

# CARDOZO LAW

Benjamin N. Cardozo School of Law · Yeshiva University  
Jacob Burns Institute for Advanced Legal Studies  
January, 2013  
Faculty Research Paper No. 380

## **Inefficient Evidence**

**Alex Stein**

Professor of Law  
Benjamin N. Cardozo School of Law  
55 Fifth Avenue, Room 943  
New York, NY 10003  
United States  
(212) 790-0348 (phone)  
[astein1@yu.edu](mailto:astein1@yu.edu)

## Inefficient Evidence

Alex Stein \*

*Why set up evidentiary rules rather than allow factfinders to make decisions by considering all relevant evidence? This fundamental question has been the subject of unresolved controversy among scholars and policymakers since it was raised by Bentham at the beginning of the nineteenth century. This Essay offers a surprisingly straightforward answer: An economically minded legal system that processes many cases must suppress all evidence that brings along a negative productivity-expense balance. Failure to suppress inefficient evidence will result in serious diseconomies of scale. To operationalize this idea, I introduce a “signal-to-noise” method borrowed from statistics, science and engineering. This method focuses on the range of probabilities to which evidence falling into a specified category gives rise. Specifically, it compares the average probability associated with the given evidence (the “signal”) with the margins on both sides (the “noise”). This comparison allows policymakers to determine the signal-to-noise ratio (SNR) of evidence. When the evidence’s signal overpowers the noise, the legal system should admit the evidence. Conversely, when the noise emanating from the evidence drowns the signal, the evidence is inefficient and should therefore be excluded. I call this set of rules “the SNR principle.” Descriptively, I demonstrate that this principle best explains the rules of admissibility and corroboration by which our system selects evidence for trials. Prescriptively, I argue that the SNR principle should guide the rules of evidence-selection and determine the scope of criminal defendants’ constitutional right to compulsory process.*

---

\* Professor of Law, Cardozo Law School. I thank Ron Allen, Charles Barzun, Rick Bierschbach, Bob Cooter, Larry Laudan, Maggie Lemos, Gideon Parchomovsky, Mike Pardo, Ariel Porat, Richard Posner, Jessica Roth, Peter Siegelman, Ed Stein, \_\_\_\_\_ and participants in workshops and seminars at Cardozo Law School, Texas Law School, \_\_\_\_\_, and \_\_\_\_\_, for helpful comments and suggestions. Copyright © 2013 Alex Stein. All Rights Reserved. Please do not distribute, cite or quote without author’s permission.

## CONTENTS

<b>INTRODUCTION .....</b>	<b>2</b>
<b>I. MACROMANAGING EVIDENCE .....</b>	<b>6</b>
A. A TALE OF TWO SYSTEMS .....	6
B. THE SNR PRINCIPLE .....	11
C. AMERICAN EXCEPTIONALISM IN THE LAW OF EVIDENCE .....	14
<b>II. UNDERSTANDING THE LAW OF EVIDENCE THROUGH THE LENS OF “SIGNAL TO NOISE” .....</b>	<b>17</b>
A. SELF-ASSERTING EVIDENCE .....	18
1. <i>Hearsay</i> .....	18
2. <i>Other Evidence</i> .....	24
B. SELF-SERVING EVIDENCE .....	24
C. SPECULATIVE EVIDENCE .....	27
<b>III. COMPULSORY PROCESS .....</b>	<b>32</b>
<b>CONCLUSION .....</b>	<b>39</b>
<b>APPENDIX .....</b>	<b>40</b>

### Introduction

“Evidence,” wrote Bentham, “is the basis of justice.”<sup>1</sup> This observation aptly describes our legal system, where the outcome of trials critically depends on the parties’ ability to produce information that substantiates their claims. Yet, not every piece of information counts as “evidence” in legal procedures. Evidence rules exclude certain types of information—even relevant one—from bearing on the outcome of cases.<sup>2</sup> This, of course, raises the question: Why?

Suppression of relevant information as legally “inadmissible” or “insufficient” presents a serious puzzle. In this Essay, I set out to resolve this puzzle and provide a comprehensive and incontrovertible justification for the extant design of evidence law. I contend that our evidence-sorting rules share one important commonality: they are designed to secure that only information that satisfies an adequate “signal to noise” ratio will be considered by factfinders and decide the outcome of cases.

<sup>1</sup> 5 JEREMY BENTHAM, RATIONALE OF JUDICIAL EVIDENCE 1 (Fred B. Rothman & Co. ed., 1995) (1827).

<sup>2</sup> See GEORGE FISHER, EVIDENCE 1 (3d ed. 2013) (“Evidence law is about the limits we place on the information juries hear.”).

All information that parties submit to factfinders is comprised of a kernel of “signal” surrounded by “noise.” Under this taxonomy, “signal” refers to information reliable enough to allow the factfinders to determine the probability of the underlying allegation and “noise” represents the exact opposite. Information not allowing the factfinders to make a reliable determination of the relevant probability is “noise.” When the noise mutes the signal, the information becomes inefficient and the court should not admit it into evidence. In what follows, I call this information-sorting principle the “signal-to-noise ratio” or, in short, SNR. I posit that this principle underlies the design of our evidence law. More precisely, I argue that our evidence law works to prevent factfinders from relying on unacceptably noisy evidence—namely, evidence with a low SNR.

The SNR is widely used in statistics, science, and engineering.<sup>3</sup> As a broad concept, it represents an efficiency-driven approach to information management.<sup>4</sup> However, scant attention has been paid to its implications for the law. In this Essay, I hope to redress this omission by shedding light on the profound effect of the SNR principle on our law of evidence.

The SNR principle focuses on the probabilities to which a given piece of information gives rise. These probabilities may fall within the same range, or cluster, on a 0-1 scale. Alternatively, they may be dispersed across the scale and far removed from each other. Any set of probabilities, clustered and dispersed alike, has an average value representing the most dependable probability that factfinders can elicit from the given information. For example, a set of clustered probabilities 0.4, 0.5, and 0.6 and a set of dispersed probabilities 0.1, 0.5, and 0.9 both have an average value of 0.5. This average probability is the “signal” coming from the information.

Any such signal stands between the outliers (the deviations from the mean) on the upper and the lower bounds of the probability scale. The difference between the signal and each outlier determines the “noise” level for the given set of probabilities. Unsurprisingly, a set of dispersed (wide-ranging) probabilities is always much noisier than a set of clustered (short-ranging) probabilities. This pivotal point is illustrated by my numerical example where the two probability sets yield the same signal (0.5), but the noise of the dispersed set (0.4) is four times stronger than the noise of the clustered set

---

<sup>3</sup> See, e.g., STEPHEN T. ZILIAK & DEIRDRE N. MCCLOSKEY, THE CULT OF STATISTICAL SIGNIFICANCE: HOW THE STANDARD ERROR COSTS US JOBS, JUSTICE, AND LIVES 23-25 (2007) (unfolding a straightforward explanation and statistical application of SNR); Christopher S. Yoo, *Beyond Coase: Emerging Technologies and Property Theory*, 160 U. PA. L. REV. 2189, 2194-95 (2012) (attesting that SNR determines the efficacy of wave-based communications and citing communication engineering literature); Paul Glasziou *et al.*, *When are Randomised Trials Unnecessary? Picking Signal from Noise*, 334 BRIT. MED. J. 349, 351 (2007) (using SNR to determine validity of clinical medical research); M.J. Firbank *et al.*, *A Comparison of Two Methods for Measuring the Signal to Noise Ratio on MR Images*, 44 PHYS. MED. BIOL. N261 (1999) (using SNR to determine the efficacy of magnetic resonance imaging systems); Johannes F. de Boer *et al.*, *Improved Signal-To-Noise Ratio in Spectral-Domain Compared with Time-Domain Optical Coherence Tomography*, 28 OPTICS LETTERS 2067 (2003) (exemplifying SNR’s centrality for optics).

<sup>4</sup> See generally JOHN R. PIERCE, AN INTRODUCTION TO INFORMATION THEORY: SYMBOLS, SIGNALS AND NOISE (1980).

(0.1). The two sets of probabilities and their underlying information thus markedly differ from each other. Information giving rise to the dispersed probabilities has a low SNR: 0.5/0.4. This SNR indicates that the noise embedded in the information is nearly as strong as its signal. Trying to elicit the truth from this information will consequently be more expensive than productive. On the other hand, information giving rise to the clustered probabilities has a very high SNR: 0.5/0.1. This SNR indicates that the information's signal is five times stronger than the noise. Factfinders consequently will have no difficulty evaluating the information.

To illustrate, consider an official weather report stating the depth of snow in New York City on February 27, 2007. Probabilities associated with this information are high and clustered. Without knowing their numerical values, one can easily see that the report's SNR is high. After introducing those values—for example, 0.7, 0.8, and 0.9—one will see it more vividly. The signal embedded in the report equals 0.8, while the noise volume amounts to only 0.1. The report's SNR thus equals 8/1, with the signal being eight times stronger than the noise. This factor guarantees that factfinders' evaluations of this and similar reports will align with the truth in nearly every case.

Consider now an alibi witness with three perjury convictions who testifies at his brother's robbery trial. This information gives rise to low probabilities, ones that are much closer to 0 than to 1. Remarkably, because these probabilities form a uniform cluster, the witness's testimony has a high SNR as well, although, of course, not as high as in the weather report example. Here, too, one can see that this SNR is high without assigning numerical values to the probabilities. Based on the experience we have with similar witnesses, assume that these values are 0.1, 0.2, and 0.3. Under this realistic assumption, the testimony's SNR will equal 2/1. The testimony's signal—0.2—is much weaker than the signal embedded in the weather report. The testimony's noisiness, however, is two times lower than the signal, which guarantees that factfinders' evaluations of this and similar testimonies will virtually never fall far off from the truth.

These examples show that whenever the range of the relevant probabilities is short, their signal will be much greater than the noise. Information that gives rise to a clustered probability—high, low, or in-between—therefore always qualifies as good evidence. This information will help factfinders reach the right decision and will virtually never mislead them. Hence, it is efficient and courts should always admit it into evidence.

Finally, consider a witness testifying in a murder trial that she heard from her friend—out of court—that the defendant killed the victim. This testimony is a classic example of “hearsay”: information that our law excludes from the category of admissible evidence. This exclusion is fully justified. The statement made by the out-of-court declarant is either true or false, but whether it is true or false is unknowable. Factfinders consequently need to evaluate the statement's probability of being true rather than false. To this end, they need to know the declarant's motives for making the statement and whether he properly perceived and remembered the alleged murder incident. Alas, these credibility cues are not available. Absent credibility cues—positive, negative, or mixed—the declarant's statement gives rise to a wide range of probabilities that cover all possible hypotheses about the statement's trustworthiness. These probabilities form three

clusters. One of those clusters occupies the upper side of the probability scale (close to 1); another cluster occupies the scale's lower side (close to 0); and yet another cluster occupies the center (0.5). This dispersion—or variance—of probabilities indicates that the statement has a low SNR, as does all hearsay evidence unaccompanied with credibility cues. The noise coming from the statement mutes its signal, which makes the statement unworthy of factfinders' consideration. This statement—and, indeed, all uncorroborated hearsay evidence—is too costly to evaluate relative to its informational benefit. Bringing it into the factfinding process would increase the marginal cost of errors and error-avoidance as a total sum. Hence, it is inefficient and courts should not admit it into evidence.

In the pages ahead, I use the SNR principle to explain our system of evidence that operates with the help of admissibility and sufficiency rules. Admissibility rules are the central core of our law of evidence. They include the hearsay doctrine, the rule against character evidence, the conditions for admitting expert testimony, and a number of other rules. Sufficiency rules encompass the corroboration requirements for accomplice testimony and some other categories of evidence. I demonstrate that our evidence law works to make sure that factfinders base their decisions only on information that gives rise to clustered probabilities and consequently has a high SNR. The law achieves this effect by disqualifying information associated with dispersed probabilities and a correspondingly low SNR.

My account of evidence law is not merely descriptive. I accompany it with two significant normative contributions to legal theory. First and most important, I show that the SNR principle decisively resolves the debate about the purpose of evidence law.<sup>5</sup> Many scholars, beginning with Bentham,<sup>6</sup> call for the abolition of all admissibility and corroboration rules.<sup>7</sup> They argue that factfinders should evaluate all relevant evidence on a case-by-case basis without prior selection, as they do in most countries in the world.<sup>8</sup>

---

<sup>5</sup> See WILLIAM TWINING, *RETHINKING EVIDENCE: EXPLORATORY ESSAYS* 192-225 (1990) (outlining and analyzing the debate about the nature and purposes of evidence law); ALEX STEIN, *FOUNDATIONS OF EVIDENCE LAW* 107-40 (2005) (arguing that evidence law should be geared toward socially desirable allocation of the risk of error).

<sup>6</sup> See 5 BENTHAM, *supra* note 1, at 477-94; WILLIAM TWINING, *THEORIES OF EVIDENCE: BENTHAM & WIGMORE* 66-88.

<sup>7</sup> See, e.g., David P. Bryden & Roger C. Park, *Other Crimes' Evidence in Sex Offence Cases*, 78 MINN. L. REV. 529, 561 (1994) ("For centuries, the movement has been toward abolition of those evidentiary rules that have as their basis the danger of misleading the fact-finder. Jurists and scholars alike increasingly have agreed with Bentham that technical rules of evidence designed to prevent fact-finders from making mistakes are, at best, more trouble than they are worth."). See also *infra* notes 29, 32-33 and accompanying text.

<sup>8</sup> See MIRJAN R. DAMASKA, *EVIDENCE LAW ADRIFT* 1-25, 94-101 (1997). See also *infra* notes 32-33 and accompanying text; Kenneth C. Davis, *An Approach to Rules of Evidence for Non-Jury Cases*, 50 AM. BAR ASSOC. J. 723, 726 (1964) ("Our sick body of evidence law will get well sooner if our American doctors will consult with some European evidence doctors"). Notably, the greatest British evidence scholar, Rupert Cross, made a striking statement "I am working for the day when my subject is abolished": see Twining, *supra* note 5, at 1.

This argument portrays our evidence law as yet another problematic example of American exceptionalism.<sup>9</sup>

Bringing the SNR principle into this debate underscores our system's need to macromanage evidence. American courts process millions of cases every year. This unparalleled volume of litigation makes it imperative for our system to minimize the total cost of errors and error-avoidance in factfinding.<sup>10</sup> To achieve this socially beneficial result, the system must get rid of inefficient evidence: one that increases the cost of factfinding without significantly improving the accuracy of court decisions. The system therefore will do well to suppress all evidence that has a low SNR.

My additional normative contribution concerns the Compulsory Process Clause of the Sixth Amendment.<sup>11</sup> The extent to which this Clause prohibits courts and lawmakers from suppressing criminal defendants' evidence is presently unclear.<sup>12</sup> Adoption of the SNR principle will remove this constitutional ambiguity. Evidence with a low SNR might raise a reasonable doubt as to whether the defendant committed the alleged crime. This factor favors the admission of such evidence. Defendants, however, should not be absolutely free to rely on such evidence, but they should be entitled to adduce it when better evidence is not within their reach. The defendant's showing of necessity should thus make him entitled to present any exculpatory evidence, including one with a low SNR. Suppressing this evidence would violate the Compulsory Process Clause.

Structurally, the Essay unfolds as follows. In Part I, I explain how the SNR principle works and demonstrate its normative superiority over unregulated factfinding. In Parts II and III, respectively, I use this principle to explain our system of evidence selection and to determine the scope of criminal defendants' entitlement to compulsory process. A short Conclusion follows.

## I. Macromanaging Evidence

### A. A Tale of Two Systems

Consider two legal systems: one large (*System L*) and another small (*System S*). *System L* processes 1,000,000 cases a year. *System S* has a much smaller inflow of cases: just 100,000. *System L*'s workload is thus ten times that of *System S*'s. The two systems are identical in every other respect: their laws are the same and their courts are equally competent and speedy. My final assumption is scarcity of resources: neither of the two systems can expend an unlimited amount of resources on its operation. Both systems must limit their expenditures to allow citizens to enjoy other amenities as well.

---

<sup>9</sup> See *infra* Section I.C.

<sup>10</sup> See STEIN, *supra* note 5, at 141.

<sup>11</sup> U.S. CONST. amend. VI ("In all criminal prosecutions, the accused shall enjoy the right ... to have compulsory process for obtaining witnesses in his favor").

<sup>12</sup> See *infra* Part III.

How would you design evidence laws for these two systems? Importantly, would you design one evidence law, or two?

These questions call for a cost-benefit analysis. Adjudicative factfinding generates an indispensable benefit for society: it enables courts to properly assign entitlements and liabilities to parties. This benefit, however, is not cost free. Adjudicative factfinding implicates two social costs: the cost of accuracy and the cost of errors. The cost of accuracy encompasses the legal system's expenditures on factfinding procedures that reduce the incidence of error. The cost of errors originates from incorrect factual findings produced by the system. These findings distort courts' assignments of entitlements and liabilities, thereby causing harm to parties.

The overarching goal of the law of evidence is to achieve a socially optimal tradeoff between these two costs. Evidentiary rules ought to improve the accuracy of court decisions as cheaply as possible. To this end, they ought to minimize the cost of errors and error-avoidance as an aggregate sum. This task is easy to formulate, but difficult to accomplish.

To make the task manageable, policymakers must split it up into three distinct subtasks. As an initial matter, policymakers need to formulate the standards of proof for civil and criminal trials. These standards are necessary because factfinders will have to make decisions under conditions of uncertainty and consequently need to have probability thresholds for making those decisions. Those thresholds should reflect society's preferences in the allocation of the risk of error. Policymakers consequently must determine for every area of the law whether society favors false positives (mistaken impositions of liability) over false negatives (mistaken exonerations), or vice versa, and how intense this preference is. This factor is crucial because any proof standard that reduces the incidence of false positives increases the number of false negatives, and vice versa. To convict a greater number of guilty defendants, policymakers must low the probability threshold for convictions. Under a low threshold, however, courts will convict a greater number of innocents. To protect the innocent from erroneous conviction, policymakers would have to move the probability threshold upwards, but then a greater number of guilty criminals would go scot-free.

Policymakers consequently must decide how many guilty criminals they are willing to free from punishment in order to protect one innocent defendant against erroneous conviction. If this number is very high, policymakers should adopt the "beyond a reasonable doubt" standard for criminal trials. Under this standard, the prosecution will have to prove each and every element of the alleged crime beyond a reasonable doubt. Any reasonable doubt as to whether the defendant committed the crime will consequently require factfinders to acquit him.

For civil litigation, policymakers should endorse a different allocation of the risk of error. In civil cases, there is no reason to favor false positives over false negatives, or vice versa. Hence both types of error should be given equal weight, and policymakers should favor a proof standard that maximizes the number of correct court decisions, namely, the

preponderance of the evidence standard. This standard should apply both to elements of the suit and to affirmative defenses.<sup>13</sup> Under this standard, when factfinders are undecided about an element of the suit, they should dismiss the suit. Correspondingly, when factfinders are undecided about an affirmative defense, they should deny the defendant that defense.

Policymakers' next mission is to formulate the basic gatekeeping criteria for evidence selection. The criteria must separate evidence that can satisfy the chosen proof standards from evidence that cannot. The gatekeeping criteria must therefore consist of evidence-sorting rules that will give courts the power to admit evidence that has the best probative potential, while excluding all inferior evidence from factfinders' consideration.<sup>14</sup>

Formulating these criteria and rules is not difficult. Evidence that lends *prima facie* support to a party's claim or defense is potentially capable of satisfying any proof standard. As a general matter, factfinders can find "preponderance" or "proof beyond a reasonable doubt" in any evidence that tends to prove the relevant claim or defense. Policymakers therefore will do well to set up a broad admissibility provision authorizing courts to admit any evidence that is of consequence to the underlying claim or defense. Policymakers must supplement this provision with rules that will motivate parties to adduce the best available evidence. These rules will require parties to call witnesses with direct knowledge of the relevant facts; to rely on the most qualified expert witnesses in matters calling for scientific or professional expertise; to adduce original documents whenever these are available; to avoid delays; and to minimize undue prejudice to opponents.

The third and final matter policymakers must consider is best identified as noisy evidence. Evidence falling into the "noisy" category is *probabilistically ambiguous*. This characteristic attaches to three categories of evidence: self-asserting, self-serving, and speculative. Evidence is self-asserting when it contains an unexaminable statement of facts, which factfinders are asked to accept on faith. Consider a witness, Alice, who testifies in a criminal trial that her coworker, Harold, told her that he saw the defendant robbing the victim at gunpoint. The prosecutor uses Alice's testimony to prove the robbery accusation, while Harold does not appear as a witness in the proceeding. Here, Harold's statement is self-asserting because its credibility is unverifiable. Based on this statement alone, factfinders can ascribe any probability to the robbery accusation. The probability can be high, low, or in-between—a characteristic that makes Harold's statement probabilistically ambiguous.

Evidence is self-serving when its producer has a motive and opportunity to fabricate it. Consider a suit against a dead person's estate. The plaintiff testifies that the dead person loaned from him \$50,000 and did not repay the loan. This testimony is self-serving

---

<sup>13</sup> See STEIN, *supra* note 5, at 143-48; Cf. Eric L. Talley, *Law, Economics, and the Burden(s) of Proof*, in RESEARCH HANDBOOK ON THE ECONOMICS OF TORTS \_\_\_\_ (Jennifer H. Arlen, ed., 2013), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2170469](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2170469) (examining cost-minimization and other core economic goals of proof burdens).

<sup>14</sup> See generally Dale A. Nance, *The Best Evidence Principle*, 73 IOWA L. REV. 227 (1988) (developing a comprehensive "best evidence" principle and unfolding its normative virtues and explanatory power).

because the plaintiff knows that his attribution of a \$50,000 debt to the dead person cannot be controverted. The dead person cannot stand up and deny the plaintiff's allegations. The plaintiff consequently can say in court anything he wants without facing rebuttal and penalties for perjury.

Evidence is speculative when it pools together cases with some shared similarities while suppressing their differences, thereby driving factfinders to treat the cases as identical. Consider a person accused of burning four of his houses over a nine-year period in order to recover money from insurance. To prove the alleged fraud, the prosecution calls an actuary from the insurance industry to testify that a person's chances of having four of her houses accidentally destroyed by fire over a nine-year period are one in 1.773 trillion.<sup>15</sup> This testimony properly rules out the accidental fire scenario. Yet, it is still speculative, because it pools together cases in which a person burns his own houses to recover money from the insurer with cases in which a person has an enemy—an underworld enemy, perhaps—who sets fire to the person's houses. Defendants falling into the first category of cases are perpetrators of insurance fraud. Defendants belonging to the second category are victims of arson.

What makes the actuary's evidence speculative is its insensitivity to moves between these two very different categories of cases. Moving from one of these categories to another does cause the evidence to adjust to the relevant category. Instead of adjusting itself, the evidence stays invariant across the categories. All it can prove is that fraudsters vastly outnumber arson victims, but this numerical prevalence says nothing about the individual defendant. Once factfinders try to connect the actuary's evidence to the specifics of the case, it becomes probabilistically ambiguous. This evidence can give rise to virtually any probability of the defendant's guilt: high, low, and intermediate.

What should policymakers do with noisy evidence? This question is not easy to answer.<sup>16</sup> Policymakers working for *System L* and *S* are unlikely to resolve it in the same way. Recall that the two legal systems are identical in all respects except caseload. *System L*'s caseload is much heavier than that of *System S*. This difference will not affect the design of the systems' proof burdens and basic evidence selection rules. Because the two systems have similar substantive preferences, their tradeoffs between false positives and false negatives will be similar as well. The two systems also would not differ in their basic evidence selection rules. These rules are fairly standard and uncontroversial.

The caseload difference, however, would affect the ways in which the two systems treat noisy evidence. Because *System S*'s caseload is relatively light, it can afford expending some of its resources on the integration of noisy evidence in adjudicative factfinding. For example, *System S* may authorize factfinders to dedicate more time to cases that involve noisy evidence. The number of such cases would be small. Cases in which noisy evidence

---

<sup>15</sup> This example is drawn from *United States v. Veysey*, 334 F.3d 600 (7th Cir. 2003).

<sup>16</sup> Richard Posner favors an evidence-screening model that tracks Federal Rule of Evidence 403. This model authorizes trial judges to select evidence for factfinding by carrying out a cost-benefit tradeoff in relation to every specific item of evidence. See Richard A. Posner, *An Economic Approach to the Law of Evidence*, 51 STAN. L. REV. 1477, 1522-30 (1999). This model will work well with *System S*. For *System L*, however, implementing it will be too costly.

would engender an erroneous assignment of liability or entitlement would be rare as well. Moreover, noisy evidence would sometimes help factfinders get to the truth. This beneficial effect would be occasional, but one cannot discount it completely.

*System L*'s heavy caseload exponentially increases the costs that this system would incur if it were to allow courts to consider noisy evidence. These costs would include the system's expenditures on factfinding—which are ten times higher than those of *System S*—as well as the distortions in the courts' assignments of entitlements and liabilities that would occur in cases in which noisy evidence will take factfinders astray. For every error engendered by noisy evidence under *System S*, courts operating under *System L* would make ten decisions that assign the relevant entitlement or liability to the wrong party. Benefits that *System L* would derive from noisy evidence would fall way below these costs. As the number of cases implicating noisy evidence gets higher, this negative balance would increase. Authorizing courts to put more time into processing noisy evidence would not improve this balance. In all likelihood, it would make it worse.

Worse yet, the massive inflow of cases would make it difficult for courts operating under *System L* to coordinate and standardize their treatments of noisy evidence. Courts would have no choice but to proceed on a case-by-case basis and evaluate every item of evidence individually. This procedure would involve an enormous amount of redundant courtwork. Moreover, it would also motivate parties to take their chances by using noisy evidence strategically (both offensively and defensively). The parties' intensified recourse to noisy evidence would widen the gap between the cost of processing the evidence and the evidence's benefits. This dynamic would drive *System L* into serious diseconomies of scale. To avoid these diseconomies, the system would do well to keep noisy evidence away from courts.<sup>17</sup>

---

<sup>17</sup> One can draw a useful parallel between this exclusionary policy and the precedent doctrine. The precedent doctrine generates economies of scale by applying a discrete court ruling on a question of law—the precedent—in multiple cases. See RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 743-44 (8th ed., 2011) (analogizing precedent to “a stock of knowledge that yields services over many years to potential disputants in the form of information about legal obligations”). These multiple applications allow the legal system to make substantial investments in the production of precedents. As part of those investments, the system gives the power to make precedential rulings to its most senior courts, with several judges—as opposed to just one—sitting on the panel. The system also allows parties to engage in extensive argumentation about the desired precedent. Moreover, the system permits, and even affirmatively encourages, the submission of amicus briefs and social-science evidence to courts. See generally Ruben J. Garcia, *A Democratic Theory of Amicus Advocacy*, 35 FLA. ST. U. L. REV. 315 (2008). The system spreads the cost of its massive investment in precedents' production across many cases. As the number of cases in which courts rely on a precedent goes up, the system's prorated per-case investment in the precedent decreases. Correspondingly, the system's net benefit from developing and applying precedents steadily increases over time. *System S* need not have a binding precedent doctrine because it has a relatively light caseload. Correspondingly, the number of court decisions that could benefit from a precedent under that system would be small as well. *System S* consequently has no reason to invest substantial resources into the production of good precedents. This system should authorize courts to revise their legal rulings, which would happen only occasionally, given the system's light caseload. This noncommittal approach would save the system's resources. By the same token, *System S* would also stay unbroken if it decides to allow factfinders to evaluate noisy evidence case by case. *System L*, on the other hand, must macromanage its courts' decisions in matters of both fact and law. Being a system with a heavy caseload, it cannot forego economies of scale. For *System L*, therefore, having a binding precedent doctrine is a clear economic

To have a simple numerical example, assume that the overall net cost of evaluating noisy evidence (after offsetting its occasional informational benefit) is \$1010 per case; that the legal system's cost of devising the appropriate evidence-selection rules and procedures is \$1,000,000; and that ancillary litigation over those rules will cost society \$1000 per case. Under these assumptions, by making a one-time investment of \$1,000,000, the system will reduce its adjudicative expenses by \$10 per case; and so it will recoup its initial investment in devising the rules after 100,000 cases. Hence, a system with more than 100,000 cases ought to set up evidence-selection rules and procedures.

For *System L*, the annual caseload of 1,000,000 cases makes the investment into evidence-selection rules absolutely mandatory: the system will recoup the investment and start making substantial savings after a short period of six weeks. Failure to adopt the evidence-selection rules and procedures would thus be highly inefficient and wasteful of societal resources. *System S*, on the other hand, processes only 100,000 cases every year, and so it would take a whole year to recoup a \$1,000,000 investment in evidence-selection rules.<sup>18</sup>

### ***B. The SNR Principle***

To address the challenge of noisy evidence in a cost-effective way, any legal system with a heavy caseload must set up a screen that would allow it to separate efficient from inefficient evidence. In the proceeding discussion, I demonstrate that in order to perform this task, the system ought to adopt a "signal-to-noise ratio" (SNR). I also argue that this ratio lies at the heart of our evidence system (and fully substantiate this argument in Part II). The function of the SNR method is to set the acceptable level of signal to noise that the legal system can handle and then screen out evidence that falls below that level.

It is important to clarify as an initial matter that finding evidence that is completely noise-free and that gives factfinders a fixed probability for deciding the case is practically impossible. Any evidence relied upon by a self-interested party in a court proceeding exhibits some probabilistic indeterminacy. Factfinders therefore cannot be completely insulated from noise. Indeed, our system relies on factfinders' ability to elicit dependable probability (a "signal") from evidence. Factfinders can perform this task cost-effectively when the evidence upon which they base their decision is informative. As I already explained, however, factfinders are unable to perform this task cost-effectively when the noise coming from the evidence mutes the signal. To be informative, a piece of evidence must contain a dependable probabilistic signal that overpowers the noise.

The extent to which this signal should be stronger than the noise is a separate question, and an important one as well. There is no doubt that the ratio of signal to noise should be greater than 1. When that ratio equals 1, the noise coming from the evidence is as strong as its signal, which makes the evidence probabilistically ambiguous and hence too noisy.

---

necessity. For the same reason, *System L* ought to eliminate diseconomies of scale by setting up rules that suppress noisy evidence.

<sup>18</sup> *System S* may still find it economically necessary to set up those rules. My primary concern here, however, is *System L*.

The evidence thus becomes inefficient. A fortiori, evidence whose signal-to-noise ratio falls below 1 is inefficient as well: noise coming from that evidence mutes its signal. To secure that factfinders always receive a clear signal from evidence, the legal system should set the minimal signal-to-noise threshold at 2. The signal coming from evidence that goes to factfinders should be at least twice as stronger than the noise. I call this requirement “the SNR principle.”

Calculating the SNR for any category of evidence is not difficult, given the available knowledge.<sup>19</sup> Statisticians have developed a formula for making the required calculus.<sup>20</sup> Computer engineers programmed this formula into automated calculators, some of which are available on-line.<sup>21</sup> Policymakers, however, can make adequate SNR assessments without this formula as well. All they need to do is specify the range of probabilities that their experience associates with the relevant category of evidence and estimate how wide it is. Consider a category of, say, self-asserting evidence that gives rise to the following probabilities: 0.1, 0.2, 0.5, 0.5, 0.8, and 0.9. This range of probabilities—“variance,” in the technical parlance—is very broad. As such, it indicates that the evidence’s SNR falls below 2, which makes it impermissibly low. Policymakers consequently should suppress the entire category of evidence without making any additional calculations. Alternatively, policymakers should arrange the relevant probabilities into three equal clusters—{0.1, 0.2}, {0.5, 0.5}, {0.8, 0.9}—and find the average probability for each cluster. Average probabilities representing each cluster—0.15, 0.5, and 0.85—would then allow policymakers to determine the signal and the noise that come from the evidence. The evidence’s signal would equal 0.5  $((0.15+0.5+0.85)/3)$  and the noise would amount to 0.35  $(0.5-0.15 \text{ and } 0.85-0.5)$ . The resulting SNR, 1.43, would indicate that the evidence is impermissibly noisy and hence inefficient.

The formula for calculating SNR would give policymakers a more precise figure: 1.58.<sup>22</sup> Evidence law, however, would not benefit from this precision. Both figures—1.43 and 1.58—are far removed from the minimal SNR threshold (2). Therefore, the difference between these two figures is inconsequential. Both figures indicate that the evidence in question is too noisy and hence inefficient, and that policymakers should therefore bar it from being admitted. Furthermore, in cases in which policymakers cannot properly identify the probabilities associated with the given category of evidence, they will do well to divide the unknown probabilities into three clusters—upper, lower, and average—that occupy roughly the same space on the probability scale between 0 and 1. Each cluster will then have an average probability (*UM*, *MM* and *LM*) that will allow policymakers to calculate the SNR. This calculation will be straightforward. The level of noise coming from the evidence will equal  $UM-MM=MM-LM$ ; and so the SNR will amount to *MM* divided by the level of noise ( $UM-MM$  or  $MM-LM$ ).

---

<sup>19</sup> When policymakers cannot determine the relevant probabilities even roughly, they should assume that these probabilities can be any. Evidence that gives rise to these indeterminable probabilities will consequently be identified as extremely noisy.

<sup>20</sup> See ALLEN RUBIN, STATISTICS FOR EVIDENCE-BASED PRACTICE AND EVALUATION 70-71 (3d ed., 2012).

<sup>21</sup> See, e.g., <http://easycalculation.com/statistics/standard-deviation.php>.

<sup>22</sup> The requisite calculation appears in the Appendix.

To illustrate how the SNR principle works, consider a rule that requires a plaintiff seeking to recover compensation for emotional distress as a stand-alone damage to adduce evidence demonstrating her direct involvement in the incident brought about by the defendant's wrongdoing.<sup>23</sup> Failure to adduce direct-involvement evidence dooms the suit.<sup>24</sup> The purpose of this rule is "to distinguish legitimate claims of the emotional trauma from the mere spurious"<sup>25</sup> by securing that factfinders have "clear and unambiguous evidence that the plaintiff was so directly involved in the incident giving rise to the emotional trauma that it is unlikely that the claim is merely spurious."<sup>26</sup> Under my terminology, this rule aims to secure a dependable SNR for self-serving evidence upon which courts award compensation for emotional harm.

Consider a suit for emotional damages unaccompanied by "direct involvement" evidence or other verifiable proof of the plaintiff's anguish. The only evidence that supports the suit is the plaintiff's self-serving testimony. Because this testimony is uncorroborated and hence unverifiable, factfinders cannot separate it from similar testimonies of other plaintiffs. Some of those testimonies are truthful, while others are false. Yet another group of the plaintiffs' self-serving testimonies are partly true and partly false. Every plaintiff, of course, knows well whether his testimony is truthful. The plaintiffs, however, are unwilling or, alternatively, unable to credibly communicate this information to factfinders. Plaintiffs with fake or inflated claims are unwilling to reveal the truth. Honest plaintiffs, on the other hand, are unable to convince the factfinders that their claims are genuine rather than fake.<sup>27</sup> Factfinders consequently face a pool of indistinguishable self-serving testimonies that can have virtually any probability on a scale between 0 and 1.

The only dependable signal that factfinders can elicit from this array of probabilities is 0.5. This average probability falls below the preponderance threshold ( $>0.5$ ), which makes it difficult for the plaintiff to satisfy the requisite standard of proof. Under regular circumstances, nonetheless, the plaintiff's case must still go to trial that would give him an opportunity to convince the factfinders that his testimony is more credible than the average. The plaintiff's testimony clearly satisfies the "prima facie proof" requirement. Under general law, this testimony consequently would defeat the defendant's motion for a direct dismissal of the suit. The reason for excluding the plaintiff's testimony—and, indeed, for effectively denying him the opportunity of a trial—is the noise surrounding

---

<sup>23</sup> See DAN B. DOBBS, *THE LAW OF TORTS* § 308 at 836-39 (2000) (attesting that most courts condition plaintiffs' ability to recover compensation for emotional distress upon presence of direct impact or other objective proof).

<sup>24</sup> *Id.* See also *Atlantic Coast Airlines v. Cook*, 857 N.E.2d 989, 998-1000 (Ind. 2006) (reversing trial court's denial of the defendant's summary-judgment motion on the plaintiffs' claim for emotional distress damages after finding that the plaintiff's evidence did not show direct impact).

<sup>25</sup> *Groves v. Taylor*, 729 N.E.2d 569, 572 (Ind. 2000).

<sup>26</sup> *Id.* See also *Spangler v. Bechtel*, 958 N.E.2d 458 (Ind. 2011) (reaffirming the "direct impact" evidence requirement and its sorting rationale).

<sup>27</sup> Cf. Daniel J. Seidmann & Alex Stein, *The Right to Silence Helps the Innocent: A Game-Theoretic Analysis of the Fifth Amendment Privilege*, 114 HARV. L. REV. 430 (2000) (explaining the right to silence as a mechanism that increases the credibility of innocent defendants' testimonies by reducing criminals' incentive to pool with innocents by fabricating self-exonerating stories).

the testimony's signal. This noise comes from the probabilities other than 0.5 that could also attach to the plaintiff's testimony and that spread across the full range between 0 and 1. This spread of probabilities is fatal to the plaintiff's case because it is too wide. As such, it increases the noise level to an inefficient and hence impermissible degree.

Assume for simplicity that probabilities attaching to this category of evidence range between 0.9 and 0.1. Under this assumption, the difference between the dependable signal (0.5) and the noisy extreme on each side (0.1 and 0.9) yields the noise level of 0.4. The signal-to-noise ratio consequently equals 1.25 (0.5/0.4), which indicates that the noise coming from the evidence is nearly as strong as the signal. Because of this low SNR, the factfinders' inquiry into the nature and causes of the plaintiff's emotional damages is bound to be more costly than productive. This factor marks the plaintiff's testimony, along with all other uncorroborated self-serving evidence, as inefficient.

Furthermore, admission of this testimony into evidence will trigger a response from the defendant. The defendant will cross-examine the plaintiff and will attempt to rebut his testimony. Adding the plaintiff's testimony and the defendant's rebuttal to a trial involving a judge, eight jurors, and two attorneys will create 78 channels for noisy, and hence unproductive, communications.<sup>28</sup> A legal system that manages multiple trials and cares about efficiency consequently has no choice but to suppress the plaintiff's testimony in this and every other case.

### ***C. American Exceptionalism in the Law of Evidence***

Our system of evidence employs many evidence-sorting rules. These rules determine which evidence is admissible and, conversely, inadmissible as a proof of the underlying facts. Admissible evidence goes to factfinders, who then evaluate its probative value and impact on the case at hand. The court must preclude all inadmissible evidence. Factfinders are not authorized to base their decision on such evidence. In addition, evidence-sorting rules determine which evidence is self-sufficient and thus requires no corroboration. Conversely, these rules also determine which evidence can never satisfy the requisite proof standard without corroboration even when factfinders find it credible. Factfinders are not authorized to base their decisions on such uncorroborated evidence.

Evidence-sorting rules that apply in American courts thus disqualify a substantial amount of evidence that other countries allow factfinders to consider. These countries form a majority of jurisdictions that adopted the regime of free proof.<sup>29</sup> This regime functions with two, rather than three, sets of evidentiary rules. One of these sets contains the proof

---

<sup>28</sup> The number of communication channels equals  $[n(n-1)]/2$ , with  $n$  denoting the communicators' number. See generally Edward W. Cleary, *Evidence as a Problem in Communicating*, 5 VAND. L. REV. 277 (1952) (pioneering association of trial evidence with communicative processes).

<sup>29</sup> For comparison between the American and the continental European systems of evidence, see DAMASKA, *supra* note 8, at 1-25. See also H. Richard Uviller, *Evidence of Character to Prove Conduct: Illusion, Illogic, and Injustice in the Courtroom*, 130 U. PA. L. REV. 845, 845n.2 (1982) ("It comes as a surprise to American lawyers and law students to discover that a substantial number of highly developed legal systems—notably European—carry on litigation quite comfortably without any discernible "law of evidence."").

burdens and another the basic evidence-selection rules. These two sets of rules are supplemented with a few privileges that protect the confidentiality of certain information and thus guard against revelational harm.<sup>30</sup> Many scholars, beginning with Bentham,<sup>31</sup> have endorsed this regime.<sup>32</sup> They argue that sorting evidence into “reliable” and “unreliable” categories is futile, as evidence ought to be evaluated on a case-by-case basis rather than categorically.<sup>33</sup> Their opposition to evidence-sorting rules sparked an ongoing heated debate about the nature and purpose of the law of evidence.<sup>34</sup>

As part of this debate, the American system of evidence was criticized for its exceptionalism.<sup>35</sup> The system’s critics argue that its evidence-sorting rules make factfinding too formal, unduly complicated, and unnecessarily expensive.<sup>36</sup> Given that free proof works reasonably well for many European countries, so goes the argument, why not have the same regime in American courts? This shift is not unprecedented. England—the birthland of evidence sorting rules—did away with most of them and effectively allowed factfinders to engage in a free evaluation of evidence.<sup>37</sup>

Traditional evidence scholars have joined the fray by voicing their support of the extant admissibility and corroboration rules.<sup>38</sup> They argue that evidence law should continue to

---

<sup>30</sup> See Alex Stein, *The Refoundation of Evidence Law*, 9 CAN. J.L. & JURIS. 279, 280-81 (1996).

<sup>31</sup> See 5 BENTHAM, *supra* note 1, at 477-94.

<sup>32</sup> See LARRY LAUDAN, TRUTH, ERROR, AND CRIMINAL LAW: AN ESSAY IN LEGAL EPISTEMOLOGY 2 (2006) (arguing that relevancy alone should make evidence admissible).

<sup>33</sup> See L. Jonathan Cohen, *Freedom of Proof*, in FACTS IN LAW, 16 ARCHIVE FÜR RECHTS- UND SOZIALPHILOSOPHIE 1 (William Twining, ed., 1983) (commending a regime in which factfinders evaluate evidence on a case-by-case basis without any predetermined rules of proof).

<sup>34</sup> See TWINING, *supra* note 5, at 192-236 (discussing virtues and vices of regulated and unregulated factfinding); STEIN, *supra* note 5, at 107-40 (arguing that evidence rules are needed for allocating the risk of error); Stein, *supra* note 30, at 296-323 (arguing that free proof rests upon weak epistemic and moral foundations). See also Michael S. Pardo, *The Nature and Purpose of Evidence Theory*, 66 VAND. L. REV. \_\_\_\_ (2013), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2060340](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2060340) (analyzing arguments for and against free proof); Robert P. Burns, *The Withering Away of Evidence Law: Notes on Theory and Practice*, 48 GA. L. REV. \_\_\_\_ (2013), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2180314](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2180314) (favoring abolition of admissibility rules); John Leubsdorf, *Evidence Law as a System of Incentives*, 95 IOWA L. REV. 1621 (2010) (interpreting evidentiary rules as inducing socially desirable management of litigation).

<sup>35</sup> See DAMASKA, *supra* note 8, at 101 (criticizing the American system of evidence for “[deviating] from ordinary decision-making” and for “[striking] discordant notes with arrangements recommended by a model of inquiry aimed at obtaining only accurate, trustworthy knowledge.”). For cultural, institutional, and legal analyses of American exceptionalism in procedure and evidence, see AMALIA D. KESSLER, *INVENTING AMERICAN EXCEPTIONALISM: THE ORIGINS OF AMERICAN ADVERSARIAL LEGAL CULTURE, 1800-1877* (forthcoming 2013) (unfolding a powerful cultural and historical account of American exceptionalism in court procedures); Oscar G. Chase, *American “Exceptionalism” and Comparative Procedure*, 50 AM. J. COMP. L. 277, 296-301 (2002) (outlining the unique characteristics of the American trial and comparing them with the European trial); Richard L. Marcus, *Putting American Procedural Exceptionalism Into a Globalized Context*, 53 AM. J. COMP. L. 709, 715-22 (2005) (comparing the unique characteristics of the American civil trial with the core features of the British, German, and Japanese trial systems).

<sup>36</sup> See sources cited above in notes 29 and 32-33.

<sup>37</sup> See STEIN, *supra* note 5, at 209-13; 243-44 (documenting and discussing the abolition of hearsay, character, and corroboration rules in England).

<sup>38</sup> See Richard Friedman, *Minimizing the Jury Over-Valuation Concern*, 2003 MICH. ST. L. REV. 967 (arguing that evidence rules counter jurors’ cognitive biases); Lisa Dufraimont, *Evidence Law and the Jury: A*

perform its time-honored sorting role in order to prevent factfinders from considering evidence that might cause them to err.<sup>39</sup> Traditional scholars are also unwilling to give judges the decisive power to select evidence for trials. They estimate that this power will lend itself to abuse and create distortions in court decisions.<sup>40</sup> Recently, this view has received an endorsement from a renowned legal philosopher, Frederick Schauer, who developed a sophisticated rule-driven theory of factfinding.<sup>41</sup> This theory draws upon experimental studies that pointed to errors that people systematically make in conditions of uncertainty.<sup>42</sup>

The third view in this important debate belongs to me. My book, *Foundations of Evidence Law*,<sup>43</sup> demonstrated that evidence-sorting rules play a pivotal role in adjudication. These rules allocate the risk of error accompanying factfinders' decisions in a way that enhances the protection of people's substantive entitlements at a socially affordable cost.<sup>44</sup> Based on this insight, I argued that our evidence law should not only retain its rules of admissibility and corroboration, but should also expand their applicability.<sup>45</sup> This rationalization of evidence law has provoked an extensive discussion.<sup>46</sup> A number of scholars<sup>47</sup> and one court<sup>48</sup> have agreed with my core idea. Other scholars have criticized it.<sup>49</sup>

---

*Reassessment*, 53 MCGILL L.J. 199, 220-31 (2008) (analyzing the traditional jury-control justifications of evidentiary rules).

<sup>39</sup> See Dufraimont, *supra* note 38, at 220-31.

<sup>40</sup> See, e.g., THOMAS A. MAUET & WARREN D. WOLFSON, TRIAL EVIDENCE 292 (3d ed., 2005) (mentioning mistrust of trial judges as states' reason for not setting up a discretionary framework for admitting expert evidence).

<sup>41</sup> See Frederick Schauer, *On the Supposed Jury-Dependence of Evidence Law*, 155 U. PA. L. REV. 165, 187 (2006); see also Charles L. Barzun, *Rules of Weight*, 83 NOTRE DAME L. REV. 1957, 1988-96 (2008) (arguing that corroboration and admissibility rules can control factfinders' cognitive biases).

<sup>42</sup> See generally DANIEL KAHNEMAN, THINKING, FAST AND SLOW (2011) (presenting and discussing psychological studies showing people's failures in cognition and reasoning). For critique of those studies, see Alex Stein, *Book Review: Are People Probabilistically Challenged?*, 111 MICH. L. REV. \_\_\_\_ (2013), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2015075](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2015075).

<sup>43</sup> See STEIN, *supra* note 5.

<sup>44</sup> *Id.* at 133-40.

<sup>45</sup> *Id.*

<sup>46</sup> See Ronald J. Allen, *Book Review: Laudan, Stein, and the Limits of Theorizing About Juridical Proof*, 29 LAW & PHIL. 195, 217-30 (2010); Dale A. Nance, *Allocating the Risk of Error: Its Role in the Theory of Evidence Law*, 13 LEGAL THEORY 129 (2007); Michael S. Pardo, *The Political Morality of Evidence Law*, 5(2) INT'L COMM. EVID. 1 (2007); David Hamer, *The Truth Will Out? Incoherence and Scepticism in Foundations of Evidence Law*, 70 MODERN L. REV. 319 (2007); Mike Redmayne, *The Structure of Evidence Law*, 26 OXFORD J. LEGAL STUD. 805 (2006); Roger C. Park & Michael J. Saks, *Evidence Scholarship Reconsidered: Results of the Interdisciplinary Turn*, 47 B.C. L. REV. 949, 1018-24 (2006).

<sup>47</sup> Five critics of my book (Allen, *supra* note 46, at 228; Nance, *supra* note 46, at 161-64; Pardo, *supra* note 46, at 17; and Park & Saks, *supra* note 46, at 1023) acknowledge the core virtue of my rule-based risk-allocation theory while criticizing its conceptual apparatus and implications.

<sup>48</sup> See *Hill v. Humphrey*, 662 F.3d 1335, 1355 (11th Cir. 2011) ("All kinds of rules serve to allocate the risk of an erroneous decision—procedural rules that determine who can participate in the presentation of evidence and argument, evidentiary rules that determine what evidence the trier of fact can consider, and decisional rules like the standard of proof at issue here." (quoting Alex Stein, *Constitutional Evidence Law*, 61 VAND. L. REV. 65, 67-68 (2008))).

<sup>49</sup> See Redmayne, *supra* note 46, at 820 (rejecting the risk-allocation theory of evidence law); Hamer, *supra*

The SNR principle and its economic motivation reshape the parameters of the debate. Thus far, the debate focused on whether evidence-sorting rules can reduce the incidence of errors in court decisions and secure the desired allocation of residual errors. The SNR principle prompts policymakers to focus on a different, yet profoundly important, question: whether the legal system's caseload makes it economically prudent for courts to consider noisy evidence. The more cases are there to process, the greater the system's need to macromanage evidence in order to avoid diseconomies of scale. For a system that manages multiple trials, screening out inefficient evidence by applying the SNR principle is a plain economic necessity.

The SNR principle also puts the American evidence system in a different light. Not only does it offer a new theoretical grounding for our system's evidential modus operandi by revealing its efficient design, but it also shows that the "exceptionalism" label that the system's critics attached to it is misplaced. Evidence-sorting rules that our system employs indeed stand out as exceptional against the "norm" formed by a numerical majority of the world's countries that adopted a free proof regime. This exceptionalism, however, has a straightforward explanation. For good or bad reasons, our state and federal courts manage an exceptionally large number of cases.<sup>50</sup> Because our legal system promotes not only fairness, but efficiency as well, we expect courts to adjudicate cases economically. These two factors call for a complete ban on all inefficient evidence. Tolerating such evidence would make our factfinding system slow and ineffectual.

Hence, evidence-sorting rules mandated by the SNR principle are unassailable. I now turn to identifying those rules and explaining how they work.

## II. Understanding the Law of Evidence Through the Lens of "Signal to Noise"

In this Part, I demonstrate that the SNR principle explains our evidence-sorting rules. Evidence we consider admissible uniformly exhibits a strong signal and a low noise level—a combination that guarantees a high SNR. Conversely, evidence we deem categorically inadmissible embodies a weak signal, a high noise level, and correspondingly a low SNR. Corroboration requirements that attach to certain categories of evidence<sup>51</sup> follow the same logic. Evidence falling into those categories has an

---

note 46, at 326 (denying the centrality of risk-allocation to evidence law).

<sup>50</sup> See, e.g., Allegra M. McLeod, *Decarceration Courts: Possibilities and Perils of a Shifting Criminal Law*, 100 GEO. L.J. 1587, 1669 (2012) (attesting that our criminal courts manage high case volumes and consequently work to substitute trial with guilty pleas); F. Andrew Hessick, *Standing, Injury in Fact, and Private Rights*, 93 CORNELL L. REV. 275, 323 (2008) (observing that "Litigation is expensive both for the litigants and for the judiciary, and the volume of civil litigation is ever increasing.").

<sup>51</sup> Our legal system includes three additional corroboration requirements that perform no sorting role. One of those requirements bars conviction for perjury on the testimony of a single witness. Any such witness must be corroborated by additional testimony or other evidence: see *Weiler v. United States*, 323 U.S. 606 (1945); *United States v. Chaplin*, 25 F.3d 1373, 1378 (7th Cir. 1994) (holding that "although criticized by some, the two-witness rule remains viable in perjury prosecutions"). Another requirement appears in Article III, Section 3(1) of the United States Constitution, which provides, "No person shall be convicted of Treason unless on the Testimony of two Witnesses to the same overt Act, or on Confession in Open

invariably low SNR and thus cannot on its own form a basis for factual findings. Conversely, evidence recognized by our system as capable of satisfying the requisite burden of proof always passes the minimal SNR threshold.

Based on the categorization established in Part I, I show that extant admissibility and corroboration rules disqualify three categories of evidence—self-asserting, self-serving, and speculative—all of which have an impermissibly low SNR. Evidence not falling into any of these categories may have a low SNR as well, but such evidence is not readily identifiable in advance and can only be dealt with case by case. Our courts' general power to exclude any piece of evidence whose prejudicial potential outweighs its probative value<sup>52</sup> allows them to suppress evidence for having a low SNR.

### *A. Self-Asserting Evidence*

#### **1. Hearsay**

The rule against hearsay is a pillar of the American system of factfinding.<sup>53</sup> The rule provides that an assertion that a person makes out of court (expressly or implicitly) is generally not admissible as evidence purporting to establish the assertion's truth.<sup>54</sup> To become admissible, any such assertion must satisfy special conditions set by one of the exceptions to the hearsay rule.<sup>55</sup> Those exceptions are numerous and diverse.<sup>56</sup> Their combined effect is to make many hearsay statements admissible—a consequence that prompted some evidence scholars to question the desirability of the hearsay rule.<sup>57</sup> These scholars argue that the rule has effectively been rendered meaningless by its exceptions and conclude that the legal system should abolish it completely.<sup>58</sup>

---

Court." U.S. CONST. art. III, § 3, cl. 1. These requirements curtail the government's power to prosecute individuals for perjury and treason—two overbroad and otherwise problematic offenses. *See* Richard A. Bierschbach & Alex Stein, *Overenforcement*, 93 GEO. L.J. 1743, 1765-71, 1771 n.128 (2005). Under our system, a criminal defendant's confession needs to be corroborated as well: *see* Wong Sun v. United States, 371 U.S. 471, 488-90 (1963). This requirement aims at securing the confession's voluntariness, but its constitutional status is unclear: *see* United States v. Bukowski, 435 F.2d 1094, 1106 n.7 (7th Cir. 1970) ("[I]t is not clear whether [the corroboration requirement for confessions] need be treated as a feature of 'Due Process.'"). For discussion of this requirement, *see* Alex Stein, *Constitutional Evidence Law*, 61 VAND. L. REV. 65, 118-19 (2008).

<sup>52</sup> *See* Fed. R. Evid. 403.

<sup>53</sup> Wigmore's monumental treatise famously described the hearsay rule as "the most characteristic rule of the Anglo-American law of evidence." JOHN HENRY WIGMORE, 5 A TREATISE ON THE SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW § 1365 at 1695 (James H. Chadbourn ed., rev. ed. 1974). Equally famously, Wigmore considered in-court cross-examination of witnesses as "beyond any doubt the greatest legal engine ever invented for the discovery of truth." *Id.* at § 1367, at 1697.

<sup>54</sup> *See* Fed. R. Evid. 801(c).

<sup>55</sup> *See* Fed. R. Evid. 802 (providing that hearsay evidence is not admissible subject to exceptions).

<sup>56</sup> *See* Fed. R. Evid. 801(d), 803, 804, 807 (codifying thirty-seven exceptions to the hearsay rule).

<sup>57</sup> *See, e.g.*, David Alan Sklansky, *Hearsay's Last Hurrah*, 2009 SUP. CT. REV. 1; Ronald J. Allen, *The Evolution of the Hearsay Rule to a Rule of Admission*, 76 MINN. L. REV. 797 (1992); Michael L. Siegel, *Rationalizing Hearsay: A Proposal for a Best Evidence Hearsay Rule*, 72 B.U. L. REV. 893, 894 (1992).

<sup>58</sup> *See* Allen, *id.* at 800; Siegel, *id.* at 928-44 (calling for admission of best available hearsay evidence); *see also* Jack B. Weinstein, *Probative Force of Hearsay*, 46 IOWA L. REV. 331, 344-46, 353-55 (1960) (listing

This argument makes a valid conceptual point: the “hearsay” category indeed has lost much of its significance. However, the fact that much hearsay evidence has become admissible does not weaken the economic reasons for excluding *self-asserting* hearsay statements.<sup>59</sup> Such statements have an impermissibly low SNR and, hence, admitting them into evidence would be a serious economic mistake. The conceptual problem spotted by evidence scholars calls for a conceptual fix, not for the wholesale abolition of the hearsay rule. The required fix should separate self-asserting hearsay evidence that ought to remain inadmissible from hearsay statements that are not self-asserting and should be considered admissible.

To illustrate, consider a witness who testifies in court and is cross-examined by the party adversary about the specifics of his testimony and other relevant circumstances. The cross-examination may unfold in three different directions: it may uncover weaknesses in the witness’s testimony; it may accentuate the testimony’s strength; and it also may reveal that the testimony has both strengths and weaknesses. In the first scenario, probabilities ascribable to the testimony being true will cluster around 0. Conversely, in the second scenario, these probabilities will cluster near 1. Finally, in the third scenario, the probabilities will cluster around 0.5. Each of those scenarios features low probabilistic variance and a correspondingly strong signal and low level of noise. Hence, testimony of a witness available for cross-examination normally has a high SNR. Any such in-court testimony is not self-asserting and is consequently more informative than noisy—and hence efficient—even when it fails to show credibility.

Consider now an uncorroborated hearsay statement made by a person who does not come to court to testify about the facts to which the statement attests. On a scale between 0 and 1, this and similar statements can have any probability of being true. This variance amplifies the noise and muffles the signal. As a result, this and all other naked hearsay statements have an impermissibly low SNR and therefore should not be admitted into evidence. Any such statement is self-asserting and hence inefficient.

With this in mind, I now move to examine the existing exceptions to the hearsay rule. Conventional wisdom, originating from John Henry Wigmore,<sup>60</sup> holds that those exceptions stem from pragmatic tradeoffs that combine experience with social policy.<sup>61</sup>

---

distinguished jurists who would abolish the hearsay rule and arguing that courts should have a broad discretion to admit hearsay into evidence).

<sup>59</sup> Nor does it weaken the moral reasons for excluding such evidence: see STEIN, *supra* note 5, at 189-96, 228-34 (arguing that unchecked admission of hearsay statements allocates the risk of error in a morally objectionable way). Cf. Sklansky, *supra* note 57, at 1, 6 (attesting that “the dysfunctionality of the hearsay rule in its traditional form” is obvious and well understood, as are “the dangers of secondhand testimony”); Siegel, *supra* note 57, at 895 (attesting that “despite the irrational nature of hearsay law, most judges use the current rule of exclusion and its myriad exceptions to admit reliable evidence, to exclude unreliable evidence, and to achieve “rough justice” in the majority of cases.”).

<sup>60</sup> See 5 WIGMORE ON EVIDENCE, *supra* note 53, § 1420-23, at 1791-94.

<sup>61</sup> See, e.g., Tom Lininger, *Prosecuting Batterers After Crawford*, 91 VA. L. REV. 747, 755 (2005) (“hearsay exceptions should be set with reference to traditional policy concerns such as necessity and reliability” (citing 5 WIGMORE ON EVIDENCE, *supra* note 53, §§ 1421-22, and Myrna S. Raeder, *The Double-Edged Sword: The Admissibility of Prior Acts of Domestic Violence: Simpson and Beyond*, 69 S. CAL. L. REV. 1463, 1512 (1996))).

Experience shows that certain hearsay statements—for example, bank records and other business documents—are trustworthy.<sup>62</sup> Trustworthiness of business records provides a compelling reason for admitting them into evidence. Social policy, for its part, calls for admission of hearsay statements necessary for implementing criminal law.<sup>63</sup> Those statements include dying declarations<sup>64</sup> and accounts coming from crime victims and intimidated witnesses.<sup>65</sup> The above-mentioned exceptions are mere illustrations of our system's *modus operandi*. The mix of experience and social policy accounts for the whole variety of hearsay exceptions that evolved under this system.

The exceptions' multiplicity and variety has driven scholars to portray them as a patchwork.<sup>66</sup> This patchwork, so goes the argument, is a product of uncoordinated efforts to align the hearsay doctrine with common sense and the common good.<sup>67</sup> Unsurprisingly, contemporary evidence literature features only one attempt at developing an organizing principle for hearsay exceptions. Four decades ago, Professor Laurence Tribe published an influential article that set up a triangle framework to map the inferences connecting a person's statement to the event to which that statement attests.<sup>68</sup> The triangle framework showed that those inferences are either direct or go through the belief that the person formed from witnessing the event.<sup>69</sup> Critically, it also demonstrated that the four hearsay dangers<sup>70</sup>—misperception, faulty memory, ambiguity, and insincerity<sup>71</sup>—are posed only by the inferences that connect the statement to the person's belief and the belief to the event.<sup>72</sup> Any out-of-court statement, express or implied, that calls for such inferences thus falls into the hearsay category. Conversely, statements that go directly to the relevant event are not hearsay.<sup>73</sup>

Equally important, Tribe's triangle allowed him to connect discrete hearsay dangers to inferences drawn from a person's statement.<sup>74</sup> Misperception and faulty memory create misalignments between the person's belief in the event's occurrence and the event itself. Ambiguity and insincerity, on the other hand, undo the match between the person's

---

<sup>62</sup> See Fed. R. Evid. 803(6) (business records broadly admissible).

<sup>63</sup> See, e.g., Lininger, *supra* note 61, at 768-82 (uncompromising application of the hearsay rule silences victims of domestic violence). In the civil context, hearsay statements are often needed and are consequently admissible to interpret and ascertain the validity of the declarant's will: see Fed. R. Evid. 803(3).

<sup>64</sup> See Fed. R. Evid. 804(b)(2).

<sup>65</sup> See Fed. R. Evid. 804(b)(6) (rendering admissible a hearsay statement "offered against a party that wrongfully caused—or acquiesced in wrongfully causing—the declarant's unavailability as a witness, and did so intending that result").

<sup>66</sup> See sources cited above in notes 57-58; see also James Joseph Duane, *The Trouble with United States v. Tellier: The Dangers of Hunting for Bootstrappers and Other Mythical Monsters*, 24 AM. J. CRIM. L. 215, 268 (1997) (describing hearsay exceptions as "patchwork").

<sup>67</sup> See Sklansky, *supra* note 57, at 1, 6; Siegel, *supra* note 57, at 895.

<sup>68</sup> See Laurence H. Tribe, *Triangulating Hearsay*, 87 HARV. L. REV. 957 (1974).

<sup>69</sup> *Id.* at 958-61.

<sup>70</sup> See Edmund M. Morgan, *Hearsay Dangers and the Application of the Hearsay Concept*, 62 HARV. L. REV. 177 (1948).

<sup>71</sup> See Tribe, *supra* note 68, at 959.

<sup>72</sup> *Id.*

<sup>73</sup> *Id.*

<sup>74</sup> *Id.* at 959-61.

statement and his underlying belief. When the person testifies in court, factfinders are often able to assess the effects of those dangers on the statement's credibility. This ability explains the hearsay exceptions that come into play when the person who made the statement testifies in court.<sup>75</sup> When the person does not testify in court, however, the hearsay dangers are beyond the factfinders' control. Under these circumstances, courts should only be able to admit the statement on exceptional grounds. According to Tribe, these grounds are present when the conditions under which the person made the statement rule out *one pair* of dangers: misperception and faulty memory or, alternatively, ambiguity and insincerity.<sup>76</sup> That is, "one good leg" of the testimonial triangle makes out the case for an exception to the hearsay rule.<sup>77</sup> Based on this insight, Tribe uncovered a substantial alignment between the "one good leg" standard and the hearsay exceptions recognized by our law.<sup>78</sup>

This insight is undeniably important. From an economic standpoint, however, Tribe's "one good leg" criterion for admitting hearsay statements into evidence is deficient. This criterion suffers from instability that precludes efficient factfinding. The removal of misperception and faulty memory dangers or, alternatively, the elimination of ambiguity and insincerity risks does not make the underlying hearsay statements trustworthy. All it does is increase the probability of those statements' trustworthiness. This probability increase is bound to be moderate because the remaining hearsay dangers still impair the statements' credibility. Importantly, the range of relevant probabilities does not get significantly narrower as a consequence of this increase. Satisfaction of the "one good leg" requirement thus does not significantly improve the statement's SNR.

The SNR principle offers a superior framework for explaining hearsay exceptions and guiding their development. This principle calls for a re-categorization of different hearsay statements based on the features that determine the statements' signal and level of noise. With this in mind, I divide the existing hearsay exceptions into three distinct groups: testifying declarant, event statements, and documents. Exceptions falling into the first group require that the person who made the statement—the declarant—testify as a witness in the court proceeding. Under this condition, the statement's opponent can cross-examine the declarant about the statement and its surrounding circumstances. As in the case of in-court testimony, the declarant's cross-examination will narrow the range of probabilities that attach to the statement. The statement's opponent, of course, does not have to cross-examine the declarant: her entitlement to do so is not an obligation. However, if the opponent decides to forego the cross-examination opportunity, the statement's probabilities of being true would normally cluster around 1. This effect will not be present in rare cases in which the declarant's statement is manifestly untrustworthy, but then the statement's probability of being true will cluster around 0. Under either scenario, the statement will have a sufficiently high SNR, which means that

---

<sup>75</sup> See Fed. R. Evid. 801(d) and 803(5) (rendering admissible different statements of testifying declarants); Fed. R. Evid. 804(b)(1) (rendering admissible a person's former testimony that allowed the opponent to adequately cross-examine the person when the testimony was delivered); Tribe, *id.* at 961-63.

<sup>76</sup> See Tribe, *supra* note 68, at 964-69.

<sup>77</sup> *Id.*

<sup>78</sup> *Id.*

factfinders would be able to process it cost-effectively with a relatively small margin of error. For that reason, statements made by testifying declarants are virtually always admissible.<sup>79</sup>

The second group of exceptions incorporates statements integrated in some specific event relevant to the factfinders' decision. Event statements qualitatively differ from descriptive statements that people make after witnessing an event. From the credibility standpoint, event and descriptive statements are indistinguishable: their probabilities of being true are bound to vary from one case to another. What makes those statements qualitatively different from each other is the range of probabilities attaching thereto. While a descriptive statement can have any probability of being true, the range of probabilities attaching to an event statement will normally be narrow.

To see why, compare the following statements: (1) complaints about pain that a victim of a workplace accident made to his co-workers immediately after the accident; and (2) the victim's description of the accident given two days later to an inspector from the Occupational Safety and Health Administration. Each of those statements may be true or false. However, the distribution of these "true" and "false" scenarios will not be the same as we move from one statement to another. Begin with the second, descriptive, category of statements. Statements falling into this category are probabilistically open-ended. We know from experience that accident reports coming from self-interested individuals can be motivated by a variety of reasons that do not always elicit a true statement. When the person who made the report does not come to testify in court, the mix of reasons that prompted him to give the report remains hidden. Under such circumstances, the report's probability of being true, rather than false, can be any. Statements affiliating to the event category do not exhibit such open-endedness. Instead, they give rise to a narrow range of probabilities that may occupy the high end, the low end, or, alternatively, the middle of the scale between 0 and 1. Factfinders will normally be able to identify the relevant cluster of probabilities by combining their general knowledge of the world with the declarant's statement and its surrounding circumstances. This general knowledge will allow factfinders to understand the event that the declarant lived through and the statement he made during that event. Importantly, this event will include the declarant's physical and emotional condition, about which factfinders will hear from testifying witnesses (the declarant's co-workers, in my example).<sup>80</sup>

---

<sup>79</sup> Functional equivalents of such statements are admissible as well. They include admissions that a party to the proceeding made personally or through an agent: *see* Fed. R. Evid. 801(d)(2)(A), 801(d)(2)(C), 801(d)(2)(D). Any such admission can be adduced into evidence because the party can controvert it by utilizing her superior access to information pertaining to her or her agent's statement. Probabilities attaching to party admissions thus always form a narrow range—a feature that guarantees a sufficiently high SNR.

<sup>80</sup> *Cf.* Eleanor Swift, *A Foundation Fact Approach to Hearsay*, 75 CALIF. L. REV. 1339 (1987). This important article develops a normative theory for admitting hearsay into evidence. Under this theory, courts ought to admit a hearsay statement when its proponent produces "foundation facts" about the statement's surrounding circumstances, thereby enabling factfinders to evaluate the statement's reliability. Statements satisfying Professor Swift's foundation-fact criterion will usually have a high SNR. Unsurprisingly, the foundation-fact criterion can explain a number of exceptions to the hearsay rule. *See id.* at 1390-1427 (justifying hearsay exceptions that align with the foundation-fact criterion and criticizing

Cases involving an event statement will virtually always present factfinders with a narrow range of probabilities.<sup>81</sup> These cases include present sense impressions,<sup>82</sup> utterances reacting to a startling event<sup>83</sup> and other spontaneous statements,<sup>84</sup> dying declarations,<sup>85</sup> statements promoting a conspiracy to commit a crime,<sup>86</sup> and patients' communications with doctors.<sup>87</sup> Remarkably, these cases also include statements expressing the declarant's intent to take a particular action.<sup>88</sup> For example, a declarant's statement to friends "Here is Pheaster. I am going to buy drugs from him" is admissible as evidence indicating that the declarant might have acted upon his stated intent. Because the declarant was killed shortly thereafter, his meeting with Pheaster singles Pheaster out as a possible murderer.<sup>89</sup> Here, too, probabilities that attach to the declarant's statement are clustered rather than dispersed. Factfinders' general knowledge of the world consequently would enable them to identify the narrow space that these probabilities occupy on the 0 to 1 scale. For instance, evidence showing that the declarant had left his friends immediately after telling them that he is going to meet Pheaster would prompt factfinders to assign the declarant's statement a high probability of being true. Conversely, evidence showing that the declarant spent the entire evening with his friends would take this probability down. Under both scenarios, the statement's SNR will be high. Factfinders would thus be able to evaluate the statement accurately and efficiently.

Documents belonging to the third group of hearsay exceptions have a high SNR as well. These documents include records compiled in the regular course of business or governmental activity.<sup>90</sup> Importantly, under the exceptions' conditions, firms and public agencies that generate those internal documents must also rely on them in carrying out their business.<sup>91</sup> As a result, the documents' probabilities of being accurate about the

---

those that do not).

<sup>81</sup> Statements against the declarant's pecuniary, proprietary or criminal interest, admissible under Fed. R. Evid. 804(b)(3), form a separate category. Under Fed. R. Evid. 804(b)(3)(A), any such statement must be so contrary to the declarant interest that a reasonable person in his position would not have made it unless he believed it to be true. This condition removes the statement from the self-asserting category, as the statement must be verifiable in order to be admitted into evidence. Moreover, Fed. R. Evid. 804(b)(3)(B) prohibits the admission of an uncorroborated statement "that tends to expose the declarant to criminal liability." This rule bolsters the separation between self-asserting and verifiable hearsay statements.

<sup>82</sup> See Fed. R. Evid. 803(1).

<sup>83</sup> See Fed. R. Evid. 803(2).

<sup>84</sup> See Fed. R. Evid. 803(3).

<sup>85</sup> See Fed. R. Evid. 804(b)(2).

<sup>86</sup> See Fed. R. Evid. 801(1)(2)(E).

<sup>87</sup> See Fed. R. Evid. 803(4).

<sup>88</sup> These statements are admissible under the Hillmon-Pheaster doctrine codified into Fed. R. Evid. 803(3). See *Mutual Life Ins. v. Hillmon*, 145 U.S. 285 (1892); *United States v. Pheaster*, 544 F.2d 353 (9th Cir. 1976), cert. denied, 429 U.S. 1099 (1977).

<sup>89</sup> *Pheaster*, 544 F.2d at 374-80. The declarant's demise was proved by his disappearance. *Id.* at 358. Notably, some courts require additional corroborative evidence connecting the declarant's statement with the non-declarant's conduct, while others impose no such requirement: see *United States v. Houlihan*, 871 F.Supp. 1495, 1499-1501 (D.Mass.1994) (describing the split among Circuits and deciding not to require corroboration). The corroboration requirement here obviously improves the statement's SNR.

<sup>90</sup> See Fed. R. Evid. 803(6)-(15), (17), (22), (23).

<sup>91</sup> This internal reliance separates admissible business and governmental records from self-serving documents that individuals, firms, and agencies prepare in anticipation of litigation. See generally Gideon Parchomovsky & Alex Stein, *The Distortionary Effect of Evidence on Primary Behavior*, 124 HARV. L.

reported facts fall into a narrow range. Furthermore, these probabilities tend to be fairly high. This feature guarantees a high SNR. Indeed, it turns documentary hearsay into a paradigmatic example of efficient evidence.

## 2. Other Evidence

Hearsay is a prime example of self-asserting evidence, but by no means the only example. Consider a witness who just finished giving his direct testimony in a legal proceeding and who for some reason refuses to answer questions at his cross-examination. Under regular circumstances, this refusal would make the witness's direct testimony inadmissible and factfinders would have to ignore it.<sup>92</sup> As another illustration, consider an expert witness who testifies about her findings without explaining the methodology she used to arrive at those findings. Under extant law, this testimony will be inadmissible as well.<sup>93</sup>

Our law of evidence does not explicitly connect those rules to each other. Evidence scholars also do not make this connection. Instead, they explain and justify those rules on separate unrelated grounds.<sup>94</sup> The SNR principle establishes an important connection between the two rules. Both rules render inadmissible self-asserting evidence that gives rise to probabilities occupying the entire scale from 0 to 1. As I already have shown, such evidence has an impermissibly low SNR: its noise mutes the signal. Having factfinders consider it would consequently be inefficient.

### *B. Self-Serving Evidence*

Evidence is self-serving when it supports its proponent's case while giving the opponent no opportunity to examine its veracity. If courts were to admit such evidence without restrictions, it would give the submitting party an unfair advantage. Worse yet, it is not

---

REV. 518 (2010).

<sup>92</sup> See, e.g., *United States v. Cardillo*, 316 F.2d 606, 611 (2d Cir.1963), cert. denied, 375 U.S. 822 (1963) (holding that when a prosecution "witness ... precludes inquiry into the details of his direct testimony, there may be a substantial danger of prejudice because the defense is deprived of the right to test the truth of his direct testimony and, therefore, that witness's testimony should be stricken in whole or in part."); *Denham v. Deeds*, 954 F.2d 1501, 1504 (9th Cir. 1992) ("Where a defense witness's invocation of Fifth Amendment protection against self-incrimination amounts to a refusal to be cross-examined, the testimony cannot be considered reliable. We therefore join with those circuits that have permitted the exclusion of a defense witness's testimony when the witness has refused on cross-examination to respond to questions on non-collateral matters." (citing *United States v. Esparsen*, 930 F.2d 1461, 1469-70 (10th Cir.1991); *United States v. Doddington*, 822 F.2d 818, 822 (8th Cir.1987); *United States v. Frank*, 520 F.2d 1287, 1292 (2d Cir.1975))).

<sup>93</sup> See, e.g., *Koken v. Black & Veatch Const., Inc.*, 426 F.3d 39, 47 (1st Cir. 2005) (holding that expert's failure to explain his methodology dooms his testimony under *Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993)); *Minix v. Canarecci*, 597 F.3d 824, 835 (7th Cir. 2010) (holding that expert testimony must be suppressed when the expert does not "explain the methodologies and principles supporting the opinion").

<sup>94</sup> See, e.g., FISHER, *supra* note 2, at 2 (attesting that "themes that unify the rules of evidence" are "[h]ard ... to identify.").

the only problem that self-serving evidence engenders. Another, more critical, problem is the range of probabilities that attach to self-serving evidence. As I explained in Part I, this range is extremely wide. When a party adduces evidence that does not open itself to scrutiny, the evidence's probability of being true can be any. This wide range of probabilities makes the evidence overwhelmingly noisy and takes its SNR below the minimal threshold. The evidence consequently becomes inefficient.

The law treats self-serving evidence in a uniform fashion. Factfinders can make no findings based on self-serving evidence when the party relying on it offers no additional proof—corroboration—that confirms its veracity. My preceding discussion provided two important examples of this requirement. One of these examples features a party to a civil proceeding whose testimony attributes a debt or transaction to a dead person. For such setups, many states require courts to ignore the party's testimony when it is not accompanied with corroborative evidence.<sup>95</sup> Importantly, courts explicitly limit this requirement to a self-serving testimony coming from an interested witness. When a disinterested witness testifies against a dead person, her testimony does not require corroboration.<sup>96</sup>

Another example involves a plaintiff who testifies that he sustained emotional distress as a result of the defendant's negligent action. For this setup, state and federal courts require corroborative evidence. By and large, they require the victim to provide independent evidence showing that he was impacted by or directly involved in the accident that allegedly caused him emotional distress.<sup>97</sup>

As I previously explained, these are clear examples of self-serving testimony: one that comes from an interested party not facing a meaningful prospect of rebuttal. Any such witness can say anything to promote her interest. For that reason, her testimony, without

---

<sup>95</sup> See, e.g., Texas R. Evid. 601(b) (2012) (“In civil actions by or against executors, administrators, or guardians, in which judgment may be rendered for or against them as such, neither party shall be allowed to testify against the others as to any oral statement by the testator, intestate or ward, unless that testimony to the oral statement is corroborated or unless the witness is called at the trial to testify thereto by the opposite party...”); VA Code Ann. § 8.01-397 (2012) (“In an action by or against a person who, from any cause, is incapable of testifying, or by or against the committee, trustee, executor, administrator, heir, or other representative of the person so incapable of testifying, no judgment or decree shall be rendered in favor of an adverse or interested party founded on his uncorroborated testimony.”); see also *Keith v. Lulofs*, 724 S.E.2d 695, 775-76 (Va. 2012) (uncorroborated testimony about testator's will held insufficient as a matter of law); *Williams v Condit*, 574 S.E.2d 241, 243 (Va. 2003) (explaining that the corroboration requirement under VA Code Ann. § 8.01-397 was “designed to prevent a litigant from having the benefit of his own testimony when, because of death or incapacity, the personal representative of another litigant has been deprived of the testimony of the decedent or incapacitated person.” (citing *Diehl v. Butts*, 499 S.E.2d 833, 837 (Va. 1998))).

<sup>96</sup> See *Jones v. Williams*, 701 S.E.2d 405, 407 (Va. 2010). This case featured a nurse who testified for the plaintiffs in a medical malpractice suit filed posthumously against an obstetrician to whom she assisted in the disputed delivery procedure. The Virginia Supreme Court held that the nurse is not an “interested party” for purposes of VA Code Ann. § 8.01-397 and that her testimony consequently does not require corroboration.

<sup>97</sup> See *supra* notes 23-26 and accompanying text. See also *Metro-North Commuter R.R. Co. v. Buckley*, 521 U.S. 424, 432-38 (1997) (requiring evidence of “physical impact” or injury for suits brought under the Federal Employers' Liability Act that demand compensation for fear and emotional distress originating from the plaintiff's long-term exposure to asbestos).

more, can have any probability between 0 and 1. Consequently, this testimony is too noisy and hence inefficient. The corroboration requirement for any such testimony brings about two effects. First, it narrows the range of probabilities to which the testimony gives rise, thereby increasing the testimony's SNR. Second and equally important, it opens the testimony to scrutiny, thereby curbing the witness's self-serving temptations.

This logic is followed by an important rule of criminal procedure: the corroboration requirement for the defendant's accomplice who testifies against the defendant.<sup>98</sup> Most states (but not the federal system<sup>99</sup>) have this requirement.<sup>100</sup> The reason for having this requirement must by now be clear. An accomplice to the alleged crime is a well-informed insider, who knows most of the crime's details, if not all of them. This knowledge enables the accomplice to develop a false, but entirely believable, self-serving account of the relevant events, which the defendant will find difficult to refute. For that reason, uncorroborated testimony of the defendant's accomplice can have any probability between 0 and 1. As in my other examples, any such testimony has an impermissibly low SNR, which makes it inefficient. This inefficiency can only be remedied by corroborative evidence that the law generally requires.

My last illustration comes from divorce law. Most, but not all, jurisdictions across the United States have switched from a fault-based to a no-fault divorce system.<sup>101</sup> Jurisdictions that still consider spousal fault as relevant to divorce, child custody, and the allocation of spousal assets encounter a serious evidentiary problem. Oftentimes, a spouse comes to court with a fabricated, yet facially credible, story that portrays himself (or herself) as a victim of the other spouse's adultery or degrading behavior. For obvious reasons, such stories are easy to make up but difficult to disprove. They address events that took place under the cloak of intimacy. Moreover, people who know the truth—the rival spouses and the alleged paramour—have an interest in the outcome of the case and are consequently not believable as witnesses. As a result, a spouse's testimony that attributes matrimonial misconduct to his or her adversary can have virtually any probability. To counter this noise and secure the minimal SNR, the law instructs courts not to rely on such testimony when it is not supported by evidence coming from a disinterested witness.<sup>102</sup>

---

<sup>98</sup> See Richard A. Bierschbach & Alex Stein, *Mediating Rules in Criminal Law*, 93 VA. L. REV. 1197, 1222 (2007) (discussing the corroboration requirement for accomplice testimony that exists in many states); Robert J. Norris *et al.*, *"Than that One Innocent Suffer": Evaluating State Safeguards Against Wrongful Convictions*, 74 ALB. L. REV. 1301, 1349 n.330 (2011) (listing states that have formal corroboration requirements for accomplice testimony).

<sup>99</sup> See, e.g., *Watson v. Howard*, 123 F. App'x 910, 917 (10th Cir. 2005) ("Federal law does not require independent corroboration of accomplice testimony..."); *United States v. Necoechea*, 986 F.2d 1273, 1282 (9th Cir. 1993) ("The uncorroborated testimony of an accomplice is sufficient to sustain a conviction unless it is incredible or insubstantial on its face." (citing *United States v. Lai*, 944 F.2d 1434, 1440 (9th Cir. 1991), cert. denied, 502 U.S. 1062 (1992))).

<sup>100</sup> See Bierschbach & Stein, *supra* note 98, at 1222.

<sup>101</sup> See Joel A. Nichols, *Louisiana's Covenant Marriage Law: A First Step Toward a More Robust Pluralism in Marriage and Divorce Law*, 47 EMORY L.J. 929, 937-40 (1998) (describing the ascendance of no-fault divorce across the United States).

<sup>102</sup> See, e.g., *Coker v. Coker*, --- S.W.3d ---- (Ark. 2012), 2012 WL 4829812 (Ark.) at \*6 (attesting that

The SNR principle offers the best explanation to these corroboration requirements. An alternative explanation, endorsed by the conventional wisdom, holds that these requirements are set to enhance the accuracy of factfinders' decisions.<sup>103</sup> This explanation has a certain appeal, but ultimately fails to convince. The reason is quite straightforward: our evidence law allows factfinders to convict a person of murder and many other serious crimes on a testimony of a single witness. All the factfinders need to do is believe that witness "beyond a reasonable doubt."<sup>104</sup> The "one witness" rule is the norm, while the corroboration requirements are properly viewed as an exception to the norm. If those requirements were to enhance the accuracy of factfinders' decisions, they would not be exceptional but would rather apply across the board. Courts would then require corroboration to accompany any prosecution witness who testifies against the defendant in a murder trial.

The corroboration requirements, however, do not enhance the accuracy of factfinders' decisions. Instead, they work to eliminate inefficient evidence: one that brings to courts high probabilistic variance and a correspondingly high level of noise. For that reason, the requirements only apply to self-interested witnesses whose informational advantage allows them to tell lies that avoid detection. Those witnesses would not mislead factfinders on many occasions, as factfinders would tend not to believe them. Those witnesses, however, would nearly always waste the factfinders' time and effort when the party who calls them does not offer corroborative evidence.

### *C. Speculative Evidence*

Evidence is speculative when it prompts factfinders to use rough statistical generalizations. Consider the following claim, made by the prosecutor in a criminal case: "Being a person with a criminal record, the defendant is prone to committing crimes—a disposition that increases the probability that he perpetrated the crime in question." Our system bans such claims and their supporting evidence: the defendant's past crimes.<sup>105</sup> By doing so, it tells factfinders "Judge the act, not the actor. Base your verdict on what the

---

Arkansas law requires corroboration for a spouse's evidence of cruelty and indignities as a ground for divorce); *Allen v. Allen*, 53 So.3d 960, 964 (Ala. 2010) ("The wife's testimony of the husband's alleged confession of adultery, alone, is not sufficient evidence upon which to base a divorce on the ground of adultery." (citing *Yates v. Yates*, 676 So.2d 365, 366 (Ala.Civ.App.1996))); *Chapel v. Chapel*, 700 So.2d 593, 597 (Miss. 1997) (reaffirming the rule requiring a party to a divorce proceeding to corroborate his or her complaint about habitual cruel and inhuman treatment by the other spouse); Baldwin's Ohio Rev. Code Ann. RCP, Rule 75(M) (West 2012) ("Judgment for divorce, annulment, or legal separation shall not be granted upon the testimony or admission of a party not supported by other credible evidence.").

<sup>103</sup>See *Idaho v. Wright*, 497 U.S. 805, 824 (1990) (associating corroboration requirement with removal of "a threat to the accuracy of the verdict"); see also, e.g., Samuel W. Buell, Purposes and Effects in Criminal Law, 93 VA. L. REV. IN BRIEF 215, 218-19 (2007) (attesting that corroborations requirements "are justified by goals of reliability and accuracy").

<sup>104</sup>See JOHN HENRY WIGMORE, 7 A TREATISE ON THE SYSTEM OF EVIDENCE IN TRIALS AT COMMON LAW § 2034(2), at 343 (James H. Chadbourne rev. ed. 1978) (stating the general rule authorizing jurors to decide a case on the uncorroborated testimony of a single witness); *United States v. Ingram*, 600 F.2d 260, 263 (10th Cir. 1979) (stating courts' general adherence to the "one witness" rule); *United States v. Levi*, 405 F.2d 380, 383 (4th Cir. 1968) (same).

<sup>105</sup>See *Michelson v. United States*, 335 U.S. 469, 475-76 (1948).

defendant did on the occasion in question, not on who he is.”<sup>106</sup> The conventional wisdom holds that this ban<sup>107</sup> is justified. The reason is straightforward: suppression of past crimes and bad-character evidence in general fends off prejudice against defendants. Allowing factfinders to consider this evidence would increase the prospect of erroneous conviction for innocent defendants.<sup>108</sup>

This principle came under attack. A number of leading scholars have criticized the suppression of past crimes and bad-character evidence.<sup>109</sup> They argued that this evidence gives factfinders relevant information that should normally increase the probability of criminal accusations.<sup>110</sup> These scholars estimate that complaints about prejudice associated with this evidence are overblown, as the prejudice can be contained. For example, judges can instruct jurors to consider past-crime and bad-character evidence with caution.<sup>111</sup> Moreover, so goes the argument, granted that this evidence will prejudice jurors, judges in bench trials could still use it, as they are not likely to be taken astray by prejudice.<sup>112</sup>

The SNR principle adds an important new dimension to this debate, while providing decisive support to the extant law. Defendants with criminal records are not equals. Some of those defendants are career criminals, whereas others have learned while serving their punishment that crime does not pay. Defendants situated between these two extremes have a variety of conflicting motivations that favor and disfavor engagement in illicit activities in the future. Evidence of past crimes, however, does not distinguish between these markedly different groups of defendants. Moving from one group of defendants to another changes things dramatically, but does not change the evidence. This invariance

---

<sup>106</sup>*Id.* (explaining that evidence of a criminal defendant’s bad character “is not rejected because character is irrelevant; on the contrary, it is said to weigh too much with the jury and to so overpersuade them as to prejudge one with a bad general record and deny him a fair opportunity to defend against a particular charge.”); *see also* Miguel Angel Mendez, *California’s New Law on Character Evidence: Evidence Code Section 352 and the Impact of Recent Psychological Studies*, 31 UCLA L. REV. 1003, 1044-59 (1984) (arguing that character evidence can rationally prove very little and is highly prejudicial to criminal defendants); TWINING, *supra* note 5, 231, 243-45, 259 (explaining the “judge the act, not the actor” principle). The Supreme Court is yet to decide, however, whether this principle is part of the defendant’s constitutional due process protection: *see* *Estelle v. McGuire*, 502 U.S. 62, 75 n.5 (1991) (“Because we need not reach the issue, we express no opinion on whether a state law would violate the Due Process Clause if it permitted the use of ‘prior crimes’ evidence to show propensity to commit a charged crime.”).

<sup>107</sup>*See* Fed. R. Evid. 404(a)(1) and 404(b)(1).

<sup>108</sup>*Michelson*, 335 U.S. at 475-76.

<sup>109</sup>*See, e.g.*, Park & Saks, *supra* note 46, at 972 (arguing that a defendant’s past violent behavior should be admitted into evidence “if [it] has been recurrent, if the situation settings for the behavior at issue were similar, and if factfinders can be given realistic, informative, data-based cautions about the predictive power of the evidence.”); Mike Redmayne, *The Relevance of Bad Character*, 61 CAMBRIDGE L.J. 684, 698-700, 713-14 (2002) (arguing that the “presumption that previous convictions are more prejudicial than probative is based on a lack of understanding of offending patterns” and that reasons underlying the suppression of bad-character evidence are overstated).

<sup>110</sup>*See* Park & Saks, *supra* note 46, at 972; Redmayne, *supra* note 109, at 713-14.

<sup>111</sup>Park & Saks, *supra* note 46, at 972; *see also* Roger C. Park, *Character at the Crossroads*, 49 HASTINGS L.J. 717, 775-79 (1998) (favoring admission of bad-character evidence when it is more probative than prejudicial).

<sup>112</sup>*See, e.g.*, Peter Tillers, *What Is Wrong with Character Evidence?*, 49 HASTINGS L.J. 781, 789 (1998) (arguing that the ban on character evidence should be and, in fact, is relaxed in bench trials).

marks past-crime evidence as rough or insensitive to the actual facts of the case.<sup>113</sup> Facts underlying such evidence can be any. Consequently, the probability of the defendant's guilt extractable from his criminal record can be any as well. Hence, past-crime and bad-character evidence have an impermissibly low SNR. This evidence is inefficient, and our system does well to exclude it.<sup>114</sup>

Things become different when a defendant's prior misdeeds are relevant to the specifics of the case and can be integrated in the event's narrative. For example, a defendant's prior burglary conviction can show his ability to burglarize houses as well as reveal his modus operandi. This use of the defendant's criminal past does not allude to rough generalizations and speculative projections about human behavior. Rather, it makes a narrow claim about the defendant's capabilities and specific behavioral pattern. Unsurprisingly, this evidence is admissible.<sup>115</sup> Any such evidence has a relatively low level of noise and a strong signal. The evidence's high SNR makes it efficient and worthy of consideration by factfinders.<sup>116</sup>

On similar grounds, our law suppresses sexual history of an alleged victim of rape or sexual assault—the so-called “promiscuity” evidence—while allowing courts to admit into evidence discrete sexual encounters that are part of the specifics of the case.<sup>117</sup> For example, evidence that the alleged rape victim and the defendant had consensual sex in the past may be admitted to prove consent and to negate the defendant's mens rea.<sup>118</sup> Courts also admit evidence showing that the alleged victim brought false rape accusations

---

<sup>113</sup>For foundational account of the “sensitivity” criterion, see TIMOTHY WILLIAMSON, *KNOWLEDGE AND ITS LIMITS* 147-63 (2000); see also David Enoch *et al.*, *Statistical Evidence, Sensitivity, and the Legal Value of Knowledge*, 40 PHIL. & PUB. AFF. 197, 202-10 (2012) (unfolding an interesting application of “sensitivity” to evidence law); STEIN, *supra* note 5, at 91-106 (introducing the “principle of maximal individualization”—a variant of “sensitivity”—and uncovering its implications for the law of evidence).

<sup>114</sup>Our system, however, admits past sexual misconduct as evidence against the defendant facing new sexual offense accusations: see Fed. R. Evid. 413-414. See generally Katharine K. Baker, *Once a Rapist? Motivational Evidence and Relevancy in Rape Law*, 110 HARV. L. REV. 563 (1997) (criticizing Federal Rule of Evidence 413 for creating a dangerous sex-offender stereotype that increases the risk of wrongful conviction for certain underprivileged defendants, while allowing “normative” rapists to escape conviction).

<sup>115</sup>See Fed. R. Evid. 404(b).

<sup>116</sup>Under specified conditions, our evidence law allows bad-character and prior-crime evidence to impeach a testifying witness. This permission is premised on the witness's implicit, and sometimes express, self-description as a truth teller. This description communicates to factfinders the witness's good moral standing, which the opponent of his or her testimony becomes entitled to attack. The impeachment doctrine thus allows one type of speculative evidence (bad character) to battle another (good character). Unsurprisingly, this doctrine is widely regarded as problematic, especially when it allows past-crime evidence to impeach a testifying criminal defendant. For my attempt at vindicating this doctrine, see STEIN, *supra* note 5, at 165 (a testifying defendant who risks impeachment by prior convictions signals truthfulness, which increases his chances of acquittal when the prosecution does not rebut his testimony). For its recent critique by two prominent scholars, see Larry Laudan & Ronald J. Allen, *The Devastating Impact of Prior Crimes Evidence and Other Myths of the Criminal Justice Process*, 101 J. CRIM. L. & CRIMINOLOGY 493, 511 n.57 (2011) (underscoring empirical data that exhibit a higher rate of conviction among defendants with criminal record who chose to testify).

<sup>117</sup>See Fed. R. Evid. 412(a), (b)(1).

<sup>118</sup>See Fed. R. Evid. 412(b)(1)(B).

against people with whom she had consensual sex.<sup>119</sup> This evidence-sorting policy can be easily explained by the SNR principle. The so-called “promiscuity” evidence is too noisy. An attempt at associating a woman’s “promiscuity” with different entrapment and retaliation scenarios, in which she agrees to have sex with the defendant and subsequently accuses him of rape, is speculative at best. Such scenarios can have any probability between 0 and 1, which indicates that “promiscuity” evidence has a very low SNR. By contrast, discrete sexual encounters that establish a case-specific defense or allegation give rise to a narrow range of probabilities. Such evidence satisfies the minimal SNR threshold and is consequently admissible.

As yet another illustration, consider a rule that suppresses evidence showing “that a person was or was not insured against liability” in order to prove that “the person acted negligently or otherwise wrongfully.”<sup>120</sup> The suppressed evidence associates a person’s disposition for careless or, conversely, careful behavior with her having or, alternatively, not having liability insurance. This association relies on a speculative generalization about human behavior. Arguably, holders of liability insurance tend to reduce their precautions against harm to another person, while uninsured individuals, who must use their own money to pay for damages they cause, tend to be more careful. This generalization is speculative because it cuts across too many people and circumstances. Under certain conditions it holds true, while under different circumstances it misses the target completely. Many insured individuals have reasons to behave carefully. Conversely, uninsured individuals may have an incentive for careless behavior. A person’s holding of liability insurance evidence consequently gives rise to a wide variety of probabilities. This variance makes the evidence noisy and inefficient.<sup>121</sup>

Consider now the suppression of “subsequent remedial measures” evidence<sup>122</sup> that often has a decisive effect on tort litigation.<sup>123</sup> Our law provides that “When measures are taken that would have made an earlier injury or harm less likely to occur, evidence of the subsequent measures is not admissible to prove negligence; culpable conduct; a defect in a product or its design; or a need for a warning or instruction.”<sup>124</sup> The suppression of potentially probative evidence serves to motivate firms and individuals to improve safety without fearing that the introduced improvement will be used in court as an implicit admission of fault or responsibility for the accident.<sup>125</sup> Another reason for suppressing the evidence is its vagueness.<sup>126</sup> Oftentimes, firms and individuals introduce new safety

---

<sup>119</sup> See, e.g., *State v. Smith*, 743 So.2d 199 (La. 1999).

<sup>120</sup> See Fed. R. Evid. 411.

<sup>121</sup> But the court may admit this evidence for another purpose, such as proving a witness’s bias or prejudice or proving agency, ownership, or control. See Fed. R. Evid. 411.

<sup>122</sup> See Fed. R. Evid. 407.

<sup>123</sup> See, e.g., *Flaminio v. Honda Motor Co.*, 733 F.2d 463, 468-70 (7th Cir. 1984) (applying Federal Rule of Evidence 407 to suppress evidence of safer motorcycle design in a products liability suit); *Tuer v. McDonald*, 701 A.2d 1101 (Md. 1997) (applying Maryland Rule of Evidence 407 to suppress evidence of the change in the physicians’ protocol for administering an anticoagulant drug).

<sup>124</sup> Fed. R. Evid. 407.

<sup>125</sup> See *Flaminio*, 733 F.2d at 470-72. For excellent discussion and critique of this rationale, see Dan M. Kahan, *The Economics—Conventional, Behavioral, and Political—of “Subsequent Remedial Measures” Evidence*, 110 COLUM. L. REV. 1616 (2010).

<sup>126</sup> See *Flaminio*, 733 F.2d at 471.

measures based upon newly acquired knowledge that was not available beforehand. What they do consequently does not acknowledge prior fault.<sup>127</sup>

This two-fold explanation is incomplete because it does not negate the case-by-case approach to subsequent remedial measures. Arguably, courts should suppress such evidence only when it is overwhelmingly prejudicial to a tort defendant. In all other cases, factfinders ought to determine the most probable implication flowing from the defendant's introduction of subsequent remedial measures. If the evidence properly signals prior negligence, they should find the defendant liable. In all other scenarios, factfinders should ignore the evidence in deciding about the defendant's fault. When a defendant's subsequent remedial measures properly indicate prior fault, suppressing this evidence may not be the most optimal way to induce safety improvement. Why give product manufacturers and other tort defendants a "carrot" when a "stick" may achieve the same effect at a cheaper price and without sacrificing the aggrieved plaintiff's interest in compensatory remedy? Specifically, why not abolish the defendants' evidentiary privilege and legislate a rule that increases a defendant's penalty upon finding that it failed to introduce an available safety enhancement?

The SNR principle removes these doubts by giving a straightforward justification to the law's suppression of subsequent remedial measures. Conflicting inferences flowing from this evidence do not merely indicate vagueness that courts are accustomed to deal with. They also associate subsequent remedial measures with a wide array of probabilities that vary from one case to another. As we already know, this variance creates noise that drowns the signal that factfinders need to elicit from the evidence, and cutting through this noise is unaffordably expensive. A legal system that processes one hundred tort cases a year could afford this expenditure. A system that handles annually hundreds of thousands of such cases cannot afford it. For that simple reason, courts should suppress subsequent remedial measures as evidence of fault.<sup>128</sup>

My final example is speculative expert evidence, sometimes labeled as "junk science."<sup>129</sup> Under extant doctrine governing the admission of expert testimony, an expert witness cannot base her opinion upon naked statistical correlations. Rather, she must base her opinion on data or replicable experiments that have a scientifically recognized low margin of error.<sup>130</sup> Absent such foundation, the expert's testimony would not be admissible.<sup>131</sup> The Supreme Court's landmark decision, *General Electric v. Joiner*,<sup>132</sup> vividly illustrates this important rule. In that case, the plaintiff's experts associated his lung cancer with his exposure, as the defendant's employee, to dioxins and furans,

---

<sup>127</sup>*Id.*

<sup>128</sup>As prescribed by Federal Rule of Evidence 407, however, "the court may admit [such] evidence for another purpose, such as impeachment or — if disputed — proving ownership, control, or the feasibility of precautionary measures." Here, narrow range of probabilities as a high SNR.

<sup>129</sup>See PETER HUBER, *GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM* (1991).

<sup>130</sup>See Fed. R. Evid. 702; *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).

<sup>131</sup>See *Daubert*, 509 U.S. at 594; *United States v. Avitia-Guillen*, 680 F.3d 1253, 1260 (10th Cir. 2012) (holding that a low error rate strongly favors admission of expert evidence under *Daubert*'s multifactor test).

<sup>132</sup>*General Electric Co. v. Joiner*, 522 U.S. 136 (1997).

byproducts of polychlorinated biphenyls (PCBs).<sup>133</sup> The experts based this association upon studies that showed an increased rate of cancer among individuals exposed to PCBs without ruling out other potential causes that included cigarette smoking and genetics.<sup>134</sup> The Supreme Court reinstated the trial court's assessment of this evidence as not rising above "unsupported speculation"<sup>135</sup> and held that this testimony is inadmissible.<sup>136</sup>

The SNR principle straightforwardly explains this rule. Statistical correlations stay invariant across different factual setups and their causal explanations. For reasons I already provided, this invariance is fatal to correlation evidence that favors one causal explanation over others. The evidence's failure to discredit the alternative explanations widens the range of probabilities that attach to the favored scenario. This wide range of probabilities amplifies noise and results in a low SNR. Think again of the *Joiner* case: there, the plaintiff's causal allegation did not fail because its probability of being true was too low. Rather, this allegation failed because its probability of being true could be any.

### III. Compulsory Process

The Compulsory Process Clause of the Sixth Amendment gives a defendant in a criminal trial the right "to have compulsory process for obtaining witnesses in his favor."<sup>137</sup> The right's categorical language, its incorporation into a broader constitutional entitlement to present a defense,<sup>138</sup> and its status as "a fundamental element of due process of law"<sup>139</sup> that applies across the United States<sup>140</sup> seem to mandate courts to admit all exculpatory evidence.<sup>141</sup>

This appearance, however, is misleading. The Supreme Court ruled that the Clause does not abridge the "power of States to exclude evidence through the application of evidentiary rules that themselves serve the interests of fairness and reliability—even if the defendant would prefer to see that evidence admitted."<sup>142</sup> More broadly, the Court

<sup>133</sup>*Id.* at 139-40.

<sup>134</sup>*Id.* at 144-46. The plaintiff's experts also based their opinion on animal experiments in which infant mice had developed cancer after being exposed to massive doses of PCBs. *Id.* at 144-45. The Supreme Court rejected this part of the experts' testimony for showing "too great an analytical gap between the data and the opinion proffered." *Id.* at 146.

<sup>135</sup> 864 F. Supp. 1310, 1329 (ND Ga. 1994).

<sup>136</sup>*Joiner*, 522 U.S. at 146.

<sup>137</sup>U.S. CONST. amend. VI.

<sup>138</sup>See *Washington v. Texas*, 388 U.S. 14, 19 (1967) (interpreting the Compulsory Process Clause as a defendant's "right to present a defense."); see generally Robert N. Clinton, *The Right to Present a Defense: An Emergent Constitutional Guarantee in Criminal Trials*, 9 IND. L. REV. 711 (1976).

<sup>139</sup>*Washington v. Texas*, 388 U.S. at 19.

<sup>140</sup>*Id.* at 17-18.

<sup>141</sup>Courts need not accept irrelevant evidence, as it is not exculpatory: see *Crane v. Kentucky*, 476 U.S. 683, 689-90 (1986) (Compulsory Process Clause does not mandate admission of evidence that is irrelevant). However, the defendant's constitutional entitlement to potentially exonerating information may set aside an established privilege: see, e.g., *Matter of Farber*, 394 A.2d 330 (N.J. 1978) (statutory privilege protecting confidentiality of media informants' identity held unconstitutional to the extent it limits criminal defendants' access to potentially exonerating information).

<sup>142</sup>*Crane*, 476 U.S. at 690.

decided that the defendant's right to adduce exculpatory evidence can be trumped by "countervailing public interests" that include "the integrity of the adversary process, which depends both on the presentation of reliable evidence and the rejection of unreliable evidence, the interest in the fair and efficient administration of justice, and the [prevention of] potential prejudice to the truth-determining function of the trial process."<sup>143</sup> This interpretation raises an important question about the limits of the government's power to block away exculpatory evidence. From criminal defendants' perspective, this question presents itself as a quest for a principle by which to identify evidence deserving the Compulsory Process protection.

The Supreme Court's decisions about the meaning of Compulsory Process reveal no such principle. Worse yet, some of these decisions contradict others. The Court's decision in *Washington v. Texas*<sup>144</sup> struck down a statute that disqualified criminal accomplices as defense witnesses.<sup>145</sup> The Court held that Texas had no legitimate interest in deeming a broad category of defense witnesses "unworthy of belief"<sup>146</sup> instead of allowing factfinders to determine the credibility of those witnesses case by case.<sup>147</sup> The Court decided that the statute in question is arbitrary, illogical, and hence unconstitutional.<sup>148</sup>

In *Rock v. Arkansas*,<sup>149</sup> the Supreme Court followed the *Washington* principles. Based on these principles, it vacated the Arkansas Supreme Court decision that upheld the suppression of the defendant's hypnotically enhanced testimony.<sup>150</sup> The Court held that the testimony's suppression was "arbitrary"<sup>151</sup> and "disproportionate to the purposes [it is] designed to serve."<sup>152</sup> The Court explained that suppression of defense evidence is warranted only when the evidence is fundamentally "untrustworthy and ... immune to the traditional means of evaluating credibility."<sup>153</sup> According to the Supreme Court, hypnotically enhanced testimony does not fall into this category—self-asserting, self-serving, and speculative under my taxonomy. The defendant therefore was entitled to give that testimony at her trial.<sup>154</sup>

Between *Washington* and *Rock*, the Supreme Court decided another important case, *Chambers v. Mississippi*.<sup>155</sup> It involved a defendant accused of murdering a police officer.

---

<sup>143</sup>Taylor v. Illinois, 484 U.S. 400, 414-15 (1988).

<sup>144</sup>Washington v. Texas, 388 U.S. 14 (1967).

<sup>145</sup>*Id.* at 18-22.

<sup>146</sup>*Id.* at 22.

<sup>147</sup>*Id.* (quoting Rosen v. United States, Rosen v. United States, 245 U.S. 467, 471 (1918)).

<sup>148</sup>Under that statute, a defendant's accomplice could be called to testify as a prosecution witness and, upon acquittal, as a defense witness as well. *See id.* at 16 n.4, 22-23. These conditions did not remove the reliability concerns from the accomplice's testimony. When a defendant's accomplice is called to testify by the prosecution, he has a motive to lie in order to curry favor with the government, while as a previously acquitted defense witness who enjoys the constitutional protection against re-prosecution, he is free to say anything he pleases. *Id.* at 22-23.

<sup>149</sup>Rock v. Arkansas, 483 U.S. 44 (1987).

<sup>150</sup>*Id.* at 61-62.

<sup>151</sup>*Id.* at 61.

<sup>152</sup>*Id.* at 56.

<sup>153</sup>*Id.* at 61.

<sup>154</sup>*Id.* at 62.

<sup>155</sup>Chambers v. Mississippi, 410 U.S. 284 (1973).

To prove his innocence, the defendant subpoenaed a witness who confessed on several occasions to being the murderer and subsequently repudiated the confession.<sup>156</sup> Expectedly, the witness insisted on his innocence. The trial court did not allow the defendant to cross-examine the witness about his admissions of guilt, nor did it permit the defendant to introduce those admissions into evidence. The first decision relied on the outdated principle that required a party who called a witness to vouch for the witness's credibility.<sup>157</sup> The second decision was based on the rule against hearsay.<sup>158</sup> The Supreme Court held that both decisions violated due process.<sup>159</sup> Specifically, it decided that the "voucher" principle and the hearsay rule should not have blocked evidence that was critical to the defense and "bore persuasive assurances of trustworthiness."<sup>160</sup> This decision cited *Washington*,<sup>161</sup> but did not explicitly rely on the Compulsory Process Clause.

Although favorable to the defendant, this decision implicitly reversed the burden of proof. Before this decision, vindicating a rule or a ruling that suppresses exculpatory evidence required the government to show compelling interest. After this decision, it is the defendant who needs to demonstrate that his evidence is potentially decisive and reliable.<sup>162</sup>

The Court's shift to reliability and necessity played a crucial role in its decision in *United States v. Scheffer*<sup>163</sup>—a case that involved an airman accused of using drugs.<sup>164</sup> At his trial before court martial, the defendant offered into evidence the results of his polygraph examination administered by the Air Force Office of Special Investigations. This examination focused on the defendant's claim that he had not knowingly used drugs while working for the Office<sup>165</sup> and indicated "no deception."<sup>166</sup> The military judge ruled this evidence inadmissible pursuant to a military rule of evidence that expressly suppresses "the results of a polygraph examination [and] the opinion of a polygraph examiner."<sup>167</sup> The defendant challenged the rule on constitutional grounds, but the judge decided that the rule is not unconstitutional.<sup>168</sup> The court martial subsequently found the

---

<sup>156</sup>*Id.* at 287-88.

<sup>157</sup>*Id.* at 291-92.

<sup>158</sup>*Id.* at 292-94.

<sup>159</sup>*Id.* at 297-98, 302.

<sup>160</sup>*Id.* at 295-98.

<sup>161</sup>*Id.* at 302 (citing *Washington v. Texas*, 388 U.S. 14, 19 (1967)).

<sup>162</sup>*Cf.* Janet C. Hoefel, *The Sixth Amendment's Lost Clause: Unearthing Compulsory Process*, 2002 WIS. L. REV. 1275, 1301-02 (describing the *Chambers* decision as a shift to reliability).

<sup>163</sup>*United States v. Scheffer*, 523 U.S. 303 (1998).

<sup>164</sup>*Id.* at 305.

<sup>165</sup>*Id.* at 306.

<sup>166</sup>*Id.*

<sup>167</sup>*See* Mil. R. Evid. 707. This rule was promulgated by the United States President pursuant to Article 36 of the Uniform Code of Military Justice that authorizes the President, as Commander in Chief of the Armed Forces under Article II, Section 2 of the United States Constitution, to prescribe for military courts "modes of proof ... by regulations which shall, so far as he considers practicable, apply the principles of law and the rules of evidence generally recognized in the trial of criminal cases in the United States district courts." 10 U.S.C. § 836(a) (2006).

<sup>168</sup>*Scheffer*, 523 U.S. at 307.

defendant guilty,<sup>169</sup> and the Air Force Court of Criminal Appeals affirmed his conviction.<sup>170</sup> However, the United States Court of Appeals for the Armed Forces reversed the guilty verdict for violating the defendant's "Sixth Amendment right to present a defense."<sup>171</sup>

On appeal by the United States, the Supreme Court rejected the defendant's constitutional claim and reinstated the guilty verdict.<sup>172</sup> The Court held that "there is simply no way to know in a particular case whether a polygraph examiner's conclusion is accurate, because ... doubts and uncertainties plague even the best polygraph exams."<sup>173</sup> The Court also underscored the government's legitimate interest in suppressing evidence that diminishes the jurors' "core function of making credibility determinations in criminal trials."<sup>174</sup> Based on these observations and on society's need to avoid collateral litigation in criminal trials,<sup>175</sup> the Court ruled that suppression of exculpatory polygraph evidence does not violate Compulsory Process.<sup>176</sup> Under my terminology, exculpatory polygraph evidence was denied constitutional protection because it is speculative, self-asserting, and potentially self-serving as well.

This decision contradicts *Rock*—a case in which the Court granted protection to hypnotically enhanced testimony that appears to be speculative and self-asserting as well.<sup>177</sup> Aware of that difficulty, the Court made a sustained effort at reconciling its decision in *Scheffer* with *Rock*, *Chambers*, and *Washington*.<sup>178</sup> Specifically, it reasoned that suppression of exculpatory evidence in each of those three cases "undermined fundamental elements of the defendant's defense,"<sup>179</sup> whereas in *Scheffer* it caused no such harm.<sup>180</sup> The Court explained that *Rock*, *Chambers*, and *Washington* remedied suppressions of factual evidence with strong exculpatory potential.<sup>181</sup> Factual exculpatory evidence—it elaborated—is vital for the defense, whereas evaluative evidence that merely bolsters the credibility of the defendant's testimony is not vital.<sup>182</sup> The Court estimated that suppression of evaluative evidence does not seriously weaken the defendant's ability to fend off criminal accusations.<sup>183</sup>

---

<sup>169</sup>*Id.*

<sup>170</sup>*Id.*

<sup>171</sup>United States v. Scheffer, 44 M.J. 442, 445 (U.S. Armed Forces, 1996).

<sup>172</sup>*Scheffer*, 523 U.S. at 317.

<sup>173</sup>*Id.* at 312.

<sup>174</sup>*Id.* at 312-13.

<sup>175</sup>*Id.* at 314.

<sup>176</sup>*Id.* at 317.

<sup>177</sup>See Hoeffel, *supra* note 162, at 1304 (attesting that *Scheffer* contradicts *Rock*, "where the uncertain state of the art of hypnosis resulted in the accused being able to present it for the jury's consideration.>").

<sup>178</sup>*Scheffer*, 523 U.S. at 315 ("The three of our precedents, ... *Rock v. Arkansas*, *Washington v. Texas*, and *Chambers v. Mississippi*, do not support a right to introduce polygraph evidence, even in very narrow circumstances.>").

<sup>179</sup>*Id.*

<sup>180</sup>*Id.* at 315.

<sup>181</sup>*Id.* at 316-17.

<sup>182</sup>*Id.*

<sup>183</sup>*Id.* at 317.

This reasoning does not properly reconcile *Scheffer* with *Rock*. The defendant in *Scheffer* did not try to exonerate himself simply by adducing the “no deception” opinion of the polygraph expert. Instead, he tried to exonerate himself by combining his testimony with that opinion. By the same token, the defendant in *Rock* did not try to exonerate herself by her testimony alone. Rather, she tried to exonerate herself by her testimony and by the hypnotic intervention that helped her testify as she did. The Court therefore ought to have carried out a comparison between these two pairs of evidence. More to the point, the Court ought to have compared Scheffer’s polygraph evidence with the potentially suggestive intervention of the hypnotic expert that took place in *Rock*. This comparison would have revealed speculative, self-asserting, and self-serving evidence on both sides. *Scheffer* and *Rock* are indistinguishable.

The upshot of these decisions is clear. Exculpatory evidence that shows reliability will always receive constitutional protection under the Compulsory Process Clause.<sup>184</sup> To show reliability, evidence must not be self-asserting, self-serving, or speculative. The Court came close to denying constitutional protection to evidence falling into these categories, but it had not yet done so expressly. This analysis suggests that criminal defendants would not be able to overturn evidentiary rules that suppress exculpatory evidence for having a low SNR.<sup>185</sup>

This proposition, however, has become uncertain after the Supreme Court’s most recent Compulsory Process decision, *Holmes v. South Carolina*.<sup>186</sup> In that case, the defendant confronted murder, rape, and other serious accusations by offering into evidence another person’s out-of-court admissions of guilt.<sup>187</sup> He called four witnesses to testify about those admissions.<sup>188</sup> The person alleged to have made the admissions testified at the pretrial hearing and denied making them.<sup>189</sup> The trial court suppressed the admissions by applying the South Carolina rules<sup>190</sup> that allow such evidence to be presented to factfinders only when it raises “a reasonable inference ... as to [the defendant’s] own innocence” rather than “a conjectural inference as to the commission of the crime by another [person]”<sup>191</sup> and when it does not contradict “strong forensic evidence” that

---

<sup>184</sup>For a recent application of this principle, see *Harris v. Thompson*, 698 F.3d 609, 623-39 (7th Cir. 2012) (holding that trial court’s disqualification of defendant’s five-year-old son as incompetent witness under Illinois law violated Compulsory Process).

<sup>185</sup>Scant academic writings about Compulsory Process did not address this question. *See, e.g.*, Akhil Reed Amar, *Sixth Amendment First Principles*, 84 GEO. L.J. 641, 699-700 (1996) (favoring an equality-driven interpretation of Compulsory Process that voids any one-sided rule that restricts the defendant’s ability to adduce certain evidence while allowing the prosecution to adduce it); Hoeffel, *supra* note 162, at 1278 (arguing that the Compulsory Process Clause entitles defendants to adduce any exculpatory evidence that the prosecution can test “with the tools of the adversary process.”); Peter Westen, *Confrontation and Compulsory Process: A Unified Theory of Evidence for Criminal Cases*, 91 HARV. L. REV. 567, 590-96 (1978) (arguing that the Compulsory Process Clause entitles defendants to adduce any exculpatory evidence subject to availability of witnesses and compelling governmental interests).

<sup>186</sup>*Holmes v. South Carolina*, 547 U.S. 319 (2006).

<sup>187</sup>*Id.* at 322-23.

<sup>188</sup>*Id.* at 323.

<sup>189</sup>*Id.*

<sup>190</sup>*Id.* at 323-24.

<sup>191</sup>*State v. Gregory*, 16 S.E.2d 532 (1941).

implicates the defendant.<sup>192</sup> Evidence suppressed by these rules thus falls into the self-asserting category that exhibits a uniformly low SNR.

Surprisingly, the Supreme Court decided that the Compulsory Process Clause did entitle the defendant to adduce the third-party admissions into evidence.<sup>193</sup> The Court ruled that the Clause entitles defendants to present virtually any proof of innocence and that exculpatory evidence can only be suppressed when it “has only a very weak logical connection to the central issues.”<sup>194</sup> Based on this new standard, the Court found the defendant’s constitutional complaint justified and vacated his conviction.<sup>195</sup> The Court explained that “because the prosecution’s evidence, *if credited*, would provide strong support for a guilty verdict, it does not follow that evidence of third-party guilt has only a weak logical connection to the central issues in the case.”<sup>196</sup>

This decision would constitute a historic expansion of Compulsory Process if, indeed, it intended to lay down a new standard that entitles defendants to rely on any exculpatory evidence except one that has “a very weak logical connection to the central issues in the case.”<sup>197</sup> Two reasons run against this understanding of the Court’s decision. The first reason has to do with the decision itself. This decision gave defendants a broad formulation of constitutionally protected evidence, but it also expressly approved *Scheffer*—a decision that favors a much narrower formulation.<sup>198</sup> The second reason is more fundamental. Pursuant to its authority under the Rules Enabling Act of 1934,<sup>199</sup> the Court promulgated Federal Rule of Evidence 804(b)(3)(B) that requires corroboration for any third-party admission of guilt by which the defendant attempts to exonerate himself.<sup>200</sup> By promulgating this rule, the Court indicated that the corroboration requirement—not very different from South Carolina’s rule that it voided in *Holmes*—is *not* unconstitutional.<sup>201</sup> Indeed, federal rules of evidence that the Court promulgates function as a safe harbor for states that adopt those rules. Adoption of one of those rules gives the state a virtual guarantee that the rule will pass constitutional muster.<sup>202</sup>

This uncertainty about a core constitutional doctrine is undesirable. In the paragraphs ahead, I propose to remove it by adopting a balanced interpretation of Compulsory Process. This interpretation addresses the problem of exculpatory evidence that falls into one of the three problematic categories: self-asserting, self-serving, and speculative. Evidence falling into any of these categories has a low SNR and is therefore inefficient.

---

<sup>192</sup>State v. Gay, 541 S.E.2d 541 (2001).

<sup>193</sup>*Id.* at 330-31.

<sup>194</sup>*Id.* at 330.

<sup>195</sup>*Id.* at 331.

<sup>196</sup>*Id.* at 330 (emphasis in original).

<sup>197</sup>*Id.*

<sup>198</sup>*Id.* at 324-26.

<sup>199</sup>See 28 U.S.C. § 2072(a) (2000) (conferring on the Supreme Court “the power to prescribe general rules of . . . evidence for cases in the United States district courts . . . and courts of appeals.”).

<sup>200</sup>See Fed. R. Evid. 804(b)(3)(B) (providing that a statement against the declarant’s penal interest can only be admitted into evidence when it is “supported by corroborating circumstances that clearly indicate its trustworthiness . . .”).

<sup>201</sup>See Stein, *supra* note 51, at 119-23 (explaining and illustrating the “safe harbor” dynamic).

<sup>202</sup>*Id.*

Whether criminal defendants should be entitled to use it is a big question. There is no disagreement over defendants' constitutional entitlement to rely on exculpatory evidence that my analysis identifies as efficient. For example, testimony of an accomplice relied upon by the defendant in *Washington*<sup>203</sup> was an unquestionably efficient evidence that properly received full protection under the Compulsory Process Clause.

Erroneous conviction and punishment of an innocent person cause enormous harm to that person and to society at large.<sup>204</sup> For that reason, our legal system is willing to let many guilty criminals go unpunished in order to protect a single innocent person against erroneous conviction.<sup>205</sup> This robust preference calls for the admission of all exculpatory evidence, efficient and inefficient. Nonetheless, I posit that defendants should not have an unqualified right to present inefficient exculpatory evidence. Efficiency of court proceedings is an important societal goal, and defendants should not be allowed to frustrate it at will. Instead, they should be allowed to adduce inefficient exculpatory evidence upon showing of necessity. Any defendant relying on self-asserting, self-serving, or speculative evidence would have to convince the court that this is the best evidence available to him under the circumstances of the case. To this end, the defendant would normally have to give up his Fifth Amendment privilege and testify as a witness.

*Chambers*, *Rock*, and *Holmes* are excellent examples of defendants who met this burden. Each of those defendants brought to court best available evidence and testified in his or her defense. The defendant in *Scheffer* also met this burden: he testified in his defense and adduced polygraph evidence generated by the office that accused him of using drugs. These factors separate *Scheffer* from a case featuring a non-testifying defendant who adduces a privately commissioned polygraph examination. To make his polygraph evidence admissible, the defendant must testify and allow the prosecution's polygraph expert to examine him as well. By the same token, criminal defendants generally cannot rely on their self-exonerating out-of-court statements as a substitute for or addition to their testimony. Our law of evidence properly categorizes such statements as self-serving and inadmissible.<sup>206</sup> My proposed principle is simple: defendants must provide the best available evidence—one that exhibits the highest SNR relative to its alternatives.<sup>207</sup>

---

<sup>203</sup>*Washington v. Texas*, 388 U.S. 14 (1967).

<sup>204</sup>See STEIN, *supra* note 5, at 172-74 and sources cited therein.

<sup>205</sup>*Id.*

<sup>206</sup>*State v. Russell*, 242 P.3d 68, 91-92 (Cal. 2010) (affirming suppression of defendant's self-serving and uncorroborated statements aligning with the hearsay rule and constitutional principles); *State v. Stano*, 159 P.3d 931, 939-40, 941 (Kan. 2007) (attesting that "a defendant's "unverified, uncross-examined, self-serving statements to the police" are inadmissible" and holding that suppression of such statements aligns with due process" (citing *State v. Barnwell*, 675 N.E.2d 148, 154 (Ill.App. 1st Dist. 1996))).

<sup>207</sup>For that reason, Fed. R. Evid. 804(b)(3)(B) is constitutionally problematic in that it indiscriminately suppresses uncorroborated admissions of guilt by third parties. To avoid the constitutional problem, courts should allow defendants to satisfy the corroboration requirement by testifying in their defense. This solution will align with my proposed principle.

### Conclusion

Bentham famously wrote that “Evidence is the basis of justice” and that when you “exclude evidence, you exclude justice.”<sup>208</sup> Bentham’s followers—the modern-day abolitionists of evidentiary rules—have adopted this slogan.<sup>209</sup> This slogan, however, is only half-true. Evidence is the basis of justice, yet its exclusion does not necessarily exclude justice. Contrariwise, admission of potentially probative, but noisy, evidence might distort justice by leading factfinders astray. At a minimum, such evidence will require costly processing and consideration, causing waste and delays in the administration of justice. At worse, it will lead to erroneous decisions. As I have shown in this Essay, a legal system that manages multiple trials cannot afford either cost.

---

<sup>208</sup>5 BENTHAM, *supra* note 1, at 1.

<sup>209</sup>See sources cited above in notes 8 and 29-37; *see also* Redmayne, *supra* note 46, at 814.

## APPENDIX

### CALCULATION OF SNR FOR FOOTNOTE 22 AND ACCOMPANYING TEXT

This calculation uses the average probability for signal (here, 0.5) and the standard

deviation formula for noise:  $\sqrt{\frac{\sum (x-a)^2}{n-1}}$ .<sup>210</sup>

In this formula,  $x$  represents each applicable probability;  $a$  represents the average probability;  $n$  represents the total number of applicable probabilities; and  $\sum$  is an aggregation of all  $(x-a)^2$ .

The requisite calculation proceeds as follows:

STEP 1:

$x$	$a$	$x-a$	$(x-a)^2$
0.1	0.5	-0.4	0.16
0.2	0.5	-0.3	0.09
0.5	0.5	0	0
0.5	0.5	0	0
0.8	0.5	0.3	0.09
0.9	0.5	0.4	0.16

STEP 2:  $\sum=0.5 (0.16+0.09+0+0+0.09+0.16)$ .

STEP 3:  $n-1=5$ .

STEP 4:  $\frac{\sqrt{0.5}}{\sqrt{5}} = \frac{0.707}{2.236} = 0.316$  (NOISE LEVEL).

STEP 5:  $0.5/0.316=1.58$  (SNR).

---

<sup>210</sup>See RUBIN, *supra* note 20, at 70-71.