

A Theory for Evaluating Evidence Against the Standard of Proof

Kevin M. Clermont*

ABSTRACT

A lively modern literature engages the fundamental nature of evidence and proof. Of late, this so-called New Evidence field has experienced a paradigm shift away from probabilism. This Article tries to chart where the field should now be going in order to allow theory to catch up to where the law went long ago.

Theory should continue away from viewing the output of factfinding in terms of probability of truth and then toward viewing it as degrees of belief that measure the extent to which each elemental fact has been fully proved. The problem with probabilism is that it conveys only randomness while burying the much more important factor of epistemic uncertainty. Degrees of belief, however, can convey both random and epistemic uncertainty because they are multivalent, nonadditive measures. In factfinding, keeping all kinds of uncertainty in mind is essential to accuracy.

This Article is intended as a reader-friendly précis of my forthcoming, more technical book entitled *A General Theory of Evidence and Proof: Forming Beliefs in Truth*.

Table of Contents

I. INTRODUCTION	346
II. PROCESSING EVIDENCE AND EVALUATING PROOF	346
III. PROBLEMS OF PROOF.....	349
A. <i>Cause: Disregarding Epistemic Uncertainty</i>	357
B. <i>Cure: Multivalent Belief Theory</i>	358
C. <i>Consequences: Overcoming Probabilism's Problems</i>	362
IV. STANDARDS OF PROOF	364
A. <i>Preponderance of the Evidence</i>	366
B. <i>Clear and Convincing Evidence</i>	369
C. <i>Beyond a Reasonable Doubt</i>	370
V. CONCLUSION	373

* Ziff Professor of Law, Cornell University.

I. INTRODUCTION

Over the last 50 years, a lively literature has engaged fundamental issues regarding the nature of evidence and proof. Currently, the field of evidential proof is experiencing a “paradigm shift” away from probabilism. This Article charts where the field should be going, a move that would allow theory to catch up to where law went long ago.

The proposed move would continue the shift from viewing the outcome of factfinding in terms of probabilities of truth and move toward viewing it as degrees of belief, which measure the extent to which each element has been fully proved. Probabilism’s critical problem lies in its conveying only aleatory (random) uncertainty while burying the much more important factor of epistemic (unknowns) uncertainty. Degrees of belief provide a solution to probabilism’s critical flaw because degrees of belief can convey both aleatory and epistemic uncertainty. When factfinding, keeping all kinds of uncertainty in mind is essential to accuracy.

Part I of this Article deconstructs the “decision stage” of factfinding into an evidence-processing phase and a proof-evaluating phase. The latter involves the application of the standard of proof.

Next, Part II exposes the problems that probabilism encounters in the proof-evaluating phase. This Article discusses two prime examples of those problems, which involve (1) how to handle a situation where both sides have only weak evidence and (2) how to resolve the ubiquitous conjunction paradox. The cause of the problems is probabilism’s failure to account for epistemic uncertainty. The triple-acting cure lies in realizing that legal proof already deals in degrees of belief, not probabilities. First, degrees of belief, being a multivalent and nonadditive measure, can account for epistemic uncertainty. Second, before accepting a fact as true, the factfinder’s degree of belief must sufficiently exceed its degree of disbelief of that fact. Third, degrees of belief combine by the MIN and MAX rules, not by the product rule. Among the consequences of shifting to degrees of belief is resolution of probabilism’s difficulties such as weak evidence and the conjunction paradox.

Finally, Part III explains how the standards of proof already employ degrees of belief. This explanation dissipates the mysteries that surround preponderance of the evidence, clear and convincing evidence, and proof beyond a reasonable doubt.

II. PROCESSING EVIDENCE AND EVALUATING PROOF

Effective decisionmaking most often requires taking an accurate position on what facts are true. Accuracy requires rationally processing

evidence and evaluating it as proof of truth. As for factfinding—or how a factfinder decides that a contestable fact exists—this Article refers to “fact” in its broad sense, as covering anything that a court, other institution, or person subjects to an evidential proof process in order to establish what the system or person will eventually treat as being true. But to focus this discussion, think initially of reaching a dichotomous finding on a historical fact material to a legal claim or affirmative defense. For example, think of: “Was the light red?”

The overall processing of evidence for the purpose of factfinding breaks down into three stages: “the fact-gathering stage, the evidence stage and the decision-making stage.”¹ The first stage, fact-gathering, is the search for and the sharing of relevant information. The second stage entails the presentation of evidence to the decisionmaker. In the third stage, or “decision stage, the decision maker will mentally weigh the evidence and render a decision on matters of fact.”² The law extensively directs the first two stages by the provisions of procedural and evidence law. But the law treads very lightly in the third stage.

Thus, the third stage is the focus of this Article. Figure 1, below, divides the decision stage into two phases: an evidence-processing phase and a proof-evaluating phase.

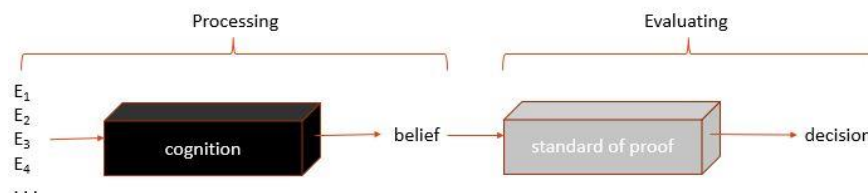


Figure 1: DECISION STAGE

Regarding the first phase, law imposes virtually no enforceable restraints on factfinders’ methods during the initial phase’s processing of pieces of evidence (E_1 , E_2 , etc.),³ other than a review of an output for irrationality, clear error, or the like.⁴ The factfinders, basically, just do

1. R.R. VERKERK, *FACT-FINDING IN CIVIL LITIGATION: A COMPARATIVE PERSPECTIVE* 1 (2010).

2. *Id.* at 2.

3. See TERENCE ANDERSON, DAVID SCHUM & WILLIAM TWINING, *ANALYSIS OF EVIDENCE* 226 (2d ed. 2005) (noting that “there is an almost total absence of formal regulation in respect of evaluating evidence or, to put it differently, the Anglo-American law of evidence has almost no rules of weight”).

4. See, e.g., FED R. CIV P. 50(b) (reasonability test); FED R. CIV P. 52(a)(6) (clearly erroneous test). The Supreme Court has held that review also includes the overturning or impeachment of a verdict for certain misbehaviors, such as jurors’ expressing racial bias. See *Peña-Rodriguez v. Colorado*, 580 U.S. 206, 225 (2017).

their job as they see fit. Psychologists have made some limited progress in figuring out how factfinders process evidence, and this Article draws on this progress.

Although the actual evidence processing may be explicitly rational⁵ or merely intuitive,⁶ it should always involve so-called critical common sense as the minimum standard for evidence processing.⁷ The process may proceed atomistically (element-by-element) or holistically (stories embodying the whole case).⁸ The factfinders need to combine into a single measure all sorts of evidence on each of the necessary facts, ranging from likelihood of a contested occurrence to a vague and partly normative characterization of blameworthiness, such as negligence. The position I take in this Article, based on psychology and introspection, posits that factfinders process the weight and credibility of the evidence largely by intuition and in an approximate and non-quantified way, perhaps while simultaneously looking at the whole case. Factfinders then take a stab at forming beliefs as to the truth. Although the stabs seem to be generally reliable,⁹ this kind of cognition remains a black box, both in the study of law as a logical matter and in the study of practice from a psychological perspective.

As for the second phase of the decision stage, the proof-evaluation phase, whereby beliefs lead to decision, the law gets involved. Here, the standards of proof reign. Psychologists have thus far had very little to

5. See Edmund M. Morgan, *Introduction to Evidence*, in AUSTIN W. SCOTT & SIDNEY P. SIMPSON, *CASES AND OTHER MATERIALS ON CIVIL PROCEDURE* 941, 943–45 (1951) (surmising the logical method that jurors use to process evidence). “Rational” here means logical. See ANDERSON ET AL., *supra* note 3, at 56 (“[A] conclusion based upon the evidence can only be justified as rational through the use of [deductive, inductive, or abductive] logic.”).

6. See Mark Spottswood, *The Hidden Structure of Fact-Finding*, 64 CASE W. RES. L. REV. 131, 154–71 (2013) (applying the dual-process psychological framework to legal factfinding); see also BENGT LINDELL, *MULTI-CRITERIA ANALYSIS IN LEGAL REASONING* 80–97 (2017) (analyzing “intuition”).

7. See D. Michael Risinger, *Searching for Truth in the American Law of Evidence and Proof*, 47 GA. L. REV. 801, 813 (2013) (discussing “the notion of critical common sense and its attendant implication that participation in rational factfinding about legal issues is possible for most humans of normal intelligence”).

8. See Dan Simon, *A Third View of the Black Box: Cognitive Coherence in Legal Decision Making*, 71 U. CHI. L. REV. 511, 559–69 (2004) (arguing that factfinders consider evidence in a holistic rather than atomistic manner); Dan Simon, *Thin Empirics*, 23 INT’L J. EVIDENCE & PROOF 82, 86–87 (2019) (giving reasons to beware of holistic factfinding, because it is better at generating confidence than accuracy).

9. See, e.g., Kevin M. Clermont & Theodore Eisenberg, *Trial by Jury or Judge: Transcending Empiricism*, 77 CORNELL L. REV. 1124, 1154 (1992) (“Apparently, judge trial and jury trial combine to operate a decisionmaking system that is, at least in [its ability to treat like cases alike], highly reliable.”); Thomas B. Metzloff, *Resolving Malpractice Disputes: Imaging the Jury’s Shadow*, LAW & CONTEMP. PROBS., Winter 1991, at 43, 85–86 (showing trial system’s usual competence and fairness by an empirical comparison of medical malpractice verdicts and insurers’ pretrial evaluations).

contribute to the understanding of the standards of proof. Philosophical logic takes over in explaining this phase, providing a theoretical basis for standards of proof. Given that basis, the law specifies a standard of proof as the level of sureness required in an uncertain world for a decision about each necessary fact, fixing the requirement's level to achieve policy goals.

The huge subject of the theory of evidence and proof—these two phases of the decision stage—remains largely unexplored. As with many foundational ideas, we regularly invoke the idea of factfinding without exploring the depths of the idea. For example, those educated in law readily state the test for granting judgment as a matter of law against a party in terms of whether “a reasonable jury would not have a legally sufficient evidentiary basis to find for the party on that issue.”¹⁰ The judge, therefore, needs to determine the limit of reasonable (or rational) factfinding in deciding whether to grant judgment as a matter of law. In this context, and in many others, it would undeniably be appropriate for judges and lawyers to think deeply about how a jury ought to find a fact. But in practice, judges rarely do so, remaining willing to represent the evidence-processing phase as an opaque black box.

In sum, the law leaves the first phase to factfinders' intuition but becomes involved somewhat with the second phase. While the prevailing understanding of both phases is seriously inadequate, this Article focuses on piercing the fog that surrounds the second phase.¹¹

III. PROBLEMS OF PROOF

Law and Probability. Classical logic is built on an assumption of an “excluded middle.” The usual semantic of an excluded middle is bivalence, so that all things are either true or false.¹² Eventually, theorists developed classical probability theory as a supplement to their classical logic. With more time, probability came to add frequentist and subjective measures to its classical version.¹³

10. FED. R. CIV. P. 50(a)(1).

11. I examine the first phase in Kevin M. Clermont, *A Theory of Factfinding: The Logic for Processing Evidence*, 104 MARQ. L. REV. 351 (2020).

12. See EUGENIA CHENG, THE ART OF LOGIC IN AN ILLOGICAL WORLD 63–66 (2018) (delineating the law of the excluded middle). “But the excessive simplifications push us into fabricated black and white situations when everything is really in infinite shades of gray and indeed multi-colors.” *Id.* at ix. “In a way the law of the excluded middle is a simplification . . . [T]here are certain situations we really can't deal with without modifying our logic.” *Id.* at 70.

13. See generally Alan Hájek, *Interpretations of Probability*, in STANFORD ENCYCLOPEDIA OF PHILOSOPHY (Edward N. Zalta ed., 2019), <https://stanford.io/3e9Jfm6> (mapping the whole range of probability theory).

Probabilities ran on a scale from 0 to 1 (or 0% to 100%), indicating how probable it was that randomness would result in the affirmative. By a basic axiom, probability was an additive system, which means that a measure of an event's happening and the measure of the event's not happening add to 1. Probability could express the chances of truth and falsity. Thus, it could give the odds of truth, p , with the necessary implication that the odds of falsity were $1-p$.

A revolution in the way people looked at the world catalyzed the development of the probability theory:

“Probability” from the ancient world to the late seventeenth century traditionally had lumped together the noncertain, the seemingly true, and the merely likely. When evidence was unclear . . . , the result was probability or mere opinion, not knowledge. A late seventeenth-century development, however, suggested that probability consisted of a graduated scale that extended from the unlikely through the probable to a still higher category called “rational belief” or “moral certainty.”¹⁴

Meanwhile, the law's first moves in the direction of overtly expressing standards of proof had given the matter, in Francis Bacon's terms, to the “‘juries’ consciences and understanding.”¹⁵ Thereafter, the common law evolved toward a standard of inner conviction. “Seventeenth- and early eighteenth-century trials abound in references to ‘conscience,’ and writers on conscience often used the trope of ‘an inner tribunal.’”¹⁶ By the turn into the eighteenth century, criminal and civil juries were basing decisions on evidence presented in court, and the authorities had come to understand the task of evaluating conflicting sets of evidence to reach a rational conclusion.¹⁷ So, the common law was ready for a great leap forward.

The law began to interplay with probability theory in the late eighteenth century. Legal theorists and their examples made early contributions to the rapid advances in the science and philosophy of probability, and then the interaction flowed back the other way.¹⁸ This early interaction made the common law more open about accepting uncertainty, and so the common law could continue its reciprocal interactions with probability theory over the ensuing centuries.

14. BARBARA J. SHAPIRO, “BEYOND REASONABLE DOUBT” AND “PROBABLE CAUSE”: HISTORICAL PERSPECTIVES ON THE ANGLO-AMERICAN LAW OF EVIDENCE 8 (1991).

15. 1 WILLIAM HOLDSWORTH, A HISTORY OF ENGLISH LAW 333 n.6 (7th ed. 1956) (quoting 3 JAMES SPEDDING, THE LETTERS AND THE LIFE OF FRANCIS BACON 390 (1859); see also SHAPIRO, *supra* note 14, at 11.

16. SHAPIRO, *supra* note 14, at 14.

17. See *id.* at 3–12.

18. See *id.* at 1–41, 123–24, 220–23, 253–55; BARBARA J. SHAPIRO, A CULTURE OF FACT: ENGLAND, 1550–1720, at 8–33 (2000).

Still in the late eighteenth century, the evolving situation caused the common-law judges to begin instructing juries in detailed Lockean terms of probability and degrees of certainty.¹⁹ Criminal cases became subject to the standard of beyond a reasonable doubt.²⁰ Although the evolution of the lower civil standard is murkier, it slowly began to diverge from the criminal standard around that same time.²¹ The civil standard has since undergone a lengthy process of refinement, as attested by the high number of cases struggling with the concept until today.²²

Why did the law develop these seemingly probabilistic standards of proof? The structure and function of the common-law court—bifurcated with a lawmaking judge in control of a lay jury and operating with openness in an adversary setting—appear to have played, in combination, a causal role. Nonetheless, the desire or need to articulate a standard does not necessarily dictate what the standard will be. The common law consciously chose its high criminal standard to avoid false positives. The common law chose its lower standard for civil cases in pursuit of error minimization. In that sense, then, sound policy was the impetus for the common law's standards of proof.

Other than these developments, probabilistic theorizing had little impact on the law until quite recently, when theorists launched a major assault on evidential proof.²³ The resulting and wonderful “New Evidence” scholarship has made tremendous progress toward a deeper understanding of proof.²⁴ Those scholars made giant strides by shifting the focus of evidence theory from rules of admissibility to the nature of evidence and proof, while opening the door to interdisciplinary insights

19. See MIRJAN R. DAMAŠKA, EVIDENCE LAW ADRIFT 51–54 (1997). For a classic statement of the probabilistic nature of knowledge, see JOHN LOCKE, AN ESSAY CONCERNING HUMAN UNDERSTANDING chs. XV–XVI (Peter H. Nidditch ed., 1975).

20. See SHAPIRO, *supra* note 14, at 21–25.

21. See Harold J. Berman & Charles J. Reid, Jr., *The Transformation of English Legal Science: From Hale to Blackstone*, 45 EMORY L.J. 437, 482 & n.87 (1996). See generally John Leubsdorf, *The Surprising History of the Preponderance Standard of Civil Proof*, 67 FLA. L. REV. 1569 (2015) (providing the definitive work on the subject).

22. See J.S. COVINGTON, JR., THE STRUCTURE OF LEGAL ARGUMENT AND PROOF 99–100 (2d ed. 2006); 2 MCCORMICK ON EVIDENCE § 339 (Robert P. Mosteller ed., 8th ed. 2020).

23. The first effective volleys of that assault on the law arguably were John Kaplan, *Decision Theory and the Factfinding Process*, 20 STAN. L. REV. 1065 (1968), and Michael O. Finkelstein & William B. Fairley, *A Bayesian Approach to Identification Evidence*, 83 HARV. L. REV. 489 (1970).

24. See generally PHILOSOPHICAL FOUNDATIONS OF EVIDENCE LAW (Christian Dahlman et al. eds., 2021); WILLIAM TWINING, RETHINKING EVIDENCE 237–48 (2d ed. 2006); Richard Lempert, *The New Evidence Scholarship: Analyzing the Process of Proof*, 66 B.U. L. REV. 439 (1986); Roger C. Park & Michael J. Saks, *Evidence Scholarship Reconsidered: Results of the Interdisciplinary Turn*, 47 B.C. L. REV. 949 (2006).

including those from psychology and—albeit less so—from logic.²⁵ Less successful was their voluminous literature using Bayesian theories of probability to reduce evidential proof to simplistic terms and then to criticize the law for not conforming to their theories.

These academics' reversion to probability theory was not surprising. Doing their job, academics had started to think about evidence and proof. The preponderance standard was particularly propulsive. What is a "preponderance"? The courts told them it means more likely than not, which to most modern academics means more probably true than false, which thus calls for use of probability theory.²⁶ These academics' consensus appears as routinely taught²⁷ in Figure 2, which shows the pull and haul of the plaintiff's (represented by π , π) and defendant's (represented by Δ , Δ) evidence, E, on a disputed factual issue in the trial's opening stages. The plaintiff's case in chief establishes the fact to be more likely than not, and then the case in defense pushes the probability back down:

25. See Lea Brilmayer, *Second-Order Evidence and Bayesian Logic*, 66 B.U. L. REV. 673, 688–91 (1986) (suggesting that the New Evidence tended to neglect the contemporaneous advances in logic); see also Peter Tillers, *Trial by Mathematics—Reconsidered*, 10 LAW PROBABILITY & RISK 167, 171 (2011) (presenting a similar argument).

26. See, e.g., RICHARD EGGLESTON, *EVIDENCE, PROOF AND PROBABILITY* (2d ed. 1983) (embracing probability fully); THOMAS J. MICELI, *THE ECONOMIC APPROACH TO LAW* 302–03 (3d ed. 2017) (giving a straightforward and uncritical account of the probabilistic approach).

27. See, e.g., THOMAS D. ROWE, JR., SUZANNA SHERRY & JAY TIDMARSH, *CIVIL PROCEDURE* 36 (5th ed. 2020) (saying, in a casebook: "The usual burden of persuasion in a civil case is 'fair preponderance of the evidence,' a less exacting standard that requires a party with the burden to persuade the factfinder that the evidence 'more likely than not' supports its view Thus, for a plaintiff to win on a claim, the factfinder must be persuaded to a slightly more than 50% degree of confidence that the plaintiff's evidence supporting the claim is credible[, that is, a >50% chance the plaintiff 'is right']."); Edward K. Cheng, *Reconceptualizing the Burden of Proof*, 122 YALE L.J. 1254, 1256 (2013) ("As every first-year law student knows, the civil preponderance-of-the-evidence standard requires that a plaintiff establish the probability of her claim to greater than 0.5." (citation omitted)).

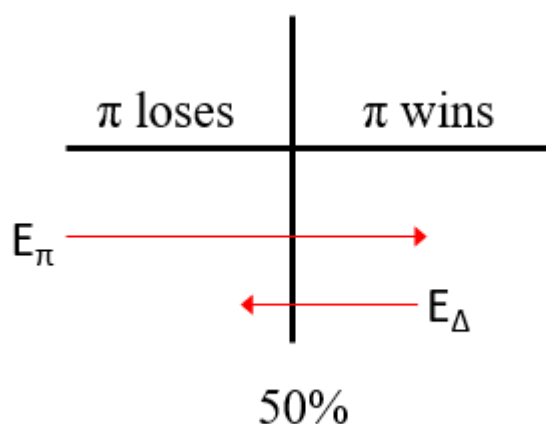


Figure 2: PREVAILING IMAGE OF PROOF AND EVIDENCE

Uncertainty. If the dispute is whether a drawn ball will be black, when taken from an urn containing 100 balls of which 60 are black, then probability is ready to work its magic in dealing with randomness. But what if the question is whether a certain culprit had in fact been Dave?

This Dave question reveals there is more than one kind of uncertainty. As an initial cut, aleatory (random) versus epistemic (unknowns) is a sound and instructive division.²⁸ Most other varieties of uncertainty that measure what we do not know about reality can be seen as subvarieties of epistemic uncertainty.²⁹

Aleatory uncertainty comes from a process that appears random to us, like ball-drawing under ideal conditions. By its nature, this randomness is a built-in part of existence. It, along with any free will, is what keeps us at the present time from seeing the universe as wholly deterministic. Obviously, aleatory uncertainty shows no patterns because patterns would mean that there is more nonrandom information extricable from the data. It is irreducible in the sense that accessible information would not cure it. Even if everything we conceive as knowable about a situation were known, we would still be left with some aleatory uncertainty. Of course, our view of what is random has shrunk over the centuries. Aleatory uncertainty expresses what we see as

28. See, e.g., Craig R. Fox & Gülden Ülkümen, *Distinguishing Two Dimensions of Uncertainty*, in PERSPECTIVES ON THINKING, JUDGING, AND DECISION MAKING 21 (Wibecke Brun et al. eds., 2011) (distinguishing aleatory from epistemic uncertainty as the first cut in classifying uncertainties).

29. See, e.g., Matthew Squair, *Epistemic, Ontological and Aleatory Risk*, <https://bit.ly/3ykSUGu> (2009) (“Ontological uncertainty lies at the far end of our continuum and represents a state of complete ignorance. Not only do we not know, but we don’t even know what we don’t know.”).

inherently unknowable, unperceivable, or unresolvable under our current understanding of the universe.

Epistemic uncertainties come from three sources: (1) the ignorance left by incomplete, inconclusive, ambiguous, dissonant, or unreliable evidence; (2) the indeterminacy produced by the vagueness of our concepts and expressed perceptions of the real world; and (3) the limits on our imaginative powers as to what we do not know. In a sense, while aleatory uncertainty captures random unsureness by expressing a first-order estimate of which way things will randomly turn out, these three sources of epistemic uncertainty imply a second-order unsureness about that estimate.

As Donald Rumsfeld put it: “There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don’t know we don’t know.”³⁰ To refine his division, the world contains (1) known information, (2) unknown but conceivably knowable information, including both known unknowns and possible unknown unknowns, and (3) random unknowables. Traditional probability³¹ looks to the first type in order to create odds that remain subject to the third type’s random effects. It, however, treats the second type as randomness. The second type is not actually random, so probability’s simplification is a source of error. The simplification might be tolerable unless the decisionmaker needs to keep track of epistemic uncertainties for accurately assessing and combining evidence.

By treating epistemic uncertainty as if it were a random effect, traditional probability assumes whatever is known includes all that is conceivably knowable, so that everything else can be treated as a random variation that shows no pattern. Accordingly, in stating a probability, you would be acting as if you know all that there is to know, leaving as uncertain only the acceptedly unknowable effects of randomness in

30. Donald Rumsfeld, Sec’y of Def., Dep’t of Def. News Briefing (Feb. 12, 2002), <https://bit.ly/3yrzF5b>.

31. Many modern probabilists have perceived the problem of epistemic uncertainty and so have adjusted their approach. See Brian Hedden & Mark Colyvan, *Legal Probabilism: A Qualified Defence*, 27 J. POL. PHIL. 448, 466–67 (2019) (“[T]he legal probabilist has more resources at her disposal than critics appreciate. For example, the legal probabilist need not interpret probabilities as relative frequencies or subjective degrees of confidence, but can instead interpret probabilities as degrees to which the evidence supports a given claim, which will be sensitive to the explanatory considerations emphasised by opponents of legal probabilism. And the legal probabilist can make room for imprecise probabilities and refuse to endorse sharp, precise probability thresholds for the various standards of proof.”). The result is a variety of nontraditional probability theories, which are brilliant but exceedingly difficult.

fixing the yes-or-no outcome. This is the essence of additive probability: it is premised on your knowing all there is to know that is nonrandom.

The bottom line is that traditional probability does not express epistemic uncertainty—uncertainty about the strength of the evidence, about the relevant matters that are vague in conception, and about the matters we do not even know that we should be considering. Even though epistemic uncertainty is far more important than aleatory uncertainty in conducting evidential proof, because of the ubiquitous limits on knowledge, probability yields first-order betting odds that express only the effect of what we are treating as randomness.

Why does this matter? After all, in most cases, factfinding ultimately comes down to a yes-or-no answer. Probability seems to provide that sort of answer, via a percentage likelihood that the culprit was Dave. The complication arises because in evidential proof, second-order epistemic uncertainty matters. Two examples drawn from many show this shortcoming.

Weak Evidence. Among the difficulties posed by traditional probability, consider when both parties can muster only weak evidence. This example shows the importance of keeping track of epistemic uncertainty when factfinding:

Assume that the evidence on fact *a*'s existence, say, Dave's identification as the culprit, remains weak after hearing all the available, but very imperfect, evidence (based on weak eyewitness identification). The factfinder somehow gauges an absolute showing of the probability that it was Dave at around 16%. Nonetheless, this affirmative evidence definitely outweighs the evidence that the fact does not exist, which the factfinder gauges at 4% (based on very weak exculpatory evidence). If you were forced to bet on whether accepting Dave's identification is the right course and you wanted to use odds to express the preceding sentence, then perhaps you would say $\text{Prob}(a) = 80\%$ and $\text{Prob}(\text{not-}a) = 20\%$ based on the evidence presented and on normalizing the percentages. That is, even though your belief one way or the other is fairly weak, if you had to allocate all your belief to either yes or no, you would formulate odds of 80/20.

The law must decide on the available evidence, and I think it would normally consider *a* to be proved in this situation, at least in a civil suit where the plaintiff has carried the burden of production by showing that *a* is reasonably possible.

Does the 16% probability tell us anything other than that there was not much evidence? Does the absence of evidence tell us that the probability it was not Dave is 84%? No. The 16% figure suggests only that a reasonable factfinder would prefer not to decide upon the weak

state of this evidence. But the factfinder must decide, even if 16% seems an inappropriate basis for decision. Moreover, the 84% figure does not represent the odds it was not Dave. It represents merely the degree to which the evidence did not prove it was Dave.

Is the 80/20 figure, all alone, an accurate representation of your state of mind as to the existence of *a*? In terms of state of mind, an 80% chance on airtight evidence of a frequentist sort is very different from an 80% chance on thin evidence. Can the factfinder safely combine the 80% finding on thin evidence about Dave with more solid findings on the case's other elements? It is natural to suspect that probability theory would introduce a source of error by discarding epistemic uncertainty and converting the weak showing on *a* to a simple and powerful 80% chance of *a*.

Conjunction Paradox. Probability's elision of epistemic uncertainty might still allow rendering an accurate final answer in a very simple legal case. But using probability at interlocutory steps of factfinding might introduce a multitude of errors. Errors might arise when the factfinder needs to work with the interlocutory probability, as when combining it with findings on other facts. The need to combine arises in connection with (1) linking uncertain inferences from a piece of evidence to reach a conclusion, (2) aggregating the probative force of several pieces of evidence that bear on a single conclusion, and (3) combining separate conclusions. When the factfinder combines findings subject to epistemic uncertainty, it arrives at a different answer if it accounts for epistemic uncertainty rather than ignores it.

The difference between the answers a factfinder comes to when accounting for epistemic uncertainty or ignoring it can be shown by the legal literature's favorite probability problem: the conjunction paradox. To convey the paradox, I must first allude to the rule for combining propositions' probabilities. For propositions *a* and *b* in an additive system, the product rule provides that the probability of the conjoined propositions, be they independent or interdependent, rests on some product of their probabilities. For example, in an additive system, if the probability of *a* is 50% and *b* is 40%, the probability of the conjoined propositions is 20% (obtained from the product of .5 and .4).

The paradox arises from the legal rule providing that, to prove a case, the proponent must prove all of a series of essential facts, or elements, such as the culprit was Dave and the culprit was negligent (*i.e.*, breached a duty so as to cause injury). The proponent is required to prove only that each element meets the standard of proof, although fairness and efficiency depend on the overall tale of liability being more likely than all the narratives of nonliability put together.

Paradoxically, under the product rule, each element's meeting the standard of proof does not guarantee that their conjunction's probability will meet the standard of proof. If identity and negligence are both proved to 60%, their conjunction would register at 36%.³² Thus, the law appears to build unfairness and inefficiency right into the heart of the system.

The discomfort caused by this entanglement is anything but insignificant. In law and in the rest of life, conjunction is ubiquitous. Conjoining propositions is a universal and constant task in factfinding because conjunction is the method required for combining inferential steps. Conjunction is necessary for any fact resting on multiple inferences, and every found fact rests on multiple inferences as to credibility and meaning. The reality is that conjunction is a necessary act in *every* fact found by a legal factfinder.

The Way Forward. The boggles induced by problems such as weak evidence and the conjunction paradox have pushed some theorists to urge abandonment of probabilism. Those theorists say that the law has long been looking instead for some sort of internal conviction on the part of its factfinders in an uncertain world.

Hence, the question for today's theorist is whether the law should be read to demand that the probability of truth reach a specified level or to demand that conviction, or belief, reach a specified strength. To answer the question, this Article restates the cause of probabilism's problem before offering degrees of belief as the cure.

A. *Cause: Disregarding Epistemic Uncertainty*

Our world's predominant way of handling uncertainty appears to be by probability. Traditional probability accounts for aleatory (random) uncertainty. It does so by expressing, given the evidence the decisionmaker got to consider, the decisionmaker's view of the likelihood of a certain proposition, subject to unavoidable and irreducible random variation. If the situation were to repeat itself a hundred times, the decisionmaker would expect that the proposition would turn out to be true $100p$ times and false $100(1-p)$ times.

Yet, p can give no indication of the information that generated this first-order estimate. It could be an estimate based on airtight evidence, or p could rest on very thin evidence. In this way, p hides the epistemic (unknowns) uncertainty. Accuracy demands keeping track of epistemic uncertainty, however. So, here lies the cause of probability's problems in legal factfinding.

32. See Charles Nesson, *The Evidence or the Event? On Judicial Proof and the Acceptability of Verdicts*, 98 HARV. L. REV. 1357, 1385–90 (1985).

Unfortunately, there is no way to meet that demand within the confines of traditional probability. Its additive nature prevents any means of accounting for epistemic uncertainty. It cannot account even by a fudge factor, whereby the decisionmaker would adjust p to reflect, say, imperfect evidence. The reason is that any imposed change of p dictates an offsetting change in $1-p$.³³ That is, the decisionmaker could arbitrarily lower p (or equivalently raise the standard of proof against the burdened party) to reflect the imperfect evidence, but that move creates both an inaccurate p and an inaccurate $1-p$ that will introduce errors when working further with probability in deciding the case.

Consequently, any traditional probability system will fail the decisionmaker in some tasks, namely, whenever the decisionmaker needs to keep track of epistemic uncertainties in order to achieve accurate decisions, as when combining findings of fact. Or as others have put it:

Human beings have the precious metacognitive ability of being aware of their own uncertainty, with respect to the conjectures they entertain. If we wish to develop models of how individuals make judgments and inferences from uncertain information, we need, first, to characterize their metacognitive representation of uncertainty. We believe this question has been largely ignored, because the answer is all too often assumed right from the start. The temptation is strong to take it for granted that standard probability calculus is the only candidate to constitute a normative psychological model of reasoning with uncertainty.³⁴

B. *Cure: Multivalent Belief Theory*

Happily, there is a comprehensible and feasible way to account for epistemic uncertainty when factfinding. It involves the use of multivalent logic rather than classical binary logic. Multivalent logic allows variables to take values between 0 and 1, not just either 0 or 1.

The sort of multivalent logic of interest here, such as fuzzy logic or possibility theory, is both highly developed and widely accepted. Essentially, it rejects as assumptions not only bivalence's postulate of the

33. See Brilmayer, *supra* note 25, at 682 (“If one were to lower the .6 ‘heads’ estimate because it was based upon very little evidence, one would also have to lower the .4 ‘tails’ estimate; it also was based upon very little evidence. After all, both estimates were based upon the same evidence [of an unfair coin].”).

34. Guy Politzer & Jean-François Bonnefon, *Let Us Not Put the Probabilistic Cart Before the Uncertainty Bull*, 32 BEHAV. & BRAIN SCI. 100, 100 (2009); cf. Lea Brilmayer & Lewis Kornhauser, *Review: Quantitative Methods and Legal Decisions*, 46 U. CHI. L. REV. 116, 144–45 (1978) (“To handle these difficulties, other schools of statistical inference customarily supplement probability statements with higher-order probability statements or nonquantifiable qualifications—statements about the size of the sample, for instance—that bear on the weight of the evidence.”).

excluded middle, but also probability's axiom of additivity.³⁵ The omitted assumptions make this nonadditive multivalent logic more general than the special cases of binary logic and its traditional probability. If we were to assume bivalence, so that everything could only be completely true or completely false, and if we were consistently to assume away epistemic uncertainty, so that everything conceivably knowable is known, then this nonadditive multivalent logic would reduce to the theoretical systems of binary logic and traditional probability with which we are familiar.

Under the subvariety that this Article refers to as multivalent belief theory, the factfinder's belief system, after hearing the evidence, will include three multivalent variables: a degree of belief in *a* as a partial truth; a degree of disbelief in *a* as another partial belief; and the remaining unallocated belief on the issue of *a* as a measure of epistemic uncertainty. The degrees of belief and disbelief in a fact, when the factfinder retains some belief as uncommitted between true and false, do not add to one.

Recall the division of the world into (1) known information, (2) unknown but conceivably knowable information, including both known unknowns and possible unknown unknowns, and (3) random unknowables. Multivalent belief theory would look to the known information of the first type in order to create beliefs and disbeliefs measured between 0 and 1. They are subject to the third type's random effects. The second type's epistemic uncertainty is recorded as uncommitted belief.

Multivalent belief theory is not in tension with probability theory—the proposed theory is a generalization of bivalent logic and its traditional probability. Moreover, one need not stick with probability to treat aleatory uncertainty. Multivalent belief theory can handle facts exhibiting aleatory uncertainty as well as epistemic uncertainty. First-order probabilities feed into the construction of the degree of belief in the fact and the corresponding disbelief. Meanwhile, the various second-order uncertainties result in the withholding of some belief. That is, belief and disbelief reflect the risk of random chance, while the uncommitted belief measures the epistemic uncertainty.

Definitions. “Belief,” for the purposes of this Article, means a justified mental acceptance of a statement as true.³⁶ A belief must rest on the person's attempt to express the state of the real world, as represented by the evidence assembled by reasonable means and processed logically.

35. See THEODORE SIDER, *LOGIC FOR PHILOSOPHY* 46–47, 72–73 (2010).

36. See Jessica Moss & Whitney Schwab, *The Birth of Belief*, 57 *J. HIST. PHIL.* 1, 2–3 (2019) (defining “belief” as “the generic attitude of taking something to be the case or taking something to be true” (footnotes omitted)).

But to qualify as a belief, the person's conviction need not be absolute or beyond all doubt; the conviction need only satisfy the standard of proof fixed for beliefs.³⁷

A "degree of belief," multivalent belief, or $Bel(a)$ is the decisionmaker's estimate of the extent, on a scale from 0 to 1, to which proposition a has been fully proved.³⁸ Importantly, the complement of $Bel(a)$ is the degree to which a has not been proved; it is not the smaller degree to which $not-a$ has been proved. Thus, a degree of belief can coexist with the degree of disbelief, or $Bel(not-a)$. Moreover, the decisionmaker can withhold part of its full belief, leaving belief uncommitted to a degree that depends on the quality of the evidence and the presence of other unknowns. This uncommitted belief represents epistemic uncertainty, and it causes the decisionmaker's degrees of belief and disbelief to add to less than one. Degrees of belief and disbelief are therefore multivalent and nonadditive, and hence non-probabilistic.

Model. Degrees of belief can be represented by a so-called belief function³⁹:

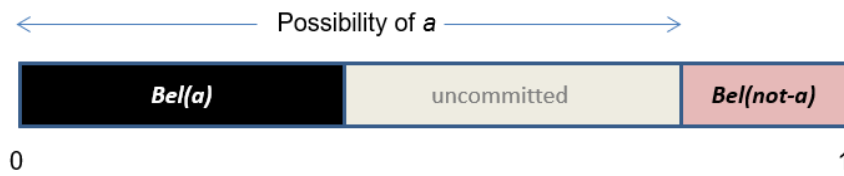


Figure 3: BELIEF FUNCTION

If the factual issue is whether Dave was the culprit, the inquiry starts with the whole range of belief standing as uncommitted. At this initial point, everything is indeterminate because the current lack of evidence requires the factfinder to withhold all belief. The proper representation of lack of proof is zero belief in the affirmative position—but also zero disbelief. The uncommitted belief is the entirety or 1, meaning that a is completely possible, as is $not-a$. Belief function theory thus utilizes the very useful notion of lack of belief, as distinguished from disbelief.

As evidence comes in, some of the factfinder's uncommitted belief should start to convert into a degree of belief in a 's existence, and the proof will usually also have the effect of generating an active degree of belief in its nonexistence. These degrees of beliefs in a and $not-a$ correspond to partial truths. The zone between $Bel(a)$ and $Bel(not-a)$ represents the remaining uncommitted belief. When we say, after

37. See Keith Frankish, *Partial Belief and Flat-Out Belief*, in DEGREES OF BELIEF 75 (Franz Huber & Christoph Schmidt-Petri eds., 2009).

38. See L. JONATHAN COHEN, THE PROBABLE AND THE PROVABLE 13 (1977).

39. See generally GLENN SHAFER, A MATHEMATICAL THEORY OF EVIDENCE (1976).

processing the evidence, that $Bel(a) = 0.40$, we are not saying that $Bel(not-a) = 0.60$. We are saying only that the proof is such that to a degree of 0.60, which could represent uncommitted belief in part or in whole, a has not been fully proved to be true, and $not-a$ is possible. This statement differs from a probability of 40% that a would somehow be revealed as completely true, and 60% that it would be false.

Magic. The reader may feel that this move to multivalent beliefs is all sleight of hand, saying that I cannot change reality by switching logic systems. Of course I cannot. The reality is the same. Within that reality, however, I can focus on different aspects of reality and try to measure them. I can deal with reality more accurately by switching logical tools when appropriate.

Traditional probability assumes that everything must be either true or false and that there is only randomness. These are odd assumptions to adopt for handling imperfect evidence in a proof system that regularly produces outputs falling partway between true and false. Multivalent beliefs measure the outputs with more gradations, include comprehensive measures of uncertainty, and use simple operators to combine these more complex beliefs. The law needs to look at a different aspect of reality than does the bettor playing his odds at a casino. It is looking at extent proven, as opposed to frequentist likelihood. It is looking at beliefs, not probabilities.

For factfinding in the real world, unavoidable epistemic uncertainty produces outputs that should not be forced into true and false boxes via randomness. To assess evidence and combine findings of fact while still considering all kinds of uncertainties, the factfinder must employ a multivalent and nonadditive logic system. Turning to multivalent logic's mathematics (which was developed to handle partial truths) is just like turning to calculus when the problem requires it. That is all that is going on here.

Scope. The test for when to employ multivalent beliefs, rather than probabilities, is whether for the sake of accuracy the decisionmaker needs to keep track of epistemic uncertainties in addition to any aleatory uncertainty. Traditional probability hides epistemic ignorance resulting from imperfect evidence and hides epistemic indeterminacy resulting from vagueness and unknown unknowns, but multivalent beliefs use uncommitted belief as a measure of these epistemic uncertainties.

The nature of the assigned decisionmaking task determines which is the appropriate measure. Whenever a factfinder encounters epistemic uncertainty and must assess evidence or combine multiple measures while keeping track of epistemic uncertainty, probability ceases to work and multivalent beliefs operate as the accurate measure. Factfinding based on evidence always requires continuing attention to epistemic

uncertainty in connection with the ubiquitous tasks of comparing imperfect evidence as proof, linking inferences from a piece of evidence to reach a conclusion, aggregating the probative force of several pieces of evidence that bear on a single conclusion, and conjoining or disjoining separate conclusions. Accordingly, because a factfinder must always keep track of epistemic uncertainty, multivalent beliefs (and their rules for combination) best suit factfinding.

C. Consequences: Overcoming Probabilism's Problems

As concepts, beliefs are not radically different from probabilities. Still, there is ground to think that beliefs—rather than probabilities—are how real people reason in the face of epistemic uncertainty.⁴⁰ There is little doubt that law has evolved to conform to multivalent belief theory, as shown in its judicial instructions.⁴¹ Legal academics' embracing the new theory would yield new understanding but require no reform of practice or doctrine.⁴²

The primary reason for factfinders and the law to use multivalent belief theory is that it delivers more accurate results when encountering epistemic uncertainty. The secondary benefits include resolving all the apparent logical problems of probability attributable to its burying of epistemic uncertainty. Multivalent belief theory circumvents the problems of seemingly requiring the proponent to prove an unattainable probability and of seemingly putting the opponent in the advantageous position of having to disprove only one element. Furthermore, the two prime examples of the issues presented by probabilism—weak evidence and the conjunction paradox—vaporize.

Weak Evidence. The civil factfinder should believe facts if it believes them more than it disbelieves them. The question becomes whether the proponent's version is believable, in the sense that it is more believed than disbelieved, more true than false, more likely than *not*. That focus on proved beliefs against a background of persistent epistemic uncertainty (persistent in the sense that the decisionmaker should keep track of it during the evidence-evaluating process) will yield the best view of the truth on which to act and with which to live.

40. See generally Jane Friedman, *Suspended Judgment*, 162 PHIL. STUD. 165 (2013).

41. See, e.g., 3 KEVIN F. O'MALLEY, JAY E. GRENIG & WILLIAM C. LEE, FEDERAL JURY PRACTICE AND INSTRUCTIONS: CIVIL § 104.01 (6th ed. 2011) ("Plaintiff has the burden in a civil action, such as this, to prove every essential element of plaintiff's claim by a preponderance of the evidence. If plaintiff should fail to establish any essential element of plaintiff's claim by a preponderance of the evidence, you should find for defendant as to that claim.")

42. See generally KEVIN M. CLERMONT, A GENERAL THEORY OF EVIDENCE AND PROOF: FORMING BELIEFS IN TRUTH (forthcoming 2023).

Using beliefs in lieu of probabilities removes all the mystery from how the law handles evidence that is unavoidably weak on both sides. Say that $Bel(a) = 0.16$ and $Bel(not-a) = 0.04$ after hearing all of the available, but very imperfect, evidence. A probabilist might be inclined to decide against the plaintiff, saying inaccurately that there is an 84% chance that the defendant was not liable.

Yet, the belief in favor of the plaintiff is stronger than the corresponding disbelief. True, the factfinder feels uncertain and longs for more evidence. But the factfinder must decide for either plaintiff or defendant, even if both sides can produce only weak evidence. The plaintiff has produced a reasonably possible narrative. There is no reasonably possible narrative contrary to the plaintiff's. A decision for the plaintiff is less likely an error than a decision for the defendant would be. Thus, the plaintiff should win a case like this.

To sum up, comparing belief to disbelief, and requiring belief sufficiently to overcome disbelief, solves probability's problem in handling weak evidence.

Conjunction Paradox. To handle the multiple values for degrees of belief, we need to use the operators of multivalent logic. For conjunction and disjunction, the operators are the MIN and MAX rules, respectively.⁴³ So, for example, the conjunction of $Bel(a)$ and $Bel(b)$ is the minimum of the two degrees of belief. This MIN operator is a more general replacement for the product rule, which would appear as a special case for an additive system. Moreover, the same MIN rule applies whether the degrees of belief are independent or interdependent, unlike the product rule. Therefore, the MIN rule of multivalent logic solves the conjunction paradox that probability theory wrongly generates.

Why do beliefs and probabilities combine differently? The reason is that a belief alone does not reveal anything about a disbelief. A belief just tells you the degree to which the fact was fully proved. So, when you combine a belief in a with a belief in b , your conjunctive belief is proved as far as the lesser degree of the two prior beliefs. By contrast, odds of truth in an additive system tell you the odds of falsity. When you combine odds of a and b , the conjunction's odds of falsity have cumulated, driving down the odds of truth. Let me explain.

As a factfinder formulates degrees of belief subject to epistemic uncertainty, they combine into a chain as strong as its weakest link. No way exists to multiply the beliefs, and if there were a way, it would make no intuitive sense. Instead, the so-called principle of conjunctive closure

43. See Richard Bellman & Magnus Giertz, *On the Analytic Formalism of the Theory of Fuzzy Sets*, 5 INFO. SCI. 149, 151–55 (1973) (proving that the MIN and MAX operators “are not only natural, but under quite reasonable assumptions the only ones possible” for multivalent logic of this sort).

prevails in a nonadditive system by virtue of the MIN rule: if you believe *a* and you believe *b* because each has passed the standard of proof for belief, then you believe *a* and *b* together.⁴⁴

However, probabilistic odds are a different measure. In an additive system, the principle of conjunctive closure cedes to the product rule. Odds of *a* dictate the odds of *not-a*. Conjoin *a* with *b* as probabilities, and the disjunctive odds of *not-a* or *not-b* rise. The conjunctive odds of an uncertain *a* and *b* drop below both *a*'s and *b*'s odds. There is no reservoir of epistemic uncertainty to buffer the effect of conjunction. Therefore, it makes good mathematical sense to stipulate different operators for multivalent beliefs and probabilistic odds.

Another happy consequence of dealing in beliefs and their MIN and MAX rules is that it should make no difference whether the factfinder proceeds atomistically or holistically; that is, whether the factfinder applies the standard of proof element-by-element or the factfinder applies the standard to the parties' overall stories. The two approaches should work out to the same outcome, just as the law has always seemed to assume. This consequence means that we can stop worrying about any differential effect of procedures that preclude the jurors from taking a holistic approach, such as when the judge requires a special verdict that asks the jury only to find each element by a preponderance. We can also stop worrying about the jurors' not fully understanding the court's element-by-element instruction and thereby falling into holistic ways.

Summary. In practice, the difference between beliefs and probabilities is stark. A degree of belief is the fractional share of one's full belief that one devotes to a proposition's truth. Multivalent beliefs can account for epistemic uncertainty as well as aleatory uncertainty. Traditional probability reports the truth as a percent in terms of the approximate number of times the proposition would be revealed as true if you were to repeat the scenario 100 times—or what odds would make truth and falsity equally attractive to you as someone betting on revelation. This measure of probability buries all epistemic uncertainty and reports only aleatory uncertainty. Beliefs and probabilities therefore produce different results, which are appropriate in different circumstances and subject to different operators.

IV. STANDARDS OF PROOF

American law has settled on three—and only three—standards of proof for purposes of trial, each applying in different circumstances.⁴⁵

44. See Simon J. Evnine, *Believing Conjunctions*, 118 SYNTHESE 201, 201, 214, 222 (1999).

45. See KEVIN M. CLERMONT, STANDARDS OF DECISION IN LAW: PSYCHOLOGICAL AND LOGICAL BASES FOR THE STANDARD OF PROOF, HERE AND ABROAD 15–16, 41–42,

First, the standard of preponderance of the evidence is translated into a more-likely-than-not standard. It is the usual standard in civil litigation, but it appears throughout law.⁴⁶ The second standard of proof is the intermediate standard or standards, often grouped under the banner of clear and convincing evidence and roughly translated as a much-more-likely-than-not standard. These variously phrased but similarly applied standards govern certain issues in special situations, such as when terminating parental rights.⁴⁷ Lastly, the standard of proof beyond a reasonable doubt means a virtual-certainty standard. It very rarely prevails outside criminal law.⁴⁸

The academic view of these standards reeks of probability theory. Sometimes the three standards are even stated as 51%, 75%, and 90% or the like.⁴⁹ Nevertheless, the standards, as developed and deployed by the courts, have never embodied the spirit of probability,⁵⁰ even if the words of probability were sometimes used.⁵¹ Again, the law was looking more for some sort of internal conviction on the part of its factfinders in an uncertain world.

61–82 (2013) (using cognitive psychology to explain the limited number of standards of proof); J.P. McBaine, *Burden of Proof: Degrees of Belief*, 32 CALIF. L. REV. 242, 245 (1944) (arguing that, for standards of proof, only three levels of strength of proof exist); C.M.A. McCauliff, *Burdens of Proof: Degrees of Belief, Quanta of Evidence, or Constitutional Guarantees?*, 35 VAND. L. REV. 1293, 1296 (1982).

46. See CLERMONT, *supra* note 45, at 16–18 (outlining the debate over the meaning of the preponderance of the evidence standard).

47. See *id.* at 23–25 (describing the clear and convincing evidence standard).

48. See *id.* at 26–31 (describing the proof beyond a reasonable doubt standard).

49. See *id.* at 103–16; Richard Seltzer, Russell F. Canan, Molly Cannon & Heidi Hansberry, *Legal Standards by the Numbers: Quantifying Burdens of Proof or a Search for Fool's Gold?*, JUDICATURE, Spring 2016, at 56, 64–65.

50. See *Sargent v. Mass. Accident Co.*, 29 N.E.2d 825, 827 (Mass. 1940) (defining preponderance to require that “it is made to appear more likely or probable in the sense that actual belief in its truth, derived from the evidence, exists in the mind or minds of the tribunal notwithstanding any doubts that may still linger there”); *Lampe v. Franklin Am. Tr. Co.*, 96 S.W.2d 710, 723 (Mo. 1936) (“The trouble with [the probability instruction] is that a verdict must be based upon what the jury finds to be facts rather than what they find to be ‘more probable.’ . . . This means merely that the party, who has the burden of proof, must produce evidence, tending to show the truth of those facts, ‘which is more convincing to them as worthy of belief than that which is offered in opposition thereto.’” (quoting *Rouchene v. Gamble Constr. Co.*, 89 S.W.2d 58, 63 (Mo. 1935))); *Anderson v. Chi. Brass Co.*, 106 N.W. 1077, 1080 (Wis. 1906) (saying preponderant evidence “must be such as to satisfy or convince the minds of the jury of the truth of his contention”); Leubsdorf, *supra* note 21, at 1595–99 (discussing early formulations of degrees of belief); Richard W. Wright, *Haack on Legal Proof*, 68 ESTUDIOS FILOSÓFICOS 517, 523 (2018) (“[T]he references in the great majority of jury instructions in the United States to persuasion, conviction or belief in the truth of the facts in issue in the particular case, based on evidence specific to that case, are inconsistent with a standard of proof based on mathematical probability.”).

51. See, e.g., *Brown v. Bowen*, 847 F.2d 342, 345 (7th Cir. 1988) (“[T]he trier of fact rules for the plaintiff if it thinks the chance greater than 0.5 that the plaintiff is in the right.”).

To date, the academic and judicial views do not do a good job of framing the proof question for the factfinder in view of the usual state of evidence. They pose odd questions to the factfinder instead. For example, despite any evidential gaps and other sources of epistemic uncertainty, what is your estimate of the chance of the plaintiff's being right in an absolute sense, and how does that chance compare to the applicable standard of proof?

Belief functions would mesh better with the factfinder's actual frame of mind when applying a standard. Instead of betting that Dave's identity as the culprit is or is not likely, the factfinder should think in terms of degrees of belief.

As to the standards' formulations in terms of belief, the law could conceivably require, for example, that a belief meet some absolute threshold or that the evidence have some specified completeness. But never has such a formulation accorded with the import of real cases. Given the law's need for immediate decision, it does not require the completeness of proof that would be necessary to get a belief above, say, 0.50. It is willing to rest decisions on the evidence presented.

Partly in recognition of the law's adversarial presentation of evidence, the cases' standards are more comparative. However, the cases do not inquire simply which side has the comparatively greater evidence. In effect, they compare the resulting belief and disbelief in the burdened party's position. If we accept that the factfinder should compare belief to disbelief, how best should the law formulate the standards of proof in a comparative way? A variety of comparisons of beliefs and disbeliefs are conceivable, involving sizes, ratios, or supplementary tests.⁵²

A. *Preponderance of the Evidence*

What should preponderance of the evidence (or its translation as more likely than not) mean in a comparative sense? As already suggested, we should directly compare *Bel(a)* to *Bel(not-a)*. In comparing them, *Bel(not-a)* is the opposite belief in the contradiction of *a*, not the complement of *Bel(a)*. It represents how much the factfinder actively disbelieves *a*, the fact in dispute. The comparison thus should look at actual belief in *a* and actual disbelief of *a*. If the factfinder were to work with only those two beliefs, and now disregard the uncommitted

52. See Dale A. Nance, *Belief Functions and Burdens of Proof*, 18 LAW PROBABILITY & RISK 53, 57–58, 64–65, 72–73 (2019) (sketching various comparison possibilities). Another possibility is variable or sliding-scale standards of proof dependent on the peculiarities of the case, but they are not the way of our law. See CLERMONT, *supra* note 45, at 15–16, 73–82 (recounting the law's rejection of variable standards, which might be theoretically desirable); cf. Hock Lai Ho, *The Legal Concept of Evidence*, in STANFORD ENCYCLOPEDIA OF PHILOSOPHY § 3.2.1 (Edward N. Zalta ed., 2021), <https://stanford.io/3fHTWN4> (questioning that desirability).

belief, the most obvious course in civil cases would be to say that the burdened party should win if and only if $Bel(a) > Bel(not-a)$. Once the burden of production is satisfied, the factfinder would decide for the plaintiff if $Bel(a)$ exceeds $Bel(not-a)$, but decide for the defendant if $Bel(a)$ does not exceed $Bel(not-a)$.

This standard not only is readily comprehensible but also avoids any need to quantify the beliefs. Even if one desired to quantify a particular proposition, one should quantify the belief only in words drawn from a coarsely gradated scale of likelihood, rather than speaking in misrepresentative numerical terms. This Article's use of percentages and decimals to this point was only for expository purposes.

Figure 4 gives an appropriately gradated scale that uses natural language and expresses the fuzzy imprecision of beliefs in a fact, whether the burden of persuasion is on plaintiff (the top scale) or on defendant (the bottom scale): (1) slightest possibility, (2) reasonable possibility, (3) substantial possibility, (4) equipoise, (5) probability, (6) high probability, and (7) almost certainty.⁵³ All importantly, the scale illuminates why, when the factfinder finds that $Bel(a)$ exceeds $Bel(not-a)$, it is not drawing a fine line or making a close call, but rather saying that the degree of belief is at least a whole step upward in believability from the corresponding degree of disbelief. That is, $Bel(a)$ must feel perceptibly stronger than $Bel(not-a)$, creating a feeling of conviction.

The reasons for conforming to this coarse gradation partly lie in the cognitive psychology literature. Cognitive limitations leave humans able only weakly to judge likelihood on any sort of scale. Studies of humans' weak absolute judgment, restricted short-term memory, and use of biased heuristics all support the limited capability of humankind. Those studies suggest that a step-like scale of intervals accords with how humans naturally process such information: judged likelihood customarily finds expression in terms of a very small set of broad verbal categories. Perhaps the law, by an intuitive but wise reconciliation with cognitive limitations, has optimized by conforming to the coarsely gradated scale of likelihood that was already in people's customary use.

So, although comparing beliefs does not require placement on a scale, the factfinder in effect might conclude in believing the burdened plaintiff's position on a disputed fact to be only "substantially possible" on Figure 4's coarse scale of seven gradations. That situation does not mean that the plaintiff should lose, however. The factfinder might, if forced to express believability, believe the falsity of the plaintiff's position merely to a "reasonable possibility." The plaintiff should then

53. See CLERMONT, *supra* note 45, at 35–36, 166–68 (extricating from legal practice this coarsely gradated scale of likelihood).

win. All the factfinder needs to do is compare belief and disbelief; all that the preponderance of the evidence standard requires is that the strength of the factfinder's belief that the plaintiff is right must perceptibly exceed its belief that the plaintiff is wrong. Although some of the factfinder's belief remains uncommitted, the plaintiff's position is a good one in the sense of being more likely true than false in the factfinder's mind.

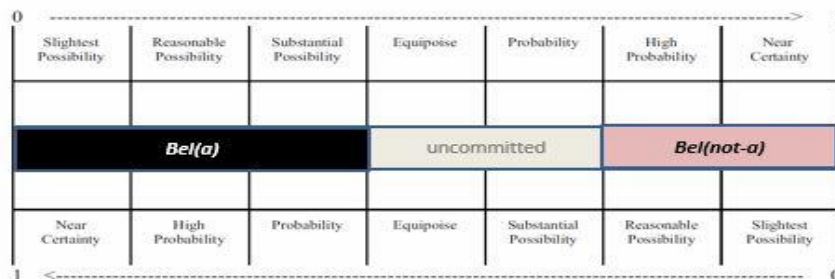


Figure 4: STANDARD OF PROOF

A preponderance of the evidence therefore means that $Bel(a) > Bel(not-a)$, not that $Bel(a) > 0.50$. If $Bel(a) > Bel(not-a)$, the factfinder would say it believes a . If the plaintiff's position is perceptibly stronger than the defendant's position after considering any failure to produce evidence and any other relevant features of the evidence, decision must go for the plaintiff. The court cannot choose not to decide, and a decision for the plaintiff is less likely an error than decision for the defendant would be.

The comparative approach to the civil standard of proof also means that the non-burdened party does not need to develop a competing version of the truth but can rely on negation of any element. A belief in the falsity of the burdened party's version of the truth may develop naturally in the course of trial. It could arise even upon hearing only the burdened party's evidence. Thus, the non-burdened party can, even by silence, prevail if the factfinder disbelieves any element as much as or more than it believes the element. Moreover, of course, any evidence from the non-burdened party should contribute to raising $Bel(not-a)$.

Relatedly, the burdened party need not fight imaginary fights under the comparative approach. Some scholars worry that the opponent's denial puts the burdened party in the impossible situation of disproving every alternative possibility.⁵⁴ But that worry comes from confusing lack of belief with disbelief. Disbelieving a entails the degree to which the

54. See, e.g., Michael S. Pardo, *Second-Order Proof Rules*, 61 FLA. L. REV. 1083, 1093 (2009).

factfinder thinks a is false. The mere possibility of other states of the world in which a is not proven goes into the uncommitted belief, and not into $Bel(not-a)$. Recall that the possibility of $not-a$ equals $Bel(not-a)$ plus the uncommitted belief; again, the degree of believing that Dave is not the perpetrator is quite different from envisaging the chance that he is possibly not the perpetrator. The proposed comparison involves the belief in $not-a$, and does not involve the possibility of $not-a$.

More clarifications and advantages flow from the belief functions' standard of proof. Not only does its comparative approach comport with the natural cognitive method that follows from telling the factfinders they must look to their beliefs and then decide for one side or the other, but also it invokes the factfinders' considerable powers of relative judgment rather than their absolute judgment of believability. Moreover, the belief functions' standard does nothing to interfere with the current procedural and substantive functioning of the standard of proof.

To summarize, the preponderance standard for civil cases asks the natural question that the law seems to pose by "more likely than not?": Is the fact shown to be more true than false, that is, do you believe the burdened party's allegation more than you believe the opponent's denial? This believed-more-than-disbelieved standard calls for constructing separate beliefs for a and $not-a$ while leaving some belief uncommitted, and then comparing the sizes of the beliefs in a 's truth and falsity.

B. Clear and Convincing Evidence

Besides preponderance, American law employs the two standards of clear and convincing evidence and beyond a reasonable doubt. When the cost of a false positive in factfinding considerably exceeds the cost of a false negative, the law tries to minimize error costs by raising the standard of proof. In doing so, it considers not just the costs of erroneous decisions rendered ex post but also the benefits of correct decisions from setting ex ante incentives.⁵⁵

Clear and convincing evidence should mean $Bel(a) \gg Bel(not-a)$, which is what the current law appears to say.⁵⁶ This standard requires "a firm belief or conviction."⁵⁷ It means that fairly close calls go against the

55. See CLERMONT, *supra* note 45, at 5, 13, 25–31 (treating the setting of standards as policy judgments).

56. See McBaine, *supra* note 45, at 263 (proposing an instruction to the effect that "the probability that they are true or exist is substantially greater than the probability that they are false or do not exist"); Edmund M. Morgan, *Instructing the Jury upon Presumptions and Burden of Proof*, 47 HARV. L. REV. 59, 67 (1933) ("[I]ts truth is much more probable than its falsity.").

57. NINTH CIR. JURY INSTRUCTIONS COMM., MANUAL OF MODEL CIVIL JURY INSTRUCTIONS FOR THE DISTRICT COURTS OF THE NINTH CIRCUIT 1.7 (2017) ("When a party has the burden of proving any claim or defense by clear and convincing evidence, it

proponent. This standard would not be that difficult to apply. We are quite used to such a standard of being clearly convinced of something, in life and in law. That standard of decision means that it is not enough to lean toward a decision but instead to think that the opposite decision would be a sizable error.

If one wanted a more explicit formulation, one could say that the factfinder needs to be more convinced than merely feeling that the belief in *a* exceeds the belief in *not-a* by being preponderance's one step higher on Figure 4's scale of seven gross categories of believability, and instead the factfinder needs to believe that it is at least two categories higher. Or one could partially capture the standard by explicating clear and convincing to the factfinder as the standard that lies between preponderance and beyond a reasonable doubt.

I admit that the cases do not make perfectly evident what clear and convincing means. Alternatively, or perhaps additionally, it imposes a requirement about the completeness of evidence. It may require admission of enough evidence to reduce uncommitted belief to the point that $Bel(a)$ exceeds the possibility of *not-a*, or $Bel(a) > 1 - Bel(a)$. I am open to those viewpoints, but I non-dogmatically doubt the law demands this extra requirement. Although the clear and convincing cases are not explicit in describing the standard, they do seem to speak in terms of the necessary degree of belief being stronger than what preponderance requires—but they do so without invoking a standard of proof that differs in kind, as by demanding more complete evidence.⁵⁸

C. *Beyond a Reasonable Doubt*

Proof beyond a reasonable doubt, however, under current law does seem different in kind as to its demandingness.

means that the party must present evidence that leaves you with a firm belief or conviction that it is highly probable that the factual contentions of the claim or defense are true. This is a higher standard of proof than proof by a preponderance of the evidence, but it does not require proof beyond a reasonable doubt.”).

58. See *Tauese v. State, Dep't of Lab. & Indus. Rels.*, 147 P.3d 785, 819–20 (Haw. 2006) (“Under Hawai'i law, ‘clear and convincing’ evidence is ‘defined as an intermediate standard of proof greater than a preponderance of the evidence, but less than proof beyond a reasonable doubt required in criminal cases.’ This standard requires ‘that degree of proof which will produce in the mind of the trier of fact a firm belief or conviction as to the allegations sought to be established, and requires the existence of a fact be highly probable.’” (citations omitted) (quoting *Masaki v. Gen. Motors Corp.*, 780 P.2d 566, 574–75 (Haw. 1989) (“The law has evolved three standards of levels of proof for different types of cases.”)); *Molyneux v. Twin Falls Canal Co.*, 35 P.2d 651, 655–56 (Idaho 1934) (saying that “clear, positive, and unequivocal” overstates the clear and convincing standard); 2 MCCORMICK ON EVIDENCE, *supra* note 22, § 340 (citing cases on the clear and convincing standard).

At the very least, it obviously must require more than clear and convincing's $Bel(a) \gg Bel(not-a)$. It might merely require $Bel(a) \gg \gg Bel(not-a)$, as the probabilists would have it.⁵⁹ But more realistically and effectively, current law appears to place separate demands on $Bel(a)$ and $Bel(not-a)$, demanding that proof of guilt be strong and that no reasonable doubt persists. Those separate demands of a sizable $Bel(a)$ and a tiny $Bel(not-a)$ will ensure that $Bel(a) \gg \gg Bel(not-a)$, but they require more.

Although there are many conceivable approaches to the extra requirements, my conjectured formulation of the current law would require both (1) that the belief in guilt ($Bel(a)$) be strong enough to exceed the so-called maximal possibility of innocence ($1-Bel(a)$) and (2) that no reasonable belief in innocence exist (meaning that the factfinder could not reasonably hold that $Bel(not-a)$ exceeds the lowest category of slightest belief on Figure 4's scale of seven gross categories).

The first requirement of strong proof of guilt ensures that the belief in guilt outweighs all alternative possibilities, including fanciful ones. Thus, $Bel(a)$ must exceed the maximal possibility of innocence. This part of the standard remains comparative. Asking for a belief that guilt is stronger than all alternative possibilities is fairly communicable to and understandable by the factfinder. The point is that the proof of guilt must be solid. The factfinder cannot be swimming in uncommitted belief. We do not want to convict when, although there is some evidence of guilt, we really do not know what happened. The first requirement thus requires a completeness of evidence that is not required on the civil side. The belief in guilt must exceed the logical possibility of innocence.⁶⁰

59. See McBaine, *supra* note 45, at 266 (proposing an instruction to the effect that a reasonable doubt exists when "you cannot honestly say that it is almost certain that the defendant did the acts which he is charged to have done"); cf. Morgan, *supra* note 56, at 67 ("[T]he preponderance of probability must be so great as to banish all reasonable doubts.").

60. Also, the first requirement might mollify those who treat the criminal standard as a unitary but very high probability standard and then argue that the standard is much too demanding to be optimal. See, e.g., Ronald J. Allen & Larry Laudan, *Deadly Dilemmas*, 41 TEX. TECH. L. REV. 65, 68 (2008) ("While the prospect of convicting or executing a truly innocent person is horrifying, this type of mistake occurs within a highly complicated matrix of relationships where other equally horrifying mistakes go unnoticed in the conventional discourse."); cf. Federico Picinali, *Can the Reasonable Doubt Standard Be Justified?: A Reconstructed Dialogue*, 31 CAN. J. L. & JURIS. 365 (2018) (reconciling deontologists' and consequentialists' views). Still, given the usual limits on available evidence, achieving such a high degree of belief that $Bel(a) > 1-Bel(a)$ constitutes a demanding standard. Bear in mind that requiring $Bel(a)$ to exceed $1-Bel(a)$, along with requiring a tiny $Bel(not-a)$, would usually convert by normalization into requiring a very high probability, not far from the probabilities often mentioned in association with beyond a reasonable doubt. See CLERMONT, *supra* note 45, at 108–11 (surveying empirical studies suggesting an 80–90% threshold); see also Lawrence T.

The second requirement expresses the accepted idea implicit in the criminal standard that the factfinder cannot retain a reasonable belief in innocence or, equivalently, a reasonable doubt as to guilt.⁶¹ This requirement works to satisfy those who contend that the criminal standard “is intended to make even the juror who thinks that the defendant ‘did it,’ in everyday terms, think twice.”⁶² The requirement explains why some infamous celebrity defendants who were “obviously guilty” were nevertheless properly acquitted.⁶³ So, “no reasonable doubt” means that the factfinder does not find *Bel(not-a)* perceptibly to exceed zero. On the view that anything is possible, zero as a coarsely gradated degree of belief equates to a slightest belief. *Bel(not-a)* in excess of zero thus refers to a step up from the slightest possibility. Consequently, that the factfinder does not find *Bel(not-a) > 0* actually means that the factfinder does not believe in innocence as a reasonable possibility. For a conviction, the prosecutor must show that *no reasonable doubt* of guilt exists.

Of course, I offer my conjecture only to clarify the elevated standard of proof for theoretical discussion. Its terms should not be conveyed explicitly to the jurors. How to elaborate the criminal standard of proof is hotly debated. Some authorities argue that reasonable doubt should not be defined at all.⁶⁴ Some pattern instructions do attempt to aid the jurors. I do not think those attempts require much amendment. For example, the Tenth Circuit’s pattern instruction runs this way:

Proof beyond a reasonable doubt is proof that leaves you firmly convinced of the defendant’s guilt. There are few things in this world that we know with absolute certainty, and in criminal cases the law does not require proof that overcomes every possible doubt. It is only required that the government’s proof exclude any “reasonable doubt” concerning the defendant’s guilt. A reasonable doubt is a doubt based

White & Michael D. Cicchini, *Is Reasonable Doubt Self-Defining*, 64 VILL. L. REV. 1, 14–24 (2019) (describing a study that suggested a 65% threshold).

61. See CLERMONT, *supra* note 45, at 36–38 (delineating equivalent standards when the burden shifts).

62. Harold A. Ashford & D. Michael Risinger, *Presumptions, Assumptions, and Due Process in Criminal Cases: A Theoretical Overview*, 79 YALE L.J. 165, 199 (1969); see Michael S. Pardo, *Group Agency and Legal Proof; or, Why the Jury Is an “It,”* 56 WM. & MARY L. REV. 1793, 1829 & n.142 (2015) (seeing the beyond a reasonable doubt standard as imposing a double requirement).

63. See generally GERALD F. UELMEN, LESSONS FROM THE TRIAL: THE PEOPLE V. O.J. SIMPSON (1996).

64. See, e.g., PATTERN CRIMINAL FEDERAL JURY INSTRUCTIONS FOR THE SEVENTH CIRCUIT 2.04 (1998) (“The Committee recommends that no instruction be given defining ‘reasonable doubt.’”); Note, *Reasonable Doubt: An Argument Against Definition*, 108 HARV. L. REV. 1955 (1995). *But cf.* Jon O. Newman, *Beyond “Reasonable Doubt,”* 68 N.Y.U. L. REV. 979, 984 (1993) (“I find it rather unsettling that we are using a formulation that we believe will become less clear the more we explain it.”).

on reason and common sense after careful and impartial consideration of all the evidence in the case. If, based on your consideration of the evidence, you are ~~firmly~~ convinced that the defendant is guilty of the crime charged, [*as against all alternative possibilities,*] you ~~must~~ [*may*] find him guilty. If on the other hand, you think there is a real possibility that he is not guilty, you must give him the benefit of the doubt and find him not guilty.⁶⁵

I would add only the words in italics. My use of “may” might water down the jury’s duty to convict, but it conveys that there are multiple requirements to convict without being too pedantic. I would eliminate the repetition of “firmly” because the subsequently stated two requirements spell out what “firmly” should convey, and because including the redundant word might be taken to exaggerate the standard into something like being firmly convinced of being firmly convinced.

V. CONCLUSION

My views on evaluating proof, then, are not at all subversive:

- probabilism has a long history of interaction with law, but it fails to explain legal factfinding;
- this failure’s cause is probabilism’s capacity to express only aleatory (random) uncertainty, and not epistemic (unknowns) uncertainty;
- law cures the failure by employing multivalent and nonadditive degrees of belief, rather than probabilities, as the measure of evidence;
- the consequences include a largely problem-free theory of evidence and proof; and
- the standards of proof, for example, require the factfinder’s degree of belief sufficiently to exceed the disbelief of the fact.

Overall, I merely contend, in accordance with multivalent beliefs’ teaching, that the law effectively charges factfinders to form coarsely gradated degrees of belief and disbelief in the burdened party’s position, while leaving some belief uncommitted in the face of epistemic uncertainty, and then to apply the standard of proof by comparing their belief to their disbelief. Many observers of the legal system would find that contention, putting its slightly new vocabulary to the side, unobjectionable.

Nonetheless, a reader always feels the temptation, upon seeing what looks like a plea for reconceptualization, to dismiss it as a pie-in-the-sky

65. CRIM. PATTERN JURY INSTRUCTION COMM. OF THE U.S. CT. OF APPEALS FOR THE TENTH CIR., CRIMINAL PATTERN JURY INSTRUCTIONS 1.05 (2021).

academic musing. When the reconceptualization involves the standards of proof, the specialists have the added temptation of dismissing it as another of the common anti-probabilist rants or pro-probabilist paeans. After all, if my reformulation were a sound one, someone would have come up with it before:

Two economists are walking along, and one of them says, "Look, there's a five-dollar bill on the sidewalk." The second economist keeps walking, and says, "It can't be a five-dollar bill; if it were, somebody would have picked it up by now."

So, I hasten to undercut my contribution further by stressing that my ideas are not new at all. I am trying little more than to explain what the law has been doing all along.