arguing that fact-finders will "maximize the total number of correct decisions by treating their best chances of arriving at the factually correct result as decisive").

[32] See Mike Redmayne, Standards of Proof in Civil Litigation, 62 Mod. L. Rev. 167, 171-74 (1999) (discussing the equality principle in civil litigation); Lawrence B. Solum, Procedural Justice, 78 S. Cal. L. Rev. 181, 286-89 (2004) (discussing the role of equality in procedural justice).

[33] In re Winship, 397 U.S. 358, 364 (1970) (discussing asymmetric risks of error in criminal cases); Addington v. Texas, 411 U.S. 418, 424 (1979) (explaining the "clear and convincing" standard applies when there are asymmetric risks of in civil cases).

the clear-and-convincing standard requiring some level of proof in between the preponderance and BARD standards.

B. The Probability Account

The features and policies outlined above are both well-accepted and generally understood in the abstract. They provide a useful starting point for any attempt to explain juridical proof. Explaining exactly how these features arise, and the policies are implemented, in the actual operation of the legal system has proven to be a considerably more difficult and controversial task. A first, and important, theoretical step in this direction was the attempt by scholars to rely on conventional probability theory[34] to explain these and other features of the evidentiary proof process,[35] and probability has remained a highly influential tool in trying to understand aspects of juridical proof. It is important to emphasize, however, that the various probabilistic approaches provide ways of thinking about aspects of law—they neither inhere in the legal features themselves, nor are they necessarily incorporated into legal doctrine.[36]

The conventional probability account defines standards of proof as thresholds on a scale between zero and one. Under this scheme, one represents certain truth and zero represents certain falsity, and the standards of proof are typically interpreted as follows: "preponderance of the evidence" as a probability of greater than 0.5; "beyond a reasonable doubt" as a probability of 0.9 (or greater); and "clear and convincing evidence" as in between, typically a probability around 0.75.[37] For each disputed legal element, fact-finders assess how probable the element is (along the spectrum between zero and one). An element is considered proven if its probability exceeds the threshold for the applicable standard of proof. The element is not proven when its probability is at or below the threshold.

Under certain assumptions, this account will reflect the normative policy choices underlying the standards. For the preponderance standard, for example, proving a disputed fact to a probability of greater than 0.5 (or greater than 50 percent) appears, as a formal matter and subject to certain constraints, to allocate the risk of error roughly evenly between the parties, and

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[34] By "conventional probability theory" we refer to the standard account of probability based on the Kolmogorov axioms. See Andrei Kolmogorov, Foundations of the Theory of Probability (1956). For a clear overview, see Ian Hacking, An Introduction to Probability and Inductive Logic (2001).

[35] See, e.g., John Kaplan, Decision Theory and Due Process, 20 Stan. L. Rev. 1065 (1968); Michael O. Finkelstein & William B. Fairley, A Bayesian Approach to Identification Evidence, 83 Harv. L. Rev. 489 (1970); Richard O. Lempert, Modeling Relevance, 75 Mich. L. Rev. 1021 (1977); Richard Eggleston, Evidence, Proof & Probability (1978). There are many differences in probabilistic accounts of evidence and proof in terms of both issues discussed and the ways in which the formal tools are employed. In this Part, we focus on the general similarities among the accounts, although we mention important differences where relevant. We discuss further details and differences in subsequent Parts.

[36] It is also important to emphasize that both the probabilistic account and the explanatory account (discussed next) focus on the same goals and polices—e.g., determining the most likely outcome in most civil cases and skewing errors away from criminal defendant and defendant in atypical civil cases.

[37] See Bell, supra note 4, at 574. See also Brown v. Bowen, 847 F.2d 342, 345-46 (7th Cir. 1988).

to minimize the total number of errors.[38] By contrast, requiring proof to a higher probabilistic threshold—for example, 0.95 for "beyond a reasonable doubt" or 0.75 for "clear and convincing evidence"—shifts more of the risk of error to the party with the burden of proof.[39]

Formalizing the standards in this manner has obvious and significant advantages. For example, probabilistic thresholds provide clarity and precision (assuming the threshold can be agreed upon[40]) to otherwise ambiguous and vague legal standards. In addition, the probabilistic framework provides formalized methods for measuring the relevance and probative value of evidence, combining items of evidence, updating prior beliefs in light of new evidence, and evaluating the "rationality" of outcomes.[41]

Despite these potential upsides, the conventional probabilistic account faces several problems that make it empirically implausible as a general explanation of juridical proof. It is also normatively undesirable, given the legal system's policy goals (this is not to deny the power of the account to explain or illuminate certain aspects of evidence or of the evidentiary process). The problems that collectively render the account implausible fall into four main categories.

First, in order to operationalize the account, coherent numbers within an axiomatic framework must be assigned to the evidence in order to compare it with the standard of proof (conceived as a probabilistic threshold, such as greater than 0.5). Although there are several ways to conceptualize probabilities, there are two possibilities that might apply to the legal evidence.[42] One possibility is to rely on "objective" numbers, such as relative frequencies or

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[38] In other words, the probability space between 0 and 1 is divided roughly evenly, with plaintiff bearing the risk when the probability is between 0 and 0.5 and the defendant bearing the risk when the probability is greater than 0.5. Moreover, accuracy would appear to be advanced by siding with the plaintiff when the claim is more likely true and with the defendant when it is not. As we explain below, however, these appearances about the risk of error and accuracy are false. See infra notes 59-65 and accompanying text.

[39] For example, plaintiffs rather than defendants now bear the risk of error for issues proven greater than a preponderance but not to "clear and convincing." Similarly, the prosecution also bears the risk of error for issues that might be proven to be greater than a preponderance but not "beyond a reasonable doubt." For a clear overview of the assumptions underlying probabilistic standards with regard to the risk of error, see David Hamer, Probabilistic Standards of Proof, Their Complements, and the Errors that are Expected to Flow from Them, 1 U. New. Eng. L.J. 71 (2004).

[40] Although the numbers above reflect common assumptions, there is in fact disagreement about what numbers to attach to the standards, even for the preponderance standard. See Eyal Zamir & Ilana Ritov, Loss Aversion, Omission Bias, and the Burden of Proof in Civil Litigation, 41 J. Legal Stud. 165, 186-91 (2012); United States v. Fatico, 458 F. Supp. 388, 410 (E.D.N.Y. 1978); Rita James Simon & Linda Mahan, Quantifying Burdens of Proof: A View from the Bench, the Jury, and the Classroom, 5 Law & Society Rev. 319 (1971).

[41] A common method for quantifying the relevance and probative value of evidence relies on a "likelihood ratio," which compares the probability of evidence if a proposition is true (e.g., the defendant is guilty) with the probability of that same evidence when the proposition is false (e.g., the defendant is innocent). See Lempert, supra note 35; Jonathan J. Koehler, When Do Courts Think Base Rate Statistics are Relevant?, 42 Jurimetrics J. 373, 375 (2002).

[42] For a clear overview, see Alan Hajek, Interpretations of Probability, Stanford Encyclopedia Phil. (2011), available at http://plato.stanford.edu/entries/probability-interpret/.

known statistical distributions. This possibility might advance the law's goals with regard to accuracy and the risk of error if the necessary data were known, but such data is simply unavailable for most items of evidence.[43] And even the exceptional items of evidence for which data are available are subject to the "reference class" problem.[44] Given the limitations of such an "objective" approach, it is simply a non-starter. And it, of course, in no way resembles how proof proceeds at trial. The second possibility is to rely on "subjective" probabilities (which are often characterized as "credences" or "degrees of belief").[45] This approach also fails as a general explanation of juridical proof. Both what are known as the "prior subjective probabilities" and the "numbers" that create the likelihood ratios[46] used to update a prior probability could be any numbers at all, and they need not be constrained in any way by the quality of the evidence or its probative value in proving the facts of consequence at trial. "Subjective probability" is truly subjective.[47] It provides a means of maintaining consistent belief structures, but has no necessary relationship to advancing accurate outcomes.[48] Such a conception, although at least

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[43] Consider, for example, each assertion made in witness testimony. We will not repeat here every criticism of the conventional theory, but we do want to reiterate one significant one. Evidence at trial is contingent. What any offer of evidence means depends on all the evidence in the case. What might appear initially to be inculpatory may actually turn out to be exculpatory. Thus, serial updating is a waste of time and also confuses what is a learning process with an updating process. Trials are educational processes where fact-finders learn about the parties' explanations rather than updating processes that involve updating a complete and coherent set of priors. The fact-finder typically has no idea what those "priors" are until all the evidence is in.

[44] We discuss this problem and several examples in Ronald J. Allen & Michael S. Pardo, The Problematic Value of Mathematical Models of Evidence, 36 J. Legal Stud. 107 (2007). For example, suppose you have frequency data about the number of blue buses in a town (80 percent) and you are trying to determine whether the bus involved in a particular accident was blue. Although you have data for one reference class (i.e., the town), other potentially relevant classes (e.g., the street, the time of day, and so on) will likely each have different frequencies. Thus, it is a mistake to assume that data from one reference class for which data are available provide the correct probability for the target inference (i.e., the color of the bus in the accident). Id.

[45] Leonard Savage, The Foundations of Statistics (1954). There is philosophical disagreement about how to characterize the relationship between beliefs and credences. See Lara Buchak, Belief, Credence, and Norms, 169 Phil. Stud. 285 (2014).

[46] See supra note 41.

[47] James Franklin has recently tried to resurrect subjective probability in general and Bayesian approaches in particular by arguing that there is an applicable objective version. James Franklin, The Objective Bayesian Conceptualisation of Proof and Reference Class Problems, 33 Sydney L. Rev. 545 (2011). The problems are precisely what we specify in the text. Objective Bayesianism requires objective priors and likelihood ratios, which rarely exist in legal decision making. He alludes to this in his discussion of the reference class problem by implicitly admitting that the proper objective reference class in virtually all legal decision-making is a reference class that contains one member, which is not helpful in this context.

[48] Consistency is maintained by conforming to Bayes' Theorem. As Bruno de Finetti explained: a subjective probability assessment is one which "no experience can prove [...] right, or wrong; nor, in general, could any conceivable criterion give any objective sense to the distinction [...] between right and wrong." Bruno de Finetti, Probabilism: A Critical Essay of the Theory of Probability and the Value of Science, 31 Erkenntis 169, 174 (1989). See also Leonard J. Savage, Difficulties in the Theory of Personal Probability, 34 Phil. Sci. 305, 307 (1967). For a clear overview of Bayes' Theorem, see Hacking, supra note 34, at 69-78.

feasible to carry out under some interpretations (if updating occurs with objective data), does not advance the fundamental goals of the proof process regarding accuracy and the risk of errors.[49] Finally, a subjective probability approach is inconsistent with the wide array of legal devices that are designed to measure "sufficiency of evidence" and whether a particular jury conclusion is reasonable in light of the evidence and the burden of proof.[50]

Second, the probabilistic account (in both objective and subjective forms) is inconsistent with how fact-finders process and reason with evidence, which occurs holistically and not in the item-by-item fashion envisioned by the account.[51] Although the account may nevertheless have some normative or educational value in understanding aspects of evidence, it is plainly inconsistent with how actual evidence evaluation works. This inconsistency is a problem for any such empirical account that purports to explain actual standards of proof because it appears to require or imply that fact-finders evaluate evidence in a manner that they obviously do not.

Third, there is inconsistency between the assumptions of the probability account, on one hand, and legal doctrine and jury instructions, on the other. For the probability thresholds to carry out their objects regarding accuracy and the risk of error, they must be applied to cases as a whole (e.g., it must be greater than 0.5 that the plaintiff's *claim* is true).[52] However, legal doctrine and jury instructions typically dictate that the standard of proof applies to the individual elements, not to cases as a whole.[53] Thus, in a two-element claim, A and B, if the plaintiff proves each to 0.6, then the plaintiff wins according to the law. However, if these two elements are independent of each other, then the probability of plaintiff's claim is 0.36, not greater than 0.5.[54] This inconsistency has become to known as "the conjunction problem," about which there will be more discussion in the Parts to follow.[55] For now, it is important to appreciate two points

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[49] See Larry Laudan, Truth, Error, and Criminal Law: An Essay in Legal Epistemology 31 (2006) (arguing that standards of proof should give jurors guidance of what to believe based on the evidence, not tell them to decide by consulting their subjective beliefs).

[50] The legal standards for measuring sufficiency of the evidence in civil and criminal cases depend on being able to separate reasonable from unreasonable conclusions. See supra note 26. Under the subjective account, however, every decision is reasonable (at least so long as it is otherwise internally consistent). This conception of proof thus fails to explain this central feature of legal doctrine.

[51] Shari Seidman Diamond, Beth Murphy & Mary R. Rose, The "Kettleful Of Law" In Real Jury Deliberations: Successes, Failures, And Next Steps, 105 Nw. L. Rev. 1537, 1605 (2012); Nancy Pennington & Reid Hastie, A Cognitive Model of Juror Decision Making: The Story Model, 13 Cardozo L. Rev. 519 (1991); Neil Vidmar & Valerie P. Hans, American Juries: The Verdict 135 (2007). It is important to keep in mind our use of "holistic." See supra note 7.

[52] See supra notes 37-40 and accompanying text. See also Hamer, supra note 39.

[53] Ronald J. Allen & Sarah A Jehl, Burdens of Persuasion in Civil Cases: Algorithms vs Explanations, 2003 Mich. St. L. Rev. 893, 897-904. We discuss this feature of the law in more detail in Part III.

[54] According to conventional probability theory, the probability of two independent propositions, A and B, is their product (A&B = A x B). If the two are probabilistically dependent, then according to conventional probability theory, the probability of their conjunction is the probability of A times the probability of B given A (A&B = A x B|A).

[55] See L. Jonathan Cohen, The Probable and the Provable 58-67 (1977). See also Clermont, Common Sense, supra note 17, at 1059 ("almost every law professor who finally contemplates the problem accepts as a matter of common sense that the law's approach is paradoxical.").

about the conjunction issue. The first point is that the law applies standards of proof to the elements of claims, crimes, and affirmative defenses.[56] The second point is that when probabilistic thresholds (standards of proof) are applied to individual elements and not to their conjunction (the claim as a whole), then the probabilistic account no longer fits with the assumed goals of the standards of proof regarding accuracy and the allocation of the risk of error.[57] Given the first point, exactly what to make of the second point has been controversial among evidence scholars. According to one interpretation, the law is committing a devastating error and such an egregious mistake in the doctrine ought to be corrected.[58] Alternatively, however, the inconsistency may reveal that probabilistic thresholds are a poor way of explaining legal standards of proof. At a minimum, such thresholds fail to explain how current standards operate or how they align with the law's goals.

Fourth, and finally, the account of proof standards as probabilistic thresholds is inconsistent with both the process of proof and the goals of the standards. The thresholds (such as 0.5) are *non-comparative* in the sense that they are expressed as fixed points on the probability spectrum that must be crossed by the party with the burden of proof, regardless of the probability of the alternative case advanced by the other side.[59] This assumes, for example, that the plaintiff must prove its case beyond 0.5, and the defendants just have to show the plaintiff's case is only 0.5 probable (or lower). This interpretation of the standards, however, is inconsistent with how jurors and judges evaluate evidence[60], and it is also inconsistent with the goals of the standards regarding accuracy and the risk of error.

Here is a stylized example to illustrate these problems. Putting aside all of the other problems discussed above[61], suppose the plaintiff presents a version of the facts that is 0.4 probable, and the defendant presents an alternative version of the facts that is 0.2 probable. The plaintiff loses under the probabilistic threshold of 0.5. But the plaintiff's version is twice as likely to be true as the alternative; accordingly, the plaintiff should win if the goal is to maximize accuracy. But what about the other 0.4 (?!), is the natural probabilist response. If the plaintiff's version is only 0.4 likely to be true, then the probability that it is likely to be false, according to the complementation axiom, is 0.6 (and so finding for the defendant, not plaintiff, will maximize accuracy).[62] Here is the problem with this response. We simply don't know whether that

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[56] See supra note 53.

[57] See supra notes 37-39.

[58] See, e.g., Richard D. Friedman, Answering the Bayesioskeptical Challenge, 1 Int'l J. Evid. & Proof 276, 280 (1997) (arguing that if there is a gap between the law and the subjective Bayesian approach, "the Bayesian approach would show that the law was wrong, not the other way around.").

[59] Under the conventional probability account, this follows from the complementation axiom. According to this axiom, the probability of a proposition and its negation sum to 1 (A + not-A = 1). Thus, if the probability that the defendant is the culprit is 0.6, then the probability that the defendant is not the culprit is 0.4.

[60] See supra note 51.

[61] For example, assume we know what the numbers mean and we are not worried about conjunctions. See supra notes 42-58 and accompanying text.

[62] See supra note 59.

unknown probability space supports the plaintiff or defendant.[63] Moreover, assuming the unknown 0.4 supports the defendant (as the conventional probabilistic account does) is inconsistent with the goals of treating the parties roughly equally with regard to the risk of error (rather it imposes much more risk on plaintiffs).[64] Dividing or ignoring the unknown (which amounts to the same thing), on the other hand, is consistent with both stated goals regarding accuracy and the risk of error.[65]

In sum, the conventional probabilistic account fails as a general account of juridical proof because it (1) fails to provide any plausible and feasible means for quantifying evidence to compare with probabilistic standards of proof; (2) is inconsistent with how judges and jurors evaluate evidence; (3) is inconsistent with legal doctrine and jury instructions on burdens and standards of proof (the conjunction problem); and (4) is non-comparative in ways that conflict with how proof proceeds at trial and with the goals underlying the standards of proof.

Given these problems, the probabilistic account fails as a general explanation of juridical proof. Explanations, however, are by their nature comparative.[66] Before we discard the conventional explanation entirely, is there a better explanation available that preserves the valuable social functions pursued by the probabilistic account? And where and how does it contrast with the conventional account? We turn now to these questions.

C. The Explanatory Account: Relative Plausibility

Relative plausibility relies on explanatory thresholds to explain the process and standards of proof.[67] Before describing the details of this account, we think it is important to emphasize two fundamental ways in which the theory differs from the conventional probabilistic account and one fundamental way in which the two accounts are similar. The differences include both (1) the *criteria* that are central to the fact-finding process (explanatory vs. probabilistic) and (2) whether the proof process is characterized as *comparative* or not. Under the explanatory account, the central fact-finding task is not to attach probabilities to the individual elements; it is to determine whether potential explanations of the evidence and events satisfy the applicable standard of proof. Moreover, unlike the probability account, the explanatory account is inherently comparative—whether an explanation satisfies the standard depends on strength of the possible explanations supporting each side (and not only the party with the burden of proof).[68] The fundamental similarity is that both the explanatory and probabilistic accounts focus on the

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[63] This is why the assumption that the 0.5 interpretation treats the parties equally with regard to the risk of error is false. See supra note 38.

[64] See supra notes 28-32.

[65] As we discuss below, the legal system largely leaves it to the parties to present their cases in whatever manner they choose. See infra note 69. This includes which legal issues to raise as well as how much of the possibility space to invoke (or contest), which facts to dispute (or concede or ignore), and what evidence to present.

[66] The explanatory account makes use of this methodological point in explaining juridical proof.

[67] See supra note 1.

[68] This comparative aspect (i.e. evaluating explanations in light of the possible alternatives) is a feature of explanations generally. See supra note 7.

same end: assessing the likelihood of the disputed facts. According to the explanatory account, however, the *means* to this end is through evaluating the relative plausibility of contrasting explanations, not trying to attach numbers to beliefs.

The discussion below first provides the details of the explanatory account, and it then explains how the account avoids the problems discussed above for the probabilistic account. It further shows that it is currently the best empirical explanation of juridical proof.

Rather than characterizing proof standards as probabilistic thresholds (such as 0.5), relative plausibility accounts for the standards in terms of explanatory thresholds. The proof process involves two stages: (1) the generation of potential explanations of the evidence and events, and (2) a comparison of these explanations in light of the applicable standard of proof. In general, the process depends on the parties to obtain evidence and to offer what they consider to be the best explanation (or explanations) that support their respective cases.[69] Fact-finders, however, also develop and rely upon explanations other than those advanced by the parties. Whether a party's explanation is sufficient will depend on the standard of proof. The explanatory thresholds vary depending on the standard, with higher standards requiring a higher threshold.[70] Under the "preponderance of the evidence" standard, fact-finders determine whether the best of the available explanations favors the plaintiff or the defendant.[71] The best available

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[69] In both civil and criminal cases, courts typically defer to litigant choices in terms of what evidence to present and which issues to raise, under the well-accepted principle that parties are the "masters of their own cases." See, e.g., Carillo v. Penn Nat'l Gaming, 172 F. Supp. 3d 1204, 1213 (D. N.M. 2016) ("Plaintiff are, of course, the masters of their litigation strategy, and may pursue litigation as they choose."); Barten v. State Farm, 2014 WL 11512602, at 2 (D. Ariz. 2014) ("Presumably, as the master of his case, Barten may use Strzelec solely as a lay witness if he wants, even though Strzelec could, under the right circumstances, qualify as an expert."); Cordes v. OSG Ship Mgt., 2013 WL 1992178, at 5 (E.D. La. 2013) ("Plaintiff, as master of his case, made a strategic decision when he declined to retain an expert."); United States v. Koo, 770 F. Supp. 2d 1115, 1124 (D. Or. 2011) ("the Government is the master of its evidence and may, 'by deciding what it offers to prove, . . . control what will be required to satisfy the authentication requirement.'") (quoting Wright & Gold, Federal Practice and Procedure: Evidence sec. 7104 (2000)); Winfield v. Roper, 460 F.3d 1026, 1041) (8th Cir. 2006) ("Winfield, the master of his case . . . told counsel he did not want them to introduce evidence that he was suffering from an emotional disturbance."). The "master of the case" principle applies not only evidence and factual theories, but more generally throughout litigation. See, e.g., Faretta v. California, 422 U.S. 806 (1975) (establishing defendants' constitutional right to refuse counsel and represent themselves); Morgan v. Gay, 471 F.3d 469, 474 (3d Cir. 2006) ("CAFA does not change the proposition that the plaintiff is the master of her own claim."); Precision Pay Phones, v. Qwest, 210 F. Supp. 1106, 1111 (N.D. Cal. 2002) ("The plaintiff is the master of his case and may ignore federal claims and assert only state claims, and thus defeat removal."); Bauer v. J.B. Hunt Transp., 150 F.3d 759, 763 (7th Cir. 1998) ("Of course, the defendant, like the plaintiff, is the master of its own case. A defendant is not compelled to pursue affirmative defenses.").

[70] In this respect, they are similar to the probabilistic account of the standards.

[71] See, e.g., Anderson v. Griffin, 397 F.3d 515, 521-22 (7th Cir. 2005) (comparing explanations); Bammerlin v. Navistar, 30 F.3d 898, 902 7th Cir. 1994) (same); Yeschick v. Mineta, 675 F.3d 622, 627 (6th Cir. 2012) (same). In the context of summary judgment, the Supreme Court has likewise emphasized the relative plausibility of explanations. See Los Angeles v. Alameda Books, 535 U.S. 424, 437 (2002)

explanation will favor the plaintiff if it includes all of the legal elements of plaintiff's claim; it will favor the defendant when it fails to include one of more elements.[72] A number of general criteria affect the strength or quality of an explanation.[73] These criteria include considerations such as consistency, coherence, fit with background knowledge, simplicity, absence of gaps, and the number of unlikely assumptions that need to be made.[74] For example, suppose a civil trespass case involves two disputed elements: whether the defendant entered the plaintiff's land and whether the defendant did so intentionally. The fact-finder will compare whether the plaintiff's explanation (e.g., "the defendant intentionally entered land owned by the plaintiff") or the explanation advanced by the defendant (e.g., "the plaintiff is mistaken about the identity of the trespasser" or "defendant entered the land accidentally," or both[75]) better fits with the evidence presented at trial.

Higher standards require more from the party with the burden of proof. In criminal cases, under the "beyond a reasonable doubt" standard, the prosecution must do more than present a *better* explanation than the defense (or the best available explanation): fact-finders convict only when the prosecution's explanation (which includes all of the legal elements) is plausible, given the evidence, and there is *no* plausible defense explanation.[76] The "clear and convincing

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("Neither the Court of Appeals, nor the respondents, nor the dissent provides any reason to question the city's theory. In particular, they do not offer a competing theory, let alone data . . ."); Matsushita v. Zenith, 475 U.S. 574, 587 (1986).

[72] An explanation will "include" an element if the element is a part of, or is entailed by, the explanation. For example, in a negligence case, the plaintiff's explanation must include each of the elements; if the better explanation fails to include an element (e.g., causation), then the defendant will win.

[73] These general criteria are not unique to law. They are the same explanatory criteria that affect the quality of explanations in a wide variety of contexts such as science, history, and everyday common-sense reasoning. See Lipton, supra note 7; Harman, supra note 7; Lombrozo, supra note 7; Peter Achinstein, The Nature of Explanation (1983); Philip N. Johnson-Laird, How We Reason 186-88 (2006) (discussing the role of explanations in reasoning).

[74] In general, the quality of an explanation serves as a proxy for likelihood: the better the explanation, the more likely it is, when compared with the available alternatives. Lipton, supra note 7; Timothy Williamson, Abductive Philosophy, Phil. Forum 263, 267 (2016) ("Inference to the best explanation does not directly rank potential explanations according to their probability. This does not make it . . . inconsistent with a probabilistic epistemology . . . [It] may be a good heuristic to use when—as often happens—probabilities are hard to estimate.") See also Anderson v. Griffin, 397 F.3d at 521-22 ("If in a particular case all the alternatives are ruled out, we can be confident that the case presents one of those rare instances in which a rare event did occur"); United States v. Beard, 354 F.3d 691, 693 (7th Cir. 2004) ("Relative to the alternatives, the government's case was more powerful than it would have seemed in the abstract.").

[75] As we discuss in more detail in Part II, parties are typically free to offer alternative or "disjunctive" explanations if they choose to do so, and fact-finders may also rely on alternative explanations (e.g., "X or Y happened and either way the plaintiff/ defendant wins"). Moreover, jurors are free to reject all of proffered explanations and simply conclude "something else must have happened," without needing to formulate a specific alternative. See Pardo & Allen, supra note 7, at 238 ("If the proffered explanations truly are equally bad . . . judgment will (and should) go against the party with the burden of persuasion.").

[76] See, e.g., O'Laughlin v. O'Brien, 568 F.3d 287, 304-08 (1st Cir. 2009); United States v. Beard, 354 F.3d 691, 692-93 (7th Cir. 2004); United States v. Newell, 239 F.2d 917, 920 (7th Cir. 2001). See also United States v. Sever, 603 F.3d 747, 753 (9th Cir. 2010) (abuse of discretion in denying defendant's

evidence" standard requires a threshold in between a preponderance and beyond a reasonable doubt. In explanatory terms, this means that the plaintiff's explanation must be not only better than the defendant's but, for the decision-maker, clearly more plausible than the defendant's.[77]

The explanatory thresholds posited by relative plausibility fit with the underlying goals of the standards.[78] As explained above, these goals include policy choices regarding accuracy and the allocation of the risk of error.[79] Under the preponderance standard, the explanatory threshold divides the risk of error roughly evenly between the parties, because each side bears the risk that the jury may mistakenly adopt the opposing side's explanation.[80] Moreover, under certain assumptions, accuracy will be advanced to the extent that better explanations are more likely to be true than implausible explanations.[81] Similarly, under higher standards of proof, the higher thresholds shift the risk of error away from parties without the burden of proof.[82] Accordingly, this expresses the preference to minimize one type of error (false positives) over another (false negatives). As with the standards themselves, this shift is greatest with the explanatory threshold

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discovery request for evidence to support defendant's "alternative explanation"). The process is comparative in the sense in that it takes into account possible alternatives on both sides, but it requires more of the prosecution than merely having the better of the available explanations. For this reason, the process is not one of inference to the *best* available explanation. Ronald J. Allen & Michael S. Pardo, Probability, Explanation, and Inference: A Reply, 11 Int'l J. Evid. & Proof 307 (2007). Nothing in this account requires criminal defendants to offer an alternative at trial; they may proceed solely by attacking the plausibility of the prosecution's explanation, but it will often be to the defendant's advantage to offer such an alternative. Cf. Wilson v. Graetz, 608 F.3d 347, 352-53 (7th Cir. 2010) (ineffective assistance of counsel in failing to offer alternative explanation).

[77] This implies that the higher civil standard should make a difference when the choice between explanations is a close call or when decision-makers have sufficient second-order doubts that a selected explanation is better. See Michael S. Pardo, The Nature and Purpose of Evidence Theory, 66 Vand. L. Rev. 547, 604 (2013). The standard and its requirements are themselves vague and poorly understood. See, e.g., Addington v. Texas, 441 U.S. 418, 425 (1979) (noting that the "clear and convincing" is less understood than either the preponderance or BARD standards). Empirical studies confirm the standard is poorly understood. David L. Schwartz & Christopher Seaman, Standards of Proof in Civil Litigation: An Experiment from Patent Law, Harv. J. L. & Tech. (2013); Dorothy K. Kagehiro & W. Clark Stanton, Legal vs. Quantified Definitions of Standards of Proof, 9 Law & Hum. Behav. 159 (1985). The explanatory account provides some clarity in specifying criteria that give content to the standard.

[78] See supra notes 27-33 and accompanying text.

[79] See supra notes 27-33 and accompanying text.

[80] Indeed, the comparative process better fits with this goal than the probabilistic account. See supra note 63.

[81] See supra note 74. Of course, what appears to be the better explanation may turn out to be false, and the best possible explanation (i.e., a true one) may not be offered at trial. But the same conditions are true of the probabilistic account. These are general features of induction, and trials involve inductive inferences. The "problem of induction" applies equally to the explanatory and probabilistic accounts. See Leah Henderson, The Problem of Induction, Stanford Encyclopedia Phil. (2018), available at https://plato.stanford.edu/entries/induction-problem/.

[82] Increasing the explanatory threshold correspondingly increases the likelihood of that explanation being true and shifts the risk of error away from the opposing party.

for BARD, with the clear-and-convincing threshold falling in between the preponderance and BARD thresholds.[83]

The explanatory account also avoids each of the problems discussed above for the probabilistic account. These problems, again, are: (1) the need to assign number values to compare the evidence with the standard of proof; (2) lack of fit between the probabilistic theory and how fact-finders actually evaluate and reason with evidence; (3) inconsistency with legal doctrine and jury instructions (the conjunction problem); and (4) inconsistency with regard to the policy goals underlying standards of proof. We discuss each in turn.

First, under the explanatory account, as in actual trials, there is no need to quantify the evidence or to attach numbers to the likelihood of legal elements being met. Rather, fact-finders compare the possible explanations being advanced in light of the evidence, their background knowledge, and the explanatory threshold for the standard of proof. The feasibility of this abductive reasoning process is a clear advantage of the explanatory account over the probabilistic account, which requires frequently unavailable information to implement (or must rely instead on subjective beliefs).[84] Moreover, the criteria for evaluating explanations in light of the evidence provide the means to assess the sufficiency of evidence, or the reasonableness of particular findings.[85] These considerations are lacking under the subjective probability conception of proof.

Second, empirical evidence confirms that fact-finders reason, and lawyers present cases, in a manner that more closely fits the explanatory account than the probability account. That jurors typically attempt to construct narratives to fit evidence dovetails with the explanatory account of standards of proof.[86] This more holistic account of evidence evaluation is inconsistent with probabilistic accounts that posit item-by-item processing of evidence in terms of probabilities, leading to a probabilistic conclusion for each element.

Third, the explanatory account avoids the conjunction paradox in a straightforward manner. Consider again a civil claim with two elements, A and B. Rather than assessing A and B serially and attaching a probability to each, fact-finders evaluate whether the plaintiff's

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[83] See supra note 33.

[84] See supra notes 42-50 and accompanying text.

[85] See Michael S. Pardo, Pleading, Proof, and Judgment: A Unified Theory of Civil Litigation, 51 B.C. L. Rev. 1451 (2010).

[86] See supra note 51. Although our account fits with this fact about juror reasoning, it is important to emphasize that relative plausibility is distinct from the "story model" (as a psychological account of juror reasoning). The story model is a descriptive account of juror behavior; unlike our account, it does not provide an explanation of standards of proof and other features of the proof process. Pennington & Hastie, for example, discuss standards of proof playing a role only after a story has been constructed. Supra note 51, at 530-31. Moreover, although explanations at trial may often take the form of stories or narratives, the concepts are distinct and parties may succeed at trial without offering the latter (e.g., by offering a disjunctive explanation). See Pardo, supra note 77, at 598-99 (discussing the differences between stories and explanations). Much patent litigation does not involve "stories" for example, even though it involves explanations.

explanation (which will include or entail A & B) is better than the defendant's explanation (which will omit A or B, or both).[87] An explanation is selected based on the explanatory threshold, and that explanation is assessed in order to determine whether it includes the elements or not. Conceptualizing the relationship between the cases and elements in this manner ameliorates the "paradoxical" consequences that arise under the probabilistic conception, and it provides an interpretation of the law that fits with the rationales underlying the standards of proof.[88]

Fourth, and finally, relative plausibility's *comparative* aspect better fits with the policies underlying the standards of proof. Suppose again an example in which a jury finds a plaintiff's explanation (e.g., he was fired because of age) more likely than the defendant's alternative explanation (e.g., he was fired because of poor performance).[89] Suppose further, as the probabilistic interpretation instructs, that jurors must assign probabilities to these explanations. They give plaintiff's 0.4 and defendant's 0.2. Plaintiff would lose under the probabilist account despite offering a much better (and thus more likely) explanation. This result is inconsistent with the goals of accuracy and equalizing the risk of error. This problem arises from the assumption that if the plaintiff's explanation is 0.4 likely, then the probability the defendant is not liable is 0.6.[90] Assuming, instead, that the unknown 0.4 is in fact *unknown* better fits the goals of the rules. Although it does not require quantifying explanations, the explanatory account makes a similar assumption about unknowns. Under the explanatory account, neither side benefits from the unknown possibilities not advanced by the parties.[91] The explanatory account thus not only better fits actual practices, but also interprets the rules consistently with their underlying goals.

At a more general level, the explanatory account also harmonizes with the procedural setting of litigation, especially in civil cases. American civil litigation practice assigns the tasks of evidence gathering and presentation to the parties with the proper incentives to invest the optimal amount of time, energy, and money in those activities, and who also have the best grasp of the relevant facts. The parties decide what to litigate, how to investigate, and what

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[87] We discuss the conjunction problem and alternative explanations in more detail in Parts II and III.

[88] One feature of the explanatory account that ameliorates the conjunction problem is the fact that explanations are assessed as a whole (and then the selected explanation is compared with the elements), which distributes the "conjunction effect" to both sides of the case, thus reducing its significance. As explained above, see supra note 57, the rationales for the standards are frustrated when applied to individual elements and not to the case as a whole. Unlike the probabilistic account, the explanatory account thus harmonizes the standards, legal practices and doctrine, and the rationales for the standards. For example, under the preponderance standard, jurors assess which of the available explanations is better as whole (and thus is most likely). A second feature is the fact that much of the evidence at trial overlaps with both of the explanations being advanced by the parties. See Allen & Jehl, supra note 53, at 937; Pardo, supra note 77, at 580-89.

[89] See, e.g., Reeves v. Sanderson, 530 U.S. 133, 150 (2000).

[90] See supra note 59.

[91] This is consistent with the fact that parties are free to offer alternative or disjunctive explanations; they may even make full use of the probability space that supports their side (i.e., by arguing for the full range of possibilities that supports them). Sometimes it will be to their advantage to do so and sometimes not. See infra at notes 135-52 and accompanying text.

explanations to provide at trial. If they choose not to litigate some aspect of a dispute, or to chase down some relatively unlikely but possible hypothesis, that is up to them. As courts around the country note with regularity, the parties are the masters of their cases.[92] Any other approach that defines the standards as probabilistic thresholds would have the parties resolve every possible way in which the universe might have been the day in question, or more accurately, would count the failure to do that against the plaintiff. That would be a hard task, indeed.[93]

In sum, relative plausibility improves on the conventional probabilistic account of proof in several ways. It does not require quantifying the evidence; it provides a more plausible conception of the value of evidence; it fits with the reasoning processes of fact-finders; it avoids the conjunction problem; it provides a plausible account of how the elements of cases relate to the case as a whole; and its comparative nature fits with both actual proof practices at trial[94] and the policies underlying the standards of proof.

There are, of course, some potential downsides to the theory—explanatory standards do not possess the apparent clarity and precision of probabilistic thresholds,[95] and there is no *a priori* way to combine or rank the various explanatory criteria in a way that provides a general recipe for determining case outcomes.[96] Evaluating explanations will depend on the details of individual cases, at the retail and not the wholesale level, as it were, as well as on the background knowledge of the decision maker. But no theory will ever explain every aspect of a social practice as complex and dynamic as juridical proof, so it will not be surprising if relative plausibility does not predict or explain everything. On the whole, however, and as we have maintained before, the theory itself is justified by the very same process it deploys: it is the best available explanation of the phenomena at issue, i.e., juridical proof and its components.[97]

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[92] See supra note 69.

[93] This is consistent with fact that defendants are not required to offer a particular alternative explanation. See supra note 91. Even so, they almost always do. See Reid Hastie, What's the Story? Explanations and Narratives in Civil Jury Decisions, in Civil Juries and Civil Justice 23, 31 (B.H. Bornstein et al. eds., 2008) ("One observation, from years of study of stories at trial, is that the defense perspective is more complicated and usually involves at least two stories: the story of the defendant's activities and a second story to account for the events that led to the lawsuit."). Even in criminal cases, it will often be to a defendant's advantage to present one or more alternative explanations. See supra note 91. See also infra note 123.

[94] It also better fits with other litigation stages that depend on the proof process. See Pardo, supra note 9; Pardo, supra note 85.

[95] For the reasons discussed above, see supra notes 42-50, this apparent precision is misleading, given the ambiguity in what is meant by probability statements and the disagreements about how to fix the standards.

[96] This is true of explanations generally, see Lipton supra note 7. In a forthcoming book, the philosopher John Norton similarly rejects a generalized, formal scheme for explanatory inferences in science, demonstrating through several case examples that inferences based on competing scientific explanations depend on the background facts and the particular details at issue in each case. See John Norton, The Material Theory of Induction (forthcoming, draft available at: www.pitt.edu/~jdnorton/homepage/cv.html#material_theory).

[97] Pardo & Allen, supra note 1.

II. Critiques of Relative Plausibility

We now turn to three recent critiques of the relative plausibility theory.[98] Although each critique acknowledges some problems with the conventional probabilistic account,[99] they raise several challenges to our account of standards of proof in terms of explanatory thresholds. In addition, they each offer their own views about standards of proof and related aspects of the law. We will discuss the problems with their alternative views in subsequent Parts. In this Part, we focus on their specific objections to our theory. Although the objections do not undermine our theory, discussing why the objections fail provides the opportunity to further clarify and expand upon our positive account.

We organize our response thematically, focusing first on areas of overlap or related objections made by more than one critique. We then discuss additional objections they each raise. The objections concern six issues: the relationship between plausibility and probability; the obligations of parties without the burden of proof; the reliance by parties on alternative or "disjunctive" explanations; standards of proof higher than the preponderance standard; the conjunction problem; and the nature of fact-finder inferences.

A. The Relationship between Plausibility and Probability

The first challenge raised by our critics concerns the relationship between the plausibility of explanations and probability. Schwartz and Sober, as well as Nance, contend that the

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[98] Schwartz & Sober, supra note 15; Nance, supra note 16; Clermont, supra note 17. In previous work, we have addressed why prominent objections to inference to the best explanation in the philosophy of science do not carry over to law, along with other possible objections to our account. See Pardo & Allen, supra note 1; Allen & Pardo, supra note 44. As we have explained, even if inference to the best explanation is not sufficient to warrant conclusions in scientific contexts, or it is a poor description of scientific reasoning, IBE (or something similar) may nevertheless adequately describe and warrant inferences in the context of juridical proof. While keeping the differences between these contexts in mind, we note that there are also some striking similarities between explanatory reasoning in the two domains. As Norton's scientific examples illustrate, see supra note 96, the comparison between alternatives accounts for much of the process and favored explanations often succeed by demonstrating the "evidential failure" of the alternative. This failure typically includes either being contradicted by the evidence (or the background facts), or making suppositions for which there is inadequate evidential support. This is also true for legal cases. See supra note 74.

[99] Of the three critiques, Schwartz & Sober present views most similar to the probabilistic account, although they are focused only on the conjunction issue and concede that our account may provide a better overall explanation of burdens of proof. See Schwartz & Sober, supra note 15, at 644 ("There is certainly some force to the Explanatory theory argument that jurors decide cases holistically, that they do not assign precise numerical values to their assessments of probability, and that they fail to make rigorous probabilistic calculations, such as multiplying the probabilities of conjunct elements of claims. Whether the explanatory account is or isn't a better account of the burden of proof than the standard probability model is not a question we purport to answer here."). Nance and Clermont offer detailed, alternative probabilistic theories that deviate in significant respects from the conventional account. We discuss and critique those theories in Parts IV and V.

relationship is obscure and in need of clarification. Schwartz and Sober, for example, claim that the details of our account are "vague" and that our theory suggests that "the statement 'X is probably true' should be recast to mean that 'X is the best explanation among the known alternatives.'"[100] Nance goes further, arguing: "Pardo and Allen do not articulate or illustrate how the two [plausibility and probability] can be meaningfully different."[101] On the one hand, he argues, if the plausibility of an explanation just means "telling a good story" no matter how unlikely, this is simply not a good criterion for legal proof.[102] On the other hand, he notes, the explanatory criteria we identify (consistency, coherence, simplicity, etc.) "are natural criteria for the assessment of epistemic probability."[103] Of these two possibilities, our view is closer to this second one. We clarify below.

According to our account, legal fact-finding does indeed aim at what are essentially probabilistic conclusions.[104] In this sense, both relatively plausibility and the conventional probabilistic account are focused on the same end or goal. Thus, our position is similar to Nance's second, epistemic interpretation described above—inferring which is the better explanation is indeed about inferring what is more likely based on the evidence. That said, we do not advocate either (1) defining "more likely" as the "best available explanation" (as S&S allege), or (2) converting inferences based on explanatory criteria into explicitly probabilistic judgments (as Nance suggests).[105] Rather, we are relying on the fact that the inferences at trial are *abductive*. Judgments about what is likely depend on judgments about the plausibility of explanations.[106] Abduction, in other words, is the process by which legal fact-finders arrive at probabilistic—i.e., inductive, non-demonstrative—conclusions.[107] This process is inherently comparative, in the sense that the plausibility (and hence likelihood) of particular explanations will depend on the available alternatives.[108] In sum, legal fact-finders arrive at probabilistic conclusions by evaluating and comparing the plausibility of explanations.

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[100] Schwartz & Sober, supra note 15, at 643.

[101] Nance, supra note 16, at 81

[102] We agree.

[103] We discuss Nance's concept of "epistemic probability" in Part IV.

[104] See supra note 36.

[105] We do not define "more likely" as the "best available explanation." We recognize the two notions are not coextensive. Nevertheless, explanatory considerations guide likelihood considerations in the context of juridical proof. Also, we reject trying to quantify explanatory inferences because we see no need to do so.

[106] See supra note 7. For detailed analysis of the structure of inferences based on plausibility considerations, see Douglas N. Walton, Abductive Reasoning (2004). Walton's recent work on formal modeling of argument structures in law adopts our explanatory account of proof. See, e.g., Floris Bex & Douglas N. Walton, Burdens and Standards of Proof for Inference to the Best Explanation: Three Case Studies, 11 Law, Prob & Risk 113 (2012).

[107] See supra notes 43, 74.

[108] This is likely true of most types of reasoning. See generally Walter Sinnott-Armstrong, A Contrastivist Manifesto, 22 Social Epistemology 257 (2008); Justin Snedegar, Contrastive Reasons (2017); Alan Garfinkel, Forms of Explanation 30 (1981) ("Lacking such a determinate sense of alternatives, one has difficulty seeing how we could give explanations at all; they would have to be so all encompassing as to be impossible").

The abductive process in law is similar to other contexts such as science, philosophy, and everyday life in which explanatory considerations guide judgments about what is true or what is probable. The philosopher Timothy Williamson describes this connection between explanations and probability thus:

> Inference to the best explanation does not directly rank potential explanations according to their probability. This does not automatically make it inconsistent with a probabilistic epistemology, for instance a Bayesian one. Inference to the best explanation may be a good heuristic to use when—as often happens—probabilities are hard to estimate, especially the Bayesian prior probabilities of theories. In such cases, inference to the best explanation may be the closest we can get to probabilistic epistemology in practice.[109]

Williamson was focusing on theoretical explanations, but his description also applies to much of what occurs in juridical proof.

In the legal context, however, the reasoning process is not always about choosing the *best* (and hence most likely) of the available alternatives. The details of the relative comparison of explanations will depend on the applicable standard of proof. A plaintiff who offers the best available explanation has provided what appears, via this abductive process, to be the most likely explanation. This is sufficient to satisfy the preponderance standard. And this result is confirmed in case after case.[110] It is sufficient *not* because we have defined "more likely" to mean "better explanation." Rather, explanatory criteria guide inferences and judgments about likelihood.[111] For this reason, the explanatory account is neither superfluous nor synonymous with the probabilistic account, even though both aim at probabilistic conclusions.[112]

B. Comparative Proof and Defendant Obligations

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[109] Williamson, supra note 74, at 267. See also Ronald J. Allen, The Nature of Juridical Proof: Probability as a Tool in Plausible Reasoning, 17 Int'l J. Evid & Proof 133 (2017).

[110] See supra note 71. We discuss higher standards below.

[111] See, e.g., supra notes 71. Moreover, nothing in our account prevents the use of statistical evidence and formal methods within this explanatory framework. See Allen, supra note 109; Pardo & Allen, supra note 1.

[112] It is, of course, possible to ask fact-finders to attach numbers to the conclusions of their abductive inferences. But we think these numbers would be purely epiphenomenal. Almost never in litigation is there reliable "relative frequency" data. Putting numbers on assertions after hearing the evidence obviously entails a consideration of what the possible alternatives are that are suggested by the evidence and the cognitive capacity of the fact-finder. See Allen, Factual Ambiguity, supra note 1. Moreover, the transmutation of explanations into probability statements would be necessary only when the standards of proof are conceptualized as probabilistic thresholds (which, we maintain, they are not and should not be). The explanatory account has no need for either. And apparently neither does the legal system. To our knowledge, no court in the Anglo-American world has allowed explicit probabilistic presentations to juries, save only when the case is itself a relative frequency case (such as disparate impact in employment cases). The notorious case of People v. Collins is an example, 68 Cal.2d 319, 438 P.2d 33 (1968), as is the more recent case of Nulty v. Milton Keynes Borough Council, [2013] EWCA Civ 15. See also (R. v. T. [2010] EWCA Crim 2439) and R v Adams [1998] 1 Cr App R 377.

The second challenge: our critics assert that our account is inconsistent with the law because it requires defendants (or, more precisely, parties without the burden of proof) to provide alternative explanations. For example, Schwartz and Sober argue that a "difficulty" facing explanatory standards of proof is "the legal rule that the plaintiff does not automatically win even when the defendant offers no affirmative contrary explanation."[113] Similarly, Clermont argues that our account "diverges from the law by compelling the nonburdened party, or at least imposing a practical obligation, to choose and formulate a competing version of the truth."[114] Legal doctrine, he explains, "allows the defendant to stand mute and still prevail."[115] There is some truth in these quotations, but they are more misleading than illuminating. Clarifying why this is so also helps reveals why the concerns raised by this challenge do not impugn our account.

Standard jury instructions and legal doctrine on the burden of proof suggest that parties without the burden (typically, civil and criminal defendants) are not required to offer alternative explanations.[116] This is true. What we have shown previously, however, is that such statements are seriously misleading. First, trials are structured in innumerable ways to facilitate the relative comparison of the plaintiff's and the defendant's explanations. The burden of proof instruction is the odd man out.[117]

More importantly, though, it does not matter what the "law" says; there is no choice but to make such a comparison. The credibility of the claims that anyone makes under any circumstances are determined in significant part by what the alternatives are. If a fact-finder concludes that the negation of a plaintiff's case has occurred, that is a determination that something has happened other than what was alleged by the plaintiff. The point is obvious. To be sure, there can be cases in which what the plaintiff alleges cannot possibly be true, but that again will be because some element in the plaintiff's case could not have happened—something else must have, and the fact-finder has to have a store of plausible candidates to reach such a conclusion.[118]

So, it is in a sense literally true that the defendant in either a civil or criminal case does not as a formal matter have to present an alternative explanation, or any explanation at all. But it

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[113] Schwartz & Sober, supra note 15, at 651.
[114] Clermont, Standards of Decision, supra note 17, at 359.
[115] Id. at 359.
[116] Id.; McCormick on Evidence, sec 339.
[117] See Allen, supra note 109, at 140 ("The overall trial process essentially forces the parties to tell their discrete stories, and the rules of evidence facilitate this").
[118] Pardo & Allen, supra note 1, at 238 ("If the proffered explanations truly are equally bad . . . judgment will (and should) go against the party with the burden of persuasion."). This is true with pretrial considerations as well. Most notably, the Supreme Court's prominent discussions of a "plausibility" requirement for pleadings in civil cases refer to alternative explanations in assessing plausibility. See Bell Atlantic v. Twombly, 550 U.S. 544, 567-68 (2007) (concluding the plaintiff's explanation was not plausible because "here we have an obvious alternative explanation"); Ashcroft v. Iqbal, 129 S. Ct. 1937, 1951 (2009) (concluding that plaintiff's explanation was not plausible "given more likely explanations" including an "obvious alternative").

is also true that they almost always do.[119] The reason is obvious: if there is only one plausible explanation of the evidence, disinterested and rational people will conclude that it is true. In other words, defendants who "stand mute," which they are often allowed to do by the law,[120] will lose.[121] That is why litigators do not first and foremost discuss "negating" the other side's case but instead showing that their version of the facts is true.[122] Similar considerations apply even in criminal cases. When defendants proceed by challenging the prosecution's explanation, the prosecution's explanation may be implausible, impossible, or "make no sense" because of alternative explanations suggested by the evidence.[123] On the other hand, when there is a strong prosecution case, defendants may stand mute, and likely be convicted, or they will try to offer a plausible alternative explanation.[124]

But, our critics assert, there are cases where defendants (civil and criminal) argue along the lines of "something else happened," without offering *any* specific alternatives.[125] They suggest that these are counter-examples to our theory. We disagree. Such cases do exist, but it is important to recognize three points in response. First, arguments at trial of this general type—i.e., "something else happened," without specifying what happened—are not, as Schwartz and Sober claim, a feature of the burden of proof.[126] Parties *with* the burden of proof also sometimes

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[119] See Hastie, supra note 93. See also infra notes 123-24.

[120] Not always. For example, in employment-discrimination cases, when plaintiffs prove a *prima facie* case of discrimination, defendants must provide an alternative explanation or they will lose as a matter of law. See Reeves v. Sanderson Plumbing Prods, Inc. 530 U.S. 133 (2000).

[121] Although the "standing mute" trope is repeated among commentators on burdens of proof, we are not aware of actual cases where (1) the plaintiff's evidence is sufficient to get to trial, and (2) civil defendants "stand mute" at trial. And even if such cases could be located, they would be the exception to the overwhelmingly more common practice of comparing alternative explanations.

[122] Hastie, supra note 93**.** See also infra notes 213-14.

[123] See, e.g., O'Laughlin v. O'Brien, 568 F.3d 287, 304-08 (1st Cir. 2009). The National Association of Criminal Defense Lawyers book, Powerful Words: Storytelling & Persuasion Techniques for Communicating Your Theory of the Defense (2016) indicates that criminal defense counsel always provide an alternative explanation. Virtually never is the "theory of the defense" that a discrete element is false. It is rather that the defense "story" is inconsistent with guilt.

[124] Wilson v. Graetz, 608 F.3d 347, 352-56 (7th Cir. 2010) (concluding that defendant's attorney failed to provide effective assistance of counsel when the attorney did not develop an alternative explanation); United States v. Beard, 354 F.3d 691, 692-93 (7th Cir. 2004) ("We asked his lawyer at argument what the explanation of the defense was for the presence of the gun in the car that Beard had borrowed. No answer was forthcoming. The lawyer seems to have thought that since the government had the burden of proof and Beard was privileged not to testify (and he did not testify), it was irrelevant that the jury was given no alternative to the government's straightforward theory as to whose gun it was. That is incorrect."); United States v. Newell, 239 F.2d 917, 920 (7th Cir. 2001).

[125] Schwartz & Sober, supra note 15, at 652 ("This scenario represents a not-uncommon pattern in disputed cause cases, in which the defendant asserts 'we simply don't know how the plaintiff was harmed.'"). In such case, defendants proceed by invoking the probability space that supports their side. Id. at 652 ("the defense in effect asserts the sum of all possible alternative negating explanations.") See also Clermont, Standards of Decision, supra note 17, at 359-60.

[126] Schwartz & Sober, supra note 15, at 651 (arguing that a "difficulty" for our "account of the *burden of proof* is the legal rule that the plaintiff does not automatically win even when the defendant offers no affirmative contrary explanation.").

succeed with general arguments of this type—for example, plaintiffs in *res ipsa loquitur* cases may win by proving that "the defendant did something negligently and thereby caused my injuries" without being able to identify a specific cause.[127] Thus, it is a mistake to conclude that the existence of such arguments at trial is a necessary feature of the burden of proof that a theory must be able explain. Second, arguments at trial of this "something else happened" type (whether made by parties with or without the burden of proof) are limiting cases; they are exceptions and not the norm in litigation.[128] Again, it is important to remember that what is being thought about here is a big, sprawling system that will be unruly on occasion. Third, even when defendants do not offer a specific, alternative explanation, fact-finders will nevertheless evaluate the plaintiff's/ prosecutor's explanation by considering possible alternatives (in light of the storehouse of knowledge of the fact-finder).[129] Related to this last point, for example, Prof. Clermont notices that a "belief in the falsity of the burdened party's version of the truth may develop naturally in the course of the trial."[130] Of course it may, as the plaintiff's evidence may indeed show that something else happened than he or she alleges. How else would a belief in the "negation" of plaintiff's version arise except by concluding that something else happened?

In sum, that the law does not formally require parties without the burden of proof to have any obligations beyond those that currently exist in the law is at best a curiosity of the difference that exists between formal legal structures and the manner in which people think. Defendants may choose to "stand mute," as they will often be allowed to do according to legal doctrine, and this will be to their peril. Given the nature of the evidence and facts at issue, it will sometimes be to a party's advantage not to offer a specific version of the events but rather to rely on more generalized assertions.[131] Whether they may do so successfully will depend on the operative substantive law and will not necessarily track the burden of proof. Finally, regardless of whether both parties offer specific explanations, fact-finders (being human reasoners) will evaluate any proffered explanations that they are given against the background of their knowledge and other possible explanations that this knowledge suggests.

C. Alternative or Disjunctive Explanations

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[127] In such cases, the burden of proof does not shift; rather, the doctrine permits the jury to draw an inference of negligence when it may reasonably be drawn from the evidence. See Restatement of Torts (2d) sec. 328D (1965). Schwartz & Sober, supra note 15, at 653 n. 122, question the possibility of "general explanations." Plaintiff explanations in such cases are examples.

[128] Hastie, supra note 93. Moreover, even when defendants do not offer a specific alternative cause in toxic tort cases (the example S&S focus on), proof of causation will proceed by considering other possible cases. See, e.g., Zuchowitz v. United States, 140 F.3d 381, 389-90 (2d Cir. 1998) (discussing expert testimony on alternative possible causes of plaintiff's pulmonary hypertension).

[129] See supra note 51. As will experts testifying about causation. See, e.g., Zuchowitz v. United States, 140 F.3d 381, 389-90 (2d Cir. 1998) (discussing expert testimony on alternative possible causes of plaintiff's pulmonary hypertension and concluding that this testimony was sufficient to support a finding of causation for the plaintiff).

[130] Clermont, Standards of Decision, supra note 17, at 211.

[131] Both possibilities are consistent with our account, see supra note 93, as is the possibility of offering alternative explanations, which we discuss next.

The previous challenge concerned the defendant's obligations to provide an alternative explanation. A third, related challenge presented by our critics concerns whether fact-finders may consider alternative explanations not offered by the parties, and whether parties may proffer "disjunctive" explanations (or explanations that aggregate two or more possibilities). The critics contend that alternative or aggregated explanations present a dilemma for our theory: either (1) we do not allow for them, which would be both contrary to existing law and lead to the undesirable consequence of increasing factual errors, or (2) we do allow for them, which causes our theory to "converge" with the conventional probabilistic view and thus "collapse."[132]

Our response focuses primarily on the second track of this purported dilemma. In previous work, we have demonstrated that juridical proof allows for alternative and disjunctive explanations.[133] Here we explain why, contrary to the allegations of our critics, such explanations do not undermine our theory. Before turning to the details of this track of the dilemma, however, it will help to clarify a few details about the first track that will also be relevant when discussing disjunctive explanations.

Relative plausibility points out that fact-finders compare and evaluate competing explanations of the evidence. Some critics read into this comparative process requirements that (1) each party must pick one and only one version of reality to compare with the evidence, and (2) fact-finders must only consider these two explanations.[134] Nothing in our account, however, requires these limitations on the fact-finding process. We agree that fact-finders are free to consider and infer possibilities not presented by the parties, and we recognize that the law sometimes allows parties to proceed "disjunctively" by presenting alternative possibilities.[135] The latter may occur when giving two distinct possibilities[136] or when, for example, defendants invoke the entire range of possibilities that support non-liability.[137] Whether the law allows parties to do so, and whether it makes sense to do so, will depend on the details of the case. As a general matter, however, parties have a great deal of leeway in how they choose to present their cases—one of those choices will involve how much of the possibility/ probability space they want to invoke in support of their cases. This may involve one story, a disjunctive explanation composed of two (or more) possibilities, or the entire range of possibilities that support their case. Our account is consistent with this state of affairs; the comparative process takes place

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[132] Nance, supra note 16, at 80; Clermont, Trial by Traditional Probability, supra note 17, at 359 ("comparing the plaintiff's story only to the defendant's favorite story, rather than to all versions of nonliability, will result in recovery by plaintiffs more often than normatively desirable. The plaintiff should lose if liability is less likely than nonliability, regardless of which story the defendant prefers."); Schwartz & Sober, supra note 15, at 653-54: ("IBE either increases the risk of erroneous decision; bars defendants from presenting disjunctive defenses, contrary to existing law; or banishes all use of unpresented explanations, thereby converging with the standard Pr(A)>0.5 account of burden of proof.").

[133] Pardo & Allen, supra note 1; Michael S. Pardo, Group Agency and Legal Proof; or, Why the Jury is an "It," 56 Wm. & Mary L. Rev. 1793 (2015).

[134] Clermont, Trial by Traditional Probability, supra note 17; Nance, supra note 16.

[135] See supra note 75.

[136] See, e.g., Schad v. Arizona, 501 U.S 624 (1991); McCormick v. Kopmann, 161 N.E.2d 720, 726 (Ill. App. Ct. 1959).

[137] See supra notes 75, 91.

against the backdrop of how the parties choose to contrast their cases.[138]

Although we acknowledge disjunctive explanations, it will also be helpful to clarify exactly why our critics think that a relative comparison of two explanations will "increase the risk of erroneous decisions" and "result in recovery by plaintiffs more often than is normatively desirable."[139] Return again to our example where a fact-finder concludes that a plaintiff's explanation is 0.4 likely and a defendant's explanation is 0.2 likely. As we explained above, when the remaining 0.4 is unknown, a comparative account (plaintiff wins) better accords with the goals of accuracy and equalizing the risk of error.[140] Thus, to the extent the criticism is based on the assumption that all unknown possibilities should favor parties without the burden of proof, this is inconsistent with the aims of the preponderance rule. More likely, however, our critics have in mind a situation in which the remaining 0.4 is a third possibility that also favors the defendant.[141] If so, and assuming the disjunction is allowed by the law, then we agree that defendants should not be limited to picking one or the other; rather, the defendant should win because the disjunction is more likely than the plaintiff's version.[142]

With these clarifications in place, we now turn directly to the second track of the proposed dilemma. Why, exactly, do our critics think that embracing disjunctive explanations causes our theory to collapse? Nance argues this occurs because the "most plausible explanation" favoring each side will always be "the disjunction of all possible stories" favoring each side.[143] But if so, then "the theory becomes the same as the decision-theoretic criterion."[144] Schwartz and Sober make a similar point, arguing that disjunctive explanations cause our account to "converge" with the conventional probabilistic account of standards of proof.[145] According to our critics, our theory can avoid collapse only if it "requires some further limitation on the fact-finder's aggregation of stories."[146] We disagree with these criticisms for two reasons.

First, the critics rely on the true (and obvious) implication that if we allow for disjunctions over the entire probability space, then we will always fill up this space, as does the conventional probabilistic account. This implication, however, does not render the explanatory account superfluous. To be clear, we reject the assumption that the plaintiff's explanation must fill more than half of the possible probability space, which if taken seriously would require the plaintiff to prove that half plus one of the ways the world could have been favor the plaintiff. But even if we were to grant this assumption, the explanatory account still differs in several

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[138] See supra note 69 (discussing the "master of the case" principle).
[139] See supra note 132.
[140] See supra notes 89-91 and accompanying text.
[141] For example, Nance proposes the following stoplight hypothetical: the light was red (plaintiff's claim) is 0.4; the light was green (defendant's claim) is 0.3; and the light was yellow is 0.3. Thus, he argues, the defendant should win. See Nance, supra note 16, at 80. We agree. See Pardo & Allen, supra note 1, at 252, and this result is consistent with our account.
[142] As we have argued previously. See id.
[143] Nance, supra note 16, at 80.
[144] Id.
[145] Schwartz & Sober, supra note 15, at 653-54.
[146] Nance, supra note 16, at 80. See also Schwartz & Sober, supra note 15, at 652-54.

important respects from the conventional probability account. It remains the case, for example, that explanatory criteria guide inferences and explanatory considerations provide the thresholds for the standards of proof, not probabilistic criteria and thresholds.[147] This is so even though the former are ultimately concerned with probabilistic conclusions. The explanatory account thus provides a better account of juridical proof even when the parties put all of the possibilities on the table, as it were.

Second, and more importantly, it is not our theory that is in need of a limiting principle for aggregating explanations. The law, the parties, and fact-finders already do so. Subject to some limitations from the law, the parties have leeway in deciding how much of the space of possibilities to invoke (and at what level of specificity or generality) and how best to contrast their case with their opponent's.[148]

To be clear, we see the point that our critics are trying to make: of course, the most probable explanation supporting each side will be the disjunction of all possible explanations supporting that side (it will be at least as probable as any single disjunct or subset). But here is another instance in which the formalities of the conventional probabilistic approach and the realities of the trial come apart. Invoking the full range of possibilities will often not be to a party's advantage at trial. Consider any case in which a civil defendant likely has information about what actually occurred during disputed events. When faced with a specific plaintiff explanation suggesting liability, it will likely be more persuasive for the defendant to give an alternative version indicating non-liability than to argue: "it wasn't me, *or* it was me but it was an accident, *or* I did it on purpose but someone else caused the damage." Or imagine a murder case in which the prosecutor has provided an evidenced explanation of guilt. Presumably our critics think the defendant can then go into court with a phone book and say "something else could have happened" and that this undermines the relative-plausibility explanation. They are right about the first point but wrong about the second. Perhaps a defendant could do so.[149] What is striking is that defendants do not. As one of us once said, parties are mostly ambiguity discarders, not creators.[150] They do not choose to litigate "the entire probability space" because to do so would almost always court disaster with the fact-finder.

Thus, in comparing competing explanations, we disagree that the most plausible explanation a party can provide will always be the full range of possible disjuncts.[151] Once

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[147] See supra notes 67-77 and accompanying text.

[148] This fits with the general principle that parties are "masters of their cases." See supra note 69.

[149] See, e.g. South Carolina v. Holmes 547 U.S. 319 (2006) suggesting both that criminal defendants do have the right to try to deflect blame onto a third party but at the same time suggesting that the phone book tactic might be prohibited by the trial courts. For a discussion, see Ronald J. Allen, From the Enlightenment to Crawford to Holmes, 39 Seton Hall L. Rev. 1-16 (2009).

[150] Allen, Factual Ambiguity, supra note 1, at 609 ("The legal mechanism for reducing the intractable ambiguity of the human condition is the creative activity of the parties through their determination of precisely what is to be litigated"); id. at 612 ("The parties will determine which stories to advance, and thus what kind of ambiguity both to advance and discard.").

[151] The critics' arguments seem to assume the probabilities are stable regardless of whether parties argue disjunctions or not. If that is so, then of course the disjunction will be preferable. In reality, however, the

again, the explanatory account better fits reality than the probability account. According to the latter, it simply makes no sense to not always argue the full range of disjunctions. The explanatory account, by contrast, is adaptive to the choices made by the parties in how they choose to define and contrast their cases. It is also adaptive to the possibility that fact-finders may consider alternatives not raised by the parties (or choose not to do so); the probability accounts suggest they should always consider all possible explanations for each side.[152]

In sum, our theory accounts for alternative and disjunctive explanations without reducing to the conventional probabilistic account. It also better fits with how such explanations arise and are used at trial.

D. Higher Standards of Proof

A fourth challenge focuses on standards of proof other than the preponderance standard—i.e., "beyond a reasonable doubt" and "clear and convincing evidence." Although our critics acknowledge a natural fit between the preponderance standard and the comparison of explanations,[153] they claim that our theory cannot account for higher (or lower) standards of proof. According to Clermont, "an ordinal comparison" of explanations "cannot easily explain standards of proof higher or lower than preponderance of the evidence" because all other standards "are hard to express as a comparison."[154] Nance goes further in his criticism, contending that our accounts of these standards "do nothing noncircular to give greater clarity of meaning or justification" for the standards.[155] Moreover, he maintains that the explanatory account of BARD "abandons the comparative emphasis entirely" and is "not comparative in any meaningful sense."[156]

These criticisms miss the mark. Before clarifying how our theory accounts for the standards in a non-circular manner, we first note one difficulty that faces all theories attempting to give content to the standards. Namely, the lack of clarity surrounding the standards—they are vague, ambiguous, and often have uncertain applications. Even among those who argue or assume that the standards express probabilistic thresholds, there is considerable variation in how the probabilities should be conceptualized, what the numbers should be, and how the standards should be applied in individual cases.[157] Indeed, to the best of our knowledge, after critiquing the relative plausibility theory's vagueness in this regard, not one of its critics has offered their

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evidence and how parties choose which possibilities to raise will affect the believability of those possibilities.

[152] Moreover, even when the full range of explanations are on the table, the explanatory account still provides a better account of juridical proof.

[153] Clermont, Standards of Decision, supra note 17, at 356-58 (discussing the advantages of relative plausibility over the probabilistic account in explaining the preponderance standard); Nance, supra note 16, at 82, n. 219 (noting relative plausibility has its "greatest appeal" in explaining the preponderance standard).

[154] Clermont, Standards of Decision, supra note 17, at 358.

[155] Nance, supra note 16, at 82, n. 219 (arguing that higher standards of proof require a "ratio").

[156] Id.

[157] See supra note 40. On the lack of clarity and confusions regarding BARD, see Laudan, supra note 49.

precise explanation of what either clear or convincing evidence or beyond reasonable doubt is. Given this lack of clarity surrounding the standards, it would be surprising indeed if a descriptive/ explanatory account of the standards could eliminate all of the uncertainty regarding their meaning or application. Thus, we do not think it is a failure of our theory (or any other, including probabilist theories) that they cannot resolve all uncertainty surrounding the standards.

This particular challenge to our theory regarding higher standards of proof is based on two assumptions, both of which are false: first, that our explanations of the standards are "circular," and second, that higher standards are not and cannot be expressed in "comparative" terms. We address each in turn.

Our theory accounts for standards of proof in terms of explanatory thresholds. With the preponderance standard, the explanatory threshold is straightforwardly comparative: the party with the burden must provide an explanation of the evidence and events that is better than the alternative(s) in light of the evidence and the cognitive capacity of the fact-finder. Higher standards of proof require more of the party with the burden, and, accordingly, under our theory the explanatory thresholds rise to meet the demands of the higher standard. The BARD standard is met when there is a plausible explanation consistent with guilt and no plausible explanation consistent with innocence. Under this conception, much more is required to convict than under the preponderance standard. The defendant may win even if the prosecution's explanation is better than the defendant's—any plausible explanation consistent with innocence (one that has not been disproven or eliminated) is sufficient to raise a reasonable doubt. Similarly, even when there is no defense explanation proffered (or constructed by fact-finders), the standard is not met if the fact-finder concludes the prosecution's explanation is not plausible (regardless of whether it is better than the defendant's, which may be none at all). Raising the explanatory threshold in this manner fits the aim of the standard to shift the risk of error away from criminal defendants.[158]

Similar considerations apply to the notoriously obscure clear-and-convincing-evidence standard.[159] Applicable in some types of civil cases (and to some affirmative defenses in criminal cases), the standard is commonly assumed to provide an intermediate standard between preponderance and BARD. Accordingly, parties with the burden of proof need not eliminate any reasonable doubt, but they must do more than prove that the elements are slightly more likely to be true. This intermediate standard thus reflects an intermediate position regarding accuracy and the risk of error. Exactly where the standard falls in between these requirements, however, is unclear.[160] We did not (and do not) purport to offer a precise, fixed position for what this standard should be, and as noted above, nobody else does, either—rather, we have sought to explain the current existing standard in explanatory terms. Our theory provides an explanatory threshold that falls in-between the explanatory thresholds for the preponderance and BARD standards. On one hand, to meet the standard parties need not have the only plausible explanation (unlike with BARD); on the other hand, parties must do more simply offer the best

[158] See supra note 33.
[159] See supra note 33.
[160] See supra note 77.

of the available explanations. Parties must offer explanations that are not only the better than the alternative, but are more persuasive to whatever extent is necessary to make them "clear and convincing." In practice, this will typically mean that defendants should win whenever the fact-finder decides that the question of which explanation is better is a "close call" (even if the fact-finder thinks the plaintiff's is slightly better).[161]

The explanatory thresholds are not "circular." As we understand this charge, an account is circular if it provides no new content or requirements other than what is already contained in the description of the standard itself. Nothing in the standards themselves mention or refer to explanations or explanatory criteria. In explaining the standards as explanatory thresholds, we are providing additional content that clarifies what the standards require; how they fit with other aspects of the process (including the inferential process and assigning value to the evidence); and how they fit with the policy goals of the rules. Characterizing the standards as explanatory thresholds, in other words, does not simply restate the standards. Of course, the explanatory thresholds do not provide "quantifications" or "ratios" for the standards, but this does not make them circular.[162] In our view, recognizing that the criteria for satisfying standards of proof are *explanatory* and that each standard requires a different explanatory threshold give (non-circular) clarity and understanding to the standards themselves.

Now turning to the second aspect of this challenge, the critics also contend that our accounts cease to be comparative because the BARD and clear-and-convincing standards cannot be expressed in terms of comparisons. We are perplexed by the criticism. Some of the confusion may involve an ambiguity in what is meant by "comparative" in this context. If "comparative" is taken to mean that the standards are satisfied only when an explanation is better than the alternatives—or, alternatively, that parties without the burden have to offer an alternative at least as good as their opponent—then, yes, we agree that they are not "comparative" in this sense. This is the preponderance standard. As we have explained,[163] there is more to the higher standards (and the thresholds they require) than a straightforward

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[161] See supra note 77. To some extent, our explanation of "clear and convincing" is quite similar to the probabilistic explanation. However, it is not the same. Although "clear and convincing" plainly means not just more plausible but noticeably more plausible, how that is determined is not through conventional probability but again through the use of common sense reasoning employing a multitude of cognitive tools. This lacks the formal rigor of mathematics, but to be clear that to us is largely irrelevant. As valuable as mathematics is in many domains, it may be a poor tool in others, as indeed we have shown with regard to juridical proof. In any event, for the mathematically inclined it may be interesting to note that one need not employ conventional probability in order to make mathematical statements about relationships of numbers, which is the essence of giving something like "clear and convincing" a probabilistic definition of X that is a larger number than 0.5. There is a mathematics of ordinal relationships (relative plausibility exploits ordinality, obviously), including that one ordinal number is much bigger than another. For a discussion, see Allen & Jehl, supra note 53, at 941-942 n.177. We don't make much of this ourselves.

[162] Indeed, our account is similar to Nance's own decision-theoretic account, see Part IV infra, in that the thresholds for the standards express underlying views about the utilities of the possible outcomes. The primary difference is that ours employs explanatory criteria rather than explicitly probabilistic judgments.

[163] See Pardo & Allen, supra note 1; Allen & Pardo, supra note 44; supra note 76-77 and accompanying text.

comparison. Higher standards are still "comparative" in a different sense, however. They are comparative in the sense that determining whether the threshold is met will involve considering and comparing the possible alternative explanations on each side. In other words, a fact-finder will not be able to find that the explanatory threshold has been met until she has compared one party's explanation with the alternative. This is the sense in which the higher standards are comparative. True, in criminal cases, things may never get this far if the prosecution doesn't offer a strong enough case. But before BARD is met there must be some comparison with possible defense explanations (the fact-finder must check whether there is any plausible explanation consistent with innocence, in which case there should be an acquittal). Similarly, in cases under the clear-and-convincing standard, one cannot determine whether a plaintiff's explanation is good enough without comparing it to the alternative. Articulating higher standards in terms of explanatory thresholds requires that explanations *must be evaluated in light of the possible alternatives*—in this sense they are comparative, but the explanatory thresholds require more of these standards than simply being better than the alternatives.[164]

To a considerable extent, this criticism is expressing dissatisfaction with a label rather than the underlying reasoning. It is true that we have lumped all of the standards under the label "relative plausibility," which admittedly maps more directly onto the preponderance standard, but we have also made clear how the explanatory account handles the other standards.

E. Explanations and the Conjunction Problem

Schwartz and Sober present a fifth challenge. As discussed in Part I, the fact that standards of proof typically apply to individual elements, and not to cases as a whole, raises conceptual difficulties for the conventional probabilistic account.[165] This so-called "conjunction problem" arises because the law appears to ignore the formal consequences of combining elements and appears to tolerate results that deviate from the goals of the standards of proof.[166] Under our account, however, the conjunction problem is avoided because the standard of proof applies to the case as a whole in evaluating explanations and is distributed to both parties.[167] The elements then come into play in determining whether the selected explanation includes the formal elements.

Not so, object Schwartz and Sober. They contend that, even though we eschew the formal probabilistic framework for standards of proof, our account also faces the same

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[164] See, e.g,, the cases cited in supra note 76. Indeed, one could model the explanatory thresholds that apply to higher standards of proof in terms of differing likelihood ratios, as Sean Sullivan does in a recent article. See Sean P. Sullivan, A Likelihood Story: The Theory of Legal Fact-Finding, 90 U. Colo. L. Rev. (forthcoming), available at: https://ssrn.com/abstract=2837155 . See also Edward K. Cheng, Reconceptualizing the Standard of Proof, 122 Yale L.J. 1254 (2013).

[165] See supra notes 52-58 and accompanying text.

[166] Id.

[167] See supra notes 87-88 and accompanying text. Clermont recognizes this. See Clermont, Standards of Decision, supra note 17, at 358 (noting that relative plausibility "sidesteps many of the difficulties and paradoxes of using a numerical standard like greater than 50 percent.").

conjunction problem.[168] They argue that if plaintiffs must win on "each element," then "the conjunction problem is replicated."[169] Why does this replicate the problem? Because, they assert:

> All that Explanatory theory tells us is that fact finders perform these two tasks—determining the most probable whole claim, and the most probable explanation of each element—without actually conducting a multiplication.[170]

Because, they assume, our theory "requires looking at the elements individually to determine that the plaintiff has the best explanation on each element,"[171] and when jurors "decide the elements serially"[172] it might turn out that the plaintiff has the best explanation on each element but not for the case a whole, which is the same set of circumstances in the original conjunction problem.[173] They conclude this particular critique by suggesting that if instead we apply explanatory criteria to both each element and the whole claim, then our theory will converge with their preferred reading of the proof requirements (a view proposed previously by Nance).[174]

This entire line of criticism is based on a misreading of our theory. The critical, mistaken assumption S&S make is that our theory "requires looking at the elements individually to determine that the plaintiff has the best explanation on each element."[175] They assume this is what it means for an explanation to "include" or "instantiate" the formal elements.[176] According to our account, however, the evaluation of competing explanations, based on the applicable standard of proof, does not occur element-by-element. It occurs at the whole claim level[177]—once the chosen explanation is selected, then the explanation is compared with the formal elements to see whether they are included in, or apply, to the explanation.[178] S&S are correct

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[168] Schwartz & Sober, supra note 15, at 646.
[169] Id.
[170] Id. at 647.
[171] Id. at 646.
[172] Id.
[173] Id.
[174] Id.: ("If the plaintiff still has to win ('include' or 'instantiate') each element, in addition to winning the whole claim, the conjunction problem is replicated, unless providing the best explanation element-by-element is a necessary but not a sufficient condition for a plaintiff victory. In other words, the 'holistic solution' avoids the conjunction problem only to the extent that it replicates the account first articulated by Nance and elaborated by us below.") We discuss the problems with this proposed reading of the proof requirements in Part III.
[175] Id. at 645. See also id. at 645-46 ("Since the best explanation must be conducted both at the whole claim and the element level to determine "inclusion" or "instantiation" of each element . . . The plaintiff must win at both levels.")
[176] Id. at 645 ("What does it mean for the explanation to 'include' or 'instantiate' 'the formal elements'? . . . presumably that requires looking at the elements individually").
[177] See supra notes 87-88 and accompanying text. See also Clermont, Standards of Decision, supra note 17, at 357-58 (recognizing that relative plausibility applies holistically and therefore "sidesteps many of the difficulties and paradoxes" of the probabilistic approach).
[178] For example, in a slip-and-fall case the jury does not compare separate explanations for each of the elements of negligence. Rather, the jury assesses plaintiff's explanation ("e.g., the defendant's employee

that applying the standard of proof to each element will recreate the conjunction problem—this is so not only for the conventional probabilistic account but for other theoretical accounts as well.[179] But this is not our theory.

F. Explanations and the Inferential Process

Finally, and related to the previous challenge, Clermont presents a sixth challenge based on the fact that fact-finders evaluate competing explanations "holistically" rather than evaluating evidence and reasoning element-by-element. He contends that the relationship between our theory and this inferential process poses two potential problems for our theory. First, it appears to be inconsistent with jury instructions that tell jurors to go element-by-element.[180] Second, it means the theory comes with "baggage" because it requires some type of holistic account of evidence processing (such as the story model).[181] We discuss each turn.

First, we have already explained how, under our account, instructions on the elements apply to explanations (they come into play after the selection of explanations).[182] Under this interpretation, there is no inconsistency. More importantly, however, regardless of what the instructions say on this point, it is clear that fact-finders do in fact proceed holistically—this is how information is processed.[183] And again, the instructions on burdens are only one part of what needs explanation. Except for those instructions, the juridical process systematically imposes a comparative process on the parties in both civil and criminal cases. We consider the fit with this process to be an important consideration for any theory of juridical proof—a test our theory meets and the conventional probabilistic one does not. If some aspects of jury instructions appear to be inconsistent with this fact, then, as discussed above, those aspects of the instructions are the anomaly.[184]

Second, we disagree that fit with how evidence is actually processed should be seen as "baggage." At least this is so given our particular theoretical aim, which is to explain the process of juridical proof at it currently operates. Our approach is a "naturalized" one—taking current facts about and limitations on human cognition as inputs.[185] It might turn out that other theories can better explain standards of proof in other possible worlds in which, for example, humans (or other types of decision-makers) reasoned differently, trials were conducted differently, or an

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spilled soap on the floor, no one cleaned it for hours, and plaintiff slipped on the soap and was injured as a result") against whatever alternative explanations the defendant chooses to advance. See Howard v. Wal-Mart, 160 F.3d 358 (7th Cir. 1998). The selected explanation is then compared with the elements.

[179] In Part V, we argue that Clermont's alternative probabilistic account succumbs to the conjunction problem for this reason.

[180] Clermont, Standards of Decision, supra note 17, at 358 ("The law says to proceed element-by-element and apply the standard of proof to each element.")

[181] Id. at 359-60.

[182] See supra notes 87-88 and accompanying text.

[183] See supra note 86.

[184] See supra note 109.

[185] See generally Ronald J. Allen & Brian Leiter, Naturalized Epistemology and the Law of Evidence, 87 Va. L. Rev. 1491 (2001).

infinite number of other things were different. But given our focus, we consider it a virtue and not a vice that our account fits with the leading empirical account of evidence processing.

On this last point, however, we again emphasize the differences between Pennington and Hastie's "story model" and relative plausibility.[186] Clermont suggests that our theory is somehow tied to the story model.[187] It is not. It is always helpful when an explanation is consistent with empirical data, and that is a connection between these two theories. But the story model is a psychological explanation of information processing—it does not contain an explanation of burdens of persuasion.[188] That is a critical addition of relative plausibility. It exposes the extent to which the litigation framework and natural reasoning push parties to articulate and defend explanations of what happened, which then results in a choice among those alternatives (or others constructed by the fact-finder in light of those alternatives). Moreover, "stories" are only one form of explanations pertinent to juridical proof. For whatever reason, the probability debates have focused on tort and criminal cases, in which stories with chronological narrative form are often advanced, but there are many other types of litigation for which there are no stories of this sort, such as anti-trust litigation. Or no-fault divorce. Or much contract litigation. Competing explanations may be advanced in these and other cases but not necessarily in the form of the normal meaning of "stories."

To sum up the discussion thus far: Part I discussed the reasons why our account provides a better explanation than the conventional account. This Part has responded to several possible objections that have been leveled against our account. We found that none in fact undermine its status as the superior explanation of juridical proof. We have not yet considered, however, the alternative views of our critics. It may be that they have even better explanations. We devote the next three sections to examining their positive views.

III. Schwartz & Sober: A Closer Look at the Conjunction Problem

Schwartz and Sober attempt to resuscitate the conventional probabilistic account of proof by trying to save it from the conjunction problem. They do so under the apparent belief that the "conjunction problem" is "the most serious of the [proof] paradoxes, posing the greatest challenge to probability theory"[189] and that by disposing of the problem the virtues of the probabilistic account are preserved.[190] As we discussed above, the problem arises from the fact

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[186] See supra note 86. The more recent Arizona Jury Project provides additional support in its demonstration that jurors proceed more or less exactly as the relative plausibility theory predicts. Diamond et al., supra note 51.

[187] Clermont, Standards of Decision, supra note 17, at 359-60.

[188] See supra note 86.

[189] Schwartz & Sober, supra note 15, at 624.

[190] "This article argues that the conjunction paradox in fact presents a theoretical problem of little if any significance." Id. at 620. The account of proof they rely upon "defines" standards of proof as "thresholds" specifying a "degree of probability." Id. at 654.

that standards of proof apply to individual elements and not to claims as a whole.[191] S&S respond to this state of affairs by attempting to re-interpret jury instructions and underlying legal doctrine in a manner that better fits the probabilistic account. They argue that the law in fact requires proof of the *conjunction* of elements (in addition to each element).[192] Demonstrating why their argument fails will allow us to clarify several critical points concerning any proposed theory of juridical proof and to further demonstrate the superiority of the explanatory account.

Let's return to some basics on the conjunction problem. A theorem of conventional probability theory is that the conjoint probability of two independents events is the product of their separate probabilities,[193] and another is that the conjoint probability of two dependent events is the probability of one multiplied by the probability of the second given that the first has occurred.[194] These theorems are obviously of interest given the elemental structure of legal liability. If a mistake would be made by returning a verdict for a plaintiff when any of the elements are in fact false, then applying burdens of persuasion to elements rather than the case as a whole will generate an inappropriate error distribution. For example, if each of two elements is proven to a 0.6 probability, and if they are independent, then the probability of at least one being false (and thus that a verdict for a defendant is appropriate) is 0.64.[195] This and related problems caught the attention of evidence scholars three decades ago and helped to initiate the scholarship attempting to explain the nature of juridical proof.[196] There is a general consensus that the conjunction problem indicates something is amiss with the conventional probabilistic interpretation of juridical proof, although there is considerable disagreement over what is amiss and how to respond to it.[197] Rather than accepting the fact that the conjunction effect is simply an aspect of the real world,[198] and not a function of any mathematical construct, a few scholars have attempted heroic efforts to preserve a robust probabilistic interpretation of juridical proof by attempting to explain it and related problems away.[199]

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[191] See supra note 53. As we also explained, this problem is ameliorated under the explanatory account because the standards apply to explanations as a whole and not to individual elements. See supra notes 87-88 and accompanying text.

[192] Id. at 620 ("Dropping the condition that proving each element is a sufficient [condition] . . . makes the conjunction problem disappear.")

[193] In other words, the probability of A&B = A x B.

[194] In other words, the probability of A&B = A x B|A.

[195] The probability of the plaintiff's claim being true would be 0.36 (the result of 0.6 x 0.6), and thus the probability of it being false is 0.64 (1 – 0.36).

[196] See Cohen, supra note 55. For an overview of the debates, see Roger C. Park & Michael J. Saks, Evidence Scholarship Reconsidered: Results of the Interdisciplinary Turn, 47 B.C. L. Rev. 949, 984-97 (2006).

[197] See supra note 58.

[198] If the probability of a coin landing "heads" is 0.5, then the probability of it landing "heads" twice in a row is 0.25 (0.5 x. 0.5).

[199] David Kaye has provided by far the most sophisticated defense of subjective bayesianism in the legal context. We disagree with his analysis for reasons that have been discussed in the literature, some of which are referred to here, but we are deep admirers of his work. See, e.g., David Kaye, Two Theories of the Civil Burden of Persuasion, 2 Law, Probability and Risk 9 (2003); David Kaye, Bayes, Burdens and Base Rates, 4 Int. J. of Evidence & Proof (2000); David Kaye, The Error of Equal Error Rates, 1 Law Probability and Risk 3 (2002); David Kaye, Clarifying the Burden of Persuasion: What Bayesian

More modestly, S&S focus on one small slice of the debates: trying the save the probabilistic account from the conjunction problem.[200] But there is an important sense in which their argument does not even get off the ground, and understanding why is critical to an understanding of what is being investigated in this literature. One of the curiosities of the evidence literature is that a number of the discussions defending probabilistic approaches to juridical proof do not appear to firmly grasp, or engage with, the mathematical foundations of probability theory. Of course, people use the term "probability" all the time more or less successfully without getting degrees in mathematics, but problems sometimes arise when the discussion changes from these everyday uses, such as the probability of rain tomorrow, to the mathematical uses, such as the claim that the best explanation of juridical proof is mathematical probability.[201]

S&S seem to assume that one can assign numbers representing the "probability" of events occurring, and that, without more, such statements are meaningful.[202] They are not. The mathematics of probability theory, like all mathematics, is formal, not substantive. Mathematics spins out the formal implications of axioms, definitions, and logical operations.[203] To be applied to real world tasks, it must be interpreted, and, as we discussed above, none of the interpretations of probability statements make much sense in the context of juridical proof.[204] This point has been discussed in the literature, and it is the reason why the mathematically sophisticated proponents of probability theory[205] embrace subjective probability as an explanation of juridical

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Decision Rules Do and Do Not Do, 3 Int. J. Of Evidence & Proof 1 (1999). Other sophisticated defenses of probabilistic approaches include Cheng, supra note 164; Friedman, supra note 58.

[200] They note that the explanatory account may be the better account of standards of proof for other reasons. Schwartz & Sober, supra note 15, at 644 ("Whether the Explanatory account is or is not a better account of the burden of proof than the standard probability model is not a question we purport to answer here.")

[201] A trivial example of the problems that can arise is S&S's repeated reference to the "axioms" of probability theory concerning conjunctions of events. See, e.g., id. at 631, 633-35, 646, 654, 672. There are no such "axioms." There are theorems derived from the axioms of standard probability theory.

[202] Id at 654 (assuming the standards of proof are defined in terms of "degrees of probability"). See also id. ("The jury will be instructed that it must find each element to the degree of probability defining the burden of persuasion in civil cases: more than 50%, or 0.5 on a probability scale of 0 to 1.").

[203] This begins to wade into the deep waters of mathematical realism. See, e.g., Oystein Linnebo, Platonism in the Philosophy of Mathematics, Stanford Encyclopedia Phil. (2018), available at https://plato.stanford.edu/entries/platonism-mathematics/ .

[204] See supra notes 42-50 and accompanying text.

[205] See supra note 199. An extreme example of this is in McCormick, Evidence 568 (6th ed. Student edition), where the authors assert that jury instructions on the "clear and convincing" and preponderance standards "are awkward vehicles for expressing the degree of the jury's belief, *because they divert attention to the evidence*, which is a step removed [from belief], being the instrument by which the jury's mind is influenced [emphasis added]." As the epistemologist Susan Haack succinctly puts it, "this has things exactly backwards." Susan Haack, Legal Probabilism: An Epistemological Dissent, in Evidence Matters: Science, Proof and Truth in the Law 47 (2014). As she demonstrates, the issue at trial is not psychology but epistemology, even if a live human being is the "instrument" through which the epistemological implications of the evidence is determined. As she also points out, standard jury

proof.[206] The difficulty with subjective probability is, as again we discuss above,[207] that it is truly subjective. Both prior probabilities and likelihood ratios are literally just made up by the decision maker. As the creators of this interpretation recognized, the charm of this lies solely in maintaining consistent subjective beliefs and not in advancing accurate appraisals of reality.[208] If S&S are concerned about accurate decision-making rather than a sense of personal satisfaction in maintaining consistent subjective beliefs, then their argument is literally a non-starter.

Perhaps, instead, S&S mean to adopt a relative-frequency account of probability. They point to proof of causation in the *Daubert* litigation as an example of the difficulties of the relative plausibility theory and why, apparently, probabilistic approaches are better.[209] Causation in toxic tort cases is not representative of the manner in which the legal system handles proof problems.[210] These cases tend to reduce to the strength of the evidence that a substance can, in fact, cause a particular outcome. The proof of such cases is invariably of a relative frequency nature because that is how causal relationships in this area are established in epidemiological studies.[211] Moreover, their presentation of the case is strange. S&S seem to think that in such cases, "the defendant does not offer an alternative,"[212] but this is simply wrong. Defendants in

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instructions seem quite clear about this, pointing the fact-finders to the evidence and not to their internal psychological states.

[206] The concern about subjectivism is playing out in the ongoing debates about forensic sciences in which the proponents of various forms of forensic science are now being forced to put their disciplines on sound epistemological (i.e. not subjective) foundations. Bayesian approaches can also operate with objective data, and if you have enough of it there are good reasons to think that decision makers will eventually converge on the truth. See Allen, Rationality, Algorithms and Juridical Proof: A Preliminary Analysis, 1 Int. J. of Evi. & Proof 254, 267 (1997); Alvin I. Goldman, Quasi-Objective Bayesianism and Legal Evidence, 42 Jurimetrics 237 (2002). The problem is in the "if" clause.

[207] See supra note 48.

[208] See supra note 48. The renowned epistemologist Alvin Goldman sums up the situation: "Orthodox Bayesianism is subjective, or personalistic, and subjective Bayesianism does not commend itself as a basis for truth acquisition. It is not at all clear how purely subjective Bayesian methods, applied to the legal context hold any promise of leading a trier of fact to truth. And it is not clear how purely subjective Bayesian criteria could be helpful in showing how certain rules or procedures of evidence should be preferred to others on grounds of promoting truth ascertainment." Goldman, supra note 206, at 239. There seems no way out of this box. There are arguments in the literature that a development in Bayesian analysis, Bayes' nets, may ameliorate some of the problems with the probabilistic account of juridical proof, but as David Shum notes, "These relationships [bayes net] will generally reflect the standpoint of the individual constructing the graph, rather than any . . . objective truth." David Schum, Wigmorean Analysis, in Philip Dawid, William Twining & Mimi Vasilaki, Evidence, Inference and Enquiry 127, 148 (2011).

[209] Schwartz &Sober, supra note 15, at 651-52.

[210] See Steve C. Gold, The "Reshapement" of the False Negative Asymmetry in Toxic Tort Causation, 37 Wm. Mitchell L. Rev. 1507 (2011) (discussing how proving causation in toxic tort cases deviates from the proof assumptions that apply in civil cases generally).

[211] Id. at 1520-33 (discussing examples)

[212] Schwartz & Sober, supra note 15, at 652 ("By saying 'we can't know the cause,' the defense in effect asserts the sum of all possible alternative negating explanations.")

toxic tort cases routinely allege multiple sources of causation at trial,[213] and the fact-finder is essentially asked to decide which is more plausible: that the condition was caused by the agent or something else.[214] As we discussed, relative plausibility allows the parties to argue what they want, including disjoint possibilities, and thus it handles these cases with ease.[215]

But put aside the idiosyncratic example of toxic torts. What would a relative-frequency interpretation mean for the general run of cases?[216] The literature has advanced an answer, but

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[213] See, e.g., Aycock v. R.J. Reynolds Tobacco Co., 769 F.3d 1063 (11th Cir. 2014) (holding it was an error to exclude defense evidence of plaintiff's alcohol use on issue of causation); R.J. Reynolds Tobacco Co. v. Mack, 92 So. 3d 244, 248 (Fla. App. Ct. 2012) (holding it was an error to exclude defendant's expert testimony when defendant "was attempting to diminish [plaintiff's] expert testimony that smoking was the probable cause of the cancer by introducing other possible causes that were pertinent to the decedent's situation.").

[214] See, e.g., Zuchowicz v. U.S., 140 F.3d 381, 390 (2d Cir. 1998) (In concluding the evidence was sufficient to prove that the drug Danocrine caused the plaintiff's primary pulmonary hypertension, the court explained: "While it was not possible to eliminate all other possible causes of pulmonary hypertension, the evidence presented showed that the experts had not only excluded all causes of secondary pulmonary hypertension, but had also ruled out all the previously known drug-related causes of PPH.") S&S also ignore that if a relative frequency account of trials were accurate, many courts place the burden of admissibility way too high. See Gold, supra note 210 (discussing examples). The relationship between confidence intervals and errors is complicated to say the least, but there is no reason to think that admitting evidence only if it has a P value of < 0.10 or 0.05 or whatever is going to allocate errors in an appropriate way. See D.H. Kaye, Apples and Oranges: Confidence Coefficients and the Burden of Persuasion, 73 Cornell L. Rev. 54 (1987); Neil B. Cohen, Confidence in Probability: Burdens of Persuasion in a World of Imperfect Knowledge, 60 NYU L. Rev. 385 (1985); Michelle Burtis, Jonah Gelbach & Bruce Kobayashi, Error Costs, Legal Standards of Proof, and Statistical Significance, Supreme Court Economic Review (forthcoming 2018).

[215] See supra notes 132-52 and accompanying text. S&S's discussion of *Daubert*, supra note 15, at 51-52, demonstrates the problematic quality of their evidence. On remand, the Ninth Circuit concluded that the expert testimony should be excluded. Undaunted, S&S say "if the plaintiff's expert testimony had been admitted and the case gone to trial, the jury would have been entitled to disbelieve the plaintiff's experts based on the testimony of the defense experts, and found for the defendant. This scenario represents a not-uncommon pattern in disputed-cause cases, in which the defendant asserts 'we simply don't know how the plaintiff was harmed.'" Id. Their evidence, in other words, is a counterfactual reconstruction of a case, followed by the assertion that the reconstruction is typical, but no citations are attached to the assertion of typicality. In any event, we agree that it is possible in a case for a fact-finder to conclude that something other than what the plaintiff asserts happened, regardless whether the defendant pinpoints a specific explanation.

[216] In an otherwise clarifying recent article on the conjunction effect, Mark Spottswood neglects this issue as well. He attempts to reconcile the explanatory and probabilistic accounts but never inquires what a probability statement might mean in the context of juridical proof. Mark Spottswood, Unraveling the Conjunction Paradox, Law, 15 Probability & Risk 259 (2016). For example, he asserts: "The law often requires that jurors combine multiple uncertain judgments before they can issue a verdict. Because such judgments are usually at least partially independent, normative rationality would suggest that jurors should discount the likelihood of their conjunction to account for this partial independence." Id. at 269. As we have demonstrated, fact-finders determine what happened and then apply the law to the found facts. When a fact-finder determines the most plausible account of what happened, they will already have

again it demonstrates that implausibility of the relative-frequency account: a plaintiff would have to show that half plus one of the ways the world might have been the day in question favor the defendant's liability. This is a tough standard, precisely because typically no one has any idea what all those possibilities might be and even less of an idea as to how to obtain evidence about them.[217] For this reason, the complementation axiom[218]—i.e., that the probability of the plaintiff's case and its negation will add up to 1—is as much, and probably more, of a problem for a probabilistic account of evidence than the conjunction theorems.[219] The probability space of conventional probability is filled with events the probability of which collectively sum to one. Knowledge of that sort simply is not part of the human condition.[220]

These conceptual issues, and their failure to address them, is why we said at the start that S&S's argument does not get off the ground. Even if we put these abstract issues to the side, however, their argument has other serious problems.[221] Most importantly, their interpretation of

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"discounted" in any appropriate way. The alternative explanations will each be comprised of parts, and thus they both will, and should, be "discounted" in the way we take Prof. Spottswood to be suggesting. That is simply the nature of the real world. If the defendant's explanation is accepted as true, and if any of the formal elements of a cause of action are not instantiated by it, then the defendant wins, whereas the plaintiff's explanation must instantiate all the formal elements.

[217] This problem was first introduced in Allen, Nature, supra note 1. See also Allen, Factual Ambiguity, supra note 1; and Pardo, supra note 77.

[218] See supra notes 59. And it is an axiom not a theorem.

[219] See Alex Stein, The Flawed Probabilistic Foundation of Law and Economics, 105 Nw. L. Rev. 199, 207-2012 (2011)

[220] S&S neglect the implications of the complementation axiom. Generally speaking, the legal system ignores the ambiguity that the parties do not choose to litigate. As we mention above, parties are more so ambiguity discarders than creators. See Allen, Factual Ambiguity, supra note 1, at 609: "The legal mechanism for reducing the intractable ambiguity of the human condition is the creative activity of the parties through their determination of precisely what is to be litigated"; id. at 612, "The parties will determine which stories to advance, and thus what kind of ambiguity both to advance and discard."

[221] We focus the remainder of our discussion on the incompatibility between their interpretation and the law. Their argument contains several other curious aspects and omissions that we will merely note. One is their neglect of the implications of the complementation axiom. See supra note 59. There are at least five others. First, they insist that the conjunction problem needs to be "solved," but the conjunction effect is a feature of the world and not something to be solved. Second, for reasons that are not clear, they seem to think that reiterating the well-known fact that many legal elements are conditionally dependent rather than conditionally independent somehow eliminates the problem. It doesn't. It may reduce the effect, but the problem remains. This was pointed out long ago (contrary to the astonishing claim by S&S that legal scholars have overlooked probabilistic dependence). See Ronald J. Allen, A Reconceptualization of Civil Trials, 66 B.U.L. Rev. 401, 405 n.18 (1986) ("For the purposes of this article I will generally assume that factual issues are independent, *even though that is hardly ever the case*. I make this assumption simply for purposes of simplification. In the event of dependence, the phenomena that I describe will still generally occur, but to a lesser degree." (emphasis added)). See also Allen, Nature, supra note 1, at 607-608, for an extensive examination of the problem; Allen & Jehl, supra note 53, at 893-944. Third, they claim the conjunction effect is practically insignificant because of dependence, one the one hand, but on the other hand, they claim that trials should require findings of the probability of the conjunction of the elements in addition to findings on the separate elements. One is inclined to ask: which is it? Fourth, they ignore the implications of dependence. Another anomaly arises as dependence

the law is inconsistent with legal doctrine and the process of proof. Demonstrating this incompatibility between their interpretation and the law will highlight in more detail the explanatory value of relative plausibility.

Their central claim, and the premise on which their "solution" to the conjunction rests, is that proof at trial requires proving the *conjunction* of the elements (in addition to each individual element).[222] If that were so, one would expect jury instructions to say so. Virtually all jury instructions, however, tell jurors to apply standards of proof to each individual element—which creates the conjunction effect—and none tell them to find the probability of a conjunction.[223] Schwartz & Sober respond to this reality by arguing that when instructions tell jurors that "each" or "every" element must be proven to the standard this specifies only a *necessary* condition (and not a *sufficient* condition) for satisfying the burden of proof.[224] Failing to prove any individual element will mean the plaintiff has failed to meet the burden of proof, but proving each element is not yet sufficient. This opens up a space to also consider the conjunction of the elements—in addition to proving each element to the standard (e.g., beyond 0.5), the plaintiff also must prove that the conjunction, too, is beyond the standard.[225] Thus, according to this interpretation, there will be cases where the party with the burden of proof has proven all the elements individually

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increases: jurors are never instructed that elements may be duplicates of each other. See Pardo & Allen, supra note 1, at 255 n.103. Moreover, proliferating elements has the effect of increasing the average probability to which each element has to be found. As a consequence, intent to deprive for theft must be proven on average to a higher probability than intent to murder. See Allen & Leiter, supra note 185. This is equivalent to saying that it is permissible to return a verdict with a lower probability of proof of culpability, and thus a higher risk of error, on a more serious crime (for which the death penalty may be imposed) than would be true for a less serious crime. This is strange in a system dedicated to skewing errors in a decision-theoretic way precisely because of the jeopardy the accused faces. See supra note 33. Fifth, and finally, they ignore the surrounding procedural context that encourages the parties to present competing explanations, see supra note 109, as well as the extensive caselaw recognizing that it is virtually senseless to ask what happened without knowing what the alternatives might be, see supra notes 71, 74, 76.

[222] Schwartz & Sober, supra note 15, at 668 ("proving each element to the probability threshold is a necessary but not sufficient condition for finding guilt or liability."). Id. at 669 ("At the end of the day, a claimant is required to prove a conjunction").

[223] Allen & Jehl, supra note 53, at 893-944.

[224] S&S, supra note 15, at 668. S&S rely on a similar argument made previously by Dale Nance. Id. at 626-27 (citing Dale A. Nance, A Comment on the Supposed Paradoxes of a Mathematical Interpretation of the Logic of Trials, 66 B.U. L. Rev. 947, 950 (1986)). They argue that many instructions that require proof of "each" or "every" element are "consistent" with their interpretation (i.e., this is necessary but not sufficient) in that the instructions do not unambiguously rule out their interpretation. Id. at 682 ("Most [jurisdictions] follow a pattern of jury instructions that is consistent with our . . . interpretation. That is to say, they include an express or implicit 'whole claim'j condition, use language suggesting that the 'each element' condition is necessary to find for the claimant, and omit language suggesting that the 'each element' condition *requires* a finding for the claimant."). Although they do acknowledge that some instructions do clearly rule their interpretation out. Id. at 685-86.

[225] They refer to cases in which the plaintiff has proven each element but not whole claims as falling into a "probability gap." Id. at 685-86.

but not their conjunction and thus will lose.[226] S&S thus conclude that any perceived "conjunction problem" is based on a simple logical mistake: misreading jury instructions by confusing necessary and sufficient conditions.[227] With this misreading cleared up, they contend, the fit between the probabilistic account and the law is re-established.

This interpretation of the burden of proof is quite implausible in significant part because it is utterly lacking any support in the law. We obviously cannot prove the negative—i.e., that their position is nowhere reflected in the law—without surveying every case and every jury instruction. Instead, we will demonstrate the analytical weakness of their position, point out the overwhelming amount of evidence in support of our position that stands completely uncontradicted, and then indicate how we can be shown to be in error if they really wish to try to do so.

The starting point for S&S's argument is the fact that jury instructions inform juries to apply instructions element by element.[228] This is often followed by an instruction that if any element is not found by the appropriate burden of persuasion, a verdict for the defendant is in order.[229] It is difficult how else to understand such instructions except as instructions to find each element by the requisite burden of persuasion. Not so fast, argue S&S. They point out (as did Nance before them) that it is *logically consistent* to say that a verdict should be given for a defendant if at least one element is not proven and that a verdict should be given for a plaintiff only if the conjunction of the elements meets the burden of persuasion.[230] This is logically correct and practically insignificant. The key issue is semantic, not logical.[231] Although it is an empirical question, virtually anyone hearing such instructions would interpret them to mean that if you do find each element to meet the applicable burden of persuasion, judgment should be for the plaintiff. Telling a lay person to find for the defendant if any element is not proven by a preponderance rather plainly conveys that she should find for the plaintiff if the list of elements she was just told to find by a preponderance is, in fact, found.[232] And if that is false, why in the world would the instructions about defense verdicts deliberately be inaccurate, by failing to say, "even if you find each element by a preponderance, you may still return a verdict for the defendant if the case as a whole does not meet the burden of persuasion"?

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[226] Id. at 626 ("There will necessarily be some claims that fall into a gap between these two conditions: that is, they will meet the 'each element' condition but not the 'whole claim' condition."). They provide no examples of any actual cases that fit this pattern.

[227] Id. at 668.

[228] Id. at 624 ("The jury will be instructed that it must find each element to the degree of probability defining the burden of persuasion.").

[229] See Allen & Jehl, supra note 53, at 900.

[230] Id. at 672-74; Id. at 674 ("The majority of jurisdictions . . . are consistent with our . . . approach"); Nance, supra note 224, at 950.

[231] As Allen & Jehl, supra note 53, at 900, pointed out.

[232] Nance has suggested that the use of the term "and" in a list of elements that each must be proven is also consistent with a separate conjunction requirement, see Nance, supra note 16, at 76-77 (citing a Mississippi instruction for medical malpractice), but he points to no cases or instructions requiring such a finding.

Moreover, and this is the analytical point, relying on the logical consistency of the present instructions with some additional proposition in order to provide justificatory support for that proposition, is a quite curious form of reasoning. Consistency of propositions alone carries virtually no justificatory force.[233] That burdens of proof instructions focus on elements is consistent with the proposition that the moon is made of green cheese. It is also consistent with the directly inconsistent proposition that the moon is an illusion created by the Russians. Under the form of reasoning promoted by S&S, the form of the present jury instructions provide support for all three of these propositions, a strange form of reasoning indeed.

In short, much of this is just rhetoric.[234] The path out of the rhetoric is to look at the evidence for their interpretation, including what one would expect to see if their conclusion were true. If the legal system wants fact-finders to determine conjunctions, one would think there would be instructions saying so. We looked and couldn't find any.[235] Maybe, suggest S&S, this is because the system just assumes that regular people will think in holistic terms (we agree on that point).[236] So, does this leave an impasse? Not quite. The next step is to see how courts actually apply standards of proof in real cases, rather than just relying on pattern jury instructions. S&S rely on arguments by Nance, who suggests that a Mississippi instruction shows a conjunctive approach.[237] S&S also assert that the U.S. Court of Appeals for the Fifth Circuit requires proof of conjunctions.[238] We looked and could not find a single case instructing fact-finders to find a conjunction, and we found numerous cases in the Fifth Circuit and Mississippi courts instructing jurors to apply burdens element-by-element and articulating that finding each element to meet the requisite burden of persuasion is not just necessary but also sufficient. For example, in *Brady v. Fort Bend County*, the jury was instructed that the plaintiffs had to establish each element of their claims by a preponderance of the evidence and then instructed: "If you find that the plaintiffs have established each element of their claims, you must then decide whether the defendant has shown by a preponderance of the evidence that R. George

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[233] Allen and Jehl pointed out long ago, supra note 53, at 900, "Consistency is not helpful in understanding the meaning of [the instructions]; requiring proof of each element is consistent with an infinite number of propositions that are themselves inconsistent with each other." S&S spin a fantastical theory to maintain consistency with the instructions, yet they never comment on the absence of what one would expect to see if their interpretation were true.

[234] There is another example of implausible rhetoric. S&S provide examples of general instructions that can be interpreted as suggesting holistic approaches to evidence but also point out that the instructions on specific causes of action from the same jurisdiction direct findings on individual elements. Schwartz & Sober, supra note 15, at 683 n. 222 ("For example, the Fifth Circuit instructs the jury to decide guilt holistically in its general instruction, and to find 'each' element in its instructions on specific charges. Fifth Circuit Pattern Jury Instructions (Criminal Cases) 1.05, 2.19 (2015) (Presumption of Innocence, Counterfeiting)"). Their response is to say that the general should control the specific. Id. at 682-84. This is completely ad hoc, empirically implausible, and for what it is worth inconsistent with universally accepted canons of construction. RadLAX Gateway Hotel, LLC v. Amalgamated Bank, 566 U.S. 639 (2012) ("[I]t is a commonplace of statutory construction that the specific governs the general." (citations omitted)).

[235] As did Allen & Jehl, supra note 53.

[236] Schwartz & Sober, supra note 15, at 684.

[237] See supra note 232.

[238] Schwartz & Sober, supra note 15, at 683 n. 222.

Molina would have elected not to hire the plaintiffs for other reasons."[239] If S&S are correct, then this case (and countless others) misstate the law. The instruction should be: "If you find that the plaintiffs have established each of the elements of their claims, *you must then consider whether the plaintiffs have established their entire cases by a preponderance of the evidence*, and if so, then you must consider whether the defendant has shown by a preponderance of the evidence that R. George Molina would have elected not to hire the plaintiffs for other reasons." Similarly, in *Palmer v Biloxi Regional Medical Center, Inc*., the Supreme Court of Mississippi concluded that "when a lack of informed consent is claimed, the plaintiff has the burden to prove by a preponderance each element of the prima facie case: duty, breach of duty, proximate causation, and injury."[240] No mention of a conjunction. Even in criminal cases, where the conjunction argument might receive some support because of the restrictions on directing verdicts, appellate review of the sufficiency of the evidence is done element by element. The issue for the Supreme Court of Mississippi in *Bust v. State*, for example, was whether the jury could have found each element beyond a reasonable doubt, and there is no mention of the conjunction.[241]

Although we are not going to go through all of the circuits and states to find these commonalities, we invite the critics to come up with evidence other than strained logical or semantic arguments. This is not an argument over who in this debate has the burden of proof. We have adduced substantial evidence that the standard meaning of the burden of persuasion is to apply the standard element by element, and we have demonstrated the error of every contrary argument. There is plenty of evidence on one side of this equation, and none on the other. Nor, we predict, will there be. The examples we have discussed are part of a larger general pattern reflected throughout the law. For example, in civil cases, when district courts evaluate and appellate courts review the sufficiency of evidence for issues such as summary judgment and judgment as a matter of law, the standard is applied for each element, not the conjunction.[242] Courts assess whether the evidence for each element is sufficient for a reasonable jury to find that element by a preponderance, although as noted above they do so in light of the alternative explanations provides by the parties.[243] Courts do not then go on to assess whether the evidence

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[239] 145 F.3d 691 (5th Cir. 1998). See also Ariza v. Loomis Armored US, 676 224, 227 n. 4, 228 n.6 (5th Cir. 2017); Davis v. World Maine, LLC, 647 Fed.Appx. 461, 465 n.5 (5th Cir. 2016); Spierer v. Evans, Inc., 46 F.3d 66 (5th Cir. 1995) ("Following a four day trial, the district court included the following in its jury instructions: the plaintiff must prove each of the following by a preponderance of the evidence . . ."); In re Corrugated Container Antitrust Litigation 756 F.2d 411 (5th Cir. 1985).

[240] 564 So.2d 1346, 1362 (1990). See also Miles v. Burcham, 127 So.3d 213 (Miss. 2013).

[241] Bush v. State 895 So.2d 836 (2005).

[242] See Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 255 (1986) (explaining that both summary judgment and judgment as a matter of law depend on the standard of proof applicable at trial). See, e.g, Georgia Pacific v. Von Drehle Corp., 618 F.3d 441, 455 (4th Cir. 2010); Cockrel v. Shelby County School Dist., 270 F.3d 1036, 1048-56 (6th Cir. 2001); Pioneer v. Alerus Financial, NA, 858 F.3d 1324, 1337 (10th Cir. 2017).

[243] See, e.g., Georgia Pacific, 618 F.3d at 455 ("Because G–P has proffered sufficient evidence, viewed in the light most favorable to G–P, for a reasonable jury to find, by a preponderance of the evidence, in favor of G–P with respect to each element of G–P's contributory trademark infringement and unfair competition

is sufficient for the conjunction.[244] The same pattern exists in criminal cases when courts evaluate whether evidence is sufficient to support a conviction.[245] Courts evaluate whether there is sufficient evidence for a reasonable jury to find each element beyond a reasonable doubt, not each element plus the conjunction.[246] Moreover, case after case discussing the constitutional requirements of *Winship* focused on which elements must individually be proven beyond a reasonable doubt, not which elements in conjunction must also be so be proven.[247]

If S&S are correct, not only are all of these cases misstating the law, so too is every single case involving special verdicts. In such cases the jury is instructed to check off various elements, and to return a verdict for the plaintiff only if all the elements and none of the defenses are checked off.[248] We have again looked and not found a single case where the special verdict then goes on to instruct, "After you have found each of the plaintiff's elements by a preponderance, you must then find if the case as a whole satisfies the burden of persuasion." This would amount to the burden-of-persuasion rule being one thing in a run-of-the-mill case with a general verdict, but quite a different thing just because special verdicts are used. To our knowledge, no one thinks that is the case.[249]

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claims under the Lanham Act and its unfair competition claim under North Carolina common law, we vacate the district court's grant of summary judgment").

[244] Not only have we found no cases of courts taking this approach, but we have likewise found no cases where parties have argued along the lines of "each element has been proven but the conjunction has not."

[245] Jackson v. Virginia, 443 U.S. 307, 314-18 (1979); Fed. R. Crim. P. 29.

[246] United States v. Delgado, 672 F.3d 320, 331 (5th Cir. 2012) ("due process requires the government present evidence sufficient to prove each element of a criminal offense beyond a reasonable doubt"); Fuller v. Anderson, 662 F.2d 420, 423 (6th Cir. 1981) ("we must examine the sufficiency of the evidence here in support of each element of the petitioner's offense.").

[247] See Clark v. Arizona, 548 U.S. 735 (2006); Martin v. Ohio, 480 U.S. 228 (1987); Patterson v. New York, 432 U.S. 197 (1977); Mullaney v. Wilbur, 421 U.S. 684 (1975). Similarly, in the sentencing context, the Court's focus was on whether a particular sentencing factor counted as an "element" and thus had to itself be proven beyond a reasonable doubt. There was no discussion that the element also had to be added to the conjunction of other elements. United States v. Booker, 543 U.S. 220 (2005); Apprendi v. New Jersey, 530 U.S. 466 (2000).

[248] S&S acknowledge that cases involving special verdicts are inconsistent with their interpretation, but they attempt to downplay the importance of this point by arguing that special verdicts are not commonly used. Schwartz & Sober, supra note 15, at 686-87. What they do not appear to appreciate, however, is the implication of such cases for all other cases: the burden of proof remains the same regardless of which type of verdict form is used. See infra note 249.

[249] See generally Fritz v. Wright, 589 Pa. 219, 235 (2006) (explaining that the proof issues are the same regardless of the form of the verdict). Whether to proceed with a general or special verdict is left to the discretion of the trial judge. Fed. R. Civ. P. 49. Wright and Miller report that district courts are given so much deference on this issue that "there appears never to have been a reversal on this ground." Federal Practice and Procedure § 2502 (3d ed., 2017 Update). If S&S are correct, then this would mean that trial courts have virtually unlimited discretion to change the applicable burden and standard of proof in every case. But see Santosky v. Kramer, 455 U.S. 745, 757 (1982) ("this Court never has approved case-by-case determination of the proper *standard of proof* for a given proceeding."). There are other absurdities: it would also mean that plaintiffs should always ask for special verdicts, because their burden of proof would be much lower than in the run-of-the-mill case (where they must not only prove the elements but

Case after case has similar patterns, and nowhere is there a mention of conjunctions, in either civil or criminal cases. The claim that the American legal system asks fact-finders to find conjunctions of elements is simply false. The most natural understanding of the instructions is to the contrary, cases routinely instruct explicitly to the contrary, and appellate courts routinely apply the standards of proof to the contrary. If there is any remaining disagreement about this, those who believe we are mistaken should provide some evidence beyond the irrelevancy that there are strained alternative ways to read the language of jury instructions.

At the end of the day, even if S&S were correct that jurors are asked to find conjunctions, the question would remain as to what that means. And as we have demonstrated, it means comparing the various alternative explanations on offer, and for the plaintiff or government to win, the selected explanation must instantiate the elements. That is all there is to it. S&S complain that this does not "solve" the conjunction problem. In a sense they are right because, being a feature of the world, there is no problem to solve. The legal system, as explained by relative plausibility, ameliorates the conjunction issue by distributing its effects over both parties' cases.[250] The point of our theory is not to "solve" the conjunction problem, nor is it to map perfectly onto every single case in the massive American legal system; rather, the point is to advance understanding of that complex system.[251] In our opinion, relative plausibility does so better than any other available explanation—how it handles the conjunction effect is just one reason why.

IV. Nance: Decision Theory, Epistemic Probabilities, and Weight

We turn now to a second example: Prof. Nance's probabilistic theory of proof.[252] His book is a marvelous example of quite erudite scholarship that contains numerous interesting, insightful, and helpful analyses of various questions pertaining to the field of evidence, but we are interested here only in his theory of proof. Nance has assembled an intricate and complex

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the conjunction as well). The reality, of course, is the complete opposite—special verdicts are typically favored by defendants not plaintiffs.

[250] Allen, supra note 221, at 427 ("the conjunction effect will be contained with *both* parties' evidentiary proffers"); Pardo, supra note 85, at 1832-24. Another ameliorating feature of the actual operation of the legal system is that the alternatives presented by parties and the evidence advanced to prove those alternatives tend to be massively overlapping. See Pardo, supra note 77, at 576-89; Allen & Jehl, supra note 53. As the number of disputed facts goes down, the scope for weird probabilistic consequences goes down as well.

[251] S&S's assertion that the conjunction problem is the biggest hurdle for probabilistic account of juridical proof, see Schwartz & Sober, supra note 15, at 624, confuses the etiology of this research program with its evolution. It is true that various proof paradoxes, including the conjunction problem, played important roles in revealing limitations of algorithmic approaches to evidence. But in our view the central issue today is explaining the nature of juridical proof, of which standards of proof are just one aspect.

[252] In Part II we addressed Nance's critique of our views. In Part III we critiqued his position on the conjunction problem, which is the same one proposed by Schwartz and Sober. In this Part we focus of the details of his positive account of proof.

theoretical account that builds on the conventional probabilistic account but deviates from it in several respects.[253] His account differs from the conventional account (discussed in Part I) in three primary ways: (1) probabilistic thresholds for the standards that vary from case to case; (2) an account of evidence in terms of "epistemic" probabilities; and (3) a "weight" requirement for evidence.[254]

In making these adjustments to the conventional account, Nance describes his methodology as "neither wholly descriptive nor wholly prescriptive."[255] He explains, instead, that his theory is "interpretive" in that it seeks to explain "how the proof standards ought to be understood."[256] Such a theory "need not match in all particulars the law's current workings"[257]—rather, it aims to "illuminate how the law works and how it can work better while remaining faithful to the basic assumptions and commitments that are implicit in the law."[258] In discussing the theory, we think it is important to separate the descriptive and the normative aspects. As we will explain below, Nance's theory fails to provide a better empirical description than our explanatory account. Nance may agree with this; as we noted, he is not claiming to be providing a better explanatory account but instead is engaging in a somewhat ambiguous (to us) "interpretive effort." Nonetheless, for the avoidance of doubt we will show that his claims are descriptively false. Moreover, we also demonstrate the incompatibility of the normative aspects of the theory with the "basic assumptions and commitments" underlying the burdens and standards of proof, which he accepts.[259] We turn now to the details of Nance's theory, focusing on each of the three ways in which it diverges from the conventional probabilistic account.

The first element in Nance's theory concerns the probabilistic threshold required by the proof standards. Under the conventional account, the thresholds are assumed to be some fixed point on the probability spectrum, with 0.5 for the preponderance standard and that number increasing for higher standards.[260] Nance refers to this requirement as "discriminatory power,"[261] and he rejects the conventional assumption that each standard has a fixed position. The argument starts with the generally accepted aims of the rules regarding accuracy and allocating the risk of fact-finding errors among the parties. As has been discussed for decades in the evidence literature, decision theory provides a helpful way to formalize and think about these underlying goals.[262] Specifically, it provides a framework for combining the costs associated

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[253] Nance, supra note 16.
[254] Id. at 31-42, 42-57, 184-250.
[255] Id. at 11.
[256] Id.
[257] Id. The "particulars" include the "psychological processes" of decision-makers and the "intricacies" of every legal rule.
[258] Id.
[259] These include systemic goals regarding accuracy and allocating the risk of error, among others. See supra notes 27-33 and accompanying text.
[260] See supra note 38.
[261] Id. at 8. ("discriminatory power" refers to how much the evidence "discriminates between the two sides in a dispute."); id. at 7 (discriminatory power refers to "which of the contending hypotheses is more favored by the evidence and by what margin and to what degree.")
[262] See supra note 35.

with the types of possible errors (false positives and false negatives) and the benefits associated with the types of correct outcomes (true positives and true negatives).[263] If one knows the values for each of these possibilities, then one can calculate the threshold that will "maximize expected utility."[264] The usual theoretical approach in the evidence literature has been to apply this framework to each standard as a general category.[265] Nance, however, takes this decision-theoretic approach to its logical conclusion. Each case is different and so will have its own values associated with each of the possible outcomes. Thus, he concludes that the threshold ought to vary from case to case. Although the standards aim to reflect general considerations of political morality,[266] Nance maintains that legal fact-finders may need to make "marginal" or "retail" adjustments to the threshold in order to "tailor" the requirements for each case.[267]

As a descriptive theory of standards of proof, this explanation fails to fit several important components of how the standards operate. Fist, as Nance concedes, this is not how actual fact-finders appear to decide cases or draw inferences from evidence.[268] On this point, we appear to have a fundamental methodological disagreement with his "interpretive" approach. We think that some fit with these inferential practices is crucial for explaining standards of proof (but again, perhaps his "interpretive" methodology liberates his analysis from these constraints, in which case he and we are simply pursuing different objectives). Indeed, Nance acknowledges the important roles played by explanations and explanatory inferences in the fact-finding process.[269] Rather than connect these roles to the standards of proof, however, he posits probabilistic thresholds that shift from case to case based on other criteria.[270] Second, the criteria for setting the probabilistic threshold at the "retail" level are not generally reflected in jury instructions: fact-finders are not, for example, told to "adjust" the standards by considering for themselves the utilities associated with different possible outcomes.[271] One would think that if this is what the law were trying to achieve from case to case, jurors would be told to do so *and* instructed in how to do so.[272] Third, parties typically do not, and generally are not allowed to,

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[263] See supra note 35-39.

[264] See supra note 35.

[265] See supra notes 37. The Supreme Court has likewise explained that standards apply to general categories of cases. Santosky v. Kramer, 455 U.S. 745, 755 (1982).

[266] Nance, supra note 16, at 31-41.

[267] Id. at 41.

[268] Id. at 83

[269] Id.

[270] Id. at 41.

[271] Nance suggests that the standards themselves may convey to jurors to engage in such adjustments, for example, in determining whether a doubt is "reasonable" in criminal cases. Id at 42-43 n. 88. For a rejection of this interpretation, see Federico Picinali, Two Meanings of 'Reasonableness': Dispelling the 'Floating' Reasonable Doubt, 76 Modern L. Rev. 845 (2013).

[272] Nance appears to recognizes this, and nevertheless argues, alternatively, that most instructions do not rule out such adjustments by fact-finders: they allow for some "wiggle room." Nance, supra note 16, at 42-43. In our opinion, the fact that some jurors can get away making such adjustments is weak evidence for a general description of what the standard requires. Consistency is not enough. See supra notes 230-33 and accompanying text.

present evidence on the utilities associated with such outcomes.[273] Fourth, judicial opinions discussing the standards do not make such retail adjustments, or consider possible adjustments by reasonable jurors, when considering sufficiency of evidence. Courts consider whether a reasonable jury could conclude that the evidence meets the fixed standard; they do not also consider where on the probability scale a reasonable jury could fix the threshold for the standard.[274] Fifth, in holding that due process requires that the "clear and convincing evidence" standard applies in proceedings to terminate parental rights, the U.S. Supreme Court has explicitly cautioned against the type of variability the theory proposes:

> this Court never has approved case-by-case determination of the proper *standard of proof* for a given proceeding. Standards of proof, like other "procedural due process rules[,] are shaped by the risk of error inherent in the truth-finding process as applied to the *generality of cases*, not the rare exceptions." Since the litigants and the factfinder must know at the outset of a given proceeding how the risk of error will be allocated, the standard of proof necessarily must be calibrated in advance.[275]

Collectively, these features indicate that Nance's theory is a poor descriptive account of current standards of proof. We agree that the decision-theoretic considerations provide a useful way of formalizing the legal system's goals regarding accuracy and the risk of error.[276] In practice, the best descriptive account of how the law attempts to achieve these results is by considering different possible explanations (in light of different explanatory thresholds), not by asking jurors and judges (whether implicitly or explicitly) to make idiosyncratic judgments about what the optimal probabilistic threshold should be.

The theory, however, also has normative ambitions, although the scope of those ambitions is ambiguous.[277] On the one hand, Nance recognizes the theoretical and practical impediments to an unconstrained, case-by-case expected utility approach,[278] while on the other he appears to approve case-by-case adjustments by fact-finders.[279] His skepticism wins the day. It is true that if the goal is to maximize expected utility—and the case-by-case utilities for each possible outcome were known—then the theory's fine-grained nature would be an improvement over the conventional probabilistic account.[280] After all, as a formal matter, optimal results in every case would be preferable to categorical thresholds that do not maximize utility for some of the cases to which they apply. But in the world in which we live, imposing variable standards of proof onto the conventional account would introduce an intractable amount of complexity and

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[273] For example, jurors are not typically given information about likely sentences, nor are civil juries typically instructed about the role of insurance.

[274] See supra notes 242-46.

[275] Santosky, 455 U.S. at 757 (quoting Mathews v. Eldridge, 424 U.S. 319, 344 (1976)).

[276] See supra notes 70.

[277] Nance, supra note 16, at 11-12 ("My theory is an attempt to discern in what respects a 'rational actor' hypothesis can shed light on prevailing practices and to suggest how they can be improved.")

[278] Id. at 21-31.

[279] Id. at 41-42.

[280] Like other general rules, the categories posited by the conventional account will be under- and over-inclusive with regard to the utilities.

information costs into the proof process. Every possible case must be imagined *a priori* and a rule provided for, or the parties (or the court, given Nance's court-centric view of evidence law) would have to establish the proper utility function for the particular case.[281] Of course, that, in turn, would depend on what the facts actually are, a contested matter, we would think, in most litigated cases. So, presumably, the probability of the relevant facts would be found and then another litigation round would occur in which the parties contest the utilities associated with the probability of the relevant facts being true. Frankly, we have literally no idea what such disputations might look like.

Alternatively, one could take the subjective approach and just instruct fact-finders to consider the relevant utilities, as Nance suggests some instructions do.[282] What basis would they have to do so? How do random laymen, or highly educated professionals for that matter, have any idea how to adjust individual cases in light of someone else's (the legislature's, the courts' . . .) expected utility preferences? What evidence could the parties adduce to resolve such questions in a rational way? One could embrace subjectivity and tell fact-finders to make adjustments as they see fit, but plainly this would invite idiosyncratic standards based on uninformed beliefs.[283] How this would advance anyone's expected utility, except the self-satisfaction of individual decision-makers, is a complete mystery.

In addition to problems associated with calculating the standards, the theory also inherits all of the other problems that beleaguer the conventional account.[284] First, as with the conventional account, for Nance's theory to achieve its decision-theoretic results, the standard must be applied to the case as a whole, not the elements. Thus, the conjunction problem again arises. When the thresholds are applied to the elements, the theory produces sub-optimal results regarding accuracy and the risk of error. This is why Nance tries to read such an elements-plus-their-conjunction requirement into the law.[285] Second, as with the conventional account, standards of proof under his theory are non-comparative; once the threshold is fixed for each standard, they assume that each element and its negation sum to 1.[286] For similar reasons, it therefore is unlikely to foster the law's underlying aims. A final problem for the conventional account concerns the need to quantify evidence; numbers are needed to compare with the fixed

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[281] In this regard, Nance's argument has certain similarities to the rather audacious arguments about burdens made by Louis Kaplow and what he calls evidentiary thresholds. Nance's arguments do not go into the Alice-in-Wonderland territory of Kaplow's, but they have similar difficulties of high, in Kaplow's case essentially infinite, transaction costs. For a discussion, see Ronald J. Allen & Alex Stein, Evidence, Probability, and the Burden of Proof, 55 Arizona L. Rev. 557 (2013).

[282] Nance, supra note 16, at 41-42.

[283] In a sense, this feature replicates on another level the same objective-subjective dilemma for probabilistic approaches to evidence. See supra notes 42-50 and infra notes 292-97 and accompanying text. See also Alex Stein, Foundations of Evidence Law xi (2005) ("There is no moral, political, or economic justification for allowing private adjudicators . . . to allocate the risk of error as they deem fit.").

[284] See Part I.B.

[285] See supra note 224 and our critique of this position in Part III.

[286] See supra note 59. His formulation, like the conventional account, accepts the complementation axiom. At times, he seems to embrace comparativism about explanations, see Nance, supra note 16, at 83, but he doesn't connect this to standards of proof.

thresholds. As we discussed above, however, basing such quantification on either objective data or subjective beliefs runs into difficulties. Nance's theory also needs numbers and, as we will see, it therefore runs into similar problems as the conventional account.[287] This issue takes us to the second way in which the theory diverges from the conventional account.

The second element in the theory relies on a particular account of "epistemic" probabilities. Recognizing problems with relying on either objective (frequentist) or subjective (credences) probabilities, Nance proposes that the target probabilities at trial are "epistemic" (or "rationalist").[288] Under this interpretation, probabilities refer to the degree of belief that is "rational" or "justified" based on the evidence. Such probabilities, he explains, provide a normative standard for the actual subjective beliefs of fact-finders: "one's subjective, credal probability that a certain proposition is true *ought* to be set equal to the epistemic probability that the proposition, determined in light of (relative to) the evidence that one has for it."[289] Moreover, epistemic probabilities "must conform to the axioms of mathematical probability."[290] Under this conception, "all rational human beings" will have the same epistemic probabilities "given the same evidence."[291]

The reliance on "epistemic probabilities," however, reduces to the same dilemma he was attempting to avoid. Indeed, in the context of adjudication, the theory's conception of probability appears to be no different than the subjective conception. We explain. Let's assume that such epistemic probabilities exist, i.e., that there is a degree of belief or level of justification that every rational fact-finder must have for a particular proposition, given the evidence.[292] That probability will either be knowable or unknowable. Let's assume it is knowable. We doubt that will be the case for most items of evidence or collective bodies of evidence, but if it exists, then by definition this is the only rational decision that can be reached. These cases would never go to trial. Moreover, cases in which such "epistemic probabilities" are known will include logical truths (rarely litigated) or else they will almost surely match known "objective," frequentist probabilities.[293] In short, knowing the correct "epistemic" probability will be the rare exception in litigation, particularly in cases that make it to trial.

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[287] Nance notes that such quantifications can involve "ranges" and "rough estimates," but the point is the same: something roughly quantitative must be compared with the threshold.

[288] Id. at 43-44.

[289] Id. at 47.

[290] Id. 49.

[291] Id. at 43.

[292] We will grant this assumption for purposes of our discussion, but there are strong reasons to doubt it. One reason has to do the disconnect between Nance's requirement that epistemic probabilities must conform to the axioms of mathematical probability, on the one hand, and the fact that some of the "evidence" on which fact-finders must rely is their own background beliefs and knowledge, on the other. Suppose a fact-finder's particular distribution of credences regarding their own beliefs and knowledge does not conform to the probability axioms (suppose they would be subject to a Dutch Book argument). Well, now what? The problem is that no "perfectly rational human being" would have *this evidence*. Timothy Williamson, Knowledge and its Limits 210 (2000).

[293] Note that he uses the example of a coin flip (a classic frequentist example) to illustrate epistemic probability. Id. at 46-47.

In most cases, the epistemic probability that must be reached by all rational agents will be unknown.[294] But when this is the case, the theory reduces to the subjective conception of probability. In a telling passage, Nance asserts that even though adjudication aims at epistemic probabilities, "fact-finders will inevitably work with their own subjective probabilities."[295] And in explaining how his theory maps onto the actual assessments made by fact-finders he again relies on subjective assessments:

> For practical purposes, such as adjudication, all that is important is to be able to make comparative assertions about *inevitably subjective assessments* of epistemic probabilities, including rough quantitative comparisons, such as the assertion that p(C|E) is more or less (roughly) r times p(not-C|E), for some number r.[296]

Here is the critical point: (1) telling jurors to make subjective assessments based on the evidence, and (2) telling them to make subjective assessments of what they think the epistemic probability is based on the evidence, is a distinction without a difference. Any fact-finder who noticed a difference between the two would change their subjective assessment to conform to what they think the epistemic one is, at least if they were trying to be "rational."[297] But telling jurors to be "rational" and to "consider the evidence" when making their subjective probabilistic determinations is still, for all relevant purposes, a subjective conception of probability.

So, Nance faces the same dilemma as the conventional account; his theory needs numbers to attach to the evidence. How do we quantity the evidence to compare with the standard of proof? There is either a correct, "objective" answer as to what that number should be or there is not. If that number is known, then there is little if anything left for the fact-finder to do. That is the only reasonable answer. But these conditions are rare in litigated cases. In the standard case, such numbers either do not exist or they are unknown. Under these conditions, there is no choice but to rely on subjective assessments based on the evidence. Regardless of whether these take the form of, e.g., "I believe that it is .95 probable that Jones committed the murder," or "I believe that .95 is the correct answer for how probable it is that Jones committed the murder," the same problems exist.

Finally, the third way in which Nance's theory diverges from the conventional probabilistic account is by building in a "weight" requirement for standards of proof.[298] According to this element of the theory, parties must do more than present evidence from which a reasonable fact-finder could conclude that the applicable standard of proof (the "variable threshold," under his theory) has been met. In addition to providing sufficient evidence to meet the standard, "the claimant must have provided whatever evidence it can rightly be expected to

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[294] Id. at 49 (stating that there may not be a "precise, verifiably correct epistemic probability for each proposition")

[295] Id.

[296] Id. [emphasis added]. In the quotation, 'r' is the standard of proof.

[297] Id.

[298] Nance's weight requirement is inspired by the notion of weight discussed by Keynes, in A Treatise on Probability (1921). Nance, supra note 16, at 103-04.

provide to ensure that the evidence is sufficiently complete."[299] Parties without the burden of proof have reciprocal obligations. For example, in the case of civil defendants these include: (1) the evidence is such that a reasonable jury could conclude the standard has *not* been met, and (2) "the defendant must have provided whatever evidence he or she can rightly be expected to provide to ensure that the evidence is sufficiently complete."[300] The failure to satisfy either requirement will, according to the theory, result in a judgment as a matter of law against the defendant. In jury trials, the theory posts a division of labor in applying these two requirements; the jury decides whether the evidence surpasses the standard's threshold[301] and the judge determines whether the evidence presented is adequate in terms of weight.[302] If the judge determines the evidential base is inadequate, then the standard has not been met as a matter of law, even if the evidence is good enough for reasonable fact-finder to conclude the standard has been met.[303]

Although Nance acknowledges at one point that a "weight monitoring function" is not "explicitly built into the conventional standard" for sufficiency-of-the-evidence determinations, he purports to uncover a weight principle implicit in such determinations.[304] Moreover, sufficiency rulings are just one doctrinal device courts use to regulate weight; others include admissibility rulings and discovery sanctions.[305] Even when courts do not explicitly or "self-consciously" invoke a weight principle, the use of such devices is "best interpreted as attempts to optimize (or at least marginally improve) Keynesian weight."[306] His theory marshals evidence of legal practices in an attempt to reveal a principle implicit in the law (which observers and the participants themselves failed to notice)[307]:

> The existence and use of the array of legal tools reviewed here show that the law has given a positive, if not always explicit and unambiguous, answer to the question of whether some adjudicative official needs to worry about augmenting Keynesian weight, beyond the regulative impact inherent in permissible discovery and its enforcement.[308]

As with the other ways in which Nance's interpretive theory diverges from the conventional probabilistic account, the theory's weight requirement fails to explain the law. Let's look at some of the evidence for this principle. As we will see, the cited cases in support of the weight requirement either fail to provide any support whatsoever for such a requirement or

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[299] Id. at 204.
[300] Id. at 204.
[301] Nance refers to this as the "discriminatory power" requirement. Id. at 233.
[302] Id.
[303] Id. at 204, 202 ("a plaintiff's case may be deemed not to have met the burden of production if important evidence is missing, even though the evidence that is presented is sufficient for a reasonable jury to infer that it meets the threshold criterion on discriminatory power.")
[304] Id. at 203.
[305] He notes his list is not "exhaustive." Id. at 213.
[306] Id. at 217.
[307] This appears to be example of his Dworkin-inspired "interpretive" methodology at work. See supra note 56
[308] Id. at 216.

they are better explained by other considerations. A clarification is necessary, however. We take Nance's interpretive claim to be about the nature of juridical proof as it currently exists. Therefore, we put to the side some of the older cases that he cites[309] that were decided prior to the emergence of modern discovery regimes, in which courts took a more active role trying to force parties to produce evidence. When we turn to more modern cases, the evidence for a judicially monitored weight requirement is weak.

One source of evidence that Nance points to are cases involving "sufficiency of the evidence" determinations that are claimed to support the theory's dictates. Evidence is sufficient, according to the theory, when it meets two requirements: a reasonable fact-finder could conclude the evidence surpasses the threshold required by the standard of proof, and the judge concludes the evidence is sufficiently weighty or complete.[310] Nance cites approvingly *dicta* by Judge Posner in which the Seventh Circuit held that the plaintiff's evidence at trial was sufficient to support a verdict under the preponderance standard.[311] The case involved a slip-and-fall injury in which the plaintiff alleged that an unknown employee of the defendant was responsible for the injury (by spilling soap on which plaintiff slipped).[312] Although neither the trial nor the appellate court required any evidence beyond what the parties themselves chose to present, Nance notices the possibility of such a judicial move in the following text from the opinion (we repeat his block quote):

> Not only is there no reason to suspect that the plaintiff is holding back unfavorable evidence; it would have unreasonable, given the stakes, to expect her to conduct a more thorough investigation. This is a tiny case; not so tiny that it can be expelled from the federal court system without a decision, but so tiny that it would make no sense to try to coerce the parties to produce more evidence, when as we have said, no inference can be drawn from the paucity of evidence that the plaintiff was afraid to look harder for fear that she would discover that a customer and not an employee of Wal-Mart had spilled the soap.[313]

Crucial for Nance's claim is the idea if the case had involved "higher stakes," then "Judge Posner would have been willing to consider demanding more" evidence from the plaintiff.[314] A weight principle is certainly consistent with this *dicta*.[315] But three things cut against this

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[309] See, e.g., id. at 202.
[310] Id. at 204.
[311] Id. 205-06 (discussing Howard v. Wal-Mart Stores, Inc., 160 F.3d 358 (7th Cir. 1998)).
[312] Id. 205.
[313] 160 F.3d at 360.
[314] Nance, supra note 16, at 206.
[315] This is another example of consistency with the law being used as evidential support for a proposed interpretation. See supra note 272. The above quotation is also consistent with another possible interpretation: that in cases with "higher stakes" the plaintiff would have been more likely to conduct a "more thorough investigation" and thus would be more likely to have uncovered and thus be withholding unfavorable evidence. In such circumstances, an inference is more likely be drawn against the plaintiff from "the paucity of evidence." Under this interpretation, the plaintiff would fail to meet the first

interpretation. First, this is a very peculiar argument. It asserts that a case actually stands for the opposite of what it holds based on speculation from an ambiguous sentence in the opinion as to what the court might do in matters not before it.[316] Rather than claiming vindication from a counter-factual, Nance would do well to present actual examples of what he asserts is true. Second, the more natural way to read Judge Posner's comment is to the effect that the court might be more inclined to do something if it thought the plaintiff was playing games in a way to disadvantage the defendant. That is not a weight problem; that is a discovery problem. We predict that, had the court thought more evidence existed and both parties had access to it, the outcome in this case would be the same. The reason for that prediction is the third difficulty with Nance's argument, which is the wide array of cases from this court and courts around the country explaining that the parties are "masters of their own cases" when it comes to presenting evidence and arguing issues.[317] As a general matter, courts, citing this "master of the case" principle, overwhelmingly tend to defer to parties' evidentiary choices and presentations.[318] This latter principle provides a much better fit with the law than a weight requirement in which judges monitor and second-guess parties' evidentiary choices.

But even if the choices made by the parties clearly dominate over judicial weight monitoring, as we contend is the case, perhaps there are clear cases in which weight truly is the best explanation? Putting aside *dicta* suggesting the possibility of such monitoring, the best evidence for Nance's account would be sufficiency cases in which the first requirement is met but the weight requirement is not. In other words, a case in which plaintiff's case is strong enough that a reasonable jury could find for the plaintiff by a preponderance of the evidence, but the court nevertheless found the evidence to be insufficient. Nance gives us a detailed discussion of the *Zych* case as an example, which he claims provides a "revealing glimpse" of "judicial requirements regarding Keynesian weight."[319] A closer look at the case, however, reveals that it supports no such thing.

Zych is an admiralty case in which the plaintiff sought to establish *in rem* rights as the finder of an abandoned vessel lying at the bottom of Lake Michigan.[320] The plaintiff claimed the ship is the *Seabird*, a passenger ship that sank in 1868.[321] Why might the case be thought to support a weight requirement? According to Nance, the "determinative fact was whether the wreck was 'embedded' within the submerged lands of the state; if so, the state [Illinois] had better title."[322] The district court granted the state's motion to dismiss because the vessel was

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requirement, not a separate weight requirement. Moreover, more recent opinions from Judge Posner recognize this possibility. See, e.g., U.S. v. Veysey, 334 F.3d 600, 605 (7th Cir. 2003).

[316] This argument is reminiscent of S&S's counter-factual argument about the *Daubert* case on remand, supra note 215.

[317] See supra note 69.

[318] See supra note 69.

[319] Id. at 211 (discussing Zych v. Unidentified, Wrecked and Abandoned Vessel, 941 F.2d 525 (7th Cir. 1991).

[320] Id.

[321] Id.

[322] Id. at 211.

"likely embedded."[323] As Nance explains, the court did so based on the pleadings and motion papers and "without hearing formal evidence."[324] "The appellate court," however, "reversed and remanded for an evidentiary hearing on whether the wreck was embedded."[325] In other words, it looks like a case that fits the two-part structure of the theory. It looks like the district court made a factual finding ("likely embedded") (i.e., the plaintiff has established this fact by a preponderance of the evidence), and the appellate reversed—not because it disagreed with the reasonableness of that finding—but because it concluded that an evidentiary hearing was required. According to Nance, the appellate court was concerned with evidentiary weight.

The details of *Zych* reveal that it does not support a weight requirement. One clue is that the opinions at issue involved a motion to dismiss.[326] Neither party was asking for a factual finding about embeddedness. It is clear from the district court's order that the judge characterized the issue of "embeddedness" as a question of law.[327] The court cited to other cases for the general proposition that "[a]bandoned shipwrecks are generally considered to be 'embedded' in the submerged land."[328] Apparently, the court reasoned the ship was "likely embedded" regardless of whether any part of the ship was buried and affixed, so long as it was submerged:

> Considering the cases cited above, the shipwrecks are likely embedded in submerged lands which the State owns pursuant to the Submerged Lands Act, and the embeddedness exception of the common law of finds gives the State a colorable claim of ownership in the shipwrecks.[329]

In reversing, the appellate court did more than just order an evidentiary hearing. First, it noted that the district court's order was based on the wrong statute.[330] Second, it explained that under the applicable statute (the Abandoned Shipwreck Act), "embeddedness" is a "question of fact" with a particular definition.[331] "Embeddedness" for purposes of the statute requires a factual finding that the wreck "is at least partially buried" or "firmly affixed."[332] The court therefore reversed and remanded, explaining that an evidentiary hearing is required to determine that factual issue. However, on remand, no such evidentiary hearing was held. Rather, as the district explained:

> After remand to this Court, the question of "embeddedness" was resolved by the parties without the evidentiary hearing suggested by the Court of Appeals. In response to requests for admission served by the State, Zych admitted for purposes of this litigation

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[323] Id.
[324] Id.
[325] Id.
[326] Zych v. Unidentified, Wrecked and Abandoned Vessel, 746 F. Supp. 1334, 1337 (N.D. Ill. 1990).
[327] Id. at 1343.
[328] Id.
[329] Id.
[330] 941 F.2d at 528.
[331] Id at 530, n. 7 ("embeddedness is a factual question").
[332] Id. at 52-30

> that the *Seabird* [was embedded]. . . . The parties and the Court agree that this admission is sufficient.[333]

As these details indicate, this case has nothing to do with a judicially imposed weight requirement. The first time around, there was no factual finding made by the trial court (or asked for by the parties). And the second time around, the court deferred to the choice of the parties not to present evidence on the issue. Rather than being a case in which a court overrides a party's choice about evidence, it is a case in which no evidence was introduced because the parties chose not to make an issue of it.[334]

Nance's attempt to read a weight requirement into admissibility rulings is similarly problematic. For example, he cites *Chambers v. Mississippi* as support for a weight requirement.[335] The case involved a defendant who was prevented from presenting evidence of a third party's confession to the crime (by a combination of the state's hearsay rule and "voucher" rule, which prevented a party from impeaching its own witness).[336] We find this a curious example for several reasons. Importantly, the defendant called the third party as a witness (in order to impeach him), and the defendant was attempting to introduce the excluded evidence.[337] More generally, *Chambers* is followed by a line of cases defining a *defendant*'s constitutional right to present a defense.[338] The case is not about a judge overriding party choice by declaring one side's evidence to be incomplete. Nance claims that the opinion "has the effect of augmenting Keynesian weight."[339] So what? Augmenting weight does not explain the decision. As the Court has discussed when considering other examples on the right to present a defense, the cases are explained by (1) the *arbitrariness* of the rule excluding the evidence, and (2) the *reliability* of the excluded evidence.[340] Neither of these considerations necessarily tracks weight. For example, when the Court held that a defendant did not have a constitutional right to introduce polygraph evidence, it was because of the questionable reliability of the evidence along

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[333] Zych v. Unidentified, Wrecked and Abandoned Vessel, 811 F. Supp. 1300, 1305 (N.D. Ill. 1992).

[334] Similar to *Zych* example, Nance also cites Warren v. Jeffries, 139 N.E. 718 (N.C. 1965) for the proposition that "a plaintiff's case may be deemed not to have met the burden of production if important evidence is missing, *even though the evidence that is presented is sufficient for a reasonable jury to infer that it meets the threshold criterion on discriminatory power* [the standard of proof]." Id. at 202 n.60 [emphasis added]. The italicized portion is crucial because, if true, it would support the existence of a distinct weight requirement. But it is false in the cited case. In concluding the plaintiff's case was insufficient, the court explained that there was no evidence at all to support the negligence allegations. Id. at 720 ("Plaintiff alleges defendant was negligent in that (1) he failed to set the hand brake, (2) failed to engage the transmission, and (3) neglected to maintain adequate brakes . . . There is no evidence as to the condition of the brakes, whether the hand brake had been set, or whether the car was in gear.") Because of this complete lack of evidence, no reasonable jury could have inferred negligence by a preponderance of the evidence.

[335] Nance, supra note 16, at 215.

[336] Chambers v. Mississippi, 410 U.S. 284 (1975)

[337] Id. at 294.

[338] These cases are summarized in Holmes v. South Carolina, 547 U.S. 319, 324-26 (2006).

[339] Nance, supra note 16, at 216.

[340] See Holmes, 547 U.S. at 324-26.

with the government's interest in excluding evidence of questionable reliability.[341] Allowing the defendant to introduce the evidence, however, would have "augmented Kenyesian weight."

These points rather pointedly challenge Nance's descriptive claims about the existence of a weight principle. The evidence is simply to the contrary.[342] In addition, the examples above also raise doubts about the normative desirability of such a principle. Nance discusses several ways the weight requirement can be made more robust, focusing on issues such as cost, availability, and the importance of evidence, as well as on whether parties acted reasonably, negligently, or in bad faith in failing to produce evidence that judges think should be there.[343] We leave the additional details of the theory on these matters to the side for two reasons. First, we're skeptical that more robust judicial intervention, beyond discovery requirements and sanctions, are likely to improve the accuracy of outcomes.[344] Parties (at least in civil cases) will tend to know their cases better than judges and have an obvious self-interest in determining which issues to raise and how best to prove them; in short, we see considerable wisdom in the "master of the case" principle.[345] Even though the court in *Zych* thought an evidentiary hearing would be best, the parties determined otherwise. Second, even if more judicial second-guessing of evidentiary decisions is warranted, we doubt that "weight" should be the controlling principle, as opposed to reliability. As the *Scheffer* case suggests, unreliable evidence may increase weight. Given the choice between an evidentiary base that is "more weighty but less reliable" or "less weighty but more reliable," it is not clear to us why anyone would prefer the former.

In sum, Nance presents a detailed and complex theory that diverges from the conventional probabilistic account in three significant ways: varying case-by-case thresholds for standards of proof, epistemic probabilities, and weight. Despite these emendations, his theory, like the conventional account, fails to provide a better explanation than relative plausibility.[346]

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[341] United States v. Scheffer, 523 U.S. 303 (1998)

[342] See supra note 69.

[343] Nance, supra note 16, at 217-27.

[344] This is particularly true in civil cases. In criminal cases, by contrast, more discovery, earlier is the process, may lead to more accurate outcomes (including pleas). See Jenia I. Tuner & Allison D. Redlich, Two Models of Pre-Plea Discovery in Criminal Cases: An Empirical Investigation, 73 Wash. & Lee L. Rev. 285 (2016).

[345] See supra note 69.

[346] Probably for numerous reasons, Nance is at pains to distinguish his analysis from ours, and that is how we have interpreted him. However, at times his analysis converges on ours. He says, for example, that commonsense, plausible reasoning (our favorite kind):

> serve[s] important functions relative to both the assessment of discriminatory power and the choice of Keynesian weight. . . [P]lausible reasoning serves as a tool for the analysis of evidence in commonsense terms. Even as litigation comes with ready-made contending hypotheses (C and not-C), those general claims typically will be refined at trial to specific theories of the case, one or more for the claimant instantiating C and one or more for the defendant instantiating not-C. In deliberation, though, the fact-finder will often find it necessary to consider other alternatives. And as Peirce noted, abduction (or inference to the most plausible explanation) becomes a critical tool by which commonsense reasoning develops such additional hypotheses. An assessment of Keynesian weight must be made relative to the contending

V. Clermont: Magical Realism, Fuzzy Sets, and Belief Functions[347]

Our third and final example is Kevin Clermont's recent attempts to explain standards of proof in terms of "fuzzy set theory" and "belief functions."[348] He claims that viewing the law through the lens of these concepts resolves the conjunction problem and constitutes a better explanation of juridical proof than any others on offer, including ours.[349] As with our discussions of Schwartz & Sober and Nance, we will demonstrate that Clermont's account of juridical proof fails to provide a better explanation than relative plausibility.

The use of "magical realism" in the heading above is ours, not his. Although the term has a long history in art criticism, "magical realism" burst upon the literary scene with the success of Gabriel García Márquez, who won the Nobel Prize in literature in 1982. The term encompasses many different ideas, but its central tenet is that the combination of realism with mystical elements may heighten readers' appreciation of their own sense of reality.[350] Prof. Clermont's theory is reminiscent of magical realism in its combination of hardheaded analysis with magical elements that could not possibly be true. His analysis is enlightening in its clear explication of complex legal concepts, coupled with astonishing erudition. The problem is that central aspects of his theory, like García Márquez's presentation of time, are literally unreal and thus cannot explain the law. Indeed, he goes so far as to say that part of his argument "may sound like magic."[351] As we will show, indeed it does.

Clermont's theory relies on a combination of two central ideas: fuzzy sets and belief functions.[352] This combination produces a theory of juridical proof that differs from the conventional probabilistic account in two fundamental ways. First, relying on fuzzy set theory, Clermont rejects the conjunction theorems for combining the probabilities of two or more

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> hypotheses, and as these hypotheses change, some modification of the practical optimization of Keynesian weight may become necessary.

Nance, supra note 16, at 140-141. Although we are not cited in this passage, it captures a good deal of our central argument, with the exception of the reference to Keynesian weight. We suspect that, too, can be accommodated within our analysis. It might be the case, for example, that because the evidence is so sparse in a given case the fact-finder cannot determine which of the competing explanations is more plausible, or alternatively, "something else must have happened" may at times be more plausible than the parties' explanations. In either case, the party with the burden of persuasion loses.

[347] This part is heavily indebted to Ronald J. Allen, The Declining Utility of Analyzing Burdens of Persuasion, 48 Seton Hall Law Rev. 995 (2018). That article contains further details and technical matters, and should be consulted by anyone interested in further explication of these matters.

[348] See Clermont, Standards of Decision, supra note 17, at 148-49. On fuzzy sets, see L.A. Zadeh, Fuzzy Sets, 8 Info. & Control 338 (1965). On belief functions, see Glen Shafer, A Mathematical Theory of Evidence (1976).

[349] We addressed his critique of our views in Part II.

[350] See Maggie Ann Bowers, Magic(al) Realism (2004).

[351] Clermont, Common Sense, supra note 17, at 1079.

[352] See supra note 348.

propositions.[353] Second, relying on belief functions, Clermont rejects the complementation axiom in which the probability of a proposition and its negation sum to 1.[354] Clermont argues that this combination provides a better descriptive account of standards of proof than either the conventional probabilistic account or relative plausibility.[355] In discussing each component of his theory, we argue that it does no such thing.[356]

The first central concept in Clermont's theory is "fuzzy sets."[357] Fuzzy set theory addresses the issue of linguistic vagueness with the concept of the "membership in a set."[358] Imagine the set of tall people. What does "tall" mean? It is vague. However, according to fuzzy set theory the taller a person is, the greater he or she participates in this set, so that perhaps a person 5'10" participates in the set to 0.7 and a person 6'10" participates to 0.95: "Fuzzy logic is primarily concerned with quantifying and reasoning about vague or fuzzy terms that appear in our natural language. In fuzzy logic, these fuzzy terms are referred to as linguistic variables . . . The underlying power of fuzzy set theory is that it uses linguistic variables rather than quantitative variables to represent imprecise concepts."[359] A feature of fuzzy set theory is that it defines the intersection of two fuzzy sets as the level of participation of the lower of the two sets.[360] Clermont attempts to exploit this feature of set theory to explain standards of proof, but his explanation fails because it is based on misapplications of fuzzy set theory and errors of mathematical logic (as we will elaborate below).[361]

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[353] See supra note 54.

[354] See supra notes 59

[355] Clermont, Trial by Traditional Probability, supra note 17.

[356] Clermont waivers at times over whether his theory is supposed to be normative or positive. Most important for our purposes, he purports to explain how standards of proof actually operate. See Clermont, Standards of Decision, supra note 17, at 164 ("My concern . . . is primarily to unearth what the law actually tells its factfinders to do."); at 150 ("My thesis is that a better explanation of what the law does with proof lies in the new logic than in two-valued logic and probability"); at 214 ("I am trying little more than to explain what the law has been doing all along."). At other times, he appears to be offering normative advice. Id. at 127 ("I therefore want to resolve, based on current knowledge, how the law should set and formulate [standards of proof]"); at 8 ("this book aims at specifying how American law should answer the ubiquitous question of what it should tell its decisionmakers about the required level of sureness in making their decision"); at 185 ("fuzzy logic is the tool that will minimize errors in legal fact-finding."). Our discussion pursues the question whether Prof. Clermont's invocation of fuzzy sets and belief functions are appropriate and intelligible. If his efforts fail those tests, as we believe they do, then there is no reason to consider its normative aspect.

[357] See supra note 348.

[358] Clermont, Standards of Decision, supra note 17, at 153-54.

[359] Bharat Sundaram, et al., Computational Intelligence Techniques, in Computational Intelligence for Movement Sciences: Neural Networks and Other Emerging Techniques 157 (Rezaul Begg & Marimuth Palaniswami eds. 2006). See also Petr Hajek, Fuzzy Logic, Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/entries/logic-fuzzy/.

[360] Sundaram, et al., supra note 359, at 158.

[361] Clermont relies primary on the "MIN operator," with defines the degree of intersection in more than one set: "The MIN rule in fuzzy logic . . . set[s] the conjoined probability of elements, whether or not independent, as equal to the least likely element." Clermont, Standards of Decision, supra note 17, at 172. As we discuss below, this is mistaken.

Accepting that standards of proof apply to individual elements,[362] he argues that fuzzy set theory dissolves the conjunction problem. He claims that the problem "implodes under the force of fuzzy logic" because "the MIN operator[363] provides that belief in the conjunction will match the least likely element."[364] In other words, "under the MIN rule, applying the standard of proof element-by-element works out to be equivalent to applying it to the whole conjoined story."[365] Take a simple example. The conventional portrayal of the conjunction problem is that the probability of two independent events is the product of their separate probabilities. If the question is the probability of getting two heads in two honest flips of an unbiased coin, the answer is 0.5 x 0.5 = 0.25. The application to a case with multiple elements (even controlling for conditional dependence) is, as we have discussed in detail, obvious and potentially troubling.[366] Not so, suggests Prof. Clermont, because all one needs to do is conceive of this problem as a matter of fuzzy logic, and then, magically, the conjoint "probability" is 0.5![367]

There are four major problems with Clermont's application of fuzzy set theory to juridical proof. The first is that changing one's theory of probability does not change the world or one's knowledge of the world. This is a basic point but it reveals the awkward fit between Clermont's theory and factual uncertainty in law. The second and third are more technical (although we will attempt to keep the discussions understandable to a general legal audience) and involve misapplications of fuzzy set theory. They include conflating the intersection of sets with the conjunction of events, and confusing fuzzy sets with membership statements. Each involves a fundamental mistake of mathematical logic. The fourth concerns mismodeling the process of juridical proof in a manner that makes the application of fuzzy set theory appear more plausible than it actually is. We discuss each of these four problems in turn.

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[362] Id. at 190-91 ("The judge does instruct literally in element-by-element terms . . . The law sometimes enforces its element-by-element theory . . . The conjunction paradox therefore remains troubling").

[363] See supra note 361.

[364] Id.

[365] Id.

[366] See supra notes 52-58 and Part III.

[367] We say "suggests" because Clermont is unclear about the matter. At one point he definitely asserts that fuzzy logic can substitute for conventional probability, but at others he seems to deny this. Compare: fuzzy logic "can handle all kinds of facts, and can do so much better than probability. . . [F]uzziness handles facts exhibiting random uncertainty as well as those showing vagueness. . . Law could choose fuzziness as its sole mode of measurement," id. at 164, with : "calculation by the product rule would be appropriate in certain kinds of decisions (and bets)," id. at 175. Obviously, the product rule would be appropriate for what Clermont calls "random uncertainty," i.e. uncertainty, thus it is completely opaque what to make of all this. If he thinks that conventional probability is appropriate to handle uncertainty, he would be right, but it would then be unclear what contribution his book is making. Apart from a few statements like the second just quoted, the enterprise seems directed to the (fallacious) argument that fuzzy logic can supplant probability theory dealing with factual uncertainty. His ambiguity continues when he says, speaking of a hypothetical involving uncertainty (identity) and vagueness (fault): "While the MIN rule seems the obvious choice if identity is a matter of occurrence uncertainty and fault is a matter of imprecise vagueness, I think it should apply even if both factfinding percentages measure only random uncertainty." Id. at 178. In any event, we read him as asserting the stronger program, that he has analytically resolved the conjunction problem simply by adopting fuzzy logic.

First, it is not clear how membership in fuzzy sets, which primarily addresses the problem of linguistic vagueness, can map onto issues of factual uncertainty at trial. Clermont gives the following image to support the superiority of fuzzy logic over conventional probability and "to make the point as to what the law deals in"[368]:

> Suppose you had been in the desert for a week without drink and you came up two bottles marked K and M [and marked respectively with a .91 membership in the fuzzy set of potable liquids and a .91 probability of being a potable liquid]. Confronted with this pair of bottles, and given that you must drink from the one that you chose, which would you choose to drink from? Most people, when presented with this experiment, immediately see that while K could contain, say, swamp water, it would not . . . contain liquids such as hydrochloric acid. That is, membership of 0.91 means that the contents of K are fairly similar to perfectly potable liquids. . . On the other hand, the probability that M is potable "equals 0.91" means that over a long run of experiments, the contents of M are expected to be potable in about 91% of the trials. In the other 9% the contents will be deadly—about 1 chance in 10. Thus, most subjects will opt for a chance to drink swamp water.[369]

He does not explain how this example is supposed to map onto juridical proof. To map onto factual uncertainty in a useful way it must be the case that both forms of information are systematically available as evidence, that either form can interchangeably solve the problem at hand, or that one can change the world by changing one's conception of probability. Two things are obvious with respect to juridical proof. First, presumably we all agree, including Prof. Clermont, that the contents of the water bottle will not change depending on whether one adopts a fuzzy or probabilistic conception. Moreover, fact-finders, like our desert wanderer, will either know (or believe) that each bottle has a 91 percent chance of being water, or that it is 91 percent pure water, or they will not. Changing conceptions of probability will not magically transform the contents of the bottle, or one's knowledge of those contents, from one thing into another.[370] The world is what it is, and it is not going to be transformed into something different because a person's conception of probability changes.

This is true not only for individual factual issues but for the conjunction problem as well. Fuzzy logic cannot dissolve or "implode" the conjunction effect because it, too, is a feature of

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[368] Id. at 165.

[369] Id. at 165-66 (quoting Bogdan R. Kosanovic, Fuzziness and Probability, http://www.neuronet.pitt.edu/~bogdan/research/fuzzy/fvsp/fvsp.html (Feb. 8, 1995)).

[370] In short, vagueness is not a property of events; it is a property of language. Uncertainty is not a property of language but of knowledge and events. Commenting on the above hypothetical, for example, Timothy J. Ross, Jane M. Booker, W. Jerry Parkinson point out, "These two different kinds of information inherently possess philosophically different notions: fuzzy relationships represent similarities of objects to imprecisely defined properties, and probabilities convey assessments of relative frequencies." Fuzzy Logic and Probability Applications: Bridging the Gap 13 (Timothy J Ross, et al., eds. 2002). One cannot magically be transmuted into the other like lead into gold by wishful thinking. "Probabilities," however, can rigorously convey information other than relative frequencies. See supra notes 42-48.

the world—not something that can magically transform by changing one's theory of probability. Any time a fact-finder must decide two or more disputed factual issues, each of which are necessary for finding for a party, a mistake will be made when any are decided incorrectly (and errors will accumulate accordingly). The probability of them all being true is not the probability of the "least likely element" any more than the probability of getting two heads in row is 0.5 (rather than 0.25). The conjunction effect is feature of the world (and a sticky one at that)—it will not change by swearing allegiance to fuzzy logic any more than the contents of the bottle will change. [371]

Not so, says Prof. Clermont, who asserts that "fuzzy logic tells us to apply the MIN operator even for independent events,"[372] and even to questions of uncertainty rather than vagueness. In commenting on a hypothetical with both a question of uncertainty (identity) and a question of ambiguity (fault), he says: "While the MIN rule seems the obvious choice [in such a case], I think it still should apply if both factfinding percentages measure only random uncertainty."[373] Consider another example that highlights why this is wrong. The classic definition of theft is the taking and carrying away of the personal property of another with the intent to deprive the owner of that property permanently. Assume that the parties dispute whether there was a taking (maybe the item was lost or there is fraud involved), who did it if there were a taking (possible misidentification), and whether there was intent to deprive permanently (it may have been a practical joke). Assume further (unrealistically but helpful to make the necessary analytical point) after all the evidence is in the fact-finder concludes that (1) there is 0.9 (or whatever meets proof beyond reasonable doubt) chance of there having been a taking, (2) a 0.9 chance that the defendant did it, (3) and a 0.9 chance that he did it with the intent to deprive permanently and (4) that these facts are stochastic independent. It is rather obvious that the fact-finder might be wrong on any or all of these issues, and conventional probability tells you exactly the likelihood of that occurring. The probability that all three are true is 0.9 x 0.9 x 0.9 = 0.729, which means there is a 1.0 - 0.729 = 0.271 probability that something else happened, which probably is not proof beyond reasonable doubt. All of this can be completely independent of vagueness in the language; it can be the case that no one is disputing what a taking, identity, and intent mean. And even if in some other case they are disputing vagueness, the uncertainty remains. For Prof. Clermont to be adding anything to the literature concerning conjunctions, he must be saying that if we just think about these issues in terms of fuzzy sets, or membership statements, or something else, then the conjunction problem disappears. But that can only happen if the uncertainty disappears. Which it doesn't. He says

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[371] To reiterate (see supra note 367), Clermont asserts to the contrary: "While the MIN rule seems the obvious choice if identity is a matter of occurrence uncertainty and fault is a matter of imprecise vagueness, I think it should still apply even if both fact finding percentages measure only random uncertainty." Clermont, Standards of Decision, supra note 17, at 178. At other times, however, he seems to assert that conventional probability should apply to factual uncertainty. Id. at 160 ("If the fact in question is or is assumed to be nonvague, and . . .its occurrence is subject only to random uncertainty, then probability is appropriate.") But if so, then the *bête noire* of the conjunction effect will again arise, which is one of the central problems his theory was designed to eliminate. See id. at 191.

[372] Id. at 173.

[373] Id. at 178.

that he is not asserting that how we think about things can change the real world, but for him to argue that his approach solves the conjunction problem then that is what he must be asserting.

We turn now to the second and third problems, which involve misapplications of fuzzy set theory through fundamental errors of mathematical logic. The second problem is a conflation of the distinct ideas of *probabilistic conjunction* in mathematics and *set intersection* in set theory (perhaps in part because set intersection is sometimes confusingly referred to as the "conjunction" of sets).[374] The two ideas are different, and there is no formalization that allows one to be transposed into the other.[375] Although Clermont is correct that the MIN operator defines the intersection of sets, this does not warrant the conclusion that the probabilistic conjunction of two or more events is equal to the least likely event; the two concepts simply are different. Nor does it warrant that conclusion when the events are conceived as fuzzy sets.[376]

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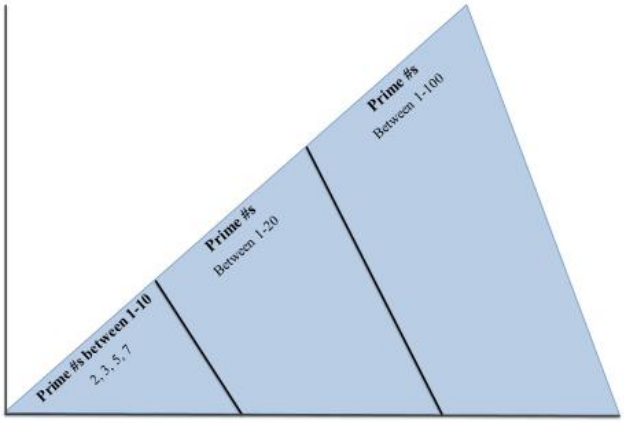
[374] The conflation may stem from failing to keep distinct fuzzy logic, which employs the concepts of conjunction and disjunction, and fuzzy set theory, which employs the different concepts of intersection and union. For a discussion, see JØrgen Harmse, Continuous Fuzzy Conjunctions and Disjunctions, 4 IEEE Transactions On Fuzzy Systems 295 (1996). To put it mildly, logic and math (including set theory) have a complicated relationship. Alfred North Whitehead & Bertrand Russell, Principia Mathematica (1910 and subsequent editions).

[375] A bit more technical detail: A clue to this problem should have been evident from the foundations of set theory. Prof. Clermont seems to think that "multivalent logic" has a different "rule" for intersection than bivalent logic that results in the radical difference in probabilistic conjunction. See, e.g., Clermont, Standards of Decision, supra note 17, at 173 ("the probability operation for AND is multiplication of the probabilities of independent events. But fuzzy logic tells is to apply the MIN operator even for independent events."). As he says, "one should use fuzzy logic, including its rule that conjoined likelihood equals the likelihood of the least likely element." Clermont, Common Sense, supra note 17, at 1058. He appears to derive this proposition from an axiom (not a derivation) of fuzzy set theory, which is, as Clermont points out, the MIN operator. Clermont, Standards of Decision, supra note 17, at 171. The intersection of two sets is defined as $\varphi A \cap B(x) = \min(\varphi A(x), \varphi B(x))$, where "φ" (phi) refers to the membership function that is necessary to define a fuzzy set. The clue that there are difficulties here is that the analogous axiom in classical set theory can be expressed in essentially identical terms except for one referring to a crisp set and the other to a fuzzy set. One form of the definition of set intersection in crisp sets is $\mu A \cap B(x) = \min(\mu A(x), \mu B(x))$, where "μ" (mu) is the characteristic function of a classical set. For a discussion, see Thayer Watkins, Fuzzy Logic: The Logic of Fuzzy Sets at http://www.sjsu.edu/faculty/watkins/fuzzysets.htm, at pp 1-5. Also see Fuzzy Logic & Fuzzy Sets from the Instituto Superior Técnico, available at https://fenix.tecnico.ulisboa.pt/downloadFile/3779578815313/CDI_SI_Fuzzy_Sets_2012.pdf at p. 6. The formulation in the text is the logical equivalent of the standard formulation of set intersection. The difference is the standard formulation refers to the elements common to the sets whereas the logical equivalence refers to those elements that are not missing from each set. The reformulation makes the connection between fuzzy and crisp sets clearer. Indeed, the general view, as Clermont notes, is that fuzzy set theory is a generalization of crisp set theory. Clermont, Standards of Decision, supra note 17, at 154, 163. Rather than there being some fundamental differences in this respect, one is simply a special case of the other. Obviously, the fact that classical set theory, like fuzzy set theory, defines the intersection of sets using the MIN rule does not warrant the conclusion that the probabilistic conjunction of two independent events is equal to the least likely of the events.

[376] The analysis ignores aspects of the foundations of mathematics as well. At one point he suggests that "membership statements" within fuzzy logic can be meaningfully and easily multiplied to get

The reason set theory defines intersection as it does is that it is a measure of the extent that sets have identical members rather than a measure of the probability within a defined probability space that one event or another will occur. To make this clear, consider the following diagrams of (1) the set of all prime numbers between 1-10; (2) the set of prime numbers between1-20; and (3) the set of prime numbers between 1-100. Their intersection, or what Prof. Clermont equates with conjunction, are the integers 2, 3, 5, and 7. Now ask a different question. Suppose random draws are made from the set of integers 1-100. What is the probability of a randomly drawn number being in one of the three original sets? It obviously varies from set to set.



It is critical to see the point here. Knowledge of uncertainty is simply different from knowledge of the extent of participation of an observation in a fuzzy set, or a crisp set for that matter.[377] The one cannot be transmuted into the other by fiat, which is what Prof. Clermont's theory purports to do by equating the conjunction of elements with the intersection of sets.

In essence, Clermont's argument disregards the meaning of the intersection of sets in fuzzy set theory. Fuzzy set intersection does not deal with the likelihood of two elements being

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comprehensible results. Id. at 175 ("Begin with the two membership statements . . . Tom is a .30 member of A and a .40 member of B. Those numbers mean something like 'Tom is not so tall' and 'Tom is not so smart'. . . The chance of a tall smart Tom according to the product rule is 0.12"). This is incorrect. The "numbers" in fuzzy logic are not precise equivalents to numbers on the number line. There is work being done to define arithmetic operations on member statements, but these results bear no relationship to Prof. Clermont's discussion. See, e.g., Yingxu Wang, On a Theory of Fuzzy Numbers and Fuzzy Arithmetic, Advances in Applied and Pure Mathematics, in Advances in Applied and Pure Mathematics 82 (Jerzy Balicki ed. 2014); Shang Gao and Zaiyue Zhang, Multiplication Operation on Fuzzy Numbers, 4 Journal of Software 331 (2009); Md. Yasin Al, et al., Comparison of Fuzzy Multiplication Operation on Triangular Fuzzy Number, 12 Journal of Mathematics 35 (2016); Ch.-Ch. Chou, The Canonical Representation of Multiplication Operation on Triangular Fuzzy Numbers, 45 Computers and Mathematics with Applications 1601 (2003).

[377] Michael Beer, Fuzzy Probability Theory, in Encyclopedia of Complexity and Systems Science 4048 (Robert A. Meyers ed, 2009); Nozer D. Singpurwalla & Jane M. Booker, Membership Functions and Probability Measures of Fuzzy Sets, 99 J. American Statistical Association 867 (2004).

true, or the likelihood of the participation of two different elements in some set, or of one element in more than one set, or any other probabilistic concept. Rather: "[i]n fuzzy sets, an element may partly belong to both sets with different memberships. A fuzzy intersection is the lower membership in both sets of each element."[378] In other words, what Clermont is treating as a surrogate for the probability of two or more elements being true is in fact a measure of the participation of a single element in two or more fuzzy sets.

The third problem is related in that it involves a similar misapplication of fuzzy set theory due to a mistake of mathematical logic. Clermont's theory confuses membership statements, on one hand, with fuzzy sets, on the other hand. He gives the following example of what he claims shows the implications of fuzzy set intersection, but it shows no such thing:

> Begin with two membership statements . . . [that] Tom is a .30 member of A [A=tallness] and a .40 member of B [B=smartness]. Those numbers mean something like "Tom is not so tall" and "Tom is not so smart."
>
> The fuzzy combination would yield: "Because Tom is not so tall and Tom is not so smart, Tom is not such a tall, smart man," [which] . . . yields a .30 belief in that intersection.[379]

It is true, as noted above, that the intersection of fuzzy sets is defined as he describes, but the definition of set intersection does not extend to membership statements, which are not sets (they could be members of sets, of course). Just as in crisp set theory and logic, the definition of set intersection is one thing, the definition for the logical operators "and" and "or" is another, and probabilistic implications are something else again. The most peculiar aspect of this example is that, rather than having to appraise the likelihood that Tom is not so tall and not so smart ("0.30 belief in that intersection"), you know exactly how tall and smart Tom is. That is what generated the member statements in tallness and smartness in the first place. Whatever the membership function is, a certain height participates 0.30 in the fuzzy set of tallness and a certain intelligence participates 0.40 in the fuzzy set of smartness. The fuzziness is in the set, and not in the membership statement.[380] Indeed, quite at odds with the idea that one can take the definition of

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[378] Siti Zaiton Mohd Hashim, Fuzzy Logic & Fuzzy Sets, p. 32, available at https://comp.utm.my/sitizaiton/files/NotaSubjek/Nota%20%20AI%20(1)/Fuzzy1.pdf.

[379] Clermont, Standards of Decision, supra note 17, at 175.

[380] That is probably why those fluent in fuzzy set theory or logic, including the publications that he cites, do not embrace the thesis that Clermont adopts. For example, id. at 148 n. 462, relies on Timothy J. Ross & W. Jerry Parkinson, Fuzzy Set Theory, Fuzzy Logic, and Fuzzy Systems, in Fuzzy Logic and Probability Applications: Bridging the Gap 20 (Timothy J. Ross, et al. eds. 2002) 29, who have this so say about membership statements and fuzzy sets:

> Zadeh extended the notion of binary membership to accommodate various "degrees of membership'' on the real continuous interval [0, 1], where the endpoints of 0 and 1 conform to no membership and full membership, respectively, just as the indicator function does for crisp sets, but where the infinite number of values in between the endpoints can represent various degrees of membership for an element x in some set in the universe. The sets in the universe X that can accommodate "degrees of membership'' were termed by Zadeh as "fuzzy sets.''

the intersection of sets and apply it to *membership statements* (as Clermont does in his example), proponents of fuzzy set theory treat this kind of example as a probabilistic problem.[381] It is perfectly coherent to discuss various probability problems from a fuzzy perspective, such as the probability of items participating in fuzzy sets, the interaction of uncertainty and fuzziness, and so on, and today there are people working in the field to develop a fuzzy probability theory.[382] But that is not Clermont's hypothetical. There is no notion of probability at play; the notion at play is vagueness. You know Tom participates in the fuzzy sets of tallness and smartness and you know exactly the extent to which this is true.[383]

Prof. Clermont might object to this on the ground that observations of a person's height or intelligence could be both uncertain and conveyed in vague language. Both are true, but they do not change the above analysis. The uncertainty will be whatever it is, as will the vagueness. This does highlight another problem in Clermont's analysis. The use of fuzzy sets requires membership functions that permit an algorithmic mapping from observation onto a fuzzy set. Clermont neglects this by never presenting an actual membership function. We give above the most obvious interpretation of an applicable membership function but admittedly it could be something quite different. Still, the analytical points would remain.

The fourth problem with the application of fuzzy sets involves a mismodeling of the standard issues of proof at trial. This mismodeling makes Clermont's analysis of the conjunction problem appear more plausible that it is in fact. He gives an example of a case involving the conjoining of a conventional probability with a fuzzy probability, and repeats similar examples a number of times, as though this structure were paradigmatic.[384] Imagine that the evidence suggests that there is a 60 percent chance that Tom did some act (a conventional probability measure) and a 70 percent "chance" (a fuzzy measure) that whomever the perpetrator was, he "was at fault," by which Prof. Clermont means subject to liability. When one combines a 60 percent chance of identification with a 70 percent participation in the set of "fault," according to

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Id. at 30.

[381] See supra note 370. Lotfi Zadeh, the progenitor of the field of fuzzy logic, rejected the idea that conventional probability could be dispensed with. See Singpurwalla & Booker, supra note 377, at 847 ("Zadeh claimed that 'probability must be used in concert with fuzzy logic'" (quoting Lotfi Zedah, Discussion: Probability Theory and Fuzzy Logic Are Complementary Rather than Competitive, 37 Technometrics 271)).

[382] See supra note 377.

[383] To say that a person is participating in a fuzzy set to a precise degree means that you know exactly how he measures on that fuzzy variable. To say that Tom participates in the set of tallness 0.30 requires that you know how tall he is, so let us say 5' 5". Similarly, to participate 0.40 in the fuzzy set of smartness means you know precisely what the measured quantity is, let us say an IQ (put aside validity and measurement issues) of 105. This means that you know exactly what quantities Tom possesses: he is a 5'5" male with an IQ of 105, and indeed you know this to 100 percent certainty. That is the information that you would need to resolve a legal case. Indeed, it would appear that this is all the information that you could possibly get; putting the information into fuzzy set terms contributes no additional information that would be helpful for making a sensible decision.

[384] See, e.g., Clermont, Standards of Decision, supra note 17, at 178, 183, 191.

Professor Clermont, then the probability of liability should be thought to be 60 percent, applying the fuzzy notion of conjunction.

To see the mismodeling, we need to unpack the meaning of "fault." Prof. Clermont has in mind that there is some paradigmatic example of what would no doubt be "fault," such as, perhaps, a person seeing the light is red with plenty of time to stop—seeing, in addition, that pedestrians are entering the intersection—and nonetheless deciding to continue through the intersection without regard to the safety of the pedestrians, entirely disregarding the legal obligation to stop at a red light. Now, imagine backing off some of these assumptions so that what the person did is not so extreme. For example, as the driver gets closer to the intersection, his "fault" is less, and it is easy to conceive of this in fuzzy set terms. This is indeed a good example of what Prof. Clermont is referring to as participation in a fuzzy set. But here is the problem. When a decision is made (and perhaps upheld on appeal) that a certain set of risks equals negligence, then that is the end of the matter. That there is a more extreme set of facts imaginable ("more extreme" from the perspective of doing something wrong than actually occurred) is irrelevant to whether this set of actions constitutes "fault" or "negligence" under the law. Once the decision is made that a hypothesized set of facts, if true, equates to fault, that particular element is established to certainty.[385] Consequently, the "conjunction" here is of one element established to 0.6 and another to 1.0 *because of the meaning of a legal term*—which as he says, but not for his reason, does indeed equal a conjunctive probability of 0.6.[386]

Finally, we turn now to other central idea that Clermont invokes to support his theory: belief functions.[387] Dempster-Shafer theory, of which belief functions are a part, is another effort to formalize reasoning under uncertainty.[388] Clermont does not develop the underlying

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[385] In other words, the question of "fault" is a question of law: is what this person has done within the meaning of "fault" for the purposes of the law? Perhaps an act that "participates" 70 percent in a certain concept of fault is at fault within the meaning of the law, but if so that simply means what the person did is within the legal definition no matter how it matches up to some idealized extreme version of legal fault. Once that decision is made, it is made for all time (or at least until an authoritative decision maker changes the outcome). Questions of "law" are indeed question of "fact," see Ronald J. Allen & Michael S. Pardo, The Myth of the Law-Fact Distinction, 97 Nw. U. L. Rev. 1769 (2003), but they have different consequences once the label is attached. So, if there really were any cases like this, Prof. Clermont would be right but for the wrong reason. A legal conclusion is reached that what happened counts as fault, and now the only question is whether the defendant is the perpetrator.

[386] This suggests that Prof. Clermont's framework may work for elements that primarily involve the application of vague legal terms (perhaps some questions of reasonableness). Even in cases with legal vagueness, however, there remains the distinct phenomenon of factual uncertainty, and thus there remains the specter of probability theory and the conjunction effect. Such factual uncertainty will not go away by applying an apparatus that may be useful for deciding vague "legal" questions to the different task of deciding questions of factual uncertainty. Mistakes will continue to accumulate as a function of mistakes on discrete factual elements, simple as that, and thus the conjunction effect that Clermont set out to dissolve will remain. As noted above, supra note 367, Clermont asserts that the MIN operator should apply even to clear questions of factual uncertainty.

[387] Clermont, Standards of Decision, supra note 17, at 201.

[388] For an easy to follow discussion, see the Wikipedia entry at https://en.wikipedia.org/wiki/Dempster%E2%80%93Shafer_theory.

theory in great detail—nor does he engage with the various criticisms of it[389] or the problematic consequences of the theory that have been suggested in some circumstances.[390] Rather, his theory exploits one aspect of it: belief functions allow for beliefs in the probability of some fact and its negation to sum to less than 1.0,[391] which is another way of saying that the evidence may leave some residual doubt about the matter in question.

Here we entirely agree with Prof. Clermont, for reasons we have discussed in detail above, that beliefs need not add up to 1.0.[392] What might be called an absolute probability, or a probability conditioned on all conceivable evidence, is not the standard for proof at trial. The evidence at trial hardly ever—and probably never—gives a complete picture of all the alternative ways that the world might have been the day in question, and thus it is correct, as we have argued, to conceptualize juridical proof in comparative terms. That is precisely how the legal system handles the problem. The fact-finder's attention is brought to the matters that the parties wish to litigate, not some God's eye view of the litigated landscape.

Prof. Clermont, however, then makes a further analytical move that is not as sensible. In order to separate his view from ours,[393] he asserts that juridical proof involves the element-by-element comparison of the plaintiff's case with its negation, conceptualized in terms of "belief functions" in which the belief in the element and belief in its negation need to not sum to one.[394] By making the relevant comparison element by element, Clermont directly recapitulates the conjunction problem he was trying to explain away.[395] Factual uncertainty regarding the

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[389] See e.g. Judea Pearl, Reasoning with Belief Functions: An Analysis of Compatibility, 4 The International Journal of Approximate Reasoning 4 (1990).

[390] Lotfi Zadeh has given the following example:

> Suppose that one has two equi-reliable doctors and one doctor believes a patient has either a brain tumor, with a probability (i.e. a basic belief assignment—bba's, or mass of belief) of 0.99; or meningitis, with a probability of only 0.01. A second doctor believes the patient has a concussion, with a probability of 0.99, and believes the patient suffers from meningitis, with a probability of only 0.01. Applying Dempster's rule to combine these two sets of masses of belief, one gets finally m(meningitis)=1 (the meningitis is diagnosed with 100 percent of confidence).

Lotfi Zadeh, Book Review: A Mathematical Theory of Evidence, 5 The AI Mag. 81 (1984). Various resolutions to these kinds of problems have been proposed, but this level of granularity is not relevant to our discussion.

[391] In other words, he rejects the complementation axiom, in which X and not-X must sum to 1 (a feature of the conventional probabilistic account). See supra notes 59.

[392] See supra notes 89-93 and accompanying text.

[393] See Clermont, Trial by Traditional Probability, supra note 17, at 359-60 ("The mathematical theory of belief functions proves an alternative superior to . . . relative plausibility.").

[394] See Clermont, Standards of Decision, supra note 17, at 218-19; see also supra note 438.

[395] For another probabilistic account that in our view correctly embraces a comparative approach, see Cheng, supra note 164 (rejecting the conventional probabilistic account of proof in favor of comparative likelihood ratios). Like Clermont's account, Prof. Cheng's account, however, also recapitulates the conjunction problem it was designed to avoid when it is applied element-by-element rather than to the case as a whole. See Ronald J. Allen & Alex Stein, Evidence, Probability, and the Burden of Proof, 55

elements will have probabilistic consequences. Errors will thus accumulate against defendants as a consequence of errors of false positives on individual elements. This is same effect that generates the problem to begin with. We think that Prof. Clermont is correct that the legal system acts to reduce this troublesome phenomenon, but it does so by embracing relative plausibility, not by adopting belief functions for individual elements.[396]

As insightful as Prof. Clermont's analysis is on many issues, his application of fuzzy sets and belief functions does not explain standards of proof. His analysis entails a series of problems: magically transforming knowledge of the external world; misapplying fuzzy set theory; conflating fact finding with the determination of the meaning of legal terms; and applying belief functions in a manner that recapitulates the very problem it was trying to avoid.

Although we think we have demonstrated the analytical difficulties with Prof. Clermont's theory, we also want to point out its value. His erudite exposition of complex topics is nothing short of astonishing. Moreover, thinking of the meaning of vague legal terms from the perspective of fuzzy set theory is interesting and perhaps useful.[397] But for the reasons laid out here, his attempt to provide a better explanation than relative plausibility does not succeed.

Conclusion

To end where we began, we of course think that the relative plausibility theory is the best available explanation of the general nature of juridical proof. After decades of trying, no one has been able to provide a sound basis for a robust probabilistic explanation.[398] As powerful as that explanation is in certain respects, it does not respect the actual human condition exemplified by Western legal systems. The theory both demands too much, much more than is humanly possible to provide, and fails to accommodate actual human cognitive practices. It also fails to explain numerous aspects of juridical proof. Perhaps sensing the loss that accompanies the demise of a powerful algorithmic explanation, other scholars have attempted to construct equally algorithmic but different explanations, but each of them fails as well, for the reasons we have discussed. Relative plausibility by contrast has strong explanatory value, explaining much about the litigation process. Other marks in favor of relative plausibility are that it is inconsistent with only trivial aspects of juridical proof as it actually exists and embraces rather than rejects human cognitive practices. And for one last time, no general theory is ever going to explain any

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Ariz. L. Rev. 557, 995-96 (2013). Sullivan's recent account based on likelihood ratios also embraces a comparative perspective, along with many of the other tenets of relative plausibility. See Sullivan, supra note 164. Similar to the other formal accounts discussed above, however, his model must rely on either objective data (which will often be lacking) or subjective beliefs to construct the likelihoods. Moreover, his model appears to restrict the ability of parties and fact-finders to aggregate possible explanations more so than our account (and the law) does. Nevertheless, we endorse the general move toward comparativism by Clermont, Cheng, and Sullivan.

[396] See supra notes 89-93 and accompanying text.

[397] See supra note 385.

[398] See Sullivan, supra note 164, at 38 ("Efforts to defend the Bayesian probability approach . . . have been strained and unpersuasive.").

complex adaptive process. Relative plausibility thus stands as the best explanation so far on offer of juridical proof.