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Causation, Responsibility, Risk, Probability, Naked Statistics, and Proof: Pruning the Bramble Bush by Clarifying the Concepts

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I. INTRODUCTION

A pervasive confusion over concepts in modern tort theory threatens the traditional moral basis of tort law. What began over sixty years ago as genuine confusion has become a tactical weapon wielded by the currently fashionable legal academic camps—the proponents of Critical Legal Studies (the Critics), the legal economists, and the libertarians—who seek to use the confusion to undermine the traditional view and replace it with their own. One of the greatest sources of confusion is the failure to perceive the distinctions and relationships among the concepts of causation, responsibility, risk, probability, and naked statistics and the relevance of these distinctions and relationships to the process of proof.

I believe that a proper understanding of the concepts will expose the artificiality of the currently fashionable theories. Yet, even if I am successful in clarifying the concepts, I do not expect to dissuade many members of the opposing camps from their respective positions. As others have noted, academics tend to be attracted more by the novelty of a theory than by its descriptive or normative persuasiveness.¹ Thus, in the context of the academic debate, I merely hope to raise some doubts in the minds of potential recruits to the opposing camps and to stiffen the resolve of those legal academics who adhere to the traditional view.

More importantly, I hope to provide a secure refuge in the midst of the theorists' maelstrom for lawyers, jurors, and judges, who have to deal realistically with actual cases, and for law students, who are trying to learn the law as it is and should be so that they too can deal realistically with actual cases. As the confusion has grown in the academic literature, judges and juries, relying on their intuitive knowledge of the basic concepts, have continued to decide cases in accordance with the traditional view.² Nevertheless, there are signs that the academic confusion is beginning to infect the courts.³ Moreover, throughout this period, law students have been taught to expect, accept, and make use of the confusion. The message, using Karl Llewellyn's apt metaphor, has been that they must "jump into the bramble bush" to have their eyes scratched out with respect to the traditional, intuitive view and opened to the "reality" of indeterminacy and confusion.⁴

I intend to prune the bramble bush. In previous articles, I did some preliminary brush clearing by assessing much of the legal literature on the concept of causation and its relationship to legal responsibility.⁵ I also did

1. See McCloskey, *The Rhetoric of Law and Economics*, 86 MICH. L. REV. 752, 752, 763-65 (1988); Merrill, *Success and Hostility: A Perspective on Law and Economics as the New Legal Language*, NW. REP., Spring 1987, at 17.

2. See Wright, *Causation in Tort Law*, 73 CALIF. L. REV. 1735, 1759, 1766-74, 1788-1803, 1809-21, 1826 (1985).

3. See *infra* text accompanying notes 350-53, 398-407.

4. K. LLEWELLYN, *THE BRAMBLE BUSH* 4 (1951) (originally privately printed in 1930); see *id.* at 12-15, 70-84, 98-99, 119. But see *infra* text accompanying note 408.

5. Wright, *Actual Causation vs. Probabilistic Linkage: The Bane of Economic Analysis*, 14 J. LEGAL STUD. 435 (1985) [hereinafter Wright, *Bane*]; Wright, *supra* note 2, at 1737-88; Wright, *The Efficiency Theory of Causation and Responsibility: Unscientific Formalism and False Semantics*, 63 CHI.-KENT L. REV. 553 (1987) [hereinafter Wright, *Efficiency Theory*].

some initial pruning by sketching the philosophic foundation of our intuitive concept of causation and elaborating a test for identifying causes that is based on that philosophic foundation.⁶ In addition, I outlined the distinctions and relationships among the concepts of causation, responsibility, and risk and the relevance of those distinctions to the process of proof.⁷ In this Article, I complete the pruning through an extensive analysis of these and other related topics.

The number and diversity of topics, ranging from comparatively pedestrian surveys of cases and detailed case analysis to both broad and narrow theoretical issues, may test the stamina of many readers. Yet I believe that a unified treatment of these related topics provides the best prospect for dispelling the confusion that clouds much recent tort and evidence scholarship.⁸ In the event that some readers may wish to turn initially to the specific parts of the discussion that are most relevant to their own interests, the various parts and subparts are relatively self-contained. Yet, since each part both builds on and adds to the arguments made in earlier parts, I hope that each reader will attempt to digest the entire Article.

In Part II, I briefly describe the traditional corrective-justice view of tort law and the opposing, currently fashionable academic views and indicate how each of these views fits into the intellectual history of tort theory in this century.⁹ In Part III, I analyze the linguistic conventions that lead many philosophers and legal scholars to confuse the issue of causation per se ("actual causation" or "causation in fact") with the issues of *proximate* causation and ultimate responsibility, and I examine the libertarian theory as a prominent example of this confusion. In Part IV, I provide a comprehensive philosophic argument for the Necessary Element of a Sufficient Set (NESS) test as the only plausible definition of causation, and I defend the NESS test against various philosophic and pragmatic objections.

In subparts V(A) and V(B), I argue that the currently popular notion of "probabilistic causation" is philosophically and pragmatically insupportable. In subpart V(C), I describe the causal basis of proof and use it to explain and justify the distinctions that the courts have drawn between particularistic evidence, *ex post* causal probabilities, *ex ante* causal probabilities, naked statistics, and degrees of belief. Finally, in Part VI, I rely upon the discussion in Part V to elaborate an approach to liability for risk exposure that is consistent with the corrective-justice view, and I demonstrate that the courts, after some initial confusion, are adopting the corrective-justice approach.

6. Wright, *supra* note 2, at 1788-1813.

7. *Id.* at 1813-26.

8. Cf. J. SAXE, *The Blind Men and the Elephant*, in CLEVER STORIES OF MANY NATIONS 59-64 (1865) (a poem about the blind men who each obtained an erroneous perception of an elephant after touching only one part of the elephant).

9. For the page numbers of the various parts and subparts, see the table of contents for this Article at p. 1001.

II. TORT THEORY IN THE TWENTIETH CENTURY

A. *The Traditional Corrective-Justice View*

As each of the currently fashionable legal academic camps recognizes, tort law traditionally has been viewed as a system of corrective justice based on individual autonomy and individual responsibility.¹⁰ Individuals who tortiously expose the person or property of others to injury ordinarily are required to compensate those others if and only if injury actually occurs as a result of the tortious behavior.

More precisely, under the traditional view as implemented by the courts, a defendant's tort liability depends on the answers to three distinct but interconnected inquiries. The first inquiry is the tortious-conduct inquiry: Did the defendant behave tortiously—for example, intentionally, negligently, or by creating an ultrahazardous situation or a defective product? The second inquiry is the actual-causation inquiry: Did the tortious aspect of the defendant's conduct contribute to an injury to the plaintiff's person or property? The third inquiry is the so-called proximate-cause inquiry: Are there any policies or principles that absolve the defendant of liability despite her tortious causation of the injury? Only the second inquiry, the actual-causation inquiry, is a causal inquiry. In the first and third inquiries, noncausal principles are used to select the *responsible* causes from all the other causes.¹¹

B. *The Libertarians*

The libertarians assume that an individual's rights in his person and property are absolute, so that anyone who causes any injury to the person or property of another, no matter how innocently and unforeseeably, is *prima facie* liable for that injury.¹² To implement their theory, the

10. See, e.g., Calabresi, *Concerning Cause and the Law of Torts: An Essay for Harry Kalven, Jr.*, 43 U. CHI. L. REV. 69, 91, 106-07 (1975) (legal economist); Epstein, *Causation and Corrective Justice: A Reply to Two Critics*, 8 J. LEGAL STUD. 477, 478-80 (1979) (libertarian); Horwitz, *The Doctrine of Objective Causation*, in *THE POLITICS OF LAW* 201, 201-02 (D. Kairys ed. 1982) (Critic); Kelman, *The Necessary Myth of Objective Causation Judgments in Liberal Political Theory*, 63 CHI.-KENT L. REV. 579, 589 n.23, 593, 598, 600-01 (1987) (Critic); Landes & Posner, *Causation in Tort Law: An Economic Approach*, 12 J. LEGAL STUD. 109, 115, 123-24 (1983) (legal economists); Rizzo, *Foreword: Fundamentals of Causation*, 63 CHI.-KENT L. REV. 397, 399-400 (1987) (libertarian).

11. See Wright, *supra* note 2, at 1741-74; see also J. FEINBERG, *DOING & DESERVING* 195-97, 200-07 (1970).

12. See, e.g., R. NOZICK, *ANARCHY, STATE, AND UTOPIA* ix, 30-35, 57-78 (1974); Epstein, *supra* note 10, at 479-80, 488-89, 499-500; Epstein, *A Theory of Strict Liability*, 2 J. LEGAL STUD. 151, 152, 163, 168-69, 192, 198, 203-04 (1973) [hereinafter Epstein, *Strict Liability*]; Rizzo & Arnold, *Causal Apportionment in the Law of Torts: An Economic Theory*, 80 COLUM. L. REV. 1399, 1402-03 & n.23 (1980); see also Barnett, *A Consent Theory of Contract*, 86 COLUM. L. REV. 269, 294-95, 296-300, 306 & n.152 (1986). No doubt influenced by his long residence in the citadel of the efficiency camp, Epstein has turned increasingly from strict libertarianism to efficiency-oriented utilitarianism. See, e.g., Epstein, *Causation—In Context: An Afterword*, 63 CHI.-KENT L. REV. 653, 655-56, 660-62, 666, 671-74, 676-79 (1987) [hereinafter Epstein, *Afterword*]; Epstein, *Nuisance Law: Corrective Justice and its Utilitarian Constraints*, 8 J. LEGAL STUD. 49, 74-98 (1979) [hereinafter Epstein, *Nuisance Law*]. Conversely, Rizzo, an economist, rejects efficiency theory

libertarians conflate the tortious-conduct, actual-causation, and proximate-cause inquiries into a single "causal" inquiry that does not explicitly address the actual-causation issue and severely distorts the tortious-conduct and proximate-cause issues. They assert that the defendant was a "cause" of, and hence is *prima facie* responsible for, injury to the plaintiff if and only if there was a physical invasion of the plaintiff's person or property that was initiated by the defendant's actual or threatened force or fraud.¹³

C. The Legal Economists

The legal economists focus on *ex ante* incentives for maximizing aggregate social wealth.¹⁴ On its face, this *ex ante* efficiency perspective seems inconsistent with tort law's traditional *ex post* focus on each individual's right to be compensated by those who infringed his rights in his person or property.¹⁵ The legal economists' response to this apparent inconsistency is ambivalent. On the one hand, they claim that the efficiency theory is consistent with the traditional view. Like the libertarians, they erroneously treat the proximate cause issue as a causal issue.¹⁶ They declare that mere creation of an increased risk of some harm constitutes causation of the harm,¹⁷ and they purport to demonstrate that this *ex ante* probabilistic notion of "causation" explains the decisions of the courts.¹⁸ On the other hand, they seek to undermine the traditional view in order to enhance the plausibility of the efficiency theory. They assert that the concept of causation has no inherent meaning and that it is, or should be,

but dresses his libertarian arguments in economic garb. See generally Rizzo, *The Mirage of Efficiency*, 8 HOFSTRA L. REV. 641 (1980); Rizzo & Arnold, *supra*.

13. See Epstein, *Afterword*, *supra* note 12, at 654-55, 666-68; Epstein, *supra* note 10, at 479-80, 489, 499-501; Epstein, *Strict Liability*, *supra* note 12, at 160-63, 165-68, 172, 174, 177-87; Rizzo & Arnold, *supra* note 12, at 1402-03, 1407 & n.45. For criticism of the libertarians' argument, see H.L.A. HART & T. HONORÉ, *CAUSATION IN THE LAW* lxxiii-lxxvii (2d ed. 1985); Wright, *supra* note 2, at 1750-58; *infra* text accompanying notes 70-91 and 257-62.

14. See, e.g., Calabresi, *supra* note 10, at 70-71, 73, 77-78; Landes & Posner, *supra* note 10, at 110-17; Shavell, *An Analysis of Causation and the Scope of Liability in the Law of Torts*, 9 J. LEGAL STUD. 463, 464-65 (1980). But cf. Calabresi, *supra* note 10, at 73 (*ex post* spreading of losses, or allocation of losses to "deep pockets," to maximize social wealth).

15. See H.L.A. HART & T. HONORÉ, *supra* note 13, at lxix-lxxiii; Borgo, *Causal Paradigms in Tort Law*, 8 J. LEGAL STUD. 419, 424-25, 452-55 (1979); Culp, *Causation, Economists, and the Dinosaur: A Response to Professor Dray*, 49 LAW & CONTEMP. PROBS., Summer 1986, at 23, 31-41; Wright, *Bane*, *supra* note 5, *passim*; Wright, *Efficiency Theory*, *supra* note 5, at 558-61, 564-78.

16. See, e.g., Calabresi, *supra* note 10, at 70-73, 105-08; Cooter, *Torts as the Union of Liberty and Efficiency: An Essay on Causation*, 63 CHI.-KENT L. REV. 523, 528-31, 540-44 (1987); Landes & Posner, *supra* note 10, at 109-11; Schwartz, *Causation in Private Tort Law: A Comment on Kelman*, 63 CHI.-KENT L. REV. 639, 639-40, 642-43 (1987); Shavell, *supra* note 14, at 463-64, 466-70.

17. See, e.g., Calabresi, *supra* note 10, at 71-72, 73-74, 78, 84-85 (causal linkage); Cooter, *supra* note 16, at 534 & n.32 (probabilistic cause); *id.* at 541-44 (material cause); Landes & Posner, *supra* note 10, at 109-16, 134 (*ex ante* risk analysis allegedly explains courts' decisions on causation); Schwartz, *supra* note 16, at 639-40, 645 n.14 (probabilistic cause); Shavell, *supra* note 14, at 466, 468-69 & n.17 (probabilistic cause); see also Rizzo, *The Imputation Theory of Proximate Cause: An Economic Framework*, 15 GA. L. REV. 1007, 1009-16, 1037-38 (1981) ("probabilistic causation" used in nonefficiency "economic" framework).

18. See, e.g., Cooter, *supra* note 16, at 534-44; Landes & Posner, *supra* note 10, *passim*; Rizzo, *supra* note 17, *passim*; Shavell, *supra* note 14, *passim*.

used as a cover for efficiency arguments.¹⁹

D. The Critical Legal Studies Movement

The Critics, who believe that the existing legal order is a tool for repression of the masses, have set themselves the task of "trashing" the law by demonstrating the impossibility of any overarching theory or unifying principle, especially one that might support the individualistic liberal state.²⁰ The traditional corrective-justice view of tort liability, which is based on principles of individual autonomy and individual responsibility, is thus a prime target.²¹ The Critics have concentrated most of their attack on the causation requirement. Like the libertarians and the legal economists, the Critics erroneously treat the proximate-cause inquiry as a causal inquiry. Like the legal economists, the Critics assert that the concept of causation has no objective, factual content.²² Unlike the libertarians and the legal economists, however, the Critics do not construct some artificial concept of causation in an attempt to match their theory with the traditional view or the decisions of the courts. Having no theory of their own—other than vague references to quixotic nonhierarchical communitarian societies—the Critics limit their enterprise to "deconstructing" the theories of others.²³

19. See, e.g., Calabresi, *supra* note 10, at 69 n.1, 86-87 & nn.23 & 24, 105-08; Cooter, *supra* note 16, at 523-24, 531-44, 551; Landes & Posner, *supra* note 10, at 109-11, 134; Shavell, *supra* note 14, at 464, 502-03 & n.79; Schwartz, *supra* note 16, at 639-40, 643-47 & nn.14 & 20. For criticism of the legal economists' arguments, see Wright, *Efficiency Theory*, *supra* note 5; Wright, *Bane*, *supra* note 5; *infra* text accompanying notes 226-67.

20. See M. KELMAN, A GUIDE TO CRITICAL LEGAL STUDIES 2-4, 9-10, 12-14, 45-49, 61-63, 196-99, 228-31, 243-49, 297 n.1 (1987); R. UNGER, THE CRITICAL LEGAL STUDIES MOVEMENT (1986); Kelman, *Trashing*, 36 STAN. L. REV. 293 (1984). See generally Burton, *Reaffirming Legal Reasoning: The Challenge from the Left*, 36 J. LEGAL EDUC. 358 (1986); *Symposium on Critical Legal Studies*, 6 CARDOZO L. REV. 693 (1985); *Symposium on Critical Legal Studies*, 36 STAN. L. REV. 1 (1984).

21. See, e.g., Abel, *A Socialist Approach to Risk*, 41 MD. L. REV. 695 (1982); Abel, *Torts*, in THE POLITICS OF LAW: A PROGRESSIVE CRITIQUE 185 (D. Kairys ed. 1982) [hereinafter Abel, *Torts*]; Hutchinson, *Beyond No-Fault*, 73 CALIF. L. REV. 755 (1985).

22. See Horwitz, *supra* note 10; Kelman, *supra* note 10, at 580-81, 590-617. For criticism of the Critics' arguments, see *infra* note 145 and text accompanying notes 175-210.

23. See, e.g., M. KELMAN, *supra* note 20, at 2-6, 64-66, 82-85; R. UNGER, *supra* note 20; Kelman, *supra* note 10; cf. Barker, *Introduction*, in O. GIERKE, NATURAL LAW AND THE THEORY OF SOCIETY, 1500 to 1800, at xvi-xvii, lviii-lxii, lxxxiv-lxxxvii (1934) (discussing dangers of romantic communitarian political philosophy); Wonnell, *Problems in the Application of Political Philosophy to Law*, 86 MICH. L. REV. 123, 130-37 (1987) (same). It is ironic that the Critics use the alleged value skepticism of liberal legal theories as their main point of attack against those theories, since the Critics themselves are the ultimate value skeptics. See M. KELMAN, *supra* note 20, at 3-4, 61-62, 64-85, 228-31. As such, they have painted themselves into a corner. If there are no basic principles to build on, how can they construct an alternative, much less persuasive, vision of the social order to replace the existing social order? Kelman refers vaguely to a regulatory state, apparently ruled by an expert elite, which, especially for a Critic, is a surprisingly unequalitarian and potentially repressive suggestion. See Kelman, *supra* note 10, at 633-37. Moreover, given the assumed lack of any rights or principles or of a determinate concept of causation, how is the regulator to frame or implement any goal?

E. The Legal Realist Heritage

Both the Critics²⁴ and the legal economists²⁵ are the intellectual heirs of the "legal realists," who were the fashionable legal academic camp during the second quarter of this century. The legal realists' goal was to dispel confusion by breaking through the categories and formulas of abstract legal doctrine to illuminate the underlying issues and policies.²⁶ Unfortunately, like the Critics, the legal realists carried their "deconstruction" to an extreme. They were so preoccupied with breaking through boilerplate doctrine to expose the real issues that they denied the existence of any underlying principles that might make up a coherent moral scheme. They believed that the law is merely a collection of isolated rulings unconnected by any overarching theory or ethic and, therefore, that this "law" can be learned only in the sense of familiarizing oneself with standard fact situations and arguments in order to obtain what now is called "legal street smarts."²⁷

One of the major achievements of the legal realists was their temporarily successful insistence on the distinction between the issues of actual causation and proximate causation. They argued that the only truly causal issue in tort liability analysis is the issue of actual causation and that the proximate-cause inquiry has nothing to do with causation but rather deals with noncausal policy reasons for limiting liability.²⁸ On the issue of actual

24. See M. KELMAN, *supra* note 20, at 10-13, 21, 45-49, 103, 257; Fischl, *Some Realism About Critical Legal Studies*, 41 U. MIAMI L. REV. 505, 510-13, 524, 532 (1987); Gordon, *Unfreezing Legal Reality: Critical Approaches to Law*, 15 FLA. ST. U.L. REV. 195, 197, 213-14 (1987); Horwitz, *supra* note 10, at 201, 204. See generally Note, *'Round and 'Round the Bramble Bush: From Legal Realism to Critical Legal Scholarship*, 95 HARV. L. REV. 1669 (1982).

25. See W. LANDES & R. POSNER, *THE ECONOMIC STRUCTURE OF TORT LAW* 4-6 & n.14 (1987) (discussing legal realist heritage, implying most legal realists viewed torts simply as a social insurance system, but noting "[o]ne distinguished realist, . . . Clarence Morris, stressed the deterrent effect of tort liability"); Calabresi, *supra* note 10, at 69 n.1 (citing, *inter alia*, works of legal realists Leon Green, Fleming James, and Wex Malone as "especially significant in the development of my ideas [on causation]"); Shavell, *supra* note 14, at 464 & n.10 (acknowledging intellectual debt to legal realist Henry Edgerton); see also Culp, *supra* note 15, at 31 n.24; Moore, *Thomson's Preliminaries About Causation and Rights*, 63 CHI.-KENT L. REV. 497, 501 (1987); Wright, *Bane*, *supra* note 5, at 436 & n.4.

26. See Llewellyn, *Some Realism About Realism—Responding to Dean Pound*, 44 HARV. L. REV. 1222, 1223, 1236-37 (1931); Note, *supra* note 24, at 1670-76.

27. See, e.g., K. LLEWELLYN, *supra* note 4, at 12-15, 98-99; Morris, *On the Teaching of Legal Cause*, 39 COLUM. L. REV. 1087, 1087-88, 1098-1109 (1939). For a torts casebook devoted to this proposition, which does not even mention the causation issue, see L. GREEN, W. PEDRICK, J. RAHL, E. THODE, C. HAWKINS, A. SMITH & J. TREECE, *CASES ON THE LAW OF TORTS* (2d ed. 1977).

28. See, e.g., L. GREEN, *JUDGE AND JURY* 29-37, 191, 195-96, 222-25, 230-31, 242-43 (1930) [hereinafter L. GREEN, *JUDGE AND JURY*]; L. GREEN, *RATIONALE OF PROXIMATE CAUSE* (1927) [hereinafter L. GREEN, *PROXIMATE CAUSE*]; F. HARPER, *A TREATISE ON THE LAW OF TORTS* § 110, at 257-58 (1933); W. PROSSER, *HANDBOOK OF THE LAW OF TORTS* §§ 45-46, at 311-21 (1st ed. 1941); Edgerton, *Legal Cause* (pt. 2), 72 U. PA. L. REV. 343, 373 (1924); Gregory, *Proximate Cause in Negligence—A Retreat from "Rationalization"*, 6 U. CHI. L. REV. 36 (1938); Morris, *supra* note 27, *passim*.

Unfortunately, in their zeal to demonstrate the incoherence of the standard doctrinal formulas for proximate causation, the legal realists overlooked the contemporaneous work of Charles Carpenter. Motivated by a nonideological, "clear-headed realism," Carpenter attempted, "without imposing a preconceived theory, to restate in consistent and workable form the principles [of actual cause and proximate cause] . . . actually found in the decisions."

causation, most of the legal realists were true "clear-headed" realists.²⁹ They correctly insisted that actual causation is a factual issue, unaffected by policy considerations.³⁰ In the absence of any workable definition of actual causation, they insisted that the issue be given to the jury without any elaboration. The members of the jury, relying on the irreducible and undefinable concept of causation, would make the correct factual determination.³¹

However, the lack of a workable definition of causation eventually led some to conclude that the actual-causation inquiry is not simply or even primarily factual, but rather, like the proximate-cause inquiry, is pervaded by policy considerations.³² Most of the major legal realists rejected this view and continued to insist, with minor qualifications, that the actual-causation inquiry is purely factual.³³ Nevertheless, the policy-oriented view of the actual-causation inquiry gained increasing favor among legal academics, until it eventually became the dominant view in the academic legal literature.³⁴

During the same period, a countermovement developed. H.L.A. Hart and Tony Honoré led this countermovement on the issue of causation and its relationship to responsibility. They argued that legal liability is not based on ad hoc policy considerations, but rather is based on widely recognized principles of responsibility.³⁵ Unfortunately, Hart and Honoré claimed that the principles of *proximate* causation, as well as the principles of actual causation, are causal principles.³⁶ They therefore argued that responsibility

Carpenter, *Workable Rules for Determining Proximate Cause* (pt. 1), 20 CALIF. L. REV. 229, 257-58 (1932). His work, which made a significant beginning on elucidating such principles, *see id.* (pt. 3) at 471-539, initially was buried by the tide of legal realism but subsequently was resurrected by Hart and Honoré when that tide lost its momentum. *See infra* text accompanying notes 35-37.

29. This phrase is borrowed from Moore, *supra* note 25, at 501 n.18.

30. *See* L. GREEN, JUDGE AND JURY, *supra* note 28, at 190-95; L. GREEN, PROXIMATE CAUSE, *supra* note 28, at 132-33, 135, 137, 139-40, 181-85; *accord* W. PROSSER, *supra* note 28, § 46, at 321, 323-24.

31. For a thorough attempt to elaborate how this approach would work in the myriad types of causation cases, *see* A. BECHT & F. MILLER, THE TEST OF FACTUAL CAUSATION IN NEGLIGENCE AND STRICT LIABILITY CASES (1961), *criticized in* Wright, *supra* note 2, at 1784-88.

32. The major article is Malone, *Ruminations on Cause-in-Fact*, 9 STAN. L. REV. 60 (1956) [hereinafter Malone, *Ruminations*], *criticized in* Wright, *supra* note 2, at 1742-45, 1792, 1807-13. Malone later reversed his position and insisted that the causal inquiry is purely factual and should be sharply distinguished from the independent policy considerations that enter into the determination of proximate causation. *See* Malone, *Ruminations on Dixie Drive It Yourself Versus American Beverage Company*, 30 LA. L. REV. 363, 370-71 (1970). Malone has explained that his reversal was tactically motivated, as part of his successful effort to get the Louisiana Supreme Court to switch from proximate-cause analysis to duty-risk analysis. Letter from Wex S. Malone to Richard W. Wright (May 28, 1986) (available at Iowa Law Review offices).

33. *See* 2 F. HARPER & F. JAMES, THE LAW OF TORTS §§ 20.1-.2, 20.4 (1956 & Supp. 1968); C. MORRIS & C.R. MORRIS, MORRIS ON TORTS 154-201 (2d ed. 1980); Green, *The Causal Relation Issue in Negligence Law*, 60 MICH. L. REV. 543, 549, 553 & n.22, 554 n.25, 556, 560, 603-07 (1962); Thode, *The Indefensible Use of the Hypothetical Case to Determine Cause in Fact*, 46 TEX. L. REV. 423, 424-27, 431 (1968); *see also* W. PROSSER, HANDBOOK OF THE LAW OF TORTS § 41, at 236-37 (4th ed. 1971).

34. *See* Wright, *supra* note 2, at 1738-39 & nn.6-9.

35. *See* H.L.A. HART & A. HONORÉ, CAUSATION IN THE LAW 3-5, 23-25, 61-63, 65, 83-105, 123-25, 261-62, 273-76 (1st ed. 1959).

36. *See id.*; H.L.A. HART & T. HONORÉ, *supra* note 13, at xxxiv-xxxvi, lii-liii, 3-5, 24-27,

is based primarily on principles of causation.³⁷

F. *The Present Situation*

Thus, by the end of the third quarter of this century, academic tort theory had come full circle. Both of the opposed academic camps rejected the legal realists' attempt to separate the actual-causation inquiry from the proximate-cause inquiry. The "super-realists" insisted that both inquiries simply camouflage ad hoc policy decisions on ultimate liability. The "principlists" insisted that the two inquiries are merely different steps in the ultimate attribution of responsibility based on commonsense "causal" principles. Given such rampant confusion about the meaning of and relationship between causation and responsibility, the soil was ripe for the emergence, during the fourth quarter of this century, of the tort theories of the libertarians, the legal economists, and the Critics.

Even the Prosser tort treatise, revered by generations of lawyers, law students, and judges, has fallen prey to the confusion—although not until well after Prosser's death. In the midst of the mounting confusion, Prosser resolutely and emphatically continued to insist that actual causation is a factual issue and that proximate causation is a noncausal policy issue.³⁸ Unfortunately, the revisers of Prosser's treatise, with minimal notice,³⁹ abandoned Prosser's longstanding, strongly held position. They replaced each of Prosser's statements on the necessity of distinguishing the factual issue of actual causation from the policy issue of proximate causation with statements that assert the policy-dependent nature of the actual-causation inquiry and the causal nature of at least part of the proximate-cause inquiry.⁴⁰

In a recent article, I began to cut through the confusion by distinguishing the three elements of tort liability analysis—the tortious-conduct, actual-causation, and proximate-cause inquiries—and by elaborating a workable test of actual causation—the Necessary Element of a Sufficient Set (NESS) test—that conforms with our common intuitions, has strong philosophic roots, and accounts for the decisions of the courts.⁴¹ Yet, as

65-67, 69-70, 88-111, 130-32, 291-92, 304-07.

37. See H.L.A. HART & T. HONORÉ, *supra* note 13, at lxxvii-lxxx, 65-67, 302. In other passages, especially in the second edition, Hart and Honoré state that legal liability requires wrongful conduct (the tortious-conduct inquiry) as well as "causation of harm" (the combined actual-causation and proximate-cause inquiries). See *id.* at xxxv, xliii-xxvii, lxxv-lxxvii, 131-32, 254-55, 466. For criticism of Hart and Honoré's thesis, see Wright, *supra* note 2, at 1745-50.

38. See W. PROSSER, *supra* note 33, § 41, at 237, § 42, at 244, 249-50, § 43, at 250-51, § 45, at 289.

39. The revisers merely note that some changes were made in the chapter on proximate cause. W. KEETON, D. DOBBS, R. KEETON & D. OWEN, PROSSER AND KEETON ON THE LAW OF TORTS, at xix (5th ed. 1984) [hereinafter PROSSER & KEETON]. In contrast, when discussing strict liability for abnormally dangerous conditions, the revisers describe their shift of position and retain the substance of Prosser's treatment. See *id.* § 78, at 554-56.

40. See *id.* § 41, at 264-65, § 42, at 273-74, 279-80, § 43, at 280-81, § 45, at 321.

41. Wright, *supra* note 2; see *infra* text accompanying notes 98-112. Moore treats discussions of the tortious-aspect causation requirement by myself, Becht and Miller, and Keeton as attempts to devise a discriminating concept of causation that would support a theory of liability based on mere causation of harm. See Moore, *supra* note 25, at 497, 517, 519-20. In

evidenced by a recent symposium,⁴² substantial confusion persists in the academic literature.

The legal economists, ignoring the NESS test, continue to assert that there is no unique, workable test of actual causation and, relying on the noncausal concept of "probabilistic causation" (increased risk), conflate the actual-causation and proximate-cause inquiries.⁴³ The libertarians now seem to distinguish the actual-causation inquiry from the proximate-cause inquiry, but they also ignore the NESS test and continue to treat certain noncausal elements, such as the use of force or fraud, as causal limitations on liability.⁴⁴ Only the Critics, represented by Mark Kelman, have confronted the NESS test. Not surprisingly, Kelman argues that the NESS test is incoherent.⁴⁵ He lumps it together with the proposals of the libertarians and the legal economists, which are treated as equally (in)valid theories of causation, as further proof of the indeterminacy of tort law.⁴⁶

I address Kelman's and others' criticisms of the NESS test of causation in Part IV.⁴⁷ First, however, I trim some outer branches of the bramble bush by distinguishing the causal issue from other elements of the tort liability analysis.

my previous article, I emphatically rejected such "causal" theories. Wright, *supra* note 2, at 1741-58. Instead, I clearly stated that both the decision to adopt the tortious-aspect causation requirement and the definition of tortious behavior are issues of policy or principle, distinct from and prior to the factual issue of whether the tortious aspect of the behavior was a cause of the injury, which is also distinct from the issues of policy or principle involved in the proximate-cause inquiry. *Id.* at 1741-44, 1759, 1769-71, 1773-74 & n.161; accord A. BECHT & F. MILLER, *supra* note 31, *passim*; cf. R. KEETON, *LEGAL CAUSE IN THE LAW OF TORTS* 8-9, 13, 17-24 (1963) (emphasizing policy issues involved in defining tortious conduct and the scope of liability, but confusing tortious-aspect causation requirement with "harm within the risk" proximate-cause limitation on liability). See generally Wright, *supra* note 2, at 1759-74 (discussing tortious-aspect causation requirement).

Moore also portrays Jeremiah Smith as having adopted a "causal" theory of liability based on a metaphysical view of causation as an undefinable primitive subject to relative measurement. Moore, *supra* note 25, at 518-19. Yet Smith distinguished the tortious-conduct, actual-causation, and legal (proximate) cause inquiries, used the but-for test—with an exception for duplicative independently sufficient causes—as the test of actual causation, and presented his substantial-factor formula—accompanied by elaborations and illustrations—as a pragmatic, rather than metaphysical, test for legal causation. See Smith, *Legal Cause in Actions of Tort* (pts. 1-3), 25 HARV. L. REV. 103, 103-04, 109 & n.20, 223, 223-24, 248-49, 303, 303-04, 308-21 & n.22 (1911-1912); see also Wright, *supra* note 2, at 1781-84 (discussing history of substantial-factor formula).

42. *Symposium on Causation in the Law of Torts*, 63 CHI.-KENT L. REV. 397 (1987).

43. See W. LANDES & R. POSNER, *supra* note 25, at 228-55; S. SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* 105-18 (1987); Cooter, *supra* note 16, at 525-44, 551; Schwartz, *supra* note 16, at 639-47 & nn.12 & 14; Sykes, *The Boundaries of Vicarious Liability: An Economic Analysis of the Scope of Employment Rule and Related Legal Doctrines*, 101 HARV. L. REV. 563, 571-72 & n.23 (1988). For an extended discussion of the legal economists' confusion on causation, see Wright, *Efficiency Theory*, *supra* note 5, at 554-62, 567-78.

44. See Epstein, *Afterword*, *supra* note 12, at 654-57, 664-74; Rizzo, *supra* note 10, at 394-402; see also *infra* text accompanying notes 70-91, 257-62.

45. See Kelman, *supra* note 10, at 602-08.

46. See *id.* *passim*.

47. See *infra* text accompanying notes 138-225.

III. DISTINGUISHING CAUSATION FROM RESPONSIBILITY

A. *Actual Causation and Proximate Causation*

As was noted above, tort liability is based on three distinct but interconnected inquiries: the tortious-conduct, actual-causation, and proximate-cause inquiries.⁴⁸ A superficial analysis of ordinary language has led many people to confuse these three inquiries, especially the second and third. Many people treat the third inquiry as a causal inquiry, merely because the word "cause" appears in the phrase "proximate cause." Yet the operative word in the phrase is "proximate," which is itself a poor substitute for "responsible." Only the second inquiry is concerned with whether the defendant's tortious conduct was a *cause* of (contributed to) the injury. The third inquiry asks, *given* that the defendant's tortious conduct was a cause of the injury, whether that tortious cause should be treated as a *proximate* (responsible) cause.⁴⁹

Tort liability requires affirmative answers to all three inquiries. Ordinarily, affirmative answers to the first two inquiries present a strong case for an affirmative answer to the third. Nevertheless, the third inquiry may be answered negatively, resulting in no liability, in the following circumstances: if the injury would have occurred anyway as a result of nonresponsible conditions, if it would not have occurred but for unforeseeable tortious conduct by others or unforeseeable independent abnormal events or conditions, or if other conditions existed that weigh against liability.⁵⁰

Although some of these proximate-cause reasons for rejecting liability deal with issues raised by the existence of causes other than the defendant's tortious conduct, the issues themselves are not causal. The question at this stage is not whether the defendant's tortious conduct was a cause—that question has already been answered affirmatively—or whether there were also other causes—there always are. Rather, the question is whether the defendant, who tortiously caused the injury, should be absolved of liability for noncausal reasons such as the unforeseeability or the nontortious duplicative nature of one or more of the other causes.

Thus, as should be clear to anyone who goes beyond the terminology to examine the actual reasoning employed in the proximate-cause inquiry, that inquiry is not a causal inquiry but rather is a policy inquiry that deals with reasons for absolving a defendant from liability even though the tortious aspect of her conduct was a cause of the injury.⁵¹ This was one of the legal realists' major points. They insisted that we distinguish the factual question of actual causation from the policy issues of proximate causation. They also urged that we abandon the phrase "proximate cause,"⁵² or at

48. See *supra* text accompanying note 11.

49. See Wright, *supra* note 2, at 1741-58.

50. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 130-307; Carpenter, *supra* note 28, at 471-539; Wright, *supra* note 2, at 1745-50, 1766-74 & n.161, 1798-1801.

51. See, e.g., L. GREEN, PROXIMATE CAUSE, *supra* note 28; J. MACKIE, THE CEMENT OF THE UNIVERSE: A STUDY OF CAUSATION 127-29 (rev. 1980); W. PROSSER, *supra* note 33, §§ 41-43, at 236-37, 244-51; Wright, *supra* note 2, at 1741-58.

52. See L. GREEN, PROXIMATE CAUSE, *supra* note 28, at 39, 195-200.

least replace it with the more accurate and less misleading phrase, "responsible cause,"⁵³ to avoid further confusion of the two inquiries. Unfortunately, their advice was not heeded and the confusion persists.

B. Causation and Responsibility

The confusion of the factual issue of causation with the policy issue of moral or legal responsibility goes deeper than the failure to distinguish the second and third elements of the liability analysis. The causal issue is often confused with the responsibility determination that results from application of all three elements.⁵⁴ Once again, the source of the confusion is superficial semantics: the failure to distinguish different usages of the words "cause" and "responsibility" in ordinary language.

On the one hand, "responsibility" has two different meanings. Its primary meaning, which is the intended meaning in this Article, is moral or legal liability for some consequence—which may exist even though the person in question was not a cause of the consequence. In certain contexts, however, "responsibility" refers merely to causation, as in the statement, "The earthquake was responsible for the destruction of the house."⁵⁵ It is logically incorrect to equate causation with responsibility in its primary sense simply because responsibility in its secondary sense means causation.

A more common source of the confusion of causation with responsibility is the failure to distinguish the different usages of "cause," particularly the frequent distinction between "a cause" and "the cause." The phrase "a cause" usually refers to causation per se—the fact of being one of many contributing conditions. The phrase "the cause" generally is used to denote which of the many contributing conditions is legally or morally responsible. This second usage, read literally and superficially, often is cited as evidence that causation is equivalent to responsibility.⁵⁶

As with the phrase "proximate cause," however, the operative word in the phrase "the cause" is not "cause" but rather "the." "The cause" is merely an elliptical way of saying "the (most significant for our purposes) cause."⁵⁷ Sometimes even the phrase "a cause" is used in this elliptical manner. All the contributing conditions are causes, but one or more are selected as being most significant for a particular purpose, using noncausal criteria relevant to that purpose.

Generally, commentators recognize that the context or purpose of the causal inquiry determines which of the many contributing conditions is

53. See W. PROSSER, *supra* note 28, § 45, at 312-13.

54. See, e.g., A. HARARI, *THE PLACE OF NEGLIGENCE IN THE LAW OF TORTS* 49-56 (1962); H.L.A. HART & T. HONORÉ, *supra* note 13, at lxxviii-lxxxix, 65-67, 302; Epstein, *Strict Liability*, *supra* note 12, at 163, 168-69; Green, *supra* note 33, at 545, 562; Malone, *Ruminations*, *supra* note 32, at 62-67; cf. RESTATEMENT (SECOND) OF TORTS § 431 comment a (1965) (substantial factor test of causation includes notion of responsibility).

55. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 65. The second usage may be a relic from the primitive notion that all things have animating spirits or at least have a divine if not human agency. See *id.*; O. HOLMES, *THE COMMON LAW* 12-13 (M. Howe ed. 1963).

56. See sources cited *supra* note 54.

57. See Wright, *supra* note 2, at 1742-44.

selected as *the* (or *a*) cause.⁵⁸ Yet many fail to recognize that, when causal language is employed in this manner, it covers two distinct issues: first, the explicit issue of identifying a cause and, second, the implicit issue of identifying, on noncausal grounds relevant to the particular context, the most-significant-in-this-context cause. By conflating these two issues, they erroneously conclude either that causation is policy-dependent⁵⁹ or that causal principles are at work in selecting the/a significant cause.⁶⁰ Either way, they feel compelled or entitled to treat the nonselected causes as “mere conditions,” or as part of the “backdrop,” “field,” or “contrast-class,” rather than as causes.⁶¹ It is not surprising that lawyers, law students, and lay persons sometimes fail to unpack the elliptical content of such attributive statements and hence fail to distinguish the causal and noncausal issues. It is surprising that philosophers, including some who have been most thorough in investigating the logic of causation,⁶² make the same error.⁶³

58. See, e.g., T. BEAUCHAMP & A. ROSENBERG, HUME AND THE PROBLEM OF CAUSATION 284-300 (1981); H.L.A. HART & T. HONORÉ, *supra* note 13, at lxxvi, 11-12, 35-38, 62; J. MACKIE, *supra* note 51, at 34-38, 63, 118-20; Borgo, *supra* note 15, at 430-32, 439-40, 452; Calabresi, *supra* note 10, at 105-08; Cohen, *Field Theory and Judicial Logic*, 59 YALE L.J. 238, 251-59 (1950); Cole, *Windfall and Probability: A Study of “Cause” in Negligence Law* (pt. 1), 52 CALIF. L. REV. 459, 459-60, 462-65 (1964); Cooter, *supra* note 16, at 528-31, 535-36, 540-44; Culp, *supra* note 15, at 23-31, 37-43, 45-46; Dray, *Causal Judgment in Attributive and Explanatory Contexts*, 49 LAW & CONTEMP. PROBS., Summer 1986, at 13, *passim*; Fraser & Howarth, *More concern for cause*, 4 LEGAL STUD. 131, 134-137, 139-42 (1984); Malone, *Ruminations*, *supra* note 32, at 62-64; Rizzo, *supra* note 10, at 398-402; Robinson, *Multiple Causation in Tort Law: Reflections on the DES Cases*, 68 VA. L. REV. 713, 713-14, 761-64 & n.154 (1982); Schwartz, *supra* note 16, at 641-43; Scriven, *The Logic of Cause*, 2 THEORY & DECISION 49, 50, 53 (1971) [hereinafter Scriven, *Logic*]; Scriven, *The Structure of Science* (Book Review), 17 REV. METAPHYSICS 403, 408-11 (1964) [hereinafter Scriven, *Structure*]; Thomson, *Preliminaries About Causation and Rights*, 63 CHI.-KENT L. REV. 471, 472-80, 483-95 (1987); Williams, *Causation in the Law*, 1961 CAMBRIDGE L.J. 62, 63-65, 69.

59. See sources cited *supra* note 58 (Calabresi, Cohen, Cooter, Dray, Fraser & Howarth, Malone, Robinson, and Schwartz).

60. See sources cited *supra* note 58 (Beauchamp & Rosenberg, Borgo, Culp, Hart & Honoré, Mackie, Rizzo, Scriven, and Thomson); Epstein, *Strict Liability*, *supra* note 12, *passim*. But cf. J. MACKIE, *supra* note 51, at 127-29 (criticizing Hart and Honoré for treating moral selection criteria as causal criteria).

61. See, e.g., H.L.A. HART & T. HONORÉ, *supra* note 13, at 11-13, 33 (mere conditions); J. MACKIE, *supra* note 51, at 34-36 (causal field); Scriven, *Structure*, *supra* note 58, at 409-10 (contrast class); Thomson, *supra* note 58, at 483 (backdrop).

62. See T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 284-300; J. MACKIE, *supra* note 51, at 34-38, 63, 118-20; Scriven, *Logic*, *supra* note 58, at 50, 53; Scriven, *Structure*, *supra* note 58, at 409-10.

63. After a lengthy struggle, Thomson eventually falls into this trap. Compare Thomson, *supra* note 58, at 472-80 (apparently rejecting pragmatic limitations on causal analysis) with *id.* at 483-84 (using pragmatic considerations to treat condition as fixed part of “backdrop” rather than as a cause) and *id.* at 485-95 (treating distinction between causing harm and conferring benefit as a causal issue). For further discussion of these issues, see *infra* note 108 and text accompanying notes 80-84. Thomson dismisses a suggestion that causal rhetoric may be elliptical with an invalid argument that replaces elliptical references to concrete features of an event-token with references to abstract event-types. See Thomson, *supra* note 58, at 478-79, criticized in Moore, *supra* note 25, at 504, 514-15. Her failure to perceive the elliptical nature of causal rhetoric perhaps explains her puzzlement over lawyers’ and laypersons’ use of the phrase “the cause.” See Thomson, *supra* note 58, at 477. Although Thomson implies otherwise, philosophers also frequently use this phrase. See T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 286-300.

In legal and moral discourse, the phrase "the cause" is an elliptical way of saying "the (responsible) cause." The phrase signifies that we are using noncausal criteria to select the responsible cause from all the other causes. In tort liability analysis, the noncausal selection criteria appear in the tortious-conduct and proximate-cause inquiries. Only tortious causes are responsible, and even tortious causes may be absolved of responsibility as a result of principles or policies considered in the proximate-cause inquiry. The noncausal criteria do not intrude into the actual-causation inquiry *per se*, but rather are used to determine which conditions should be tested for actual causation and then which actual, tortious causes should nevertheless be absolved of responsibility.⁶⁴

A major source of the confusion between causation and responsibility is Hart and Honoré's work. As was noted above,⁶⁵ Hart and Honoré attempted to rebut the legal realists' account of legal liability as *ad hoc* and policy-oriented by providing an explanation based on commonsense "causal" principles. They derived these commonsense principles from an analysis of ordinary statements used to attribute responsibility. According to these commonsense principles, a contributing factor is "the cause" rather than a "mere condition" if it satisfies two requirements: (1) it must be (a) a voluntary human intervention that was intended to produce the consequence—for example, deliberately shooting someone—or (b) an abnormal action, event, or condition in the particular context—for example, a freak storm or driving carelessly, and (2) it must be the last deliberate intervention or independent abnormal occurrence.⁶⁶

As Hart and Honoré themselves acknowledge,⁶⁷ their commonsense principles do not have anything to do with the issue of actual causation, but rather are used to determine whether some contributing factor is a responsible cause. Principles (1)(a) and (1)(b), as applied to human action, simply describe intentional or negligent conduct, respectively, and thus incompletely describe the tortious-conduct inquiry. Similarly, principle (2) incompletely describes the proximate-cause inquiry. Hart and Honoré's attempt to fit these two noncausal inquiries into a causal rubric creates numerous problems for their theory. For example, they are unable to accommodate strict liability, to explain why liability often is imposed on a defendant despite subsequent deliberate or negligent intervention by another, or to fashion definitions of deliberate or abnormal conduct that will work in both the tortious-conduct and proximate-cause inquiries.⁶⁸ Hart and Honoré could have avoided all these problems if they had treated their commonsense principles as principles of responsibility rather than as principles of causation.⁶⁹

64. See Wright, *supra* note 2, at 1741-50, 1759-74.

65. See *supra* text accompanying notes 35-37.

66. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 2-6, 33-35, 41-42, 130-31.

67. See *id.* at xlviii-xlix, 72-74, 110-11.

68. See Wright, *supra* note 2, at 1745-50.

69. Tony Honoré has recently summarized his position as follows:

What I think after all these years is that the principles of selection, as I would call them (rather than principles of responsibility, though they can indirectly amount to that), are indeed causal principles but that (i) the basis of selection is pragmatic. We chop up the flow of events in ways which enable us to find our way around—

C. An Example: The Libertarian Theory

A number of scholars have been misled by Hart and Honoré's apparent equation of causation and responsibility.⁷⁰ The most relevant example, in the context of this Article, is the "causal" theory that has been put forth by the libertarians, led by Richard Epstein.⁷¹ Initially, Epstein claimed that his "causal" paradigms—which describe situations in which harm is caused through force, the threat of force, force compelled by force, or the creation of dangerous conditions that release or redirect force—resolve both the actual-causation and proximate-cause inquiries.⁷²

Yet, as shown elsewhere, the paradigms do not help us identify instances of actual causation, but rather assume that we somehow already have identified them.⁷³ The function of the paradigms is to arbitrarily reserve the "cause" appellation for those instances of causation that were volitional and that involved force or the fear of force—a tortious-conduct or *proximate*-cause function. Moreover, the paradigms provide no guidance on the central proximate-cause issue of how far we should trace the force, or the fear of force, to attribute liability. In sum, the paradigms do not address the actual-causation inquiry at all, but rather constitute an artificial proximate-cause limitation on Epstein's otherwise absolute *prima facie* liability for causation of harm.⁷⁴

In his most recent work, Epstein acknowledges that liability based on mere causation of harm would be indeterminate in theory and stifling in practice.⁷⁵ He asserts that liability exists only for physical invasion of the

understand—the world and to some extent manipulate it. We also chop it up in a way which enables us to figure as the authors of actions for which we want to be treated as responsible. But (ii) the fact that we do this cannot properly be described as any sort of policy. There could not be, the world and human beings being what they are, a different "policy". That is why the principles about voluntary intervention, abnormality, etc., are not to be described as principles of legal policy, though they aren't descriptions of the furniture of the universe either. But, as I've tried to argue in the second edition particularly, there are genuine legal policy considerations which influence what are often called "causal" determinations. So I do still differ from you in that I think that (at least) four and not only three (as you state) inquiries are needed in a tort case (not forensically, perhaps, but analytically). Number three is whether on general causal principles of selection/attribution the result is attributable to the supposed cause and number four is whether there are reasons of legal policy which move the court to restrict or expand the liability so determined.

Letter from Tony Honoré to Richard Wright (Dec. 3, 1987) (available at *Iowa Law Review* offices).

70. See, e.g., A. HARARI, *supra* note 54, at 49-56; Epstein, *Strict Liability*, *supra* note 12, at 163, 168-69; Epstein, *supra* note 10, at 479; Rizzo, *supra* note 10, at 400-02; Rizzo & Arnold, *supra* note 12, at 1401-03 & n.17, 1406 & n.38, 1407-08 & n.50; Schwartz, *supra* note 16, at 641-42; cf. Borgo, *supra* note 15, at 425 & n.17, 431 & n.31, 432-40, 452-55 & nn.55 & 59 (selecting responsible causes).

71. See Epstein, *Strict Liability*, *supra* note 12, at 163-204; Rizzo, *supra* note 10, at 400-02; Rizzo & Arnold, *supra* note 12, at 1402-03. Hart and Honoré have rejected Epstein's "causal maximalism." H.L.A. HART & T. HONORÉ, *supra* note 13, at lxxiii-lxxvii.

72. Epstein, *Strict Liability*, *supra* note 12, at 160-69, 184-85; Epstein, *supra* note 10, at 478-80.

73. See Wright, *supra* note 2, at 1752-54.

74. See *id.* at 1750-58.

75. See Epstein, *Afterword*, *supra* note 12, at 653-54.

plaintiff's person or property, that only causation involving the use of force or fraud will count as interference with personal or property rights, and that his original paradigms describe what counts as the use of force.⁷⁶ Epstein admits that the force-or-fraud limitation is used to pick out a "subset of causes . . . relevant to legal and moral inquiry."⁷⁷ He seeks to justify that limitation through a policy argument that compares the social-welfare consequences of permitting unlimited force or fraud, on the one hand, and unlimited business competition, on the other.⁷⁸ Finally, he describes the questions involved in applying the force limitation as questions of "proximate causation" or "remoteness of damage."⁷⁹ Thus, Epstein now seems to acknowledge the distinction between the question of actual causation and the issues of policy or principle involved in the proximate-cause inquiry.

Nevertheless, he continues to obscure that distinction by referring to the proximate-cause issues and even the ultimate issue of responsibility as "causal."⁸⁰ For example, Epstein considers the following situation:

A threatens to punch B in the nose, and C intervenes to stop the blow. Is this a case where the intervention of C confers a benefit upon B; or a case where, if C does not stop the blow, the nonintervention of C causes a harm to B[?]⁸¹

Epstein correctly notes that we can maintain the distinction between "conferring a benefit" and "causing a harm" once we decide whether the person in need of aid had a *right* to the aid.⁸² Yet he writes as if this somehow were a causal issue.⁸³ It is not. The question is not whether the failure to give aid contributed to the victim's loss; it is assumed that it did. Rather, the question is whether the person who failed to give aid should be liable for that loss, and the answer depends on whether the victim had a right to the aid. In this context, the phrase "causing a harm" does not mean simply "contributing to a loss." Rather, it means "being a *responsible* cause of the loss" or "contributing to a *legal* injury."

76. *Id.* at 654-55, 666-68; Epstein, *Nuisance Law*, *supra* note 12, at 50-53, 56-60; Epstein, *supra* note 10, at 479-81, 488-89, 497-501. He does not explain the relationship, if any, between fraud and the original paradigms or how fraud produces physical invasions.

77. Epstein, *Afterword*, *supra* note 12, at 655.

78. *Id.* at 655-56. The argument assumes that there is a dichotomy between the use of force or fraud on the one hand and ordinary competition on the other, thereby ignoring a broad range of other types of harmful conduct. At best, the argument justifies nonliability for harm caused by ordinary competition. It does not justify nonliability for harm caused by other means.

79. *Id.* at 666-67.

80. *See id.* at 653, 665-74.

81. *Id.* at 668.

82. *Id.* at 668-70.

83. *Id.* This is true also of Rizzo and Thomson, who both assume that omissions cannot be causes. *See* Rizzo, *supra* note 10, at 398-99; Thomson, *supra* note 58, at 494-95; *see also* Coleman, *Property, Wrongfulness and the Duty to Compensate*, 63 CHL.-KENT L. REV. 451, 453 (1987). This assumption is wrong. *See* H.L.A. HART & T. HONORÉ, *supra* note 13, at 16, 21, 30-31, 112-13, 127-28, 138-41, 447-49; J. MACKIE, *supra* note 51, at 62-63, 67, 75-76, 125; Wright, *supra* note 2, at 1784-85 & n.212.

Epstein similarly obscures the distinction between causation and responsibility in his discussion of "joint causation."⁸⁴ When there is more than one tortious, proximate cause of the same injury, the problem arises of how to allocate liability among the multiple responsible causes. The allocation issue is not a causal issue, but rather is an issue of policy or principle that we resolve by comparing the types and degrees of tortious conduct involved and the principles underlying liability for each type of tortious conduct.⁸⁵ Yet Epstein treats the allocation issue as a problem of "causal attribution." He argues that the allocation problem can be evaded in many instances by using his idiosyncratic scheme of "causal" paradigms and "causal" priorities to "eliminate" or lexically "rank" causes until we arrive at a "unique causal judgment" that attributes the entire liability to a single cause.⁸⁶ When no such evasion is possible, he throws up his hands and declares that there is no conceptually plausible solution to the allocation problem.⁸⁷ The problem is insoluble only because Epstein continues to confuse the issue of identifying causes with the noncausal issues of attributing responsibility to identified causes and allocating liability among multiple responsible causes.⁸⁸

In all of his writings on tort liability, Epstein never addresses the actual-causation issue, except for occasional references to proof problems or to the inadequacy of the but-for test. Even then, he focuses on issues of proximate causation or overall responsibility rather than on causation per se. His objection to the but-for test is that it treats too many conditions as causes of the injury—a proximate-cause concern—whereas the objection from the standpoint of causation per se is that the test treats too few conditions as causes.⁸⁹ Similarly, when he purports to deal with problems in proving causation by arguing for contractual or regulatory changes in the definition of tortious conduct or the agreed level of precaution or risk, he fails to recognize that the causal proof problems still exist when injuries occur within the specified or agreed-to scope of liability.⁹⁰

In sum, Epstein, although purporting to discuss causation, actually only uses causal rhetoric to dress up his theory of responsibility. He apparently believes that his theory will seem more plausible if, aided by

84. See Epstein, *Afterword*, *supra* note 12, at 670-74.

85. See Wright, *Allocating Liability Among Multiple Responsible Causes: A Principled Defense of Joint and Several Liability for Actual Harm and Risk Exposure*, 21 U.C. DAVIS L. REV. 1141, 1143-46 (1988).

86. Epstein, *Afterword*, *supra* note 12, at 670-71, 672-74.

87. *Id.* at 671.

88. Epstein cites a previous article of mine as being part of a debate on "causal" methods of allocating liability. *Id.* at 671 & n.53 (citing Wright, *supra* note 2). In the article that he cites, I did not discuss the allocation issue. Rather, I concentrated on distinguishing the causal issue from the noncausal issues and on elaborating a test for actual causation that enables causes to be identified in the problematic situations involving causal overdetermination. I criticized Epstein and others who confuse the issue of causal identification with the noncausal issues of attributing responsibility to and allocating liability among identified causes. See Wright, *supra* note 2, at 1741-58, 1798-1801 & n.265. For my analysis of the allocation issue, see Wright, *supra* note 85.

89. See Epstein, *Strict Liability*, *supra* note 12, at 160-61; Epstein, *supra* note 10, at 478-79; *infra* text accompanying notes 110-12.

90. See Epstein, *Afterword*, *supra* note 12, at 675-78.

confusion over the concept of causation, it is viewed as part of "the rich diversity of approaches that may be taken toward the question of causation."⁹¹

IV. THE CONCEPT OF CAUSATION

A. *The Meaning of Causation: The NESS Test*

In the above discussion, I assumed that people can and do make factual causal judgments that are not influenced by policy considerations. Many, including the Critics and the legal economists, have challenged this assumption by pointing to the alleged lack of a comprehensive definition of causation.⁹²

Michael Moore provides one plausible response to this challenge: an intelligible, determinate concept may exist and be used without anyone being able to provide its precise definition.⁹³ Indeed, the concept of causation is a preeminent example of this phenomenon. Despite the lack of an explicit comprehensive definition of causation, people from time immemorial have shown remarkable agreement in their causal judgments, at least once they are clearly focused on the causal issue rather than on some noncausal inquiry regarding *the* (most significant for some purpose) cause. In particular, judges and juries, when not confined by incorrect tests or formulas, consistently have demonstrated an ability to make intuitively plausible factual causal determinations.⁹⁴

For example, assume fire X and fire Y each would be independently sufficient—that is, sufficient in the absence of the other fire, when combined with other existing conditions—to destroy a certain house if it reached the house. Few, if any, would disagree with the following propositions: (1) fire X was a cause of—contributed to—the destruction of the house if fire X, but not fire Y, reached the house and the house would not have been destroyed if fire X had been absent; (2) fire X and fire Y both were causes of the destruction of the house if they reached the house simultaneously and the house would not have been destroyed if both had been absent; and (3) fire X was a cause of the destruction of the house but fire Y was not if fire X reached the house before fire Y, the house was destroyed before fire Y arrived, and the house would not have been destroyed if both fires had been absent.

Some scholars rely heavily on this shared yet undefined concept of causation in their writings on causation and responsibility by grounding their arguments on intuitive responses to hypothetical situations.⁹⁵ Yet intuitions that are not conjoined with theory in a search for underlying principles are often inadequate for the hard cases and sometimes may

91. *Id.* at 653.

92. See *supra* text accompanying notes 19, 22, 32-34.

93. Moore, *supra* note 25, at 502-03 & nn.31 & 32. See generally M. POLANYI, *THE STUDY OF MAN* 11-39 (1959) (discussing tacit knowledge).

94. See Wright, *supra* note 2, at 1766-74, 1788-1813.

95. See, e.g., Thomson, *supra* note 58; Thomson, *Remarks on Causation and Liability*, 13 PHIL. & PUB. AFF. 101 (1984).

mislead even in the easy cases.⁹⁶ In these situations in particular we would benefit greatly from elaboration of the concept that, unarticulated and imperfectly understood, underlies the intuitive judgments. In addition, to leave the concept undefined is to lend credence to theories, such as those of the libertarians, the legal economists, and the Critics, that invalidly invoke or belittle the concept.

A better response, therefore, is to set forth a workable definition of causation. Attempts to define causation in terms of the most obvious candidates—necessary conditions, sufficient conditions, or necessary and sufficient conditions—have all failed to produce a comprehensive, workable test.⁹⁷ Recently, however, a number of legal and nonlegal philosophers have formulated substantively identical definitions that capture the essence of the concept of causation by subordinating the necessity requirement to the sufficiency requirement.⁹⁸ According to one such definition, which I call the Necessary Element of a Sufficient Set (NESS) test, *a particular condition was a cause of (contributed to) a specific result if and only if it was a necessary element of a set of antecedent actual conditions that was sufficient for the occurrence of the result.*⁹⁹

The NESS test is based on the dominant regularity account of causation that was first elaborated by David Hume and subsequently modified by John Stuart Mill. Hume revolutionized philosophic thinking on causation when he insisted that, contrary to the then-popular belief, singular causal judgments are not based on direct perception of causal qualities or forces inherent in objects or events: no such quality or force has ever been identified. Instead, causal judgments are based on the belief that a certain succession of events instantiates one or more causal laws. A fully described causal law would list all the conditions that together are sufficient for the occurrence of a certain consequence. Yet, to avoid including causally irrelevant conditions in this sufficient set, the antecedent conditions must be restricted to those that are necessary for the sufficiency of the set. Thus the necessity requirement is subordinate to the sufficiency requirement.¹⁰⁰

96. See Barnett, *Foreword: Judicial Conservatism v. A Principled Judicial Activism*, 10 HARV. J.L. & PUB. POL'Y 273, 281-86 (1987). See generally R. DWORKIN, *LAW'S EMPIRE* (1986) (law as best principled theory for interpreting and reshaping practice). For the difficulties that Thomson runs into, see Moore, *supra* note 25, at 512-13; *supra* note 63; *infra* notes 108, 284.

97. See J. MACKIE, *supra* note 51, at 31-32, 38-39; Sosa, *Introduction*, in CAUSATION AND CONDITIONALS 1-3 (E. Sosa ed. 1975); Wright, *supra* note 2, at 1775-76.

98. As far as I am aware, H.L.A. Hart and Tony Honoré first developed this approach. See H.L.A. HART & A. HONORÉ, *supra* note 35, at 105-10, 116-19, 122, 216-29; see also T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 212-13; H.L.A. HART & T. HONORÉ, *supra* note 13, at 111-17, 122-25, 128-29, 235-53; J. MACKIE, *supra* note 51, at 60-63; D. PAPINEAU, *FOR SCIENCE IN THE SOCIAL SCIENCES* 54-55 (1978); Mackie, *Causes and Conditions*, 2 AM. PHIL. Q. 245, 245-47 (1965), reprinted in CAUSATION AND CONDITIONALS 15, 15-19 (E. Sosa ed. 1975); Marc-Wogeuau, *On Historical Explanation*, 28 THEORIA 213, 222-24 & n.7 (1962); Papineau, *Probabilities and Causes*, 82 J. PHIL. 57, 62-63 (1985); Scriven, *Logic*, *supra* note 58, at 52, 57; Scriven, *Structure*, *supra* note 58, at 407-11. As Mackie observed, "[s]uch a convergence of independent approaches suggests that we may be getting near to the truth." J. MACKIE, *supra* note 51, at 59 n.1.

99. Wright, *supra* note 2, at 1788-91; see also J. FLEMING, *THE LAW OF TORTS* 173, 176 (7th ed. 1987).

100. See D. HUME, *A TREATISE OF HUMAN NATURE* bk. I, pt. III, §§ 14-15 (A. Selby-Bigge ed., rev'd P. Nidditch 1978); see also T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 4-11, 23-24, 80-81, 84-88, 91-97, 114-17, 132, 136-37, 139-43; H.L.A. HART & T. HONORÉ, *supra* note 13, at

When the foregoing is combined with Mill's observation that there may be a plurality of distinct sets of conditions that are each sufficient to produce the consequence, so that there is no unique sufficient set, the NESS test is complete.¹⁰¹

Philosophers have described the NESS test as a test of weak necessity or strong sufficiency, to distinguish it from other possible senses of necessity and sufficiency.¹⁰² In descending order of stringency, a strict-necessity test requires that *Q* be necessary for the occurrence of *R* whenever *R* occurs; a less stringent, strong-necessity test requires only that *Q* have been necessary for the occurrence of *R* on the particular occasion, considering the circumstances that existed on the particular occasion; and the least stringent, weak-necessity test requires only that *Q* have been a necessary element of some set of actual conditions that was sufficient for the occurrence of *R*—the NESS test.¹⁰³ A strict-sufficiency test requires that *Q* be sufficient by itself for the occurrence of *R*; a less stringent, strong-sufficiency test requires only that *Q* be a necessary element of some set of existing conditions that was sufficient for the occurrence of *R*—the NESS test again; and the least stringent, weak-sufficiency test "requires" only that *Q* be a part of some set of existing conditions that was sufficient for the occurrence of *R*.¹⁰⁴

Contrary to the statements of some,¹⁰⁵ the choice among these senses of necessity and sufficiency is not governed by policy considerations, but rather by how well each test corresponds with our intuitive concept of causation. The strict-necessity and strict-sufficiency tests are too strict. Contrary to the strict-necessity test, a certain result—for example, death—can be caused in more than one way. Contrary to the strict-sufficiency test, few if any conditions are sufficient by themselves for the occurrence of any result.¹⁰⁶ The weak-sufficiency test, on the other hand, is too weak. It could be trivially satisfied by any condition, by simply adding the condition to an

10-11, 14-15, 44-49; J. MACKIE, *supra* note 51, at 3, 5-15, 25-27, 54-57, 59-75.

101. See J.S. MILL, A SYSTEM OF LOGIC bk. III, ch. v, § 3, ch. viii, §§ 1-4, ch. x, §§ 1-3, in 7 COLLECTED WORKS (J. ROBSON ed. 1973); see also T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 88-91; H.L.A. HART & T. HONORÉ, *supra* note 13, at xxxix-xlii, 19-22, 111-14; J. MACKIE, *supra* note 51, at 3, 5-15, 25-27, 54-57, 59-75.

102. See J. MACKIE, *supra* note 51, at 39-40, 60-66, 126-27; Scriven, *Logic*, *supra* note 58, at 52-53.

103. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 112-13; J. MACKIE, *supra* note 51, at 126-27; Scriven, *Logic*, *supra* note 58, at 49, 52-53.

104. See J. MACKIE, *supra* note 51, at 38-40; Scriven, *Logic*, *supra* note 58, at 51-52. As the text indicates, the gradations of sufficiency are not parallel to the gradations of necessity. For sufficiency, unlike necessity, there is no distinction between "on every occasion" and "on the particular occasion." A condition—or set—which is sufficient by itself on the particular occasion also will be sufficient by itself on every occasion, while a condition may be necessary on the particular occasion without being necessary on every occasion. Conversely, there is no sense of necessity weaker than the NESS test that would correspond with the weak—trivial—sense of sufficiency. On the other hand, the strong-necessity and strong-sufficiency tests can be stated in parallel counterfactual form. See *infra* note 108.

105. See Cole, *supra* note 58, (pt. 2) at 769-71 & nn.15 & 16.

106. See T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 23, 88-91; H.L.A. HART & T. HONORÉ, *supra* note 13, at xxxix-xlii, 19-20; J. MACKIE, *supra* note 51, at 31, 38, 126-27; D. PAPINEAU, *supra* note 98, at 54; Marc-Wogeuau, *supra* note 98, at 221-22; Scriven, *Logic*, *supra* note 58, at 49, 52-53.

already sufficient set.¹⁰⁷ This leaves only the NESS test, which corresponds to weak necessity and strong sufficiency, and the strong-necessity test.

The strong-necessity test expressed in counterfactual form is the familiar but-for test that is often cited as the primary test of causation in the law. According to the but-for test, a condition was a cause of some result if and only if, but for the occurrence of the condition, the result would not have occurred, considering the circumstances that existed on the particular occasion.¹⁰⁸ The NESS test collapses into the but-for test if there was only one set of conditions that was actually or hypothetically sufficient for the occurrence of the result on a particular occasion. Yet the NESS test is more inclusive than the but-for test. A condition was a cause under the NESS test if it was necessary in the circumstances for the sufficiency of any actually sufficient set, even if, due to other actually or hypothetically sufficient sets, it was not—as required by the but-for test—necessary in the circumstances for the result.¹⁰⁹

107. See J. MACKIE, *supra* note 51, at 39; D. PAPINEAU, *supra* note 98, at 55; Marc-Wogeu, *supra* note 98, at 223-24; Scriven, *Logic*, *supra* note 58, at 52; Sosa, *supra* note 97, at 1-3. In the remainder of this Article, the term “sufficient set” will not encompass any such trivial extensions of an already sufficient set.

108. See, e.g., W. PROSSER, *supra* note 33, § 41, at 237-39. When applying the but-for test, the condition being tested, *Q*, is hypothetically eliminated and the world is run forward from that point, leaving all the other actual conditions the same insofar as possible, to see if the result, *R*, still would have occurred. See J. MACKIE, *supra* note 51, at 51-53; *infra* text accompanying notes 222-25.

The strong-sufficiency test can be expressed in counterfactual form as a “reverse but-for” test, according to which *Q* was a cause of *R* if and only if, had *R* not occurred, *Q* could not have occurred, considering the circumstances that existed on the particular occasion. J. MACKIE, *supra* note 51, at 39-40, 60-66, 126-27. When applying this reverse but-for test, the result, *R*, is hypothetically eliminated and the world is run backward from that point, leaving all the other actual conditions the same insofar as possible, to see if the condition being tested, *Q*, still could have occurred. If *R* had not occurred, then there could not have been any set of actual conditions sufficient for the occurrence of *R*. If *Q* was a necessary element of some sufficient set of actual conditions, then, given the other circumstances that existed on the particular occasion—including the other elements of the sufficient set—*Q* could not have occurred. If, on the other hand, *Q* was not a necessary element of any actually sufficient set, its occurrence had no effect on *R*. So had *R* not occurred, *Q* still could have occurred. See *id.* at 65-66.

In sum, this reverse but-for test has no independent utility but rather, when properly applied, reduces to the NESS test. Cf. *id.* at 167-69 (sufficiency counterfactual much less natural than necessity counterfactual). Thomson seems not to recognize this. She expresses bewilderment that there allegedly is nothing in the legal literature that resembles the reverse but-for test. Thomson, *supra* note 58, at 482-83 & n.13. Yet the NESS test was first articulated in the legal literature and has been most fully developed and discussed in that literature. See H.L.A. HART & A. HONORÉ, *supra* note 35, at 105-10, 116-19, 122, 216-29; Wright, *supra* note 2, at 1788-1803 & n.227.

Thomson herself rejects the reverse but-for test—and all other counterfactual tests—because they allegedly depend on ontologically irrelevant pragmatic considerations. Thomson, *supra* note 58, at 483-84; see *id.* at 472-80. She uses these pragmatic considerations to treat the condition that supposedly is being tested for causation, rather than the other existing conditions, as a fixed part of the “backdrop” when “considering” the reverse but-for test. *Id.* at 483. This is not an application of the reverse but-for test, but rather a refusal to apply it, based on Thomson’s own unjustified introduction of pragmatic considerations. For further discussion of the counterfactual analysis of causation, see *infra* text accompanying notes 211-25.

109. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 112-13; Mackie, *supra* note 98, at

The NESS test, together with its philosophic derivation, supports, explains, and justifies all three of the causal judgments reported above with respect to fires X and Y.¹¹⁰ In contrast, the but-for test only supports the causal judgment in situation (1). Worse yet, the but-for test entails the obviously ridiculous conclusion that neither fire was a cause of the house's destruction in situations (2) and (3), leaving the cause of the destruction mysteriously unidentified.

In situation (1), in which fire X reached the house but fire Y did not, there was only one actually sufficient set, which contained fire X as a necessary element. There was no alternative actually or hypothetically sufficient set. Fire X therefore was a but-for cause as well as a NESS cause of the house's destruction, while fire Y was neither a but-for cause nor a NESS cause.

In situation (2), in which both fires reached the house simultaneously, there were two overlapping actually sufficient sets. One set contained fire X but not fire Y, making fire X necessary for the sufficiency of the set. The other set contained fire Y but not fire X, making fire Y necessary for the sufficiency of the set. Thus, while neither fire was a but-for cause of the house's destruction, each was a *duplicative* NESS cause.

In situation (3), in which both fires reached the house but fire X arrived first and fire Y arrived after the house had already been destroyed, there was only one actually sufficient set—the one containing fire X but not fire Y. The set containing fire Y but not fire X was hypothetically, but not actually, sufficient. It would have been sufficient if fire X had not existed, since then the house would still have been standing when fire Y arrived—but this was not an actual condition. The earlier arrival of fire X preempted its occurrence. Thus, fire Y was neither a but-for cause nor a NESS cause, but rather a preempted condition. It was not a necessary element of any actually sufficient set of antecedent conditions. Fire X also was not a but-for cause, because there was an alternative hypothetically sufficient set, containing fire Y, that would have been sufficient if fire X had not existed. Nevertheless, fire X was a *preemptive* NESS cause, since it was a necessary element of the actually sufficient set containing fire X but not fire Y.

As the above examples indicate, the but-for test works well as a test of inclusion, but not as a test of exclusion.¹¹¹ Courts and legislatures have long recognized the need to avoid or to supplement the but-for test to reach instances of causation that it does not identify. The courts in these situations have simply instructed the jury to determine whether the condition “contributed” to the result or was a “substantial factor” in the result's occurrence. In almost all instances, the fact finder's determination

246-47; Scriven, *Logic*, *supra* note 58, at 53-55.

110. See *supra* text following note 94.

111. See Carpenter, *Concurrent Causation*, 83 U. PA. L. REV. 941, 946-49 (1935). In an earlier article, Carpenter treated the but-for test as a test of exclusion, as well as inclusion, for omissions. See Carpenter, *supra* note 28, at 396-97; accord, A. BECHT & F. MILLER, *supra* note 31, at 22-23; F. HARPER, *supra* note 28, § 109, at 254. For omissions as well as positive acts, the but-for test is a rule of inclusion only. See Wright, *supra* note 2, at 1737, 1801. Yet it is often erroneously described as a rule of exclusion. See, e.g., W. PROSSER, *supra* note 33, § 41, at 238.

is consistent with the NESS test.¹¹²

In the succeeding sections of this part, I address doubts and criticisms that have been raised against the NESS test. Mackie's philosophic criticisms are considered first. Mackie claims that, although causes generally are sufficient in the strong sense embodied in the NESS test, they need not be. He argues that the concept of causation entails the but-for test's strong-necessity requirement, rather than the NESS test's strong-sufficiency requirement.¹¹³ The first part of his argument, in support of the strong-necessity requirement, provides a useful summary of the various efforts that have been made to salvage the but-for test. The second part, against the strong-sufficiency requirement, contains some of the better arguments that have been raised against the NESS test. After discussing Mackie's philosophic arguments, I turn to Kelman's pragmatic arguments against the NESS test. Finally, I respond to critics of the NESS test as well as the but-for test who assert that both tests, being conditional tests, inevitably fall prey to the indeterminacy of "counterfactual" conditional analysis.

B. Mackie's Philosophic Arguments for the But-For Test

Mackie initially relies on a hypothetical involving an indeterministic machine, *M*, that produces candy whenever a shilling is inserted, but that occasionally produces candy even though nothing has been inserted. He interprets this to mean that the insertion of a shilling is strongly sufficient, but not strongly necessary, for the production of candy. Mackie asserts that, because we cannot determine on any particular occasion whether the

112. See Wright, *supra* note 2, at 1774-77, 1781-88, 1791-1803, 1809-13. Similarly, legislatures, to avoid a possible narrow reading of causal language, often refer to conditions that "cause or contribute to" some result. See, e.g., Clean Air Act §§ 108(a)(1)(A), 111(b)(1)(A), 112(a)(1), 42 U.S.C. §§ 7408(a)(1)(A), 7411(b)(1)(A), 7412(a)(1) (1984).

113. J. MACKIE, *supra* note 51, at 38-48, 76-77, 126-27. Mackie, a preeminent modern philosopher of causation, is only one of several counterexamples to Thomson's claim that no philosopher has ever accepted the but-for test of causation. See Thomson, *supra* note 58, at 481. Mackie developed a version of the NESS test that treats a condition as a cause if it was an Insufficient but Necessary part of an Unnecessary but Sufficient set—an INUS condition. Yet Mackie, like almost every other philosopher, converted the INUS test into the but-for test by requiring that an INUS condition be necessary for the occurrence of the result on the particular occasion. Mackie, *supra* note 98, at 245-48 & n.9; accord T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 119, 212-13; D. PAPINEAU, *supra* note 98, at 55; Marc-Wogeuau, *supra* note 98, at 224-32; Sosa, *supra* note 97, at 3-4. For other philosophers' adoptions of the but-for test, see E. NAGEL, *THE STRUCTURE OF SCIENCE* 559-60 (1961); Lewis, *Causation*, 70 J. PHIL. 556, 557, 563 (1973); Lyon, *Causality*, 18 BRIT. J. PHIL. SCI. 1, 7-8, 15, 17-18 (1967); Martin, *The Sufficiency Thesis*, 23 PHIL. STUD. 205, 208-10 (1972).

In his later work, Mackie constructed detailed arguments in favor of the strong-necessity (but-for) test and against the strong-sufficiency (NESS or INUS) test. See J. MACKIE, *supra* note 51, at 38-48, 62, 76-77, 126-27; *infra* text accompanying notes 114-74. Hart and Honoré rather than Mackie were the original articulators and, until recently, the only advocates of the NESS test as opposed to the but-for test. See H.L.A. HART & A. HONORÉ, *supra* note 35, at 105-10, 116-19, 122, 216-29. Unfortunately, most lawyers and philosophers who refer to the NESS test cite Mackie rather than Hart and Honoré. See T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 212-13, 288; D. PAPINEAU, *supra* note 98, at 55 n.5; W. SALMON, *SCIENTIFIC EXPLANATION AND THE CAUSAL STRUCTURE OF THE WORLD* 185-86 (1984); Cooter, *supra* note 16, at 527; Kelman, *supra* note 10, at 602; Moore, *supra* note 25, at 506; Rizzo, *supra* note 17, at 1009-16; Sosa, *supra* note 97, at 3-4.

insertion of the shilling was strongly necessary for the subsequent production of the candy, we cannot determine whether the insertion of the shilling was a cause of the production of the candy, even though the insertion of a shilling is known to be strongly sufficient for the production of candy.¹¹⁴ But this argument obviously assumes the point to be proved: that strong necessity is required and that strong sufficiency is not enough.

Mackie acknowledges that his conclusion "prejudges a question about causal over-determination that has still to be considered."¹¹⁵ By causal over-determination, he means situations like our burnt-house situations (2) and (3), which are commonly judged to involve duplicative causation and preemptive causation, respectively.¹¹⁶ When he subsequently addresses these sorts of situations, Mackie agrees that causation exists even though the but-for test seems not to be satisfied.¹¹⁷ He attempts to salvage the but-for test with some familiar but clearly unsatisfactory embellishments on the test.

In the preemptive-causation situations, illustrated by burnt-house situation (3),¹¹⁸ there is only one actually sufficient set, and this set preempts the potential causal effect of an alternative hypothetically sufficient set. In one of Mackie's examples, an enemy poisons a desert traveller's can of water, but another enemy, unaware that the water has been poisoned, empties the can before the traveller drinks the poison, so that the traveller dies of thirst rather than from the poison.¹¹⁹ As Mackie states, it is clear that the emptying of the can caused the traveller's death and that the poisoning of the water did not.¹²⁰ Only those who are seduced by the but-for test would question this conclusion.¹²¹

The conclusion has a straightforward explanation under the NESS test. The emptying of the can was necessary for the sufficiency of a set of actual antecedent conditions that did not include the poisoning of the water, and the sufficiency of this set was not affected by the poisoning of the water. On the other hand, the poisoning of the water was not a necessary element of any sufficient set of *actual* antecedent conditions. Any sufficient set for which the poisoning of the water would be a necessary element would also have to include the traveller's drinking of the water, but that was not one of the actual antecedent conditions.¹²²

Mackie admits that neither the poisoning of the water nor the emptying of the can would be a cause of the traveller's death under a straightforward application of the but-for test.¹²³ He explains his contrary

114. J. MACKIE, *supra* note 51, at 41-43. Machine *M* is discussed further *infra* text accompanying notes 151-55.

115. J. MACKIE, *supra* note 51, at 43.

116. See *supra* text following note 94.

117. See J. MACKIE, *supra* note 51, at 44-47.

118. See *supra* text following note 94; cf. J. MACKIE, *supra* note 51, at 44 (examples (iii) through (v)).

119. J. MACKIE, *supra* note 51, at 44.

120. See *id.* at 45.

121. Yet even Hart and Honoré succumb on this hypothetical. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 239-41.

122. For further discussion of this hypothetical, see Wright, *supra* note 2, at 1802.

123. See J. MACKIE, *supra* note 51, at 45.

conclusion—that the emptying of the can was a cause, but the poisoning of the water was not—in terms of completed causal stories or causal chains. The causal story or chain that includes the emptying of the can can be completed or traced using the conditions that actually occurred, but the causal story or chain that includes the poisoning of the water cannot.¹²⁴ This causal story approach comes very close to being an implicit NESS test, since a completed causal story or causal chain is simply an actually sufficient set.¹²⁵ Indeed, Mackie's causal story argument derives its force from its implicit invocation of the requirement that to be a cause a condition must be a necessary member of an actually sufficient set.

Yet, Mackie misconceives the true nature of the causal story argument by interpreting it as a more precise but-for test. Under Mackie's modified but-for test, a condition is a cause of some result if it is necessary for the result "as it came about," rather than necessary for the result "described in some broad way."¹²⁶ Thus, the emptying of the can was a cause of the traveller's death because it was necessary for the traveller's death as it came about—by thirst rather than by poisoning.¹²⁷

As I have discussed elsewhere,¹²⁸ this as-it-came-about addition to the but-for test turns the test into a useless tautology. How the result came about is the very issue to be resolved. To include how the result came about in the description of the result is to assume an answer to the causal issue before it is posed. Thus, in the desert traveller example, the question of whether the traveller died by thirst, by poisoning, by both, or by neither, is precisely the issue that the causal inquiry is supposed to resolve. To describe the death as "death by thirst" is to assume an answer to that question before it is posed and to guarantee that, when the question is posed, the ultimate answer will match the initially assumed answer. The causal process believed to be at work—determined through some other means—is incorporated in the description of the injury. Then any condition which is a necessary part of that purported causal process is tautologically proven to be a cause of the injury, since it is necessary for the occurrence of the injury as so described. Under this method, it can be proven that *any* condition was a cause of the injury, by merely including the condition as a necessary part of some alleged causal process and then incorporating the alleged causal process into the description of the injury "as it came about."¹²⁹

124. *Id.* at 45-46, 224; accord Scriven, *Logic*, *supra* note 58, at 55-57. For a thorough elaboration of this sort of approach, see A. BECHT & F. MILLER, *supra* note 31, *passim*. For a summary and critique of Becht's and Miller's argument, see Wright, *supra* note 2, at 1784-88.

125. The causal story approach does not come close enough, however, because there may be overdetermination in the causal chain itself. See Wright, *supra* note 2, at 1786-88.

126. J. MACKIE, *supra* note 51, at 46 (emphasis removed); accord A. BECHT & F. MILLER, *supra* note 31, at 15-19, 28, 210; R. KEETON, *supra* note 41, at 7; R. PERKINS, *CRIMINAL LAW* 689 (2d ed. 1969); Honoré, *Causation and Remoteness of Damage*, 11 INT'L ENCYCLOPEDIA COMP. L., *Torts*, pt. 1, at 7-126, 7-132 (A. Tunc ed. 1983); Moore, *supra* note 25, at 510-11 & n.68; Rizzo, *supra* note 17, at 1020; Schwartz, *supra* note 16, at 647 n.20.

127. J. MACKIE, *supra* note 51, at 46.

128. Wright, *supra* note 2, at 1777-78; accord H.L.A. HART & T. HONORÉ, *supra* note 13, at xli-xlii, 124-25, 235 n.56.

129. Mackie claims that "[t]his matter can be thoroughly clarified if we introduce here a distinction . . . between *facts* and *events* both as causes and as results or effects." J. MACKIE, *supra*

In the duplicative-causation situations, illustrated by burnt-house situation (2),¹³⁰ there is more than one actually sufficient set, each of which duplicates—rather than preempts—the actual causal effect of the other actually sufficient sets. In one of Mackie's examples, a man dies when two bullets, each of which by itself would have been immediately fatal, enter his heart simultaneously.¹³¹ Mackie notes that, since "even a detailed causal story fails to discriminate between the rival candidates for the role of cause, we cannot say that one rather than the other was necessary in the circumstances even for the effect *as it came about* [death by shooting]."¹³²

Mackie therefore concludes that neither bullet by itself was a cause. Paradoxically, he goes on to assert that the volley composed of both bullets

note 51, at 46. An event is a particular occurrence as fully constituted by all its myriad features, some of which will be causally relevant and some of which will not. A fact is one of the concrete features of the event. Thus, an event can be thought of as the instantiation of many different fact-types, depending on the features described, but it is always the same unique event with all features, no matter how it is described. *See id.* at 248-49, 256-58, 260-67. Mackie notes that, in the desert traveller hypothetical, the result thought of as a fact can be described broadly as "A's death," for which the emptying of the can was not a but-for cause, or more narrowly as "A's death by thirst," for which the emptying of the can was a but-for cause. *Id.* at 46; *accord* Schwartz, *supra* note 16, at 646 n.20. Conversely, he states that, no matter how the result thought of as an event is described, it is still the same event with all features—including death by thirst—that, as a concrete event, must be linked to the purported cause by a causal chain. The causal chain involving the emptying of the can was completed but the causal chain involving the poisoning of the water allegedly was not. J. MACKIE, *supra* note 51, at 46. Yet, with respect to event causation, why isn't the poisoning of the water one of the features of the event with all features? Would not this make the poisoning of the water a necessary part of the causal chain? *See id.* at 256 ("[I]f we included [all] the circumstances in the event we should have to conclude . . . that anything may cause anything."); *id.* at 258 ("[I]t seems a disadvantage of [event] causes that they will nearly always include irrelevant components."). With respect to fact causation, why is "A's death by thirst"—which assumes the point at issue—the relevant fact rather than "A's death," "A's death due to lack of water in can that once contained poison"—which again would make the poisoning a but-for cause—or "A's death while gazing at moon"? For further discussion of the ontology of causation, see *infra* note 171 and accompanying text.

130. *See supra* text following note 94; *cf.* J. MACKIE, *supra* note 51, at 44 (examples (i) and (ii)).

131. J. MACKIE, *supra* note 51, at 44.

132. *Id.* at 47; *accord* H.L.A. HART & T. HONORÉ, *supra* note 13, at xli-xlii; Scriven, *Logic*, *supra* note 58, at 54-55. Other writers have been more persistent. For instance, Perkins asserts that the victim "would not have died when *and as* he did die (by two bullets) had only one been fired." R. PERKINS, *supra* note 126, at 689, *criticized in* Wright, *supra* note 2, at 1778.

Alan Schwartz's treatment of one of my hypotheticals is another example of this tautological approach. The hypothetical involves duplicative causation by several sources of pollution. *See* Wright, *supra* note 2, at 1792-93. Schwartz states: "Wright seemingly supposes that an antecedent action—the emitting of a small amount of pollution in his illustration—can be a cause of a harm although the harm would have occurred without the action because enough pollution was emitted by another actor." Schwartz, *supra* note 16, at 644 n.12. Schwartz implies that it is ridiculous to assert that causation exists when the but-for test is not satisfied. *See id.* at 643-44 & n.12. Yet Schwartz himself recognizes that the small amount of pollution contributed to the harm. He therefore asserts: "Wright individuates the harm inappropriately. The harm that actually occurred in his example—the cancer—resulted from *all* the pollution that was emitted; hence, the action of every emitter was necessary to this specific harm—i.e., a cause of it." *Id.* at 644 n.12. Schwartz thus begins by assuming the very point to be proven: that the harm "resulted from *all* the pollution that was emitted." Even with this assumption, the conclusion that *each bit* of pollution was necessary does not follow—unless the harm is tautologically described as "injury by all the pollution." Schwartz explicitly uses such a tautological description in the preemptive-causation situations. *See id.* at 647 n.20 ("individuated" harm is "P's particular form of death").

was a cause, since the death would not have occurred without the volley.¹³³ This aggregate but-for test is also invalid. It allows causally irrelevant factors to be included in the cluster and thus to be treated as part of the cause. For instance, expand Mackie's example by assuming that, when the two bullets simultaneously entered the victim's heart, *B* was 10,000 miles away climbing Mt. Everest. None of the three conditions by itself was a but-for cause of the victim's death, but the cluster composed of all three of them was a but-for cause. The aggregate but-for test does not distinguish the actual causes—the two bullets—from completely irrelevant conditions, such as *B*'s climbing Mt. Everest.

The aggregate but-for test also does not distinguish actual causes from preempted conditions. For example, assume one bullet arrived first and the victim died before the other bullet arrived. The aggregate but-for test still treats each bullet, as well as *B*'s climbing Mt. Everest, as a cause of the victim's death: none of the conditions by itself was a but-for cause of the death, while the cluster composed of all three conditions was a but-for cause.¹³⁴

Nevertheless, Mackie suggests that the aggregate but-for test is the best we can do, that we cannot know precisely which items in the cluster caused the result.¹³⁵ This is true with respect to the aggregate but-for test, but not with respect to the NESS test. If the two bullets arrived simultaneously, the NESS test correctly treats each as a duplicative cause of the death. Each bullet is necessary for the sufficiency of a set of actual antecedent conditions that does not include the other bullet, and the sufficiency of each set is not affected by the concurrent existence of the other actually sufficient set. If one bullet arrived first and the victim died before the second bullet arrived, the NESS test correctly treats the first as a cause of the death and the second as a preempted condition. The first bullet is necessary for the sufficiency of a set of actual antecedent conditions that does not include the second bullet, while the second bullet cannot be a necessary part of any actually sufficient set, since the victim was already dead when the second bullet arrived. Finally, whether the two bullets arrived simultaneously or sequentially, *B*'s climbing Mt. Everest clearly was not a cause, since it was not necessary for the sufficiency of any set of actual antecedent conditions.¹³⁶

133. J. MACKIE, *supra* note 51, at 47; see 2 F. HARPER & F. JAMES, *supra* note 33, § 20.2, at 1110; PROSSER & KEETON, *supra* note 39, § 41, at 268; Carpenter, *supra* note 28, at 406-07; Carpenter, *supra* note 111, at 944-45, 952; cf. A. BECHT & F. MILLER, *supra* note 31, at 211 (mentioning the aggregate but-for test); Cole, *supra* note 58, (pt. 2) at 810-11 (defendant liable in overdetermined causation situation if defendant's condition and duplicative or preemptive condition have same relation to plaintiff under compensation rule).

134. The aggregate but-for test can be modified so that it will eliminate totally irrelevant conditions. The modification is to require that the cluster include only those conditions that are necessary in order for the cluster to satisfy the but-for test—that is, that a condition be included in the cluster only if it is necessary for the necessity of the cluster. Yet this double but-for test, unlike the NESS test, still fails to distinguish actual causes from preempted conditions.

135. See J. MACKIE, *supra* note 51, at 47.

136. See Wright, *supra* note 2, at 1795-96.

Thus, Mackie, like many others,¹³⁷ fails in his efforts to rework the but-for test to account for our common causal judgments in the overdetermined causation cases. Contrary to Mackie's assertion, the concept of causation does not entail the strong-necessity requirement embodied in the but-for test. Indeed, the discussion so far confirms that the concept of causation instead entails the strong-sufficiency requirement embodied in the NESS test.

C. Mackie's Philosophic Arguments Against the NESS Test

Mackie himself recites a variety of powerful arguments in favor of the NESS test's strong-sufficiency requirement and only two arguments against it. On the affirmative side, he notes the following arguments: (1) causes usually "are and are taken to be sufficient in the circumstances in the strong sense;"¹³⁸ (2) rejection of the strong-sufficiency requirement for causation leads to the "strange" conclusion that "causal consequence is *not* formally analogous to logical consequence, legal consequence, and so on," all of which do entail the strong-sufficiency requirement;¹³⁹ (3) to say "*P* caused *Q*" is practically equivalent to "since *P* occurred, *Q* occurred," which in turn seems equivalent to "if *P* occurred, *Q* occurred," which entails the strong-sufficiency counterfactual "if *Q* had not been going to occur, *P* would not have occurred";¹⁴⁰ (4) future-tense causal statements, such as "*P* will cause *Q*," clearly imply the strong-sufficiency requirement;¹⁴¹ and (5) the strong-sufficiency requirement conforms with the traditional notion that a cause contingently necessitates its effect, and thus supports causal inferences with new events as well as causal prediction of future events, whereas the strong-necessity interpretation does neither.¹⁴²

Against these powerful arguments for the strong-sufficiency requirement, which are in addition to those developed in the previous section, Mackie presents only two counterarguments. The first counterargument relies on the possibility of indeterministic causal processes. He hypothesizes an indeterministic machine, *L*, that will not produce candy unless a shilling is inserted, but that sometimes, for purely indeterministic reasons, will not produce candy even when a shilling is inserted. That is, the insertion of a shilling is strongly necessary, but not strongly sufficient, for the production of candy. Mackie asserts that, if we inserted a shilling and candy were produced, we would treat the insertion of the shilling as a cause of the production of the candy, because the candy would not have been produced if the shilling had not been inserted.¹⁴³ This, Mackie argues, shows that causation does not entail the strong-sufficiency requirement.¹⁴⁴

There are two responses to this counterargument. First, the counter-

137. See *id.* at 1777-81.

138. J. MACKIE, *supra* note 51, at 65; see *id.* at 39-40, 43, 48-49, 57-58.

139. *Id.* at 48.

140. *Id.* at 48-49.

141. *Id.* at 49.

142. See *id.* at 141, 193-96.

143. *Id.* at 41-42.

144. *Id.* at 43; see Dretske & Snyder, *Causal Irregularity*, 39 PHIL. SCI. 69, 70 (1972); Martin, *supra* note 113, at 209.

argument depends on the possibility of indeterministic processes. Yet, as Mackie himself observes, the existence of such processes is questionable. Many apparently indeterministic processes turn out on closer examination to be deterministic, and as far as we know all apparently indeterministic processes may be deterministic.¹⁴⁵ The difficulty one encounters in trying to describe truly indeterministic statistical "laws of working" reinforces doubt about their existence. Such a law would seem to require an objective chance or propensity inherent in each individual occurrence of the antecedent conditions, but one can deny the existence of such objective entities with arguments similar to those used to deny the existence of objective causal qualities or powers in deterministic processes.¹⁴⁶ Mackie concludes that the only workable formulation would be a limiting frequency on actual outcomes of a series of instances of a certain set of antecedent conditions.¹⁴⁷ Yet, he notes, this formulation deprives such statistical laws of explanatory power. There is no apparent way to explain, without invoking deterministic laws, why an actual series does or should approach a limiting frequency. Truly indeterministic laws, therefore, are unintelligible and mysterious.¹⁴⁸

However, this first response evades Mackie's central point. Even if there are no indeterministic processes, so that machine *L* is entirely hypothetical, Mackie argues that our willingness to treat the insertion of a shilling in machine *L* as a cause of the subsequent production of candy shows that our concept of cause does not entail strong sufficiency.¹⁴⁹ This argument must be confronted head on, by taking the hypothetical seriously.

The second response is that, contrary to Mackie's assumption, strong sufficiency does exist in the circumstances described in the machine *L* hypothetical. It is true that the set of antecedent conditions up to and including the insertion of the shilling was not sufficient for the production of the candy. Yet, with the addition of one more actual antecedent condition, the set was sufficient. This condition was the occurrence of a

145. See J. MACKIE, *supra* note 51, at 49-50, 76, 237-38, 242-46; see also Williams, *The Mathematics of Proof* (pt. 1), 1979 CRIM. L. REV. 297, 298. Some writers believe that the notion of deterministic causation collapsed with the announcement in 1927 of Heisenberg's uncertainty principle. E.g., Horwitz, *supra* note 10, at 206, 213 n.10; see *id.* at 204, 210. Even if the uncertainty principle is an accurate description of nature, that principle merely states that it is impossible to simultaneously measure the position and velocity of an object so that the product of the uncertainties in measurement is less than an infinitesimally small constant—about 10 to the minus 34th power joule-seconds. See 10 ENCYCLOPAEDIA BRITANNICA, MICROPAEDIA 253 (15th ed. 1979). While this might cause problems in hypothetical lawsuits between subatomic particles, it creates no problems in actual tort litigation.

Other writers believe that the notion of causation collapsed with the introduction of functional equations in science. E.g., Cohen, *supra* note 58, at 251-52; Cooter, *supra* note 16, at 523, 541, 551. Yet functional relationships in science are merely mathematically quantified statements of causal laws or generalizations, which usually are expressed through time-based derivatives of the regularities of succession that constitute ordinary causal generalizations. J. MACKIE, *supra* note 51, at 143-48, 153-54, 216-18. The concept of causation is alive and well in the natural and social sciences. See *id.* at 153-54; D. PAPINEAU, *supra* note 98, at 5 & n.3.

146. See J. MACKIE, *supra* note 51, at 239.

147. *Id.* at 240-41.

148. *Id.* at 242-47; see Fetzer, *Statistical Probabilities: Single Case Propensities vs. Long-Run Frequencies*, in DEVELOPMENTS IN THE METHODOLOGY OF SOCIAL SCIENCE 387, 393-96 (1974).

149. See J. MACKIE, *supra* note 51, at 43.

particular "roll of the dice"—or its equivalent in the mysterious indeterministic workings of machine *L*. The roll of the dice, as well as the insertion of the shilling, was necessary for the production of the candy, and the set that contained both of these conditions was sufficient for the production of the candy. Thus both the insertion of the shilling and the roll of the dice were NESS causes of the production of the candy.¹⁵⁰

Machine *L* can usefully be contrasted with Mackie's other indeterministic machine, machine *M*, which was discussed earlier.¹⁵¹ Machine *M* produces candy whenever a shilling is inserted, but occasionally, as a result of a mysterious indeterministic process, produces candy even though nothing was inserted. That is, machine *M* is independently activated by each of two distinct processes, one deterministic and the other indeterministic. The deterministic process is initiated by the insertion of a shilling. The indeterministic process is initiated by, or consists of, a certain roll of the dice. Mackie assumes that insertion of a shilling is strongly sufficient but not strongly necessary for the production of candy.¹⁵² He asserts that, because candy might have been produced even if a shilling had not been inserted, we cannot determine on any particular occasion whether the insertion of the shilling was a cause of the production of candy.¹⁵³

Yet, if candy is produced when a shilling is inserted in machine *M*, we know by definition that the insertion of the shilling produced the candy through the deterministic process, since Mackie assumes that insertion of a shilling is strongly sufficient for the production of candy. We do not know whether the roll of the dice or its associated indeterministic process also occurred, since we cannot directly observe the roll of the dice or its associated indeterministic process.¹⁵⁴ If the roll of the dice did not occur, the candy was produced solely by the deterministic process. If the roll of the dice did occur, then either the candy was duplicatively produced by both the deterministic and the indeterministic processes (if the roll of the dice also is strongly sufficient) or else the candy was produced solely by the deterministic process, which preempted the indeterministic process. Thus, no matter what happened with the indeterministic process, the insertion of the shilling was a (possibly duplicative or preemptive) cause of the production of the candy.

This conclusion is logically compelled by the definition of strong sufficiency, given Mackie's assumption that insertion of a shilling is strongly sufficient for the production of candy in machine *M*. If that assumption is removed, so that we only have the empirical observation that machine *M* produces candy whenever a shilling is inserted, but sometimes produces candy although nothing was inserted, then Mackie is right when he insists that we cannot say on any particular occasion that the insertion of the

150. Cf. T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 97-101 (noting need for "roll of dice" as well as activation of machine, but treating activation of machine as not a cause since it was not sufficient by itself—the strict-sufficiency test rather than the strong-sufficiency test).

151. See *supra* text accompanying note 114.

152. See J. MACKIE, *supra* note 51, at 41.

153. *Id.* at 42-43.

154. We will know that the roll of the dice and its associated indeterministic process occurred only when candy is produced when no shilling was inserted.

shilling was a cause of the production of the candy. In the absence of the strong-sufficiency assumption, it is possible that the deterministic process initiated by the insertion of the shilling was preempted by an indeterministic process initiated—or constituted—by the roll of the dice. But this reinforces the argument that causation requires strong sufficiency. When we assumed that strong sufficiency existed, we were compelled to conclude that causation existed. When we dropped the strong-sufficiency assumption, we no longer could reach a causal conclusion.

Thus, Mackie's indeterministic machine hypotheticals demonstrate the reverse of what he claims. They demonstrate that causation entails the strong-sufficiency requirement embodied in the NESS test, but not the strong-necessity requirement embodied in the but-for test. This leaves Mackie with only his second counterargument against the strong-sufficiency requirement.

The second counterargument is more subtle and more fundamental. Mackie notes that, if the NESS test's strong-sufficiency requirement is even part of the meaning of causation, then every singular causal statement¹⁵⁵ entails the claim that the specific cause-result sequence about which the statement is made is an instantiation of a causal law—the regularity thesis.¹⁵⁶ Mackie argues that, while singular causal statements often imply such a claim, they sometimes do not.¹⁵⁷ If he is right, the strong-sufficiency requirement is not part of the meaning of causation.

Initially, Mackie observes that singular causal statements rarely if ever invoke a completely specified causal *law*, which would list all the antecedent conditions necessary for some set of conditions to be sufficient for the occurrence of the result—we simply do not have such knowledge.¹⁵⁸ Nevertheless, he acknowledges that singular causal statements might well invoke gappy or elliptical causal *generalizations*.¹⁵⁹ Causal generalizations are incompletely specified causal laws that list only some of the NESS conditions along with the result, but nevertheless assert that the listed NESS conditions combine with unlisted, unknown NESS conditions to form a set of conditions that is sufficient for the result.¹⁶⁰ Mackie states:

It is not so easy conclusively to refute this suggestion, but since it is only in recent years that a number of philosophers have approached a correct formulation of the generalizations in question [the gappy NESS approach], we must say at least that this would be an implication of which most users of singular causal statements can be only very vaguely aware. In fact, I would go further and say, referring to what I called . . . a primitive and unsophisticated way of arriving at counterfactuals and the associated causal judgements, that a singular causal statement need not imply even the vaguest generalization One can judge that this

155. A singular causal statement is a statement which asserts that a specific actual condition was a cause of a specific actual result.

156. See J. MACKIE, *supra* note 51, at 62, 64, 76-77.

157. See *id.* at 43, 49, 77.

158. See *id.* at 66, 77.

159. *Id.* at 77.

160. See *id.* at 66-76; *infra* text accompanying notes 243-48.

(very hot) stone was cracked by water being poured over it without being committed to any generalization, meaning only that the stone would not in the circumstances have cracked had the water not been poured on¹⁶¹

Mackie's first rebuttal—that it would be strange to assume that generalizations of the gappy NESS form are implied by singular causal statements because philosophers have only recently elaborated this approach to causal generalizations—erroneously assumes that the only form of knowledge is explicit, articulated knowledge. As we noted above, tacit intuitive knowledge of causation has been much more accurate than explicit legal or philosophic theory for a very long time.¹⁶² Mackie's argument obviously proves too much, for it denies that any singular causal statement has meaning unless there exists, and the speaker is aware of and relying on, an explicit accurate theory of causation.

Mackie's second rebuttal postulates a method of arriving at causal judgments that allegedly does not rely on causal generalizations. Along with almost all other modern philosophers, he rejects the pre-Hume notion that objects or events contain causal qualities or forces that can be directly observed.¹⁶³ He presents a third alternative: that causal judgments can be arrived at by a primitive method based on analogy and imagination. Under this method, the actual situation, *Y*, in which the candidate condition and the result actually occurred, is contrasted with an analogous actual situation, *X*, in which neither occurred—for example, the same situation prior to the occurrence of the candidate condition. Then the nonoccurrence of the result in *X* is transferred to fill out the "imaginative picture" in the counterfactual situation, *Y**, which is constructed by hypothesizing that the candidate condition did not occur in *Y*.¹⁶⁴

Mackie asserts that this imaginative transfer occurs without any reliance on causal generalizations.¹⁶⁵ But what justifies the imaginative transfer? What, other than an implicit causal generalization, would support the inference that the same (non)result would occur in the counterfactual situation, *Y**, as occurred in the actual situation, *X*? Mackie himself states elsewhere that we must base these inferences on an assumed "constancy of conjunction" (regularity) and that strong sufficiency, but not strong necessity, licenses causal inference.¹⁶⁶ Yet Mackie will only admit that the imaginative transfer "is somewhat like having an unconscious belief that there is some underlying regularity in the world," and he claims that it is "only in these very tenuous senses that singular causal statements . . . are implicitly general, that they necessarily assert or presuppose regularities of

161. J. MACKIE, *supra* note 51, at 77-78.

162. See *supra* text accompanying notes 93-94, 110-12.

163. J. MACKIE, *supra* note 51, at 6-7, 10-13, 21-23, 26-27, 54-55, 86, 133-34, 141-42; see T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 4-11, 80-81, 87-88, 91-92, 139-43; H.L.A. HART & T. HONORÉ, *supra* note 13, at 10-11, 14-15. But see J. MACKIE, *supra* note 51, at 215-30 (qualifying earlier discussion), criticized in T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 125-31.

164. See J. MACKIE, *supra* note 51, at 55-56.

165. *Id.* at 77-78; see *id.* at 121-24, 224, 257 n.14, 267-68.

166. See *id.* at 141, 193, 195-96; see also H.L.A. HART & T. HONORÉ, *supra* note 13, at 15-16; *supra* text accompanying note 142.

any sort."¹⁶⁷

Mackie acknowledges that abstract causal statements—for example, the statement that heating a gas, without reference to any specific occurrence, causes it to expand—seem to imply causal laws.¹⁶⁸ He states, however, that “the essential point is that singular causal statements are prior to general ones, whereas a regularity theory of the meaning of causal statements would reverse this priority.”¹⁶⁹ He provides no support for the alleged priority of singular causal statements. Even when the applicable causal generalization is based on observation of the single occurrence that it is meant to explain—which Mackie agrees is possible¹⁷⁰—only the observation of the occurrence is clearly prior to the causal generalization. The singular causal statement’s assertion of causation depends on, and hence implies the prior adoption of, some (perhaps very gappy) causal generalization. That is, in such instances the order is (1) observation of the occurrence, (2) adoption of the causal generalization based on the observation, and (3) assertion of causation through enunciation of the singular causal statement, which implicitly invokes the causal generalization.

That singular causal statements depend on causal generalizations becomes transparently obvious in Mackie’s discussion of the ontology of causation. He notes that, while we often think of causes as events with all their features, it is better and more accurate to treat only the causally relevant features of the event as part of the cause and to interpret any reference to the event as an elliptical reference to its causally relevant features.¹⁷¹ These causally relevant features are concrete instantiations of abstract conditions that are related to the abstract result by some

167. J. MACKIE, *supra* note 51, at 79-80; *see id.* at 121.

168. *See id.* at 80.

169. *Id.*

170. *Id.* at 25, 78-79, 121-22, 135-36; *accord* T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 107-08.

171. J. MACKIE, *supra* note 51, at 256-58, 260-65; *see* Marc-Wogeu, *supra* note 98, at 218. Moore, who views features as types (abstract universals) rather than as tokens (concrete instantiations of types), notes that, as types, features could only appear in causal generalizations; they would not have the concreteness needed to participate in singular instances of causation. Moore, *supra* note 25, at 505 n.47, 519, 521; *accord* T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 281. Mackie sometimes seems to suggest that features of an event-token are types rather than tokens. *See* J. MACKIE, *supra* note 51, at 59 n.1, 260-62. Yet elsewhere he clearly states that it is the concrete instantiation of the feature-type in the particular event-token—a feature-token or fact—that participates in singular instances of causation. *Id.* at 261, 266-67; *see* T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 251-52, 255-56, 281-82 (acknowledging concreteness of feature-tokens and their indispensability to a regularity theory).

We should interpret descriptions of a cause that refer to the event-token as a whole, or that include references to causally irrelevant features, as imprecise, elliptical references to the (perhaps unknown) causally relevant feature-tokens that constitute the “explanatory cause.” J. MACKIE, *supra* note 51, at 262-65. Unfortunately, Mackie confuses matters by treating the event-token as a whole as a “producing cause,” at least when considering what we say and know about causation, rather than what constitutes causation in the objects themselves. *See id.* at 46, 257, 265-67; *supra* note 129. Treating causation as a relation between event-tokens as a whole leads either to counterintuitive multiplication of events or to a very nondiscriminating notion of cause. *See* T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 269-75 (counterintuitive multiplication of events); J. MACKIE, *supra* note 51, at 256-58 (nondiscriminating notion of cause); Moore, *supra* note 25, at 512 n.69 (same).

regularity.¹⁷² Yet, despite the explicit reference to regularities, Mackie asserts that this interpretation of singular causal statements does not imply the existence of causal laws.¹⁷³

When discussing causation as it actually is in the objects, as opposed to how we learn about it or what we say about it, Mackie concedes, first, that it is undeniable that the regularity theory is assumed by scientists and others and, second, that the only plausible alternative would be indeterministic statistical laws that mysteriously generate approximations to the commonly observed regularities.¹⁷⁴

In sum, both of Mackie's counterarguments against the strong-sufficiency or NESS test, when carefully examined, support the NESS test rather than the but-for test. Detailed consideration of all of Mackie's arguments provides very strong philosophic support for the NESS test.

D. *Kelman's Pragmatic Arguments Against the NESS Test*

Although philosophically secure, the NESS test must be capable of being implemented in particular situations if it is to be useful in legal practice. In a recent article, Mark Kelman relies primarily on pragmatic arguments while mounting a comprehensive attack on the liberal notion of responsibility based on an objective, determinate concept of causation.¹⁷⁵ Most of his article, including much of the section entitled "Defining Cause,"¹⁷⁶ addresses the connection between causation and responsibility rather than the concept of causation itself. When Kelman focuses on the concept of causation, he acknowledges that the NESS test is the "most plausible *conceptual definition* of cause that purports to make the *ex post* [causal] inquiry resolvable."¹⁷⁷ Nevertheless, he asserts that the NESS test fails in actual practice for three distinct reasons.¹⁷⁸

I will begin with Kelman's second argument, which Kelman himself expects most readers will find "the most counterintuitive and unpersuasive of the three."¹⁷⁹ The argument is that something which seems to be a cause when described in terms of the conditions that actually occurred will appear not to have been a cause when described in terms of the intent behind it or its success or lack thereof, so that causal attribution arbitrarily depends on the description and hence is indeterminate.¹⁸⁰ For example, assume X pours gas on a fire, started by Y, that was about to go out, and the fire then destroys a house. Y's starting the fire was necessary for the sufficiency of the set of antecedent conditions that actually occurred and hence was a NESS

172. See J. MACKIE, *supra* note 51, at 260-62, 265, 266-67; *supra* note 171.

173. J. MACKIE, *supra* note 51, at 267-68.

174. *Id.* at 80-81, 194, 225, 229-30, 241-42, 246-47; see *supra* text accompanying notes 145-48.

175. See Kelman, *supra* note 10. Kelman's article is a major improvement over the Critics' prior analyses of causation in tort law. Cf., e.g., Horwitz, *supra* note 10, discussed *supra* note 145.

176. See Kelman, *supra* note 10, at 590-617.

177. *Id.* at 602; see *id.* at 603.

178. *Id.* at 603.

179. *Id.* Kelman's expectation has been borne out. In addition to this discussion, see Moore, *supra* note 25, at 503-05; Schwartz, *supra* note 16, at 642 n.8.

180. See Kelman, *supra* note 10, at 605-06.

cause of the destruction of the house. Yet, Kelman argues, if X's conduct is described as "doing whatever is needed to burn the house down," then Y's starting the fire would not appear to have been necessary—and thus allegedly would not be a cause—since X would have supplied the flame had Y not already done so.¹⁸¹

This argument does not expose any defect in the NESS test. Rather, Kelman has confused the NESS test with the but-for test. He is applying the but-for test's strong-necessity requirement rather than the NESS test's strong-sufficiency (weak necessity) requirement.¹⁸² Moreover, Kelman misunderstands the reference of the phrase "doing whatever is needed to burn the house down." The phrase by itself is completely uninformative. It invites the query, "Well, *what* was needed? *What* did X actually do?" X only poured the gas, since there already was a flame—Y's. Since X only poured the gas, Y's flame was necessary in the circumstances that actually occurred.¹⁸³ Contrary to Kelman's assertion,¹⁸⁴ we cannot "disjoin" X's activity from Y's, because X's activity by itself was not sufficient for the destruction of the house.

Kelman's strongest argument deals with the so-called subset problem, which allegedly is created by my attempt to extend Hart and Honoré's elaboration of the NESS test. Hart and Honoré apparently require that a duplicative cause be independently sufficient—in the NESS sense of sufficiency—for the result.¹⁸⁵ Yet a condition can be a cause under the NESS test—and usually is recognized by the courts as a cause—even if it was neither necessary nor independently sufficient. For example, if five units of pollution were necessary and sufficient for a particular injury and each of seven defendants discharged only one unit, no defendant's unit was either necessary or independently sufficient for the injury, but each was a NESS cause of the injury. Each unit was necessary for the sufficiency of an actual set that included only four of the other units, and the sufficiency of each such set was not affected by the existence of two additional duplicative units.

Since the source of the units is causally immaterial, it would not make any difference if there were only two defendants, one of whom discharged five units while the other discharged only two. Each unit would still be a duplicative cause of the injury. The first defendant's five units in the aggregate were independently sufficient for the injury. The second defendant's two units were neither necessary nor independently sufficient, but they were necessary elements of a sufficient set of actual antecedent conditions that included only three of the first defendant's five units, and

181. *Id.* at 605; *see id.* at 603.

182. *See supra* text accompanying note 109.

183. J. MACKIE, *supra* note 51, at 127-28.

184. *See* Kelman, *supra* note 10, at 605-06.

185. *See* H.L.A. HART & T. HONORÉ, *supra* note 13, at 123-24, 125, 206-07, 235-39, 245, 249; accord RESTATEMENT (SECOND) OF TORTS § 432(2) (1965). A condition is "independently sufficient" in the NESS sense if it is a necessary element of an actually sufficient set that does not also include all or "part" of some identical-type condition as a necessary element. That is, "independently sufficient" means that the condition is independently strongly sufficient. It does not mean that the condition is sufficient *in itself*—strict sufficiency. *See supra* text accompanying notes 104 & 106.

the sufficiency of this set was not affected by the second defendant's other two units. To put it another way, the second defendant's discharge of two units was necessary for the sufficiency of a set of actual antecedent conditions that also included another discharge of *at least* three units.¹⁸⁶

Kelman argues that the "at least" formulation is a purely formal technique that relies on hypothetical subsets of the conditions that actually occurred, that we can always imagine hypothetical subsets that will make the condition being tested necessary in conjunction with those hypothetical subsets, and that the technique therefore is hopelessly vague and manipulable and conceptually unacceptable.¹⁸⁷

Even if this argument were valid, it would not be, as Kelman assumes, fatal either to the NESS test or to a determinate concept of causation, but only to the NESS test's extension to cover conditions that were neither necessary nor independently sufficient. As noted above, the but-for test works as a determinate test for inclusion of conditions as causes; it fails only as a test of exclusion.¹⁸⁸ Similarly, Hart and Honoré's restricted interpretation of the NESS test works as a broader test of inclusion: it recognizes a condition as a cause if it was either necessary or independently sufficient.¹⁸⁹ Kelman's argument does not apply to either of these determinate tests for inclusion of conditions as causes.

Moreover, Kelman's argument is not valid. He misconstrues the "at least" technique, due in part to my attempt to introduce the technique by initially relying on the conceptually simpler situations, such as the pollution example, in which the conditions at issue break down easily into actual subsets. In such situations, the claim—contrary to Kelman's interpretation¹⁹⁰—is not that only the specified subset existed, but rather that the specified subset is one of the actual subsets that existed. The purpose—contrary to Kelman's repeated assertions¹⁹¹—is not to eliminate redundancy (duplication) but to identify and distinguish it from preemption.

Kelman correctly notes that the subset approach sometimes is not feasible unless hypothetical rather than actual subsets are used.¹⁹² Yet, the "at least" technique does not rely on the identification of hypothetical subsets, but rather on the identification of actual properties of the relevant events—for example, the actual property of a particular cable's having "a load capacity of at most one ton."¹⁹³ As discussed above, it is these actual properties that figure in singular instances of causation.¹⁹⁴

186. For further discussion, see Wright, *supra* note 2, at 1791-94.

187. Kelman, *supra* note 10, at 603-04.

188. See *supra* note 111 and accompanying text.

189. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 122-25, 206-07, 235-39, 245, 249; *supra* text accompanying note 185.

190. See Kelman, *supra* note 10, at 604.

191. See *id.* at 602-03, 604-05, 606. Although Kelman's substitution of "redundant" for "duplicative" is fairly harmless, his substitution of "successive" for "preemptive" or "preempted" is not. Compare *id.* at 602 with Wright, *supra* note 2, at 1794-1803.

192. See Kelman, *supra* note 10, at 603-04.

193. See Wright, *supra* note 2, at 1794; see also *id.* at 1800, 1809-10.

194. See *supra* note 171 and accompanying text. I was pleased to discover, upon reading Mackie's book while writing this Article, not only his focus on properties of events, which

For example, in Kelman's accomplice hypothetical,¹⁹⁵ the causal issue turns on whether the accomplice's encouragement counted positively, rather than not at all or negatively, with the principal, who was willing to kill the victim without the accomplice's encouragement.¹⁹⁶ If it did count positively, then the principal had the actual property of being a person who was *at least* willing enough to kill the victim that he would have done so if, but only if, he obtained the accomplice's encouragement, and thus, under the NESS test, the accomplice's encouragement was a duplicative cause of the victim's death. If, on the other hand, the accomplice's encouragement did not count or counted negatively with the principal, then, contrary to Kelman's assertion,¹⁹⁷ the principal did not have the property specified above, and the accomplice's encouragement was not a cause of the victim's death. The NESS test points to the critical causal issue in the accomplice cases, in which the courts—contrary to Kelman's claim¹⁹⁸—*do* require that it be proven that the accomplice's encouragement actually contributed to the crime.¹⁹⁹

Kelman's third argument, unlike the first two, is based on a valid point, but it is overdrawn. Moreover, it supports rather than undermines the NESS test. The point is that, due to evidentiary problems—lack of perfect knowledge—we sometimes may be unable to decide whether a condition contributed to the result.²⁰⁰ This admittedly valid point is irrelevant to the appropriate theory of actual causation. As lawyers, judges, jurors, or lay persons, we do the best that we can.²⁰¹ The NESS test enables us to resolve the causal issue correctly in as many cases as the evidence and our scientific knowledge will allow. It explains and aids the courts' perception that a condition was a cause if it contributed to the injury, even if it was not necessary for the injury.²⁰²

provides philosophic support for my elaboration of the tortious-aspect causation requirement, but also his use of the "at least" technique in his discussion of a hammer blow with more than sufficient force to flatten a chestnut. See J. MACKIE, *supra* note 51, at 153, 265; *id.* at 65 ("consuming at least such-and-such an amount of a certain poison (which was in the dish in question, but nowhere else)"). Mackie, however, seems unaware of the technique's general significance. He uses it only when the overdetermination is internal to the condition being tested.

195. See Kelman, *supra* note 10, at 604.

196. See *id.*

197. See *id.*

198. See *id.*

199. Kelman himself notes that the cases typically require proof that the accomplice "did something facilitative." See *id.* at 604 n.46. This is simply another way of stating that the accomplice must have contributed—been a NESS cause—although he need not have been a but-for cause. This interpretation is explicitly confirmed in the Alabama case that Kelman cites and is implicit in the English case. See *State v. Tally*, 102 Ala. 25, 69-70, 15 So. 722, 738-39 (1894); *Wilcox v. Jeffrey*, [1951] 1 All E.R. 464, 466. Moreover, even if proof of causation were not required in these cases, this would tell us little about causation in tort law. These cases are criminal cases, and criminal law, unlike tort law, often provides for punishment of wrongdoers whether or not harm results.

200. See Kelman, *supra* note 10, at 606-08.

201. Although Kelman argues that the knowledge problem would be less serious for his regulatory elite than it is for our decentralized tort adjudication system, *id.* at 633-37, the reverse might well be true. See Epstein, *Afterword*, *supra* note 12, at 678-79; Schwartz, *supra* note 16, at 649-50.

202. See Wright, *supra* note 2, at 1791-1803, 1809-13; *supra* text accompanying notes

Thus, as we have already seen, the NESS test easily resolves the simpler overdetermined causation cases, exemplified by the merged-fires and multiple-bullet hypotheticals.²⁰³ It points to the critical causal issue in Kelman's accomplice hypothetical: Did the accomplice's encouragement count positively with the principal?²⁰⁴ Similarly, it points to the critical causal issue in Kelman's falling-down-the stairs hypothetical, in which a drunken *V*, "so drunk that he would have fallen regardless of the amount of light," fell down stairs negligently left unlit by *D*.²⁰⁵

In technical NESS language, the lack of light was a cause of the fall only if there was an actually sufficient set that included the actual property of *V*'s having at least an *X* level of drunkenness, with *X* being such that the lack of light as well as the at-least-*X* level of drunkenness was necessary for the sufficiency of the set. There was such an actually sufficient set only if *V*'s drunkenness in excess of *X* did not preempt—prevent the existence of—those conditions in which the lack of light could have a causal effect. Thus, the critical causal issue is whether *V*'s vision, physical control of his movements, or sense of caution was so impaired by drunkenness that he was totally unable to see or to control his movements in accordance with what he saw or made no attempt to do so. If so, the causal effect of the lack of light was preempted by the drunkenness, and hence the lack of light was not a cause of—did not contribute to—his fall. If not, the lack of light combined with the effects of the drunkenness to make it even more difficult for *V* accurately to perceive and respond to his environment, and hence the lack of light was a duplicative cause of his fall.

It is not necessary, as Kelman assumes,²⁰⁶ that the judge or jury be able to identify or even to imagine level *X*, or that the judge instruct the jury in NESS language, or even that the judge analyze the problem in technical NESS terms. It is only necessary that the judge perceive, and the jury be instructed, that the issue is whether the causal effect of the lack of light was preempted completely by *V*'s drunkenness, or instead combined with *V*'s drunkenness as a duplicative cause of the fall. More specific instructions would phrase the issue as whether *V* was so drunk that he could not have seen even if there had been light, or could not control his movements, or made no attempt to see or control his movements. If not, then there was a level *X*, and the lack of light was a NESS cause of the fall. Yet, as stated above, it is not necessary to identify or to imagine level *X* or even to analyze the case in such technical NESS terms.

As the above discussion indicates, the unlit stairs cases and similar so-called doubtful causation cases are simply additional examples of the overdetermined causation problem, although they sometimes are not seen

111-12.

203. See Wright, *supra* note 2, at 1791-1803; *supra* text accompanying notes 110-11, 136.

204. See *supra* text accompanying notes 195-99.

205. See Kelman, *supra* note 10, at 607.

206. See *id.* at 607. In this third argument, Kelman continues to assume, erroneously, that the jury is being asked to find that the defendant's conduct was necessary for the fall. That is, he continues to assume that the NESS analysis is meant to eliminate the causal duplication or redundancy rather than to identify and distinguish it from causal preemption. See *id.*; *supra* text accompanying note 191.

as such. Usually the courts recognize that these cases involve overdetermined causation, and therefore, as in the simpler overdetermined causation cases—for example, the merged-fires cases—they use “contribution” or “substantial factor” language, rather than the but-for test, to instruct the jury.²⁰⁷ Some writers, assuming that the but-for test is the exclusive test of causation, conclude that the courts for policy reasons are lowering the burden of proof in these cases,²⁰⁸ but this is not true. The courts are merely using the best rubric they can find to indicate that the condition need only be a NESS condition, not a but-for condition, in order to qualify as a cause. The “contribution” rubric is more accurate and less misleading than the “substantial factor” rubric.²⁰⁹ Hopefully, better rubrics, or more specific instructions to back up the “contribution” rubric, will be devised based on the NESS test.

In sum, with the insights provided by the NESS test, the causal issue is resolvable in many more cases than Kelman supposes. In those cases in which the causal issue is still not resolvable, the problem lies with insufficient evidence or our imperfect scientific knowledge, not with the NESS test. None of Kelman’s arguments against the NESS test is sound. Instead, as with other arguments that we have canvassed, discussion of each argument further demonstrates the plausibility and power of the NESS test.²¹⁰

E. The Factual, Determinate Nature of “Counterfactual” Causal Analysis

One other argument, which is posed at a higher level of abstraction than the preceding arguments, remains to be discussed. Both the NESS test and the but-for test are commonly associated with counterfactual analysis. The but-for test has an explicit counterfactual form, and the NESS test leads naturally to counterfactual statements or arguments about weak necessity and strong sufficiency.²¹¹ This association raises a potential problem for those who believe that the causal inquiry is factual and determinate, because many writers believe that, given the supposedly open-ended nature of the hypothesized counterfactual world, counterfactual causal analysis is almost by definition indeterminate.²¹²

207. See, e.g., *Reynolds v. Texas & Pac. Ry.*, 37 La. Ann. 694, 698 (1885) (unlit stairs); see also Wright, *supra* note 2, at 1809-14.

208. See, e.g., Fraser & Howarth, *supra* note 58, at 141-42; Malone, *Ruminations*, *supra* note 32, at 68-79, 85-89, 94-96; Robinson, *supra* note 58, at 714, 716-17, 751-52 & n.135; Rosenberg, *The Causal Connection in Mass Exposure Cases: A “Public Law” Vision of the Tort System*, 97 HARV. L. REV. 849, 855 n.27, 863-64 (1984).

209. See Wright, *supra* note 2, at 1781-88, 1792, 1809-13.

210. I will discuss another of Kelman’s arguments, which deals with the process of proof rather than the NESS test, *infra* text accompanying notes 300-19. The rest of Kelman’s article raises issues that, although often quite interesting, must be left for another time, for they are not relevant to causation itself.

211. See, e.g., T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 119-20, 156-57; J. MACKIE, *supra* note 51, at 29-34, 37-40, 49, 53-60, 133-34, 140-42, 196-203, 224; Lewis, *supra* note 113, at 557; *supra* note 108 and accompanying text.

212. See, e.g., Chisholm, *Law Statements and Counterfactual Inference*, 15 ANALYSIS 97 (1955); Lewis, *supra* note 113; Rescher, *Belief-Contraventing Suppositions and the Problem of Contrary-to-*

For some legal writers, including the Critics,²¹³ the legal economists,²¹⁴ and some of the legal realists,²¹⁵ this indeterminacy is desirable, either per se—because it confirms the indeterminacy of the law—or instrumentally—because it permits policy considerations to be introduced into the causal inquiry. For others, including the true realists on causation²¹⁶ and the libertarians,²¹⁷ the indeterminacy is a source of concern, because it undermines the supposedly objective, factual nature of the causal inquiry.

This is not the place for an extended discussion of counterfactual causal analysis. Yet it bears repeating that the counterfactual analysis employed in the causal inquiry is not nearly as open-ended as many believe.²¹⁸ Some believe it is permissible, when engaged in counterfactual causal analysis, to create a counterfactual world containing any imaginable actor, event, or state—for example, to conjure up a “counterfactual second agent” who would have smashed the glass anyway or cut the wire to the doorbell before the doorbell button was pushed, thus purportedly eliminating the strong necessity or strong sufficiency, respectively, of the condition being tested for causation.²¹⁹ Others, although avoiding such irrelevant fantasies, nevertheless speculate on what the actor’s most likely alternative course of action would have been. For example, when considering the causal effect of a person’s driving ten miles per hour (mph) over the speed limit, they speculate on what her next most likely speed would have been—nine mph over the speed limit, two mph under, or some other speed—and what changes in behavior likely would have accompanied the

Fact Conditionals, 60 PHIL. REV. 176 (1961); Stalnaker, *A Theory of Conditionals*, in *STUDIES IN LOGICAL THEORY* 165 (N. Rescher ed. 1968); Strachan, *The Scope and Application of the “But For” Causal Test*, 33 MOD. L. REV. 386, 389-95 (1970); Thomson, *supra* note 58, at 481-84; Weinrib, *A Step Forward in Factual Causation*, 38 MOD. L. REV. 518, 529-33 (1975). The Chisholm, Lewis, Rescher, and Stalnaker articles are reprinted in *CAUSATION AND CONDITIONALS* 147, 180, 156, 165 (E. Sosa ed. 1975) and are discussed in the Introduction, *id.* at 12-14.

213. See Kelman, *supra* note 10, at 603-05; cf. Horwitz, *supra* note 10, *passim* (no determinate, objective concept of causation).

214. Cf. Calabresi, *supra* note 10, at 70-71 & n.4, 106-08 (concept of causation has no inherent meaning); Landes & Posner, *supra* note 10, at 109-10, 134 (same).

215. See Malone, *Ruminations*, *supra* note 32, at 67-68 & n.9.

216. See Cole, *supra* note 58, at 482-87, 505-06 & n.133, 768-97 & n.16; Green, *Are There Dependable Rules of Causation?*, 77 U. PA. L. REV. 601, 605 (1929); Green, *supra* note 33, at 556-57, 559; Moore, *supra* note 25, at 506-10; Thode, *supra* note 33, at 424-27 & nn.15 & 17, 431; Thomson, *supra* note 58, at 481-84.

217. See Epstein, *Strict Liability*, *supra* note 12, at 160-61.

218. For prior discussion of this issue, see Wright, *supra* note 2, at 1803-07.

219. Thomson, *supra* note 58, at 481-84. Moore follows Thomson by introducing imaginary agents or events into the counterfactual causal analysis. Moore, *supra* note 25, at 506, 508-10. However, he argues that indeterminacy can be avoided by employing finely detailed descriptions to “individuate” event-tokens in the different possible worlds. *Id.* at 510-11 & n.68. This approach is inadequate for several reasons. First, at best, the individuation allows us to conclude only that the condition being tested was necessary for—and hence a cause of—some usually irrelevant, minute detail of the result, rather than the relevant features of the result. Wright, *supra* note 2, at 1778-79. Second, the approach supports findings of causation in almost every instance, thereby reducing the counterfactual analysis to a “trivial truth.” See Moore, *supra* note 25, at 512 n.69. Third, as noted in our discussion of overdetermined causation, this approach often becomes a tautological exercise, in which those conditions deemed causally relevant are included in the description of the result “as it came about.” See *supra* text accompanying notes 126-32.

change in speed.²²⁰ Both groups assert that the construction of the counterfactual world is hopelessly indeterminate and hence inevitably influenced by policy-based conventions, expectations, or goals.²²¹

These writers erroneously assume that the causal inquiry is concerned with all the hypothetical scenarios that might have happened, rather than with determining the causal processes at work in the one scenario that *did* happen. The only question in the causal inquiry is whether the condition being tested was necessary on the particular occasion for the sufficiency of a set of actual antecedent conditions that was sufficient for the occurrence of the result—as required by the NESS test. There is an obvious, straightforward way to resolve this question. We hypothetically eliminate only the condition being tested—for example, the ten mph of excess speed, which is the tortious aspect of the actor's conduct—from the sufficient set of actual antecedent conditions.²²² Then, without adding or subtracting any other conditions, we determine—by matching the remaining conditions in the set against the applicable causal generalization—whether the set still would be sufficient for the occurrence of the result.²²³ The resolution of this causal inquiry depends on our empirical knowledge of the conditions that existed and the possibly applicable causal generalizations, not on policy considerations. Any indeterminacy results solely from defects in our empirical knowledge, rather than from the nonexistent open-ended nature of the counterfactual context.

David Lewis objects that, when constructing a counterfactual possible world, we cannot eliminate only the condition being tested. We must also change either the prior conditions that produced the condition being tested or the causal laws that linked those prior conditions to the condition being tested. Thus, at best, we can only construct the most appropriate “similar world.”²²⁴ This is a valid point, yet I believe it only reinforces the argument made above. In the causal inquiry, we are not—or should not be—

220. Cole, *supra* note 58, at 769-71, 773-77, 783-85, 792-97; see Malone, *Ruminations*, *supra* note 32, at 67; Thode, *supra* note 33, at 426-27 & n.17.

221. E.g., Cole, *supra* note 58, at 769-85, 792-97; Thode, *supra* note 33, at 426-27 & nn.15 & 17; Thomson, *supra* note 58, at 481-84. For a discussion of Cole's and Thode's argument, see Wright, *supra* note 2, at 1805-07. For a discussion of Thomson's argument, see *supra* note 108.

222. See J. MACKIE, *supra* note 51, at 51-53, 64-67; Wright, *supra* note 2, at 1806-07. If the condition being tested was the omission of something, then its elimination consists of the addition of that something. A. BECHT & F. MILLER, *supra* note 31, at 21-24, 34-35, 38-41, 88-89; H.L.A. HART & T. HONORÉ, *supra* note 13, at 453-55.

223. This analytic method avoids the collateral effect or epiphenomenon problem, which is a stock counterexample to the regularity theory. See, e.g., J. MACKIE, *supra* note 51, at 33-34, 51-52, 83-85; D. PAPINEAU, *supra* note 98, at 55-57; Lewis, *supra* note 113, at 556-57, 566. A collateral effect or epiphenomenon is an effect that shares a common cause with the result in issue but that itself has no causal effect on the result in issue—a second, independent branch from the same node in the causal network. The set of actual antecedent conditions containing the collateral effect is not sufficient for the occurrence of the result in issue unless the common cause is also included, but if the common cause is included the collateral effect is not necessary for the set's sufficiency. Thus the collateral effect is not a cause of the result in issue. See Lyon, *supra* note 113, at 9-11.

224. D. LEWIS, COUNTERFACTUALS 9 (1973); see *id.* at 72-77. For criticism of Lewis' “similar world” approach, see Kim, *Causes and Counterfactuals*, 70 J. PHIL. 570 (1973), reprinted in CAUSATION AND CONDITIONALS 192 (E. Sosa ed. 1975); Moore, *supra* note 25, at 509-10.

attempting to construct a counterfactual possible world. Instead, we are trying to determine which causal generalizations have been instantiated in the actual world by the conditions that occurred on the particular occasion. Thus, we do not change any causal generalizations. Nor do we need to worry about changing the prior conditions that produced the condition being tested. The effects of these prior conditions are incorporated in the particular sufficient set of existing conditions, which is a time-slice view of the ongoing causal network. When we hypothetically eliminate the condition being tested we automatically hypothetically eliminate the effects of prior conditions insofar as they operate through the condition being tested.

Even the condition being tested is not really eliminated in this "counterfactual" causal analysis. Rather, we attempt to fit it in as part of the complete instantiation of some possibly applicable causal generalization. Although counterfactual language is employed, we are dealing solely with actual conditions in the actual world. The counterfactual supposition is merely a technique for conceptually separating the actual condition being tested from the other actual conditions when matching the conditions with the possibly applicable causal generalizations, to make sure that the condition being tested is not inappropriately included in an already sufficient set or treated as part of a supposedly sufficient set that actually is insufficient due to a preemptive cause.

In sum, when we use counterfactual suppositions in the causal inquiry, we are simply making telescoped arguments or statements about the actual effects of various actual antecedent conditions.²²⁵ The causal inquiry is counterfactual only in this very limited sense. Indeed, it may be inappropriate—and certainly has proven misleading—to describe causal analysis as counterfactual. In any event, it should be clear that proper causal analysis neither relies upon nor justifies the use of policy considerations. Instead, causal analysis relies solely upon—and is limited by—our empirical knowledge of the conditions that actually existed on the particular occasion and the possibly applicable causal generalizations. Those who rejoice or fear that causal analysis is an open-ended, policy-dependent form of counterfactual analysis misperceive the counterfactual element in causal analysis.

V. CAUSATION, PROBABILITY, AND PROOF

A. *The Noncausal Concept of "Probabilistic Causation"*

Unfortunately, the confusion over causation cannot be dispelled simply by making a positive case, no matter how strong, for the NESS interpretation of causation. A competing interpretation, "probabilistic causation," has arisen from the confusion, which, despite its obvious implausibility, continues to attract a growing number of adherents, at least among legal academics. According to the proponents of "probabilistic causation," a condition was a cause of some result if it increased the

225. See T. BEAUCHAMP & A. ROSENBERG, *supra* note 58, at 145-48, 160-64; J. MACKIE, *supra* note 51, at 64-67, 199, 201-03.

probability—risk—that the result would occur.²²⁶ Under this approach, a condition would be a cause of some result even if the result did not actually occur: all that is required is that the condition have increased the probability that the result would occur.²²⁷

This is a very strange concept of causation. How can a condition be a cause of a result that does not occur? Even when the result occurs, we all recognize that a condition may increase the probability that the result will occur through causal process *A* and yet not contribute to its actual occurrence, which instead is due to causal process *B*. The other conditions required to complete causal process *A* may be missing, or causal process *B* may preempt causal process *A*.²²⁸ Conversely, it is also clear that a condition may be a cause of a result even though it has no effect on, or even decreases, the probability that the result will occur.²²⁹

The noncausal concept of “probabilistic causation” originated with the legal economists and has their almost unanimous support.²³⁰ As I have discussed elsewhere, the *ex ante* version of the concept is indispensable to the efficiency theory of tort law, which is concerned solely with *ex ante* incentives for efficient behavior.²³¹ Recently, the concept, in either an *ex ante* or an *ex post* version, has attracted other supporters, including the Critics,²³² some of the libertarians,²³³ and traditionalists who are concerned about our inability to make determinate causal judgments with respect to manifested injuries in certain types of cases.²³⁴

Each of the groups that support the increased-risk probabilistic concept of causation has been encouraged by the observation that, in making causal judgments, we use causal generalizations that are implicitly probabilistic, since they describe what usually or often happens rather than

226. See sources cited *supra* note 17 and *infra* notes 232-34.

227. See, e.g., Calabresi, *supra* note 10, at 71-72, 78-81, 98; Robinson, *supra* note 58, at 739 & n.101.

228. See H.L.A. HART & T. HONORE, *supra* note 13, at 48-49, 469-71, 485-88; Kelman, *supra* note 10, at 591; Wright, *supra* note 2, at 1794-98, 1801-02, 1804, 1823-24; Wright, *Bane*, *supra* note 5, at 445-49, 453-54; *supra* text accompanying notes 118-22.

229. See Rizzo, *supra* note 10, at 403-04 & n.11 (citing Hesslow, *Two Notes on the Probabilistic Approach to Causality*, 43 PHIL. SCI. 290 (1976)); Wright, *supra* note 2, at 1792-93, 1795-97, 1801-02.

230. See sources cited *supra* note 17. But see Grady, *A New Positive Economic Theory of Negligence*, 92 YALE L.J. 799, 804-05 & n.21, 827-29 & n.67 (1983) (relying on traditional but-for test).

231. See Wright, *Bane*, *supra* note 5; Wright, *Efficiency Theory*, *supra* note 5, at 567-73; see also Robinson, *Probabilistic Causation and Compensation for Tortious Risk*, 14 J. LEGAL STUD. 779, 793-94 (1985) (*ex ante* assessment of risk required).

232. See Abel, *Torts*, *supra* note 21, at 191; Horwitz, *supra* note 10, at 204, 210-11, 212 n.10; Kelman, *supra* note 10, at 591-601.

233. See Rizzo, *supra* note 17, at 1009-16, 1037-38; Rizzo & Arnold, *supra* note 12. But cf. *infra* text accompanying notes 257-60.

234. See G. CHRISTIE, *CASES AND MATERIALS ON THE LAW OF TORTS* 246 (1983) (second paragraph); 4 F. HARPER, F. JAMES & O. GRAY, *THE LAW OF TORTS* § 20.2, at 242 (2d ed. Supp. May 1988); Fraser & Howarth, *supra* note 58, at 137-41 (actuarial cause); Robinson, *supra* note 58, at 738-39 & n.101, 758-60, 764-65 & nn.166 & 168; Robinson, *supra* note 231; Rosenberg, *supra* note 208, at 855-59, 869-74. See generally J. HENDERSON & R. PEARSON, *THE TORTS PROCESS* 119-27 (2d ed. 1981).

what always happens.²³⁵ This observation is also a basic starting point for another group of legal academics, who focus on the law of evidence rather than on the law of torts. These evidence scholars claim that, since all proof is ultimately probabilistic—in the sense described above—there is no justification for the courts' refusal to accept abstract statistical evidence as proof of causation or identification.²³⁶ The tort theorists have borrowed this argument to support their increased-risk interpretation of causation.²³⁷

To finish pruning the bramble bush, the probabilists' arguments must be addressed. In subpart V(B), I explain the distinctions and relationships among causal laws, causal generalizations, and singular causal statements and use those distinctions to emphasize that mere proof of increased risk or high probability is not sufficient to establish causation. In subpart V(C), I elaborate the causal basis of proof in order to explain and defend the courts' refusal to accept abstract statistical evidence. Finally, in Part VI, I use the distinctions and relationships elaborated in this part to discuss the causal issues in the risk-exposure cases.²³⁸

B. *The Role of Probabilities in Causal Laws, Causal Generalizations, and Singular Causal Statements*

The proponents of *ex post* concepts of causal attribution do not deny that probabilities enter into the *ex post* determination of actual causation.²³⁹ To the contrary, they insist that, given our limited knowledge, singular

235. See *DePass v. United States*, 721 F.2d 203, 207 (7th Cir. 1983) (Posner, J., dissenting); Kelman, *supra* note 10, at 591-93; Rizzo, *supra* note 17, at 1009, 1012-13; Rizzo & Arnold, *supra* note 12, at 1408-09 n.54; Robinson, *supra* note 58, at 764-65; Robinson, *supra* note 231, at 780-81 & n.3, 792 n.30; Rosenberg, *supra* note 208, at 870; see also W. SALMON, *supra* note 113, at 184-90; P. SUPPES, *A PROBABILISTIC THEORY OF CAUSALITY* 7-8 (1970).

236. E.g., Allen, *A Reconceptualization of Civil Trials*, 66 B.U.L. REV. 401, 402 & nn.10 & 11, 412-15, 420-21, 428-30 & nn.66 & 67 (1986); Ball, *The Moment of Truth: Probability Theory and Standards of Proof*, 14 VAND. L. REV. 807, 807-08, 810-12, 818-22 (1961); Brook, *The Use of Statistical Evidence of Identification in Civil Litigation: Well-Worn Hypotheticals, Real Cases, and Controversy*, 29 ST. LOUIS U.L.J. 293, 323-40 & n.151, 348-49 (1985); Kaye, *The Laws of Probability and the Law of the Land*, 47 U. CHI. L. REV. 34, 38-40 & n.21, 45 (1979) [hereinafter Kaye, *Laws*]; Kaye, *The Limits of the Preponderance of the Evidence Standard: Justifiably Naked Statistical Evidence and Multiple Causation*, 1982 AM. B. FOUND. RES. J. 487, 488-89, 492 n.22, 514 [hereinafter Kaye, *Limits*]; Kaye, *The Paradox of the Gatecrasher and Other Stories*, 1979 ARIZ. ST. L.J. 101 [hereinafter Kaye, *Gatecrasher*]; Saks & Kidd, *Human Information Processing and Adjudication: Trial by Heuristics*, 15 LAW & SOC'Y REV. 123, 149-54 (1981); Schmalbeck, *The Trouble with Statistical Evidence*, 43 LAW & CONTEMP. PROBS., Summer 1986, at 221, 223-25, 232-36; Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329, 1330 n.2, 1341 n.37, 1344-50 & nn.45, 65 & 66, 1361 & n.102 (1971); cf. Williams, *supra* note 145, at 304-05 (accepting distinction between naked statistics and particularistic evidence, although allegedly "illogical").

237. E.g., *DePass v. United States*, 721 F.2d 203, 207 (7th Cir. 1983) (Posner, J., dissenting); Robinson, *supra* note 58, at 764-65 & nn.166, 167, 168 & 169; Robinson, *supra* note 231, at 780 & n.3; Rosenberg, *supra* note 208, at 870-73; see also Kelman, *supra* note 10, at 591-93 & n.31, discussed *infra* text accompanying notes 300-27. It is not clear if Judge Posner, in *DePass*, supports use of all types of statistics, including naked statistics, or only causally relevant statistics.

238. See *infra* text accompanying notes 343-407.

239. *Contra* Kelman, *supra* note 10, at 591, 601; see also Rosenberg, *supra* note 208, at 870 (implying that proponents of particularistic evidence view such evidence as providing "direct and actual knowledge of the causal relationship").

causal judgments must be based on causal generalizations that are framed in implicitly probabilistic terms.²⁴⁰ Yet they also insist that it is erroneous to assume, simply because probabilities are involved in making singular causal judgments, that causation is equivalent to a mere increase in probability²⁴¹ or that naked statistics constitute probative evidence on the issue of causation.²⁴² Those who make such claims fail to understand the distinctions and relationships among causal laws, causal generalizations, and singular causal statements.

A *causal law* describes an invariable, nonprobabilistic, causal connection between some fully specified set of antecedent NESS conditions and some result: whenever all the listed conditions occur together, the result inevitably follows.²⁴³ The antecedent conditions and the result are described as abstract types, which cannot in themselves cause anything.²⁴⁴ An actual *singular instance of causation* consists of the complete, concrete instantiation of a causal law on a particular occasion. Each actual antecedent condition that is a part of this complete instantiation of the causal law is a NESS cause of the instantiated result. Yet each is a cause *only* if the causal law is completely instantiated, that is, if all the other abstract antecedent conditions and the abstract result listed in the causal law also have been instantiated.²⁴⁵

Due to imperfect knowledge, we rarely if ever can fully specify a causal law. Instead, we employ *causal generalizations*, which list only some, not all, of the abstract antecedent conditions that would be found in the fully specified causal laws.²⁴⁶ Thus, even if, on a particular occasion, the result and all the known antecedent conditions specified in a causal generalization have been instantiated, we cannot be *certain* that any of the actual antecedent conditions was a cause of the actual result, because we cannot be sure that all the unknown antecedent conditions that must be added to the causal generalization to convert it into the fully specified causal law have also been instantiated.

Nevertheless, we can and do make justifiable singular causal attributions, despite our incomplete knowledge of causal laws and the details of actual events. In our world of imperfect knowledge, a singular causal statement asserts a belief that an incompletely known causal law, represented by some causal generalization, was fully instantiated on a particular occasion and that the condition which is believed to be a cause was a NESS element of the complete instantiation of the causal law.²⁴⁷

240. E.g., H.L.A. HART & T. HONORÉ, *supra* note 13, at 31-32, 44-48; J. MACKIE, *supra* note 51, at 66-76; Papineau, *supra* note 98, at 62-66; Wright, *supra* note 2, at 1822-24; *supra* text accompanying notes 158-60; *infra* text accompanying notes 245-49.

241. H.L.A. HART & T. HONORÉ, *supra* note 13, at 48-49, 469-71, 485-88; J. MACKIE, *supra* note 51, at 49-50; Papineau, *supra* note 98; Wright, *supra* note 2, at 1822-24.

242. Wright, *supra* note 2, at 1822-23, 1825-26.

243. See *supra* text accompanying notes 99-100.

244. See *supra* note 171 and text accompanying notes 171-72.

245. See J. MACKIE, *supra* note 51, at 63-66, 260-62; *supra* text accompanying notes 100, 155-74.

246. See sources cited *supra* note 240.

247. See *supra* text accompanying notes 155-72.

More precisely, when we assert that a particular actual antecedent condition was a cause of some actual result, we are asserting that (1) the actual result and the actual antecedent condition instantiate an abstract result and an abstract antecedent condition listed in some causal generalization, (2) all the other abstract antecedent conditions, if any, listed in that causal generalization also have been instantiated, or at least there is no reason to believe that they have not, and (3) all the unknown abstract antecedent conditions that complete the causal law also must have been instantiated. The third assertion, which is critical, is an inference drawn from the sufficiently high probability that this particular causal generalization is applicable in the specific circumstances and the sufficiently low probability that any competing causal generalization is applicable.²⁴⁸

Proof of causation involves proving these three assertions. Thus, to prove that a specific condition was a cause of a particular result, one obviously must establish that the condition and the result both occurred and that some credible causal generalization links conditions of that type to results of that type. The proof will be strengthened to the extent that one can establish that other conditions known to be part of the causal generalization also occurred. Conversely, the proof will fail if one establishes that some required condition did not occur. Finally, one must distinguish any competing causal generalization that may be applicable, by disproving or casting sufficient doubt on the occurrence of one or more of the conditions that are required by the competing generalization.²⁴⁹

In contrast, the only apparent requirement for a "probabilistic cause" is that it be an instantiation of one of the abstract antecedent conditions that is linked to the abstract result in a causal generalization. The abstract result itself need not be instantiated, although it is often assumed that it has been. There need not be any proof that the other abstract antecedent conditions in the causal generalization have been instantiated. Finally, other possibly applicable causal generalizations do not have to be distinguished.²⁵⁰ Therefore, proof that an actual condition was a "probabilistic cause" of some result is at most only proof that it increased the risk of the result's occurring. It is not proof that the condition caused the result itself—especially when the result has not even occurred!

The most promising attempts to define causation in terms of increased risk rely on probabilities that are calculated *ex post* in the light of all the conditions that actually occurred.²⁵¹ David Papineau has convincingly

248. See H.L.A. HART & T. HONORÉ, *supra* note 13, at 31-32, 44-49, 111-13; J. MACKIE, *supra* note 51, at 66-76, 78-79, 121-24.

249. See L.J. COHEN, *THE PROBABLE AND THE PROVABLE* 207-13, 252-55 (1977); 4 F. HARPER, F. JAMES & O. GRAY, *supra* note 234, § 20.2, at 93-101 & n.8, 107-10 & nn.40, 43, 44 & 49 (2d ed. 1986); K. LLEWELLYN, *supra* note 4, at 30; Kaye & Aickin, *A Comment on Causal Apportionment*, 13 J. LEGAL STUD. 191, 193-94 & n.18 (1984); Papineau, *supra* note 98, at 62-66; Royal, *The Defense of Medical Causation*, TRIAL, Oct. 1987, at 40, 42; Scriven, *Structure*, *supra* note 58, at 413-14. In cases of duplicative causation, more than one causal generalization may be applicable.

250. See *supra* text accompanying notes 226-27.

251. See W. SALMON, *supra* note 113; W. SALMON, R. JEFFREY & J. GREENO, *STATISTICAL EXPLANATION AND STATISTICAL RELEVANCE* (1971); P. SUPPES, *supra* note 235; see also Kelman, *supra* note 10, at 601, 608-09 (MEPS approach).

demolished these attempts.²⁵² Initially, he notes that the *ex post* probabilities will be misleading unless they are based on a “homogeneous partitioning” of the features of an occurrence into contrasting “reference classes,” based on the feature-types, until no further partitioning alters the probability associated with any reference class.²⁵³ For example, to determine the magnitude of the risks associated with a particular occurrence of lung cancer, one might first distinguish between smokers and nonsmokers, then further distinguish between smokers who were exposed to asbestos and those who were not, and so forth.

Yet, Papineau observes, this partitioning into reference classes with associated probabilities merely identifies possibly applicable reference classes—causal generalizations. At most, the resulting probabilities provide evidence in favor of the applicability of different causal generalizations. They do not in themselves indicate which of the possibly applicable causal generalizations actually applies to the particular concrete occurrence.²⁵⁴

To identify the actually applicable causal generalization, a complete partitioning, using all possible combinations of the actual features, would be necessary. Then, in a deterministic world, we would have identified the actually sufficient sets, with probabilities of one, and the insufficient sets, with probabilities of zero. That is, the probabilistic approach would have lost its probabilistic quality and turned into the deterministic NESS approach.²⁵⁵ Even then, the increased-probability approach would fail to identify duplicative causes. A duplicative cause would not produce an increase in probability, because the probability given the other indepen-

252. See Papineau, *supra* note 98.

253. See *id.* at 57-59, 65. Papineau states that under the increased-risk view of probabilistic causation, unlike the high-probability view, the partitioning need not be homogeneous, but rather need only include all possible combinations of the presence or absence of possible “screener-offers”—causes of both the result and a collateral effect—to avoid treating a collateral effect as a spurious cause. *Id.* at 59-61, 64. But there would have to be a complete partitioning, based on all possible combinations of the feature-types, even under the increased-risk view, to ensure that some causally relevant feature or screener-offer had not been overlooked. See D. PAPINEAU, *supra* note 98, at 72-73; cf. W. SALMON, *supra* note 113, at 74, 76, 81-82 (noting difficulty of identifying nontrivial—nondeterministic—homogeneous reference classes).

254. Papineau, *supra* note 98, at 64-65.

255. *Id.* at 66. Papineau implies that complete partitioning would also identify the actual causes in an indeterministic world. See *id.* at 66-68. Yet, since the probabilities in an indeterministic world would not be either zero or one, but rather some number in between, there would be no way under the increased-risk approach to select among the classes—possibly applicable causal generalizations—since each would produce a marginal increase in probability given the others. For example, if there were only two homogeneous classes with associated independent probabilities of .8 and .6, respectively, the combined probability would be .92 ($1 - .2 \times .4$), so the marginal increase due to the first given the second would be .32 and due to the second given the first would be .12. Papineau also argues that, in an indeterministic world, we could only say that the chance of the result, rather than the result itself, was caused in a particular situation. *Id.* at 71-72. Both parts of this assertion are doubtful. The existence of objective chances or propensities inherent in each instantiation of an event-type is problematic. Conversely, treating the appropriate “roll of the dice” as one of the NESS elements explains causation of the result itself, if we can establish the existence of the other (deterministic) NESS elements and eliminate other possibly applicable causal generalizations. See *supra* text accompanying notes 143-50.

dently sufficient duplicative causes already would be one.²⁵⁶

Mario Rizzo, who formerly was the leading advocate of *ex post* “probabilistic causation” in the law,²⁵⁷ recently has accepted Papineau’s arguments.²⁵⁸ Rizzo backslides a little, however, when he tries to use the probabilists’ reference-class technique to support the libertarians’ effort to base liability on a distinction between “commonsense” causes and but-for causes. He discusses a hypothetical in which Smith, while driving his automobile, negligently hits and injures a pedestrian, Jones.²⁵⁹ Rizzo argues that Smith’s parents are not a cause of the injury because a partition of the reference class of injured people into those who have been hit by a car driven by a person who was born and those who have been hit by a car driven by an unborn person is meaningless.²⁶⁰

Yet, to the contrary, the partition is unhelpful because it is *too* relevant. In our world, at least, it is not possible to be a driver without being born. On the other hand, a partition of injured pedestrians into those hit by cars and those not hit by cars suggests the causal relevance of the moving car, not—as stated by Rizzo²⁶¹—the relevance of Smith’s driving. A further partition of those injured by moving cars into those injured by cars with drivers and those injured by “runaway” cars—cars without drivers—presumably would show a higher rate of injury for runaway cars than for cars with drivers. Does this demonstrate the causal irrelevance of Smith’s driving? Clearly not. The partitions merely suggest possibly applicable causal generalizations. They do not in themselves rule out any generalization that has a positive probability in the light of the conditions that occurred.²⁶²

When we are trying to make singular causal attributions, probabilities that are calculated *ex ante* in the light of only those conditions that were known to exist at the time the candidate condition occurred²⁶³ obviously will be much less useful than probabilities that are calculated *ex post* in the light of all the conditions that are known to have occurred up through and including the result. The *ex ante* probabilities are useful only for predicting what is likely to occur in the future, rather than for explaining what has actually occurred, and they are of limited utility even with respect to causal prediction.²⁶⁴ As previously noted, the legal economists’ focus on *ex ante*

256. See Papineau, *supra* note 98, at 66.

257. See Rizzo, *supra* note 17; Rizzo & Arnold, *supra* note 12.

258. Rizzo, *supra* note 10, at 403 & n.10 (citing Papineau, *supra* note 98). Rizzo now limits probabilistic causation to stochastic (indeterministic) causal processes, and he interprets the probability as a propensity or physical tendency inherent in the process itself. Rizzo, *supra* note 10, at 403, 405. As Mackie points out, the existence of such physical propensities or tendencies, or even of stochastic processes that tend toward certain limiting frequencies in the long run, is problematic. J. MACKIE, *supra* note 51, at 239-47; see *supra* text accompanying notes 145-48.

259. Rizzo, *supra* note 10, at 401.

260. *Id.* at 402.

261. *Id.*

262. Rizzo, in conformance with the libertarian position, fails to use a highly relevant feature—the negligence of the driver—to partition each class. See *id.* at 401-02; *supra* text accompanying notes 12-13.

263. These *ex ante* probability calculations correspond to Kelman’s pure *ex ante* approach. See Kelman, *supra* note 10, at 601, 608. Like the legal economists, Kelman sometimes confuses *ex ante* probabilities with *ex post* probabilities. See *id.* at 608-17.

264. For discussions of the fundamental distinction between causal explanation and causal

incentives for efficient behavior commits them to the use of *ex ante* probabilities,²⁶⁵ although they sometimes forget this point and attempt to use *ex post* probabilities to make their theories appear more plausible.²⁶⁶

As discussed above, even positive probabilities that are calculated *ex post* do not themselves constitute causation, but rather are merely evidence of causation. Moreover, a positive probability, no matter how high, by itself is insufficient evidence of actual causation. To establish the complete instantiation of the causal law that underlies the causal generalization with which the probability is associated, other competing causal generalizations suggested by the evidence must be ruled out as being either inapplicable, because some necessary element was missing, or implausible, due to their minimal probability.²⁶⁷

C. *The Causal Basis of Proof: Particularistic Evidence, Ex Post and Ex Ante Causal Probabilities, Naked Statistics, and Degrees of Belief*

The preceding discussion of the role that probabilities play in the proof of causation suggests an answer to the broader question of the relevance of different types of probabilities for proof in general. Usually, the issue is what has happened—including how it happened and who did it—although sometimes the issue is what is expected to happen—for example, the expected reduction in future life or income as an element of damages. That is, proof generally involves either causal explanation or causal prediction. In either case, we match the concrete evidence specific to the particular occasion against the abstract elements in possibly applicable causal generalizations and compare the associated probabilities.

If the issue is what is expected to happen, we use the *ex ante* probabilities associated with competing possibly applicable causal generalizations to pick the result with the highest *ex ante* probability or to calculate a weighted expected result. On the other hand, if the issue is what actually has happened on a particular occasion, we must be able to infer that a particular causal generalization and its underlying causal law have been fully instantiated on the particular occasion.²⁶⁸ As noted above, this requires (1) that the concrete evidence specific to the particular occasion instantiate the abstract elements in the causal generalization and (2) that any competing causal generalizations can be ruled out as being either

prediction, see H.L.A. HART & T. HONORÉ, *supra* note 13, at 46-49; Scriven, *Structure*, *supra* note 58, at 414-15; Wright, *supra* note 2, at 1823-24.

265. See *supra* text accompanying notes 230-31.

266. See, e.g., W. LANDES & R. POSNER, *supra* note 25, at 228-55; Landes & Posner, *supra* note 10, *passim*; Shavell, *Uncertainty Over Causation and the Determination of Civil Liability*, 28 J.L. & ECON. 587, *passim* (1985). For a discussion of the legal economists' frequent confusion of the *ex ante* and *ex post* perspectives, see Wright, *Bane*, *supra* note 5, *passim*; Wright, *Efficiency Theory*, *supra* note 5, at 569-70.

267. See Papineau, *supra* note 98, at 64-65; *supra* text accompanying notes 248-56, 262.

268. See *People v. Risley*, 214 N.Y. 75, 86, 108 N.E. 200, 203 (1915). To simplify the discussion, I assume that the particular occurrence is explained by a single causal generalization and its underlying causal law. In reality, a particular occurrence usually involves a network of causal processes and thus is explained by multiple consistent causal generalizations and their underlying causal laws. The mechanics of proof are the same whether one or many causal processes are involved.

inapplicable, because some necessary element was not instantiated, or implausible, because the *ex post* probability associated with each competing causal generalization is comparatively minimal.²⁶⁹

Once we recognize that proof generally involves causal explanation or causal prediction, we can explain the disparate treatment afforded to different types of proffered evidence—"particularistic" evidence, *ex post* causal probabilities, *ex ante* causal probabilities, and "naked statistics." An item of "particularistic evidence" is a concrete feature of a particular occasion that instantiates, or negates the instantiation of, one of the abstract elements in a possibly applicable causal generalization. An *ex post* causal probability is a case-specific probability, based solely on the particularistic evidence specific to a particular occasion, that the causal law underlying a possibly applicable causal generalization was fully instantiated on the particular occasion. An *ex ante* causal probability is an abstract class-based probability, independent of the particularistic evidence specific to a particular occasion, that the causal law underlying a causal generalization will be fully instantiated if the causal generalization is fully instantiated. A "naked statistic" is a report of an accidental grouping that neither instantiates an abstract element in a possibly applicable causal generalization nor is a probability associated with any such generalization—for example, the happenstance that ten percent of the cars parked on a certain block at a certain time were blue.²⁷⁰

Judges generally have refused to accept naked statistics²⁷¹ or *ex ante* causal probabilities²⁷² as evidence of what actually happened on a particular

269. See *supra* text accompanying notes 248-49, 267.

270. The use of the term "naked statistics" to refer to this type of evidence was, I believe, initiated by David Kaye. See Kaye, *Naked Statistical Evidence* (Book Review), 89 YALE L.J. 601, 603 (1980). However, Kaye and others often use the term both more broadly and more narrowly than it is used here. I apply the term to any statistic that is not related to a possibly applicable causal generalization, whether or not the statistic is explicitly quantified. Kaye and others often apply the term to any statistic that is explicitly quantified, whether or not it is related to a causal generalization. See, e.g., Kaye, *Limits*, *supra* note 236, at 490, 492 & n.22. Sometimes, to distinguish unfavorable judicial holdings, they refuse to apply the term to unquantified—although clearly implied—statistics or to situations in which particularistic evidence also was introduced. See Allen, *supra* note 236, at 429 n.67; Brook, *supra* note 236, at 299-303 & n.42; Friedman, *Generalized Inferences, Individual Merits, and Jury Discretion*, 66 B.U.L. REV. 509, 514 n.23 (1986); Lempert, *The New Evidence Scholarship: Analyzing the Process of Proof*, 66 B.U.L. REV. 439, 459-60 (1986); Thomson, *Liability and Individualized Evidence*, 49 LAW & CONTEMP. PROBS., Summer 1986, at 199, 205 n.13.

271. *Guenther v. Armstrong Rubber Co.*, 406 F.2d 1315, 1318 (3d Cir. 1969); *Wetzel v. Eaton*, 62 F.R.D. 22, 24-25, 29-30 (D. Minn. 1973) (*but cf. id.* at 31 (might avoid directed verdict if show defendant was exclusive or predominant supplier)); *Sawyer v. United States*, 148 F. Supp. 877, 878-79 (M.D. Ga. 1956); *Curtis v. United States*, 117 F. Supp. 912, 913 (N.D.N.Y. 1953); *Kamosky v. Owens-Illinois Glass Co.*, 89 F. Supp. 561, 562-63 (M.D. Pa.), *aff'd*, 185 F.2d 674 (3d Cir. 1950); *Sheffield v. Eli Lilly & Co.*, 144 Cal. App. 3d 583, 596-98, 192 Cal. Rptr. 870, 877-78 (1983); *Garcia v. Joseph Vince Co.*, 84 Cal. App. 3d 868, 873-75, 148 Cal. Rptr. 843, 846-47 (1978); *Smith v. Rapid Transit, Inc.*, 317 Mass. 469, 470, 58 N.E.2d 754, 755 (1945); *Sargent v. Massachusetts Accident Co.*, 307 Mass. 246, 250, 29 N.E.2d 825, 827 (1940) (*dicta*); *Welch v. Coca-Cola Bottlers' Ass'n*, 380 S.W.2d 26, 28-30 (Tex. Civ. App. 1964). For a rare contrary holding, in the special context of a defendant's pre-trial motion for summary judgment, see *infra* text accompanying notes 398-401.

272. *United States v. Rangel-Gonzales*, 617 F.2d 529, 532 (9th Cir. 1980); *Johnston v. United States*, 597 F. Supp. 374, 412-13, 425-26 (D. Kan. 1984); *O'Connor v. Industrial*

occasion. They instead have insisted on particularistic evidence and *ex post* causal probabilities based on such evidence.²⁷³ Although the intuitive support for these distinctions is quite strong, they have not been given a firm theoretical foundation. In this subpart I attempt to provide such a foundation by describing the causal basis of proof.

A judgment on what actually happened on a particular occasion is a judgment on which causal generalization and its underlying causal law was fully instantiated on the particular occasion. Particularistic evidence connects a possibly applicable causal generalization to the particular occasion by instantiating the abstract elements in the causal generalization, thereby converting the abstract generalization into an instantiated generalization. Without such particularistic evidence, there is no basis for applying the causal generalization to the particular occasion.

Moreover, we cannot infer that the causal law underlying the causal generalization also has been instantiated unless we can rule out competing causal generalizations. An item of particularistic evidence can negate the instantiation of one of the abstract elements in a competing causal generalization or lower the *ex post* probability that it was instantiated, thereby eliminating the competing causal generalization or lowering the *ex post* causal probability associated with it. On the other hand, particularistic evidence can support the competing causal generalization by establishing that one or more of the abstract elements in the competing causal generalization was actually or probably instantiated.

To determine whether a specific causal law was fully instantiated, we use particularistic evidence to determine the *ex post* probability that each of the abstract elements in the causal law was instantiated. The *ex post* causal probability for complete instantiation of the causal law is equal to the lowest *ex post* probability for instantiation of any constituent element.²⁷⁴ For example, if we are certain that one of the abstract elements was not instantiated, the *ex post* probability that the causal law was fully instantiated is zero.²⁷⁵ The *ex post* probability for instantiation of the known abstract elements—those listed in the causal generalization—either is based on direct particularistic evidence of such instantiation or, as with the unknown abstract elements—those required to complete the causal law, is circumstantially inferred from particularistic evidence of the network of causal

Comm'n, 19 Ariz. App. 43, 47-48, 504 P.2d 966, 970-71 (1972); *Bazemore v. Davis*, 394 A.2d 1377, 1382-83 & n.7 (D.C. 1978); *Day v. Boston & Me. R.R.*, 99 Me. 207, 217, 52 A. 771, 774 (1902); *King's Case*, 353 Mass. 488, 492, 225 N.E.2d 900, 901-02 (1967); *Garner v. Hecla Mining Co.*, 19 Utah 2d 367, 370-71, 431 P.2d 794, 796-97 (1967); see *Jaffe, Res Ipsa Loquitur Vindicated*, 1 BUFFALO L. REV. 1, 3-4 (1951); *James, Relevancy, Probability and the Law*, 29 CALIF. L. REV. 689, 692-93, 697-700 (1941).

273. See *supra* notes 271 & 272. Judge Weinstein has questioned the distinction between particularistic evidence and *ex ante* causal probabilities. *In re "Agent Orange" Prod. Liab. Litig.*, 597 F. Supp. 740, 835-36 (E.D.N.Y. 1984). Yet he would dispense with the particularistic-evidence requirement only in the mass-exposure cases, and in those cases he would grant proportional, rather than full, recovery based on the *ex ante* causal probabilities. *Id.* at 836-39. This, in effect, is recovery for the risk exposure that possibly led to the manifested injury, rather than recovery for the manifested injury itself, and is consistent with the arguments made in this Article. See *infra* text accompanying notes 344-49, 383-94.

274. See L.J. COHEN, *supra* note 249, at 265-67.

275. *Id.* at 207-09, 252-53.

relationships that encompasses the particular occasion.²⁷⁶

The final judgment on what actually happened depends on whether the *ex post* causal probability associated with one possibly applicable causal generalization—the *ex post* probability, based on all the particularistic evidence, that the causal law underlying the causal generalization was fully instantiated—sufficiently outweighs, in accordance with the applicable standard of proof, the *ex post* causal probabilities associated with competing causal generalizations.²⁷⁷

An abstract *ex ante* causal probability associated with some possibly applicable causal generalization is not evidence of what actually happened on the particular occasion because it provides no information on whether the abstract elements in the causal generalization and the underlying causal law actually were instantiated on the particular occasion. It merely states that, *N* percent of the time that the known abstract elements in the causal generalization are instantiated, the unknown abstract elements required to complete the causal law also are instantiated. It does not help us determine whether this particular occasion is one of the *N* percent, or instead is the instantiation of the causal law underlying a competing causal generalization.²⁷⁸ As the court in *Day v. Boston & Me. R.R.*²⁷⁹ stated:

Quantitative [*ex ante*] probability, however, is only the greater chance. It is not proof, nor even probative evidence, of the proposition to be proved. That in one throw of the dice there is a quantitative [*ex ante*] probability, or greater chance, that a less number of spots than sixes will fall uppermost is no evidence whatever that in a given throw such was the actual result. Without something more, the actual result of the throw would still be utterly unknown. The slightest real [particularistic] evidence that sixes did in fact fall uppermost would outweigh all the [*ex ante*] probability otherwise.²⁸⁰

In the dice throwing hypothetical, there are six competing causal generalizations—"throwing a dice causes six (five, four, three, two, one)

276. See *supra* text accompanying notes 248-49, 267, 269; *infra* text accompanying notes 313-15.

277. See L.J. COHEN, *supra* note 249, at 248-55; *infra* text accompanying notes 336-39.

278. A statistical correlation, when combined with a credible causal hypothesis, may be evidence of a possibly applicable causal generalization with an associated *ex ante* causal probability that is described by the statistical correlation. But particularistic evidence, rather than the *ex ante* causal probability, is required to determine whether this causal generalization or another was actually instantiated on the particular occasion. An *ex ante* causal probability is probative evidence of what actually happened on a particular occasion only when the *ex ante* causal probability is so high that it practically excludes any competing causal generalization, so that the possibly applicable causal generalization is tantamount to a causal law. For example, habits or customs, which involve "an invariable regularity of action" with regard to specific conduct (rather than general character), can be used as evidence that the specific conduct occurred on a particular occasion. 1A WIGMORE, EVIDENCE § 92, at 1608 (Tillers rev. 1983); see *id.* at 1607-10 & nn.1 & 3; *id.* § 93, at 1610-19 & n.1, 1623-27; Annotation, *Habit Or Routine Evidence Under Uniform Evidence Rule 406*, 64 A.L.R.4th 567 (1988). Of course, there must be particularistic evidence that the particular occasion was one in which the habit or custom is applicable.

279. 96 Me. 207, 52 A. 771 (1902).

280. *Id.* at 217, 52 A. at 774.

spots to fall uppermost one-sixth of the time"—that can be rephrased as two competing causal generalizations: (1) "throwing a dice causes six spots to fall uppermost one-sixth of the time" and (2) "throwing a dice causes less than six spots to fall uppermost five-sixths of the time." The *ex ante* causal probabilities associated with these two causal generalizations—seventeen percent and eighty-three percent, respectively—provide a strong basis for a causal prediction, "postdiction," or bet that the second causal generalization was more likely, *ex ante*, to be instantiated on this particular occasion—and every other occasion considered separately. Nevertheless, they provide no information at all on which of the two causal generalizations actually was instantiated on this particular occasion.

To prove that a causal generalization and its underlying causal law have been instantiated, one must prove that all the abstract elements in the causal generalization and the underlying causal law have been instantiated. Only particularistic evidence can establish such instantiation. Thus, the demand for particularistic evidence—and *ex post* causal probabilities that are derived solely from particularistic evidence—is not based on the notion that such evidence is "uniquely highly probabilifying,"²⁸¹ but rather on the fact that particularistic evidence is uniquely *instantiating*.

The particularistic evidence that a throw of the dice occurred provides an equal *ex post* probability that the single known abstract antecedent condition—"throwing a dice"—in each of the two competing causal generalizations was instantiated. Thus, given this single item of particularistic evidence, there is no basis for inferring a greater *ex post* causal probability that the causal law underlying one rather than the other causal generalization was fully instantiated. On the other hand, if there is any particularistic evidence that a six actually fell uppermost, that would be evidence that the abstract result in the first causal generalization was instantiated and that the abstract result in the second causal generalization was not instantiated. There then would be a greater *ex post* causal probability that the causal law underlying the first causal generalization, rather than the second, was fully instantiated, despite the much greater *ex ante* causal probability for the second causal generalization. As the *Day* court observed, "[t]he slightest real [particularistic] evidence that sixes did in fact fall uppermost would outweigh all the [*ex ante*] probability otherwise."²⁸²

A naked statistic merely reports an accidental grouping. It neither instantiates an abstract element in a possibly applicable causal generalization²⁸³ nor is an *ex post* or *ex ante* causal probability associated with

281. See Thomson, *supra* note 270, at 206 & n.14 (criticizing statement quoted in text accompanying note 280).

282. See *supra* text accompanying note 280. Since the *ex ante* causal probability is not probative at all on the issue of what actually happened, it is improper to use it as an initial probability in Bayes' Theorem to impugn the *ex post* causal probability based on the particularistic evidence. See *infra* text accompanying notes 320-25. For further discussion of the fundamental distinction between causal explanation based on *ex post* probabilities and causal prediction based on *ex ante* probabilities, see H.L.A. HART & T. HONORE, *supra* note 13, at 44-49, 487; Wright, *supra* note 2, at 1822-24.

283. If a statistic does instantiate an abstract element in a possibly applicable causal generalization, it is not a naked statistic, but rather particularistic evidence of the instantiation of the causal law underlying the causal generalization. For example, a statistic on the racial

any such generalization. Since it is not related to any possibly applicable causal generalization, a naked statistic is of no use for either causal explanation²⁸⁴ or causal prediction.

In sum, particularistic evidence is necessary for causal explanation—determining what actually happened—because only particularistic evidence can establish or negate the instantiation of the abstract elements in a possibly applicable causal generalization and its underlying causal law. *Ex post* causal probabilities, which are based solely on particularistic evidence, also are needed for causal explanation. They are the means by which we compare the *ex post* plausibility of competing causal generalizations and their underlying causal laws. *Ex ante* causal probabilities, being nonparticularized class-based probabilities, are necessary for causal prediction—projecting what will happen—but are useless for causal explanation. Naked statistics are not useful for causal explanation or causal prediction, since they are not related to any possibly applicable causal generalization.

Many writers, failing to fully appreciate the implications of the connection between proof and causal explanation, have rejected the distinctions that the courts and lay persons draw among particularized evidence, *ex post* and *ex ante* causal probabilities, and naked statistics.²⁸⁵ Indeed, some assert that the distinctions violate principles of rational decisionmaking by ignoring the lessons of mathematical probability theory.²⁸⁶

Much of the debate has centered on Jonathan Cohen's paradox of the gatecrasher. Cohen hypothesizes a situation in which 1000 people attended a rodeo, but only 499 paid for admission, so that 501 were gatecrashers. He

composition of some particular group often is alleged to be the instantiated result of racial discrimination. There often are competing causal generalizations, and sometimes insufficient attention is paid to the need to distinguish those competing causal generalizations when determining whether racial discrimination actually occurred on the particular occasion. See Laycock, *Statistical Proof and Theories of Discrimination*, 49 LAW & CONTEMP. PROBS., Autumn 1986, at 97.

284. See L.J. COHEN, *supra* note 249, at 271; Cohen, Letters to the Editor, 1980 CRIM. L. REV. 257, 258, 259, 747, 749; Cohen, *The Logic of Proof*, 1980 CRIM. L. REV. 91, 92-93, 97-99; Cohen, *Subjective Probability and the Paradox of the Gatecrasher*, 1981 ARIZ. ST. L.J. 627, 633-34 [hereinafter Cohen, *Gatecrasher*]; Wright, *supra* note 2, at 1825.

Nesson recognizes that evidence must generate acceptable stories of what happened—causal explanations—and that naked statistics do not contribute to these stories. Nesson, *The Evidence or the Event? On Judicial Proof and the Acceptability of Verdicts*, 98 HARV. L. REV. 1357, 1358-59, 1378-79 (1985). Yet he equates probability with truth and treats naked statistics as probative probabilities. See *id.* at 1357-58 & n.4, 1378-79, 1385-86, 1391-92. Thus, he is forced into the unhappy argument that the appearance of justice, generated by acceptable stories, is more important than actual justice, which allegedly would use the naked statistics. *Id.* at 1391-92.

Similarly, Thomson recognizes that particularistic evidence is causally related while naked statistics are not. Thomson, *supra* note 270, at 203-05, 218-19; Thomson, *supra* note 95, at 127-32. Yet she also treats naked statistics as probative evidence. Thomson, *supra* note 270, at 205-06 & n.14, 214. She explains the demand for at least some particularistic evidence as merely providing support for a mental "guarantee" by the factfinder, rather than as being necessary to determine what actually happened. *Id.* at 208-09, 213-15 & n.21; cf. Tribe, *supra* note 236, at 1375-77 (symbolic function of trials), criticized by Brook, *supra* note 236, at 335-40.

285. See sources cited *supra* notes 236 & 237.

286. E.g., Saks & Kidd, *supra* note 236, at 125-31; Thomson, *supra* note 270, at 206, 214; see *infra* text accompanying notes 320-25.

further assumes that no tickets were issued and that there is no other way to establish who actually paid and who was a gatecrasher. Given the happenstance that over half of the spectators were gatecrashers, there is a 50.1% naked mathematical probability that any particular spectator was a gatecrasher. If this naked statistic is accepted as probative evidence and the preponderance-of-the-evidence standard of proof in civil cases is interpreted as requiring only a greater than fifty percent mathematical probability, then each and every one of the 1000 spectators can be held civilly liable for gatecrashing. Since this result seems incorrect and unjust for each individual spectator and certainly is incorrect and unjust for all 1000 spectators in the aggregate, Cohen argues that the mathematical probability interpretation of the preponderance-of-the-evidence standard is incorrect.²⁸⁷

For the most part, the mathematical probabilists agree that there should not be liability in this situation, despite the 50.1% naked mathematical probability that any particular spectator was a gatecrasher. Many of them heroically insist that there is nothing manifestly unjust about holding each and every spectator liable when the mathematical probability is indeed greater than fifty percent, but argue that the probability in this situation is actually less than fifty percent. Allegedly, the judge or jury discounts the objective 50.1% probability because of concern that the plaintiff, in relying on the naked statistics, is concealing, or has insufficient incentive to discover and produce, probative evidence other than the naked statistics.²⁸⁸

This response clearly is inadequate. First, it does not explain why the jury is not even allowed to consider the naked statistics,²⁸⁹ rather than being allowed to consider and possibly discount the statistics.²⁹⁰ Second, it does not explain why the plaintiff, rather than the defendant, is being charged with failure to supply other types of evidence.²⁹¹ Third, it at least implicitly admits that other types of evidence are more probative than naked statistics; otherwise, why insist on more than the naked statistics?²⁹² Fourth,

287. L.J. COHEN, *supra* note 249, at 75.

288. E.g., Brook, *supra* note 236, at 315-16, 323-25, 328-34; Friedman, *supra* note 270, at 512-19; Kaye, *Limits*, *supra* note 236, at 488-89, 491, 492 & n.22, 505-07 (*but see id.* at 488 n.9, quoted *infra* note 297); Kaye, *Gatecrasher*, *supra* note 236, at 103-08; Kaye, *supra* note 270, at 610-11 & n.37; Kelman, *supra* note 10, at 592-93; Lempert, *supra* note 270, at 454-62; Tribe, *supra* note 236, at 1341 n.37, 1349-50 & nn.65 & 66, 1361 & n.102; *see* Ball, *supra* note 236, at 822-23. Several of the mathematical probabilists improperly analogize the gatecrasher hypothetical to situations in which it has been proven that the defendant tortiously contributed to the manifested injury or to the risk-exposure injury for which she is being held liable. *See* Brook, *supra* note 236, at 330 n.160, 341-51; Kaye, *Gatecrasher*, *supra* note 236, at 104 & n.20; Lempert, *supra* note 270, at 460, 461; *cf. infra* text accompanying notes 383-407 (discussion of multiple-exposure and alternative-causation cases).

289. *See, e.g.,* Kaye, *Laws*, *supra* note 236, at 39-40, 47 n.48; Tribe, *supra* note 236, at 1349, 1361.

290. *See* Brook, *supra* note 236, at 325-27, 334-35; Nesson, *supra* note 284, at 1380-81.

291. *See* R. POSNER, *ECONOMIC ANALYSIS OF LAW* § 21.2, at 521 (3d ed. 1986); Allen, *supra* note 236, at 412-13, 428 & n.66 (*but see id.* at 413 n.39, 429); Brook, *supra* note 236, at 325-26; Rosenberg, *supra* note 208, at 869-70 & n.72; Schmalbeck, *supra* note 236, at 224-25.

292. *See* Brilmayer, *Second-Order Evidence and Bayesian Logic*, 66 B.U.L. REV. 673, 676-77 (1986); Rosenberg, *supra* note 208, at 870, 871-72. For examples of this admission, *see* Allen, *supra* note 236, at 412 n.36, 429 (*but see id.* at 428 & n.66); Brook, *supra* note 236, at 304-05, 323-25; Kaye, *Laws*, *supra* note 236, at 39-40, 47 n.48; Kaye, *supra* note 270, at 610 & n.36;

it fails to explain why there is no liability even when the objective probability is much higher than fifty percent—for example, when only fifty of the 1000 spectators paid for their tickets. In this situation, even when the objective ninety-five percent probability is discounted, the subjective probability almost certainly is greater than fifty percent.²⁹³ Fifth, it fails to address the hypothetical as Cohen presented it, which assumes that no other evidence is available.²⁹⁴

When confronted with a real or hypothetical situation in which it is clear that the plaintiff is not holding back probative evidence and there is no evidence other than the naked statistics, many proponents of probabilistic evidence, as stated above, heroically insist that there is no injustice involved in holding the defendant liable purely on the basis of the naked statistics.²⁹⁵ Others, including Glanville Williams, have a less mathematical notion of justice. They admit that it is wrong to hold the defendant liable even if there is a ninety-five percent naked statistical chance that he tortiously caused the plaintiff's injury.²⁹⁶ Williams, although stating that "we are illogical in this," observes that the naked statistics do not "sufficiently mark out the defendant from others. . . . This requirement that evidence should focus on the defendant must be taken to be a rule of law relating to proof, distinct from the general rule governing quantum of proof."²⁹⁷

Although Williams does not articulate the precise nature of, or basis for, the distinction that he draws, his observation is accurate. Regardless of what rule governs the required quantum or preponderance of proof, naked statistics, which are merely reports of accidental groupings, do not count at all as proof of what actually happened on a particular occasion. To determine what actually happened—including how it happened and who did it—we must match particularistic evidence from the particular occasion

Tribe, *supra* note 236, at 1339 n.33, 1340 n.34, 1345 n.48, 1349 & n.65, 1359-61 & nn.100 & 102; *infra* note 325.

293. See Brook, *supra* note 236, at 326-28 & n.151, 334 n.178, 342-43; Williams, *supra* note 145, at 304. Some of the mathematical probabilists argue that the naked statistical probability still would be, or should be, discounted to less than fifty percent. *E.g.*, Tribe, *supra* note 236, at 1349, 1361. This argument proves too much. It implies that the naked statistics per se have minimal, if any, evidential weight. *Cf. infra* note 312 and accompanying text (naked statistical probability of 99% only reduced to 86% after taking into account two items of particularistic evidence, which together indicate that there is only a six percent probability that the proposition supported by the naked statistics is valid); Brook, *supra* note 236, at 327 n.151 (similar calculation).

294. See Allen, *supra* note 236, at 412-13.

295. R. POSNER, *supra* note 291, § 21.2, at 521; Allen, *supra* note 236, at 402 & nn.10 & 11, 412-15, 420-21, 428-30 & n.66; Eggleston, *The Probability Debate*, 1980 CRIM. L. REV. 678, 681-82; Rosenberg, *supra* note 208, at 869-73 (*but see id.* at 858); Schmalbeck, *supra* note 236, at 225; sources cited *supra* note 288.

296. *E.g.*, Williams, *supra* note 145, at 304; see Williams, *A Short Rejoinder*, 1980 CRIM. L. REV. 103, 105-06 (no liability even if only one out of 1000 spectators paid).

297. Williams, *supra* note 145, at 305; *cf.* Kaye, *Limits*, *supra* note 236, at 488 n.9 ("It can be argued that notwithstanding whatever probability theory may teach us, assuring the appearance of fairness precludes imposing liability in the absence of some evidence singling out particular defendants."); Rosenberg, *supra* note 208, at 858 ("Individualized determination [through particularistic evidence] of the causal connection also comports with deeply rooted notions of moral responsibility and just compensation.").

against possibly applicable causal generalizations to decide which underlying causal law was instantiated on the particular occasion. Naked statistics are not probative because they neither instantiate an element in a possibly applicable causal generalization nor constitute a probability associated with such a generalization.²⁹⁸

The problem is not, as some have supposed,²⁹⁹ that it ordinarily is improper to rely *solely* on naked statistics. Rather, the problem is that naked statistics are not probative at all on the issues of what actually happened, how, and by whom. Consider a hypothetical, as recently revised by Kelman, that I posed in a prior article.³⁰⁰ Assume that (1) X fired ninety-nine bullets at V, (2) Y fired only one bullet at V, (3) a single bullet hit V and killed him, and (4) the single bullet is identified by its markings, through ballistics tests performed on the guns of both X and Y, as having come from Y's gun, not from X's.³⁰¹

Kelman recognizes that "most of us" instinctively trust the particularistic ballistics evidence more than the naked statistical comparison of the number of bullets fired.³⁰² Yet, like others, he attributes "that (occasionally misleading) habit" to the alleged fact that, in most cases in which only naked statistics are offered, we perceive that "additional evidence unfavorable to the proposition suggested by the [naked statistics] has been squelched," so that we subjectively discount the naked statistics.³⁰³ He claims that, in situations like our hypothetical, where this belief is not justified—since by

298. See *supra* text accompanying notes 271-84. James Brook proposes an alleged counterexample in which a person filming the rodeo environs for part of the time accidentally films all 499 of the paying spectators while they are paying. Brook states that the film surely is relevant evidence of nonpayment by the other 501 spectators. Yet, he asserts, the film evidence "seems about as accidental as you can get" and is not causally related to the 501 spectators' nonpayment. Brook, *supra* note 236, at 321. While the evidence may have been obtained accidentally, it is particularistic evidence that is causally related to payment by the 499 paying spectators—their acts of paying caused the specific images on the film. The film images thus are highly probative evidence exonerating the 499. Since the images strongly support a factual finding—that these 499 paid—that is inconsistent with payment by any of the remaining 501, the images are also highly probative evidence against each of the 501. If the film captured only 498 of the paying spectators, it would be probative only in exonerating those 498. The fact that those 498 paid is not inconsistent with and thus sheds no light on payment by any of the remaining 502, one of whom actually paid. See also Williams, *supra* note 296, at 105-06 (similar hypotheticals).

Kaye proposes another alleged counterexample, involving the relationship of gender to length of life. See Kaye, *Paradoxes, Gedanken Experiments and The Burden of Proof: A Response to Dr. Cohen's Reply*, 1981 ARIZ. ST. L.J. 635, 640. Contrary to Kaye's assertion, there clearly is a causal relationship, at least in our society, between being a female and living longer, although the precise reasons for the causal relationship—genes or gender-based social habits, or both—may not be well understood.

299. R. POSNER, *supra* note 291, § 21.2, at 520-21; Brook, *supra* note 236, at 321, 324-25; Fienberg, *Gatecrashers, Blue Buses, and the Bayesian Representation of Legal Evidence*, 66 B.U.L. REV. 693, 695 (1986); Kaye, *Limits*, *supra* note 236, at 488-89 & n.9; Kaye, *Gatecrasher*, *supra* note 236, at 106-08; Kelman, *supra* note 10, at 592-93; Martin, *Comment*, 66 B.U.L. REV. 709, 710-11 (1986); Robinson, *supra* note 58, at 765 & n.168; Rosenberg, *supra* note 208, at 869-73; Thomson, *supra* note 270, at 202-03, 205-06 & n.14; Tribe, *supra* note 236, at 1341 n.37, 1349-50 & nn.65 & 66, 1361 & n.102; see *infra* note 325.

300. See Kelman, *supra* note 10, at 592; Wright, *supra* note 2, at 1825.

301. Kelman, *supra* note 10, at 592.

302. *Id.*

303. *Id.*; see *supra* text accompanying notes 288-94.

hypothesis all the available evidence was produced—there is no reason to prefer the particularistic evidence over the naked statistics.³⁰⁴

Kelman points out that the ballistics tests themselves are not one hundred percent accurate.³⁰⁵ He assumes that the ballistics tests are only eighty percent accurate,³⁰⁶ so that there still would be a six percent *ex post* probability—based on the ballistics evidence alone—that X was the killer.³⁰⁷ Kelman concludes that “it would really be more probable, *ex post*, that X in fact killed V than that Y did, not simply more probable that he *would* be the killer if all we had seen were the guns being fired.”³⁰⁸ This conclusion apparently relies on the fact that there is only a one percent (naked mathematical) probability that Y was the killer based on the number of bullets fired, compared to a six percent (*ex post* causal) probability that X was the killer based on the ballistics tests.³⁰⁹

A Bayesian would use Bayes’ Theorem to combine the naked statistics and the results of the ballistics tests.³¹⁰ Bayes’ Theorem provides a formula for using additional information to revise some initial probability estimate.³¹¹ Using the naked statistics as the initial probabilities and taking into account the results of the ballistics tests on both guns, the revised probabilities would be eighty-six percent for X as the killer and fourteen percent for Y.³¹² Thus, applying Bayes’ Theorem strengthens Kelman’s argument.

Both Kelman and the Bayesians have fallen into the trap of assuming that, simply because both items of evidence generate probabilities of some sort, both are probative. This is not true. The probabilities involved are qualitatively different, and only the probabilities derived from the ballistics tests are probative on the issue of what actually happened.

The probabilities derived from the ballistics tests are *ex post* causal probabilities based on highly probative particularistic evidence. Every gun has unique irregularities on the surface of its breech and barrel that cause

304. Kelman, *supra* note 10, at 592-93.

305. *Id.* at 592.

306. *Id.* Ballistics tests are much more accurate than Kelman suggests and also are very particularistic. See *infra* text accompanying note 313.

307. Kelman states that there would be a four percent chance that X was the killer. Kelman, *supra* note 10, at 592. The probability actually would be six percent. The probability that the tests were wrong on both guns is $.20 \times .20 = .04$, while the probability that the tests were right on both guns is $.80 \times .80 = .64$. In the circumstances of our hypothetical, those are the only two possibilities. Thus, using Bernoulli’s Theorem, the corrected probability that both tests were right—so that Y was the killer—is $.64 / (.64 + .04) = .94$, and the corrected probability that both tests were wrong—so that X was the killer—is .06. For discussions of Bernoulli’s Theorem, see L.J. COHEN, *supra* note 249, at 95; Williams, *supra* note 145, at 344.

308. Kelman, *supra* note 10, at 593.

309. *Id.* at 592.

310. Letter from Richard D. Friedman to Richard Wright (Feb. 8, 1988), at 2 (available at Iowa Law Review offices); see, e.g., Brook, *supra* note 236, at 327-28 & nn.151 & 152, 329 n.156, 330 n.158; Saks & Kidd, *supra* note 236, at 128, 130 & n.9.

311. Assume that X is the proposition to be proved, P(X) is the initial probability estimate assigned to X, and E is some item of evidence. Then Bayes’ Theorem states that the probability of X given E—P(X|E)—is equal to $[P(E|X) \times P(X)] / [(P(E|X) \times P(X)) + (P(E|\text{not-X}) \times P(\text{not-X}))]$. Tribe, *supra* note 236, at 1350-52.

312. The calculation for X is $(.04 \times .99) / [(0.04 \times .99) + (.64 \times .01)]$. See *supra* note 311. The calculation for Y is similar.

distinctive markings on each bullet that is fired from the gun. In our hypothetical, the markings on the particular bullet that killed *V* were compared with the markings on bullets that are known to have been fired from *X*'s gun and the markings on bullets that are known to have been fired from *Y*'s gun. The markings on the bullets are particularistic evidence that the bullet that killed *V* was fired from *Y*'s gun, not *X*'s. Moreover, the essentially unique character of the surface irregularities in each gun makes the ballistics tests much more accurate than Kelman indicates, especially when we know that the bullet came from one of the two guns being tested. The possibility of error is almost entirely a function of the competence of the person who compares the bullets.³¹³

Even using Kelman's assumption of only eighty percent accuracy, the ballistics tests on both guns in our hypothetical result in a ninety-four percent *ex post* causal probability that the bullet that killed *V* came from *Y*'s gun, compared to a minimal six percent *ex post* causal probability that it came from *X*'s gun.³¹⁴ This should be sufficient to justify a finding, based on the preponderance of the evidence as required in a civil suit, that *Y* rather than *X* caused *V*'s death.³¹⁵

On the other hand, the naked statistics on the number of bullets fired by *X* and *Y*, respectively, merely report an accidental grouping. They neither instantiate an abstract element in a possibly applicable causal generalization nor constitute an *ex post* or *ex ante* causal probability associated with such a generalization. There is no causal generalization that would explain *V*'s being killed in terms of the ratio of bullets fired by *X* and *Y*, or vice versa. There is a causal generalization which states that "firing a bullet at someone often kills him." Yet this causal generalization applies to each bullet fired separately. Using this causal generalization, the single bullet fired by *Y* is just as plausible—or implausible—a cause of *V*'s death as any of the ninety-nine bullets fired by *X*.

Some might argue that there is a causal generalization that includes as one of its abstract elements the number of bullets fired by one person or the other, rather than the ratio of their shots. The alleged causal generalization would be "the more bullets one fires at somebody, the more likely you are to kill him." Those who support such a causal generalization might even argue that a person—*X*—who fires ninety-nine bullets is almost certain to kill the intended victim, while a different person—*Y*—who fires only one bullet is much less likely to do so.³¹⁶ Yet the alleged causal generalization

313. See 2 WIGMORE, EVIDENCE § 417a, at 495-99 (Chadbourn rev. 1979); cf. *id.* § 414, at 482-87 (highly probative particularistic nature of fingerprint evidence); Cohen, *The Role of Evidential Weight in Criminal Proof*, 66 B.U.L. REV. 635, 645 (1986) (same). Courts and commentators have warned against confusing the odds of matching particularized traces with the odds of misidentification. See, e.g., *United States v. Massey*, 594 F.2d 676, 679-81 (8th Cir. 1979); C. MCCORMICK, MCCORMICK ON EVIDENCE § 210, at 653-55 (E. Cleary gen. ed. 3d ed. 1984).

314. See *supra* note 307.

315. In one comparative study of judges, jurors, and sociology students, only three percent of the responding judges, twelve percent of the jurors, and six percent of the students interpreted the preponderance of the evidence standard as requiring a probability greater than ninety-five percent. Simon & Mahan, *Quantifying Burdens of Proof: A View from the Bench, the Jury, and the Classroom*, 5 L. & Soc. REV. 319, 327 (1971); see *infra* note 339.

316. This argument is false. See *infra* text accompanying note 318.

seems spurious. A causal generalization must be capable of being instantiated. What particularistic evidence would instantiate the abstract element described as "the more bullets one fires"?

Perhaps we are to imagine an infinite sequence of causal generalizations—each with a successively higher *ex ante* causal probability of death—based respectively on firing one bullet, two bullets, . . . *N* bullets. This would imply, when *N* bullets are fired and only one hits *V*—as in our hypothetical—that all *N* bullets caused *V*'s death, since all *N* bullets are required to instantiate the alleged multiple-shot causal generalization. Yet only one bullet entered *V*'s body. How can the other bullets be causes? By affecting the *ex ante* causal probability that the single bullet would enter *V*'s body? As the mathematical probabilists themselves point out, the number of bullets fired does not affect the *ex ante* causal probability that any particular bullet will hit *V*, which is the same for each bullet fired.³¹⁷

Although the number of bullets fired does not affect the *ex ante* causal probability that any particular bullet will hit *V*, it does affect the *ex ante* causal probability, calculated before any bullets are fired, that *V* will be hit. It does so through a straightforward application of standard mathematical probability rules to the *ex ante* causal probability associated with the only causal generalization that is relevant in our hypothetical, "firing a bullet at someone often kills him." It is this latter causal generalization that was instantiated, by a single bullet rather than by multiple bullets. As noted above, this single-shot causal generalization provides no basis for distinguishing *V*'s single bullet from any of *X*'s ninety-nine bullets.

For example, the fact that at most one of *X*'s ninety-nine bullets hit *V* implies that *X* is a very poor marksman, who misses at least ninety-nine percent of the time. Thus, for *X*, the relevant single-shot causal generalization is "*X*'s firing a bullet at someone kills him at most one percent of the time." The *ex ante* causal probability might be even lower, since all ninety-nine of *X*'s bullets may have missed *V*. Applying standard mathematical probability rules, the *ex ante* causal probability that all ninety-nine of *X*'s bullets would miss *V* was at least .37 (.99 to the 99th power). So the *ex ante* causal probability that at least one of *X*'s ninety-nine bullets would hit *V* was at most only sixty-three percent. There is insufficient data to estimate the effectiveness of *V*'s shooting, which might have been highly effective (one out of one). Thus, even if we compare *ex ante* causal probabilities inferred from the respective number of bullets fired, there is no basis for a causal prediction or "postdiction" that *V* was more likely to be killed by *X*'s ninety-nine shots than by *V*'s single shot.³¹⁸

Moreover, as discussed above, although *ex ante* causal probabilities are relevant—indeed necessary—for causal prediction of what will or might happen, they are irrelevant for causal explanation of what actually happened.³¹⁹ They are nonparticularized class-based probabilities that provide no information on which competing causal generalization actually was instantiated on the particular occasion. Thus, in our shooting hypo-

317. See, e.g., Saks & Kidd, *supra* note 236, at 127, 128-29.

318. Cf. *supra* text accompanying note 316 (noting contrary argument).

319. See *supra* text accompanying notes 278-82.

thetical, even if *Y* is presumed to be as poor a marksman as *X*, so that the *ex ante* causal probability that *Y* would kill *V* was at most one percent while the *ex ante* causal probability that *X* would kill *V* was at most sixty-three percent, the great disparity in *ex ante* causal probabilities tells us nothing about which possibility *actually occurred* on this particular occasion. To determine what actually occurred, we must determine whether the causal law underlying the causal generalization involving *X* or the causal law underlying the causal generalization involving *Y* was fully instantiated on this particular occasion. Only particularistic evidence—and *ex post* causal probabilities based solely on such evidence—are probative on the issue of instantiation.

In sum, as stated above, naked statistics are useless for causal explanation—determining what actually happened. In addition, by themselves they are useless even for causal prediction or “postdiction”—predicting what might or possibly did happen. They are useful for causal prediction or “postdiction” only to the extent that they can be (1) combined with *ex ante* causal probabilities for single events to calculate *ex ante* causal probabilities for groups or series of events or (2) used to estimate the *ex ante* causal probability for a single event from the aggregate results of a lengthy series of repetitions of the same event-type.

Since naked statistics and *ex ante* causal probabilities are not probative evidence on the issue of what actually happened, it is improper to combine them—even as initial probabilities in Bayes’ Theorem³²⁰—with probative *ex post* causal probabilities. For example, in the gatecrasher hypothetical, assume that only one of a thousand spectators paid, the ticket seller identifies *A* as the one who paid, and there is only a two percent chance that the ticket seller is mistaken. Using the naked statistic that 99.9% of the spectators were gatecrashers as the initial “base rate” probability in Bayes’ Theorem, the revised probability that *A* was a gatecrasher, even after taking into account the ticket seller’s particularistic identification testimony, would still be over ninety-five percent.³²¹ The Bayesians would stubbornly conclude that *A* almost surely was a gatecrasher, despite the ticket seller’s testimony that *A* almost certainly was not a gatecrasher.³²²

This conclusion not only is counterintuitive, but also is clearly incorrect. The problem is not Bayes’ Theorem itself, which is a valid mathematical probability theorem. Rather, the problem is the use of abstract base rates, whether naked statistics or *ex ante* causal probabilities, to impugn *ex post* causal probabilities based on particularistic evidence. The Bayesians are mixing apples and oranges. The base rates merely describe the overall distribution of occurrences in a class. They provide no information about any particular occurrence. Only particularized evidence can give us information about the particular occurrence. When the proposition to be proved is what actually happened, using base rates—which provide no information about what actually happened—as initial probabilities in Bayes’ Theorem is

320. Cf. Tribe, *supra* note 236, at 1359-60 & n.100 (nonparticularistic class-based statistics can only be used as initial probabilities in Bayes’ Theorem).

321. The calculation is $(.02 \times .999) / [(0.02 \times .999) + (.98 \times .001)]$. See *supra* note 311.

322. See, e.g., Brook, *supra* note 236, at 327-28 & nn.151 & 152, 329 n.156, 330 n.158; Martin, *supra* note 299, at 711-12; Saks & Kidd, *supra* note 236, at 128, 130 & n.9.

an example of the computer programmers' maxim: "garbage in, garbage out."³²³ The fact that judges, jurors, and lay persons ignore the base rates and instead focus on the particularistic evidence is, contrary to the assertions of the Bayesians,³²⁴ highly rational.³²⁵

At most, *ex ante* causal probabilities, or naked statistics in conjunction with *ex ante* causal probabilities, can be used for placing a *bet* on what actually happened—a causal prediction or "postdiction." They cannot be used to resolve the bet—to determine what actually happened. To determine what actually happened we must provide a causal explanation of the particular occurrence, and providing a causal explanation requires proof—through particularistic evidence—of the instantiation of the purportedly applicable causal generalization and its underlying causal law.

323. Another example of this maxim is the use of Bayes' Theorem to calculate a "probability of paternity" based on a totally unjustified prior probability of fifty percent, as authorized in *Commonwealth v. Beausoleil*, 397 Mass. 206, 211 n.6, 217-21 & n.19, 490 N.E.2d 788, 792 n.6, 795-97 & n.19 (1986). Although recognizing the invalidity of the prior probability, the court allows the introduction of a "probability of paternity" calculation based on the invalid prior probability, leaving to defense counsel "the task of highlighting on cross-examination the exact nature of the probability of paternity calculation and its weaknesses." *Id.* at 220 n.19, 490 N.E.2d at 797 n.19.

The majority would authorize, but not require, an instruction that the jury not consider such "evidence" of paternity unless they have first found that the alleged father had sexual intercourse with the mother at or about the time of conception. *Id.* at 220 n.18, 490 N.E.2d at 797 n.18. Justice O'Connor, concurring and dissenting, would insist on such an initial finding in a bifurcated trial. *Id.* at 225-29, 490 N.E.2d at 799-800. Yet this initial finding would not justify the prior probability of fifty percent, which would be justified only if it was also found that the mother was inseminated with equally potent sperm from one and only one other male during the relevant time period. See Peterson, *A Few Things You Should Know About Paternity Tests (But Were Afraid To Ask)*, 22 SANTA CLARA L. REV. 667, 684-86 (1982). "Subjective" probabilities, unless they are implicit *ex post* causal probabilities based on particularistic evidence, simply illustrate the maxim, "garbage in, garbage out." Cf. C. McCORMICK, *supra* note 313, § 211, at 660 & n.22 (suggesting, but questioning, the use of *ex ante* causal probabilities rather than *ex post* causal probabilities).

Moreover, even if all the input probabilities are properly supported *ex post* causal probabilities based on the particularistic evidence, the overall "probability of paternity" calculated by using Bayes' Theorem is merely the *ex post* causal probability for the alleged father, which must be compared with the *ex post* causal probability for the other male(s)—whose existence is usually the main point in dispute—to determine whether there is a sufficient basis to conclude that the alleged father, rather than some other male, actually was the father. See C. McCORMICK, *supra* note 313, § 211, at 661; *supra* text accompanying notes 268-69, 274-77, 281-82.

324. See, e.g., M. FINKELSTEIN, *QUANTITATIVE METHODS IN LAW: STUDIES IN THE APPLICATION OF MATHEMATICAL PROBABILITY AND STATISTICS TO LEGAL PROBLEMS* 70, 72, 92 n.57 (1978); Saks & Kidd, *supra* note 236, at 125-31. The seminal article is Tversky & Kahneman, *Decisions Under Uncertainty: Heuristics and Biases*, 185 Sci. 1124 (1974).

325. See L.J. COHEN, *supra* note 249, at 258-64; Brilmayer & Kornhauser, *Review: Quantitative Methods and Legal Decisions*, 46 U. CHI. L. REV. 116, 147-48 & n.114 (1978); cf. Edwards & von Winterfeldt, *Cognitive Illusions and Their Implications for the Law*, 59 S. CAL. L. REV. 225, 232-34 (1986) (discussing subjects' refusal to take base rates into account unless they are causally related or individuating). Some nonlegal Bayesians treat base rates, even when they are observed frequency distributions specific to the particular occasion as in the gatecrasher hypothetical, as not being "observable" or relevant evidence when standing alone, yet inconsistently treat the base rates as probative evidence that should be used as initial probabilities in Bayes' Theorem when particularized evidence also is available. See Fienberg, *supra* note 299, at 695; Martin, *supra* note 299, at 710-12.

Moreover, *ex ante* causal probabilities and naked statistics, being abstract probabilities that are not based on particularistic evidence specific to the particular occasion, provide the weakest sort of basis even for a bet on what actually happened. They are quickly displaced by *ex post* causal probabilities, which are based on the particularistic evidence.³²⁶ In our shooting hypothetical, only a benefactor of bookies or a fool would place a bet on *X* after the results of the ballistics tests are known.³²⁷

The mathematical probabilists have confused the betting odds that a person is willing to accept on the existence of a certain fact with the degree of belief that the person has in the actual existence of that fact.³²⁸ A willingness to accept betting odds that some condition occurred does not necessarily imply *any* belief that the condition actually occurred.³²⁹ This is inevitably true when—as in our dice throwing, gatecrasher, and shooting hypotheticals—the betting odds are based on abstract *ex ante* causal probabilities or naked statistics, rather than on particularized *ex post* causal

326. See Tribe, *supra* note 236, at 1339 n.33, 1340 n.34, 1345 n.48, 1347-48, 1349 & n.65, 1360 n.100, 1361 & n.102; *supra* text accompanying notes 279-82.

327. See *supra* text accompanying notes 300-19.

328. E.g., Brook, *Inevitable Errors: The Preponderance of the Evidence Standard in Civil Litigation*, 18 TULSA L.J. 79, 83-84 (1982); Friedman, *supra* note 270, at 515-16, 519 & n.38; Kaye, *Laws*, *supra* note 236, at 38-39 & n.21, 45-47; Kaye, *Gatecrasher*, *supra* note 236, at 105 & n.127; Kaye, *supra* note 298, at 644-45; Kaye, *supra* note 270, at 609-10; Rizzo, *supra* note 17, at 1017; Rizzo & Arnold, *supra* note 12, at 1409 n.56; Robinson, *supra* note 58, at 766 n.173, 767 n.174; Tribe, *supra* note 236, at 1346-49; Wagner, Book Review, 1979 DUKE L.J. 1071, 1072-73 & n.6; see Nesson, *supra* note 284, at 1385-92 & nn.92, 98, 104 & 105 (truth measured by probability); *id.* at 1389 n.107 (ad hoc exception when conclusion clearly untrue).

Kaye recently has significantly revised his probabilistic theory of proof. He still claims that the standard of proof refers to a threshold probability, and that the betting odd of a certain factual proposition's being true is equivalent to a "partial belief." See Kaye, *A First Look at "Second Order Evidence"*, 66 B.U.L. REV. 701, 703 & n.16 (1986) [hereinafter Kaye, *First Look*]; Kaye, *Do We Need a Calculus of Weight to Understand Proof Beyond a Reasonable Doubt?*, 66 B.U.L. REV. 657, 661-62, 668-69 & n.29 (1986) [hereinafter Kaye, *Calculus of Weight*]. (A more supportable claim is that, if there is a belief in the truth of the proposition, the strength of the belief can be measured through the betting odds technique.) Yet Kaye is no longer willing to assert that such "partial beliefs" can be manipulated by Bayes' Theorem or by the other mathematical probability theorems to arrive at an overall probability for the truth of the case as a whole. See Kaye, *Calculus of Weight*, *supra*, at 659-61 & n.7, 669-72.

329. Rather than emphasizing this point, Cohen attacked the betting odds approach on the ground that jurors, or people considering the paradox of the gatecrasher, could not or would not make bets. See L.J. COHEN, *supra* note 249, at 89-91. His extended debate with Kaye demonstrates that this argument is a loser. See Kaye, *Laws*, *supra* note 236, at 45-47; Cohen, *Gatecrasher*, *supra* note 284, at 630-32; Kaye, *supra* note 298, at 641-44. Cohen eventually concedes the debate to Kaye, but erroneously assumes that this entails acceptance of Kaye's assumption that betting odds represent "partial beliefs" and that such "partial beliefs" conform to the mathematical probability theorems. See Cohen, *supra* note 313, at 645-47. Cohen therefore is reduced to arguing that it is not the "partial beliefs," but rather the completeness of the evidence—independent of the beliefs generated by the evidence—that should determine liability, and that the mathematical probability theorems do not apply to the nonordinal measures of completeness. See *id.* at 646 n.19, 647-49. Kaye argues that the completeness of the evidence can be taken into account in the probability calculation and that no independent concept of "evidential weight" is needed. See Kaye, *Calculus of Weight*, *supra* note 328, at 657-58, 662-67. But see Callen, *Second-Order Considerations, Weight, Sufficiency and Schema Theory: A Comment on Professor Brilmayer's Theory*, 66 B.U.L. REV. 715, 723-26 & nn.71 & 72 (1986). Nevertheless, Kaye has begun to back away from use of the mathematical probability theorems. See *supra* note 328.

probabilities.³³⁰ Yet, even *ex post* causal probabilities may not distinguish the competing possibly applicable causal generalizations sufficiently to support a belief—no matter how slight—that the causal law underlying one generalization, rather than another, was fully instantiated.³³¹

The failure to distinguish probability from belief commits the mathematical probabilists to the aggregative concept of justice that underlies the views of the legal economists and the Critics.³³² For the mathematical probabilists, the legal economists, and the Critics, justice consists in the minimization of errors, the maximization of wealth or utility, or the equalization or spreading of risk, respectively. Hence, they assert, if the mathematical odds even slightly favor the plaintiff, it is unjust to deny him relief, even if there is insufficient particularistic evidence from which the jury could conclude that the defendant actually contributed to the plaintiff's injury.³³³

This probability-based aggregative approach is not consistent with the traditional concept of corrective justice that is held by ordinary people and is implemented by the courts. Ordinarily, we consider it unjust to single out the defendant to pay for the plaintiff's injury unless it is established that the defendant actually contributed to the injury.³³⁴ Jurors are not told that they need only place a bet on the existence of some fact, but rather are instructed that they must determine whether it has been proved by a preponderance of the evidence that the fact actually existed.³³⁵

330. See *supra* text accompanying notes 279-82, 287-88, 300-19.

331. See *supra* text accompanying notes 248-49.

332. See Zuckerman, *Law, Fact or Justice*, 66 B.U.L. REV. 487, 499-500 (1986). This point is noted by Nesson, who has developed a seemingly cynical, yet implicitly principled account to avoid the aggregative approach. See Nesson, *supra* note 284, at 1377-78 & n.67, 1379, 1383, discussed *supra* note 284. Others are not troubled by the aggregative implications. See Allen, *supra* note 236, at 414; Brook, *supra* note 236, at 321-23, 339-40, 348-51 & n.223; Bush, *Between Two Worlds: The Shift from Individual to Group Responsibility in the Law of Causation of Injury*, 33 UCLA L. REV. 1473, 1529-63 (1986); Schmalbeck, *supra* note 236, at 235 n.24.

333. For the mathematical probabilists, see Allen, *supra* note 236, at 405 n.21, 412-13, 420-21, 426, 428-30 & n.66; Brook, *supra* note 236, at 296-97; Eggleston, *supra* note 295, at 681-82; Kaye, *Limits*, *supra* note 236, at 496-97 & n.39, 501, 509, 510 & n.62, 514-16; Schmalbeck, *supra* note 236, at 223, 234-36 & n.24; Tribe, *supra* note 236, at 1361 & n.102 (*but see id.* at 1378-83); Williams, *supra* note 145, at 303. For the legal economists, see R. POSNER, *supra* note 291, §§ 21.1- .2, at 517-21. For the Critics, see Kelman, *supra* note 10, at 592-601; see also Abel, *Torts*, *supra* note 21, at 191, 196-97 (equalizing risk); Horwitz, *supra* note 10, at 210-11 (spreading risk).

334. For a discussion of the centrality and pervasiveness of the actual-causation requirement, see Wright, *supra* note 2, at 1771-77, 1788-1828.

335. See *Bertram v. Wunning*, 385 S.W.2d 803, 807 (Mo. Ct. App. 1965); 9 WIGMORE, EVIDENCE § 2498, at 325-27 (3d ed. 1940). Contrary to Kaye and the other mathematical probabilists, there is a vast difference between these two tasks. The difference cannot be brushed off as "more a matter of phraseology than substance." Kaye, *Laws*, *supra* note 236, at 39 n.21; see Brook, *supra* note 236, at 303; Kaye, *First Look*, *supra* note 328, at 703 n.16. Contrary to Judge Weinstein's reported view, the fact that his Brooklyn jurors figure odds on horses and subway safety does not mean that they or others think that it is appropriate to treat verdicts as mere bets, rather than belief judgments on what actually happened. See Cohen, *The Costs of Acceptability: Blue Buses, Agent Orange, and Aversion to Statistical Evidence*, 66 B.U.L. REV. 563, 566-67 & n.21 (1986) (quoting Letter from Hon. Jack B. Weinstein to Charles Nesson (Oct. 21, 1985)). See generally Nance, *The Best Evidence Principle*, 73 IOWA L. REV. 227, 232-33 & nn.25 & 26 (1988) (citing FED. R. EVID. 102 and Twining, *Evidence and Legal Theory*, 47 MOD. L. REV. 261, 272 (1984)) (central purpose of adjudication is ascertainment of the truth).

There has been considerable debate on whether a specific level of *ex post* causal probability constitutes a preponderance of the evidence. Some courts and scholars interpret "preponderance of the evidence" as merely meaning "more probable than not" in the sense of a greater than fifty percent probability.³³⁶ Yet even the proponents of the more-probable-than-not interpretation usually assume that the required preponderance of probability reflects some degree of belief—no matter how weak—that the proposition is true; they are primarily concerned with dispelling the notion that the degree of belief must amount to an absolute certainty.³³⁷ Other courts and scholars reject any specific quantitative probability interpretation of the preponderance-of-the-evidence standard and emphasize that the evidence must be sufficient to generate a belief that the disputed fact actually occurred.³³⁸ The latter interpretation recognizes that a judgment on what actually happened requires going beyond a mere comparison of mathematical probabilities to the establishment of some minimal level of belief. The little empirical data that exists strongly supports the latter interpretation.³³⁹

336. See, e.g., *In re "Agent Orange" Prod. Liab. Litig.*, 597 F. Supp. 740, 835 (E.D.N.Y. 1984); *Davies v. Taylor*, 1974 A.C. 207, 219 (Lord Simon of Glaisdale); C. McCORMICK, *supra* note 313, § 339, at 957.

337. See, e.g., *Livanovitch v. Livanovitch*, 99 Vt. 327, 328, 131 A. 799, 800 (1926) ("If . . . you are more inclined to believe from the evidence that he did so deliver the bonds . . . even though your belief is only the *slightest degree* greater than that he did not, your verdict should be for the plaintiff."); C. McCORMICK, *supra* note 313, § 339, at 957-59 & n.13; McBaine, *Burden of Proof; Degrees of Belief*, 32 CALIF. L. REV. 242, 244, 246-54 (1944). A frequently used set of federal jury instructions states:

To "establish by a preponderance of the evidence" means to prove that something is more likely so than not so. In other words, a preponderance of the evidence means such evidence as, when considered and compared with that opposed to it, has more *convincing* force, and produces in your minds belief that what is sought to be proved is more likely *true* than not true. This rule does not, of course, require proof to an absolute certainty, since proof to an absolute certainty is seldom possible in any case.

E. DEVITT, C. BLACKMAR & M. WOLFF, 3 FEDERAL JURY PRACTICE AND INSTRUCTIONS (CIVIL) § 72.01, at 32 (4th ed. 1987) (emphasis added).

338. See, e.g., *Fitzgerald v. Manning*, 697 F.2d 341, 350-51 & n.9 (4th Cir. 1982); *Larson v. Jo Ann Cab Corp.*, 209 F.2d 929, 931-35 & n.25 (2d Cir. 1954); *King's Case*, 352 Mass. 488, 492, 225 N.E.2d 900, 902 (1967); *Lampe v. Franklin Am. Trust*, 339 Mo. 361, 384, 96 S.W.2d 710, 723 (1936); *Bertram v. Wunning*, 385 S.W.2d 803, 806-07 (Mo. Ct. App. 1965), *upon subsequent appeal*, 417 S.W.2d 120, 124, 125 (Mo. Ct. App. 1967); *Bornstein v. Metropolitan Bottling Co.*, 26 N.J. 263, 274-75, 139 A.2d 404, 411 (1958); *Frazier v. Frazier*, 228 S.C. 149, 168, 89 S.E.2d 225, 235 (1955); *McDonald v. Union Pac. R.R. Co.*, 109 Utah 493, 501-02, 167 P.2d 685, 689 (1946) (Wolfe, J., concurring); 9 WIGMORE, EVIDENCE § 2498, at 326-27 (3d ed. 1940) (quoting Trickett, *Preponderance of Evidence, and Reasonable Doubt*, 10 THE FORUM (Dickinson School of Law) 75, 76-77 (1906)); James, *Burdens of Proof*, 47 VA. L. REV. 51, 53-54 (1961); Note, *Causation in Toxic Torts: Burdens of Proof, Standards of Persuasion, and Statistical Evidence*, 96 HARV. L. REV. 376, 381-86 & nn.23, 42 & 46, 390 n.72, 395 (1986). For a summary of the debate, see R. EGGLESTON, EVIDENCE, PROOF, AND PROBABILITY 130-37 (2d ed. 1983).

339. Researchers have asked judges, jurors, and students to state what level of probability would be sufficient, in general or for a particular case, for a preponderance-of-the-evidence finding. Even many of the responding judges—80 out of 255 in one survey—refused to commit to a specific probability. McAuliff, *Burdens of Proof: Degrees of Belief, Quanta of Evidence, or Constitutional Guarantees?*, 35 VAND. L. REV. 1293, 1325 n.184, 1330 (1982). Many of the judges explicitly objected to interpreting burdens of proof in terms of quantitative probabilities. *Id.* at 1332. Of the judges who were willing to attach a quantitative probability to the preponderance-of-the-evidence standard, only about three-fifths chose a probability of fifty to

The confusion of the various types of probabilities with one another and with degrees of belief accounts for many, if not all, of the difficulties that the mathematical probabilists encounter in trying to account for the various aspects of legal proof. Once the distinctions are recognized and understood, it is possible to accommodate the objections to the mathematical probability theory by limiting that theory to its proper domain, without having to abandon the theory in the broad range in which it is applicable. Although the axioms of mathematical probability theory generally work well when applied to the same type of probability, they do not work when different types of probabilities are mixed together.³⁴⁰ Nor, as Jonathan Cohen has persuasively demonstrated, should the mathematical probability theorems be used to combine *ex post* causal probabilities and degrees of belief that are attached to discrete elements of a causal explanation.³⁴¹

As we shall see in Part VI, some courts have failed to observe the fundamental distinctions among particularistic evidence, *ex post* causal probabilities, *ex ante* causal probabilities, naked statistics, and degrees of belief.³⁴² In the vast majority of cases, however, regardless of the verbal

fifty-five percent; about two-fifths chose a probability of sixty percent or greater, almost one-fifth a probability of seventy percent or greater, one-tenth a probability of eighty percent or greater, and one twentieth a probability of ninety to one hundred percent. *Id.* at 1331; Simon & Mahan, *supra* note 315, at 324-25, 327 (table 7). The distribution of probabilities was about the same for the more-probable-than-not standard. McAuliff, *supra*, at 1331. Lay persons—jurors and students—were even less willing to interpret the preponderance-of-the-evidence standard as a mere greater-than-fifty-percent probability. About four-fifths of the lay persons chose a probability of seventy percent or greater, half a probability of eighty percent or greater, and more than one-tenth a probability of ninety-five to one hundred percent. Simon & Mahan, *supra* note 315, at 327 (table 7). Over ninety percent of the judges and about two-thirds of the lay persons were opposed to having the jurors simply make a probability finding, which the judge would then use to determine liability. *Id.* at 329, 330 n.8. The judges were quoted as stating that "[p]ercentages or probabilities simply cannot encompass all the factors, tangible and intangible, in determining guilt—evidence cannot be evaluated in such terms." *Id.* at 329; see also Kagehiro & Stanton, *Legal vs. Quantified Definitions of Standards of Proof*, 9 LAW & HUM. BEHAV. 159, 164, 169 (1985) (empirical study demonstrating divergence between subjects' findings under legal preponderance-of-the-evidence standard and quantified fifty-one percent standard, with results closer to those obtained under legal standard even when legal and quantified standards combined in same instruction).

340. See *supra* text accompanying notes 320-25.

341. See L.J. COHEN, *supra* note 249, at 49-120; accord Allen, *supra* note 236, at 404-15; Nesson, *supra* note 284, at 1377-90; Williams, *supra* note 145, at 302-05, 340-44. Some mathematical probabilists claim that Cohen's arguments have been refuted. See, e.g., Fienberg, *Misunderstanding, Beyond a Reasonable Doubt*, 66 B.U.L. REV. 651, 652-53 (1986); Kaye, *Laws*, *supra* note 236, at 33 & n.18, 41; Kaye, *supra* note 298, at 635 n.5; cf. Edwards, *Summing Up: The Society of Bayesian Trial Lawyers*, 66 B.U.L. REV. 937, 937 (1986) ("[N]o one laid a glove on us! . . . [N]one of them backed us in to a corner ducking . . .").

As Ron Allen points out, most of Cohen's arguments have been evaded rather than refuted—there has been lots of ducking. See Allen, *supra* note 236, at 404, 410-14; Allen, *Analyzing the Process of Proof: A Brief Rejoinder*, 66 B.U.L. REV. 479, 480-84 (1986). For examples of the evasion, see R. EGGLESTON, *supra* note 338, at 36, 38-39, 40-44; Fienberg, *supra* note 299, at 693-97; Lempert, *supra* note 270, at 451-62; Martin, *supra* note 299, at 710-12; Schmalbeck, *supra* note 236, at 224-31; Wagner, *supra* note 328, at 1074-79; *supra* note 325 and text accompanying notes 288-94; cf. Nance, *A Comment on the Supposed Paradoxes of a Mathematical Interpretation of the Logic of Trials*, 66 B.U.L. REV. 947, 949-52 (1986) (an attempt to reinterpret jury instructions that clearly support Cohen's position; only passing reference is made to special verdicts and jury interrogatories, which are fatal to the probabilists' position).

342. See *infra* text accompanying notes 350-53, 398-407.

formulations used, the courts have adhered in practice to the traditional evidentiary distinctions elaborated in this part. Even in those areas, such as the loss-of-chance cases, in which the courts most frequently have gone astray, there is a pronounced trend toward more careful conceptual analysis in the recent cases.

VI. LIABILITY FOR RISK EXPOSURE

In this final part, I turn to the most problematic area of current tort practice: cases involving liability for risk exposure. In the first subpart, I discuss the lost-chance or increased-risk cases. In the second subpart, I discuss the multiple-exposure and alternative-causation cases. Compared to, and in the light of, the theoretical discussions in the previous parts, the case-specific discussions in this part may seem relatively prosaic. Yet the issues involved are important and controversial, and the attempts by judges and academics to deal with these issues have generated much of the conceptual confusion that I have been laboring to dispel. To complete my pruning of the bramble bush, I use the concepts and distinctions developed in the previous parts to pierce through the confusion that has surrounded the risk-exposure cases.

A. Causation in the Lost-Chance or Increased-Risk Cases

We have previously seen how the NESS test enables us to identify causal contribution in many of the so-called doubtful causation cases.³⁴³ Even under the NESS test, however, there are cases in which it is impossible to determine whether or not the defendant's tortious conduct contributed to the plaintiff's injury. This is particularly true in many of the medical malpractice cases. Often it can be proven that the doctor negligently reduced the chance of the patient's avoiding some manifested injury or increased the risk of its occurrence, but not that the doctor's negligence actually contributed to the manifested injury.³⁴⁴

The courts nevertheless frequently have held the defendant liable in these situations.³⁴⁵ These cases, together with the mass-exposure cases discussed in the next section, are often considered to be evidence of the invalidity, or at least the incompleteness, of the traditional corrective-justice theory of tort liability.³⁴⁶ Whether this is true depends on the approach that

343. See *supra* text accompanying notes 205-09.

344. See sources cited *infra* notes 351-52, 364.

345. See *infra* text accompanying notes 350-80.

346. See Brook, *supra* note 236, at 305-08, 316, 329, 336, 341-52; Elliott, *Why Courts? Comment on Robinson*, 14 J. LEGAL STUD. 799, 799-800 (1985); Kelman, *supra* note 10, at 579-80, 589 n.23, 597-600; Landes & Posner, *supra* note 10, at 121-24 & n.33; Landes & Posner, *Tort Law as a Regulatory Regime for Catastrophic Personal Injuries*, 13 J. LEGAL STUD. 417, 422-25 (1984); Lempert, *supra* note 270, at 460-61; Robinson, *supra* note 231, at 780-83; Rosenberg, *supra* note 208, at 855-59; Schwartz, *supra* note 16, at 640, 644-46 & n.14; Shavell, *supra* note 266, at 587-89; Note, *The Inapplicability of Traditional Tort Analysis to Environmental Risks: The Example of Toxic Waste Pollution Victim Compensation*, 35 STAN. L. REV. 575, 583-84, 600-07 (1983).

the courts explicitly or implicitly are following in these cases. At least two possible approaches can be identified, only the first of which is inconsistent with the corrective-justice view.

Under the first approach, the defendant is liable for the full amount of the manifested injury—even though it has not been proven that she tortiously contributed to that injury—if she sufficiently reduced the chance of the victim's avoiding the manifested injury or increased the risk of its occurrence.³⁴⁷

Under the second approach, a new legal injury—risk exposure that possibly led to the manifested injury—is recognized, and the defendant is held liable for this risk-exposure injury if, and only if, the plaintiff proves that such a risk exposure occurred and the defendant was a cause of the risk exposure. Since the injury is the risk exposure that possibly led to the manifested injury, rather than the manifested injury itself, liability is limited to the proportion of the manifested injury that is equivalent to the increase in risk that the defendant caused.³⁴⁸ If it is established that the defendant did not contribute to the manifested injury, she is not liable for the manifested injury or for risk exposure that possibly led to the manifested injury. Proof that she did not contribute to the manifested injury necessarily is proof that the risk that she created did not lead to the manifested injury, and she is liable under this second approach only for risk exposure that possibly led to the manifested injury. On the other hand, if the plaintiff can prove that the defendant actually contributed to the manifested injury, the plaintiff can recover for the full amount of the manifested injury, but not also for the risk exposure that led to it, since that would be double recovery.³⁴⁹

A number of courts seem to have adopted the first approach. They allow a plaintiff who has merely presented evidence of increased risk to get to the jury on the issue of causation of the manifested injury.³⁵⁰ In some of these cases, there was evidence that, in the absence of the defendant's negligence, the plaintiff would have had a better-than-even chance of avoiding the manifested injury.³⁵¹ In other cases, the probability of

347. The first approach is favored by the mathematical probabilists and the legal economists for nonrepetitive single-victim cases such as the typical medical malpractice case. The mathematical probabilists would impose full liability on the most likely cause of the manifested injury, even if causation of the manifested injury cannot be established, because doing so minimizes erroneous liability decisions. *E.g.*, Kaye, *Limits*, *supra* note 236, at 492-94, 496-504, 507-08; Shavell, *supra* note 266, at 605 n.28. The legal economists would impose full liability if the increase in risk exceeds a certain threshold, because doing so allegedly minimizes administrative costs with a minimal adverse effect on incentives. *See, e.g.*, Landes & Posner, *supra* note 10, at 121-23; Landes & Posner, *supra* note 346, at 425 & n.9; Shavell, *supra* note 266, at 604-07 & n.28.

348. Wright, *supra* note 2, at 1815-16; *see* PROSSER & KEETON, *supra* note 39, § 41, at 272; Green, *supra* note 33, at 558-59; King, *Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences*, 90 YALE L.J. 1353, 1376-87 (1981); Malone, *Ruminations*, *supra* note 32, at 80-81.

349. *See* Wright, *supra* note 2, at 1813, 1815-16; *see also* Carpenter, *supra* note 111, at 943, 947, 952; Malone, *Ruminations*, *supra* note 32, at 71, 77, 78.

350. *See* sources cited *infra* notes 351-52.

351. McBride v. United States, 462 F.2d 72, 75 (9th Cir. 1972) (Hawaii law); Sharp v. Kaiser Found. Health Plan, 710 P.2d 1153, 1154-56 (Colo. Ct. App. 1985), *aff'd on other grounds*, 741

avoiding the manifested injury, in the absence of negligence, would have been less than fifty percent or the probability is not stated.³⁵² Theoretically, the jury is still required to apply the usual standards and burdens of proof in deciding the causation issue: the plaintiff must establish by a preponderance of the evidence that the tortious aspect of the defendant's conduct was a "substantial factor" in producing the injury.³⁵³

All the courts that follow this first approach rely primarily on ambiguous language in *Hicks v. United States*,³⁵⁴ on the reasoning of the Supreme Court of Pennsylvania in *Hamil v. Bashline*,³⁵⁵ or on both. Some of the more recent decisions adopting the first approach also rely on the opinion of the Supreme Court of Washington in *Herskovits v. Group Health Cooperative*.³⁵⁶ Yet these cases provide little support for the first approach.

Seven of the nine judges in *Herskovits* explicitly rejected the first approach. The only opinion that explicitly addressed the second approach was the special concurring opinion authored by Judge Pearson, joined by three other judges, which was the plurality opinion.³⁵⁷ Judge Pearson insisted that mere proof of increased risk is not sufficient to establish causation of the manifested injury, that the relevant injury is the loss of the chance, that an action should be allowed for the loss of the chance, and that causation of the loss of the chance has to be established in accordance with the usual evidentiary standards for proof of causation.³⁵⁸ Three dissenting judges, in two separate opinions, also rejected the first approach, but did not explicitly address the second approach.³⁵⁹ Only Judge Dore, who announced the "opinion of the court" in an opinion joined solely by Judge Rossellini, adopted the first approach.³⁶⁰ Judge Dore also did not explicitly address the second approach, but he did state that damages would be

P.2d 714, 718 & n.5, 720 (Colo. 1987)(on motion for summary judgment, defendant failed to establish lack of genuine issue regarding causation); *Hamil v. Bashline*, 481 Pa. 256, 263, 268-73 & n.9, 392 A.2d 1280, 1283, 1286-89 & n.9 (1978); *Truan v. Smith*, 578 S.W.2d 73, 76-77 (Tenn. 1979); *Brown v. Koulizakis*, 229 Va. 524, 532-33, 331 S.E.2d 440, 446 (1985).

352. *Daniels v. Hadley Memorial Hosp.*, 566 F.2d 749, 757-58 (D.C. Cir. 1977) (D.C. law); *Jeanes v. Milner*, 428 F.2d 598, 604-05 (8th Cir. 1970) (Ark. law); *Thompson v. Sun City Community Hosp.*, 141 Ariz. 597, 605-08, 688 P.2d 605, 613-16 (1984); *Northern Trust Co. v. Weiss Memorial Hosp.*, 143 Ill. App. 3d 479, 486-88, 493 N.E.2d 6, 11-12 (1986); *Roberson v. Counselman*, 235 Kan. 1006, 1020-21, 686 P.2d 149, 159-60 (1984); *Hastings v. Baton Rouge Gen. Hosp.*, 498 So. 2d 713, 720-21 (La. 1986); *Evers v. Dollinger*, 95 N.J. 399, 404-06, 413-17, 471 A.2d 405, 408-09, 413-15 (1984); *Kallenberg v. Beth Israel Hosp.*, 45 A.D.2d 177, 179-80, 357 N.Y.S.2d 508, 510-11 (1974), *aff'd mem.*, 37 N.Y.2d 719, 337 N.E.2d 128, 374 N.Y.S.2d 615 (1975) (*but see* *Kimball v. Scors*, 59 A.D.2d 984, 984-85, 399 N.Y.S.2d 350, 351 (1977)); *Thornton v. CAMC, Etc.*, 305 S.E.2d 316, 323-25 (W. Va. 1983); *cf. McKellips v. Saint Francis Hosp.*, 741 P.2d 467, 472-77 (Okla. 1987) (allowing finding of causation of manifested injury based on mere increased risk, yet limiting damages to lost chance to avoid distorting traditional principles of causation).

353. See sources cited *supra* notes 351-52.

354. 368 F.2d 626, 633 (4th Cir. 1966) ("If there was any substantial possibility of survival and the defendant has destroyed it, he is answerable.").

355. 481 Pa. 256, 392 A.2d 1280 (1978).

356. 99 Wash. 2d 609, 664 P.2d 474 (1983).

357. See *id.* at 619, 636, 664 P.2d at 479, 487 (plurality opinion).

358. *Id.* at 624-26, 631-35, 664 P.2d at 481, 485-87 (plurality opinion).

359. See *id.* at 636-42, 664 P.2d at 487-91 (Brachtenbach & Dimmick, J.J., dissenting); *id.* at 642-45, 664 P.2d at 491-92 (Dolliver, J., dissenting).

360. See *id.* at 610-19, 664 P.2d at 474-79.

limited to those tangible injuries directly attributable to the increased risk.³⁶¹ In sum, *Herskovits* is a much stronger precedent for the second approach than it is for the first approach.

Similarly, in its recent decision in *Waffen v. United States*,³⁶² the United States Court of Appeals for the Fourth Circuit, which decided *Hicks*, also explicitly rejected the first approach and adopted the second approach, using reasoning similar to Judge Pearson's in *Herskovits*.³⁶³ Indeed, every court that has explicitly considered both approaches has rejected the first and either adopted the second or left room for its adoption in an appropriate case.³⁶⁴

The Supreme Court of Pennsylvania did adopt the first approach, in *Hamil*,³⁶⁵ and has adhered to the approach in subsequent decisions.³⁶⁶ Yet the court has never considered the second approach, and its rationale for adopting the first approach is flawed. The court relied on section 323(a) of the *Restatement (Second) of Torts*,³⁶⁷ which reads as follows:

One who undertakes, gratuitously or for consideration, to render services to another which he should recognize as necessary for the protection of the other's person or things, is subject to liability to the other for physical harm resulting from his failure to exercise reasonable care to perform his undertaking, if

(a) his failure to exercise such care increases the risk of such harm³⁶⁸

At first glance, section 323(a) may appear to support the first approach.³⁶⁹ The appearance is deceiving. As several courts recently have

361. See *id.* at 619, 664 P.2d at 479 (damages limited to those "caused directly by the premature death").

362. 799 F.2d 911 (4th Cir. 1986).

363. See *id.* at 917-19, 922-23.

364. See *Waffen v. United States*, 799 F.2d 911, 917-19, 922-23 (4th Cir. 1986) (Md. law), *qualified in* *Weimer v. Hetrick*, 309 Md. 536, 552-54 & n.7, 525 A.2d 643, 651-53 & n.7 (1987) (mere proof of increased risk insufficient to establish causation of death; leaves open possibility of action for loss of chance in appropriate case); *DeBurkate v. Louvar*, 393 N.W.2d 131, 135-38 (Iowa 1986); *Herskovits v. Group Health Coop.*, 99 Wash. 2d 609, 619, 664 P.2d 474, 479 (1983) (plurality concurring opinion), *discussed supra* text accompanying notes 357-61. *But cf.* *McKellips v. Saint Francis Hosp.*, 741 P.2d 467, 472-77 (Okla. 1987) (allowing finding of causation of manifested injury based on mere increased risk, yet limiting damages to lost chance to avoid distorting traditional principles of causation). For other cases adopting the second approach, but less explicit on the choice between the two approaches, see *O'Brien v. Stover*, 443 F.2d 1013, 1018-19 (8th Cir. 1971) (Iowa law); *Mays v. United States*, 608 F. Supp. 1476, 1480-83 (D. Colo. 1985) (Colo. law); *James v. United States*, 483 F. Supp. 581, 586-87 (N.D. Cal. 1980) (Cal. law); *Glicklich v. Spievack*, 16 Mass. App. Ct. 483, 492-95, 452 N.E.2d 287, 290-92, *reh'g denied*, 390 Mass. App. Ct. 1103, 454 N.E.2d 1276 (1983); *Aasheim v. Humberger*, 695 P.2d 824, 827-28 (Mont. 1985); *Morrison v. Stallworth*, 73 N.C. App. 196, 203-05, 326 S.E.2d 387, 393-94 (1985).

365. See 481 Pa. at 268-73, 392 A.2d at 1286-89.

366. See *Jones v. Montefiore Hosp.*, 494 Pa. 410, 416-20 & n.8, 431 A.2d 920, 923-25 & n.8 (1981); *Gradel v. Inouye*, 491 Pa. 534, 541-43, 421 A.2d 674, 677-79 (1980).

367. See *Hamil*, 481 Pa. at 268-69, 392 A.2d at 1286.

368. RESTATEMENT (SECOND) OF TORTS § 323(a) (1965).

369. See *Gardner v. National Bulk Carriers*, 310 F.2d 284, 287 (4th Cir. 1962), *cert. denied*, 372 U.S. 913 (1963); see also *Hicks*, 368 F.2d at 632-33 (relying on *Gardner*); *Waffen*, 799 F.2d at 918-19 (limiting *Gardner*).

pointed out,³⁷⁰ section 323 was not drafted to deal with causation issues. Rather, it elaborates the scope of the *duty* that attaches to those who undertake to help others who are in an endangered position. The section merely states that those who undertake, even gratuitously, to help an endangered person have a duty to exercise reasonable care and that, if they fail to do so and thereby increase the risk to which the endangered person is exposed, they will be liable for physical harm *resulting* from the failure to exercise reasonable care. The section does not define “resulting” or indicate any intention to depart from the ordinary requirements for proving causation, which are covered in sections 431 and 433B.³⁷¹ Therefore, the *Hamil* court’s reliance on section 323(a) is unjustified.

A substantial majority of courts have rejected the first approach on the clearly correct ground that mere proof of increased risk is not sufficient to establish causation of the manifested injury.³⁷² Those that have explicitly considered the second approach have adopted it instead.³⁷³ The others, often for procedural reasons, have not explicitly considered the second approach.³⁷⁴

Conversely, at least one court that follows the first approach candidly admits that the approach makes the supposed judgment on causation of the manifested injury “somewhat speculative” and that juries “often discount damages according to the statistical evidence in order to accurately evaluate the true loss.”³⁷⁵ Other courts that follow the first approach explicitly restrict the damages to those attributable to the increased risk.³⁷⁶ In short, for most courts the first approach is a covert method for allowing juries to award damages for the risk exposure, rather than for the manifested injury. Very few cases have resulted in damage awards that appear to be sufficiently large to encompass the manifested injury itself.³⁷⁷

370. See *Curry v. Summer*, 136 Ill. App. 3d 468, 477, 483 N.E.2d 711, 717-18 (1985); *Sherer v. James*, 290 S.C. 404, 407-08, 351 S.E.2d 148, 150-51 (1986).

371. RESTATEMENT (SECOND) OF TORTS §§ 431, 433B (1965).

372. See *Morgenroth v. Pacific Medical Center*, 54 Cal. App. 3d 521, 532-33, 126 Cal. Rptr. 681, 688-89 (1976); *Gooding v. University Hosp. Bldg.*, 445 So. 2d 1015, 1018-21 (Fla. 1984); *Curry v. Summer*, 136 Ill. App. 3d 468, 476-78, 483 N.E.2d 711, 717-19 (1985); *Walden v. Jones*, 439 S.W.2d 571, 576 (Ky. Ct. App. 1968); *Cornfeldt v. Tongen*, 295 N.W.2d 638, 640-41 (Minn. 1980); *Clayton v. Thompson*, 475 So. 2d 439, 444-45 (Miss. 1985); *Pillsbury-Flood v. Portsmouth Hosp.*, 128 N.H. 299, 304-05, 512 A.2d 1126, 1129-30 (1986); *Cooper v. Sisters of Charity of Cincinnati, Inc.*, 27 Ohio St. 2d 242, 250-53, 272 N.E.2d 97, 102-04 (1971); *Sherer v. James*, 290 S.C. 404, 406-08, 351 S.E.2d 148, 149-51 (1986); see also *Rewis v. United States*, 503 F.2d 1202, 1204-05, 1210-11 (5th Cir. 1974) (N.M. law); cases cited *supra* note 364.

373. See cases cited *supra* note 364.

374. See, e.g., *Curry v. Summer*, 136 Ill. App. 3d 468, 480, 483 N.E.2d 711, 719 (1985) (cannot introduce new theory of recovery at trial); *Cooper v. Hartman*, 311 Md. 259, 264-70, 533 A.2d 1294, 1296-1300 (insufficient evidence to support loss of chance theory). The *Cooper* court, which describes the first approach as a new tort and the second approach as merely a different way of calculating damages for a traditional tort, erroneously cites *Waffen* as adopting the first approach. *Id.* at 265-66 & n.4, 533 A.2d at 1297 & n.4.

375. *Thompson v. Sun City Community Hosp.*, 141 Ariz. 597, 607-08, 688 P.2d 605, 615-16 (1984).

376. *Sharp v. Kaiser Found. Health Plan*, 710 P.2d 1153, 1156 (Colo. Ct. App. 1985), *affirmed on other grounds*, 741 P.2d 714, 718 & n.5, 720 (Colo. 1987); *McKellips v. Saint Francis Hosp.*, 741 P.2d 467, 475-77 (Okla. 1987); see *supra* text accompanying note 361.

377. For a rare example, see *Northern Trust Co. v. Weiss Memorial Hosp.*, 143 Ill. App. 3d

It seems clear that the underlying concern of the courts that follow the first approach is the defendant's nonliability for having tortiously deprived the victim of a significant chance of avoiding the manifested injury. It is not so clear why these courts are unwilling to directly address the policy issue of whether the loss of the chance should be treated as a compensable injury in these types of cases. Instead, these courts indirectly and covertly permit recovery for the loss of the chance by an approach that (1) confuses and undermines the causation requirement, (2) permits, and sometimes may result in, liability for the manifested injury itself, despite the lack of proof of causation of the manifested injury, and (3) thereby undermines respect for the law as a coherent and principled system among jurors, litigants, lawyers, and even the judges themselves.

The issues have been cogently analyzed in a recent decision by the Supreme Court of Iowa.³⁷⁸ The court refused to adopt the first approach and instead adopted the second, even though there was evidence that the defendant's negligence had almost completely eliminated an *ex ante* chance of avoiding the manifested injury that was estimated at more than fifty percent and as high as eighty percent.³⁷⁹ As discussed above, even high probabilities—especially if they are mere *ex ante* probabilities—are not *per se* sufficient to establish causation of the manifested injury.³⁸⁰

There have been proposals to allow recovery for risk exposure in the absence of any manifested injury.³⁸¹ Such liability would also be possible under the corrective-justice approach—compare the longstanding action for assault. Again, the question of whether to allow such recovery is a policy issue dealing with the recognition of a new type of injury; it should not be mishandled as an issue concerning causation or the standard of proof.³⁸² If such a free-floating risk-exposure injury were recognized, the valuation of the injury would be calculated based on the *ex ante* expected injury, rather than being based on a proportionate amount of the manifested injury as in the cases that allow recovery for risk exposure that possibly led to manifested injury.

479, 482, 493 N.E.2d 6, 8 (1986) (\$1.5 million).

378. See *DeBurkarte v. Louvar*, 393 N.W.2d 131 (Iowa 1986).

379. See *id.* at 137-38.

380. See *supra* text accompanying notes 267, 274-82, 336-39.

381. E.g., *DePass v. United States*, 721 F.2d 203, 206 (Posner, J., dissenting); Landes & Posner, *supra* note 346, at 425-26, 428-34; Robinson, *supra* note 231; Note, *Increased Risk of Cancer as an Actionable Injury*, 18 GA. L. REV. 563 (1984); Note, *Increased Risk of Disease from Hazardous Waste: A Proposal for Judicial Relief*, 60 WASH. L. REV. 635 (1985). But see Dworkin, *Fear of Disease and Delayed Manifestation of Injuries: A Solution or a Pandora's Box?*, 53 FORDHAM L. REV. 527 (1984); Wittman, *Prior Regulation versus Post Liability: The Choice Between Input and Output Monitoring*, 6 J. LEGAL STUD. 193 (1977). The proposals to allow *ex ante* recovery for risk exposure *per se*, in the absence of any manifested injury, should not be confused with cases allowing recovery for actual damages caused by risk exposure, such as medical monitoring costs or serious emotional distress. See, e.g., *Ayers v. Township of Jackson*, 106 N.J. 557, 576-607, 525 A.2d 287, 296-313 (1987).

382. See Nesson, *supra* note 284, at 1384-85; Wright, *supra* note 2, at 1761-63, 1766, 1814-21.

B. Causation in the Multiple-Exposure and Alternative-Causation Cases

As I have discussed elsewhere, similar considerations apply in the multiple-exposure and alternative-causation cases.³⁸³ In some cases, such as the asbestos and cigarette-smoking cases, the risks created by different sources may be cumulative or synergistic. If the risks are cumulative or synergistic, joint and several liability for the total risk that led to the manifested injury is appropriate under the corrective-justice view.³⁸⁴ In other cases, such as the DES cases, the risks created by different sources are independent and alternative. In these cases, the courts generally recognize that it is inappropriate to hold any defendant liable for the total risk that led to the manifested injury.³⁸⁵ Instead, some courts allow recovery for the separate risks that possibly led to the manifested injury, by imposing several (separate) liability for a proportionate share of the manifested injury, based on each defendant's contribution to the total risk that led to the injury.³⁸⁶

However, the courts have not fully understood the implications of the risk-exposure-as-injury approach. They sometimes incorrectly hold the joined defendants liable for the risks attributable to unjoined defendants.³⁸⁷ This, in part, explains the charges by some judges and commentators that liability in these cases is improper because it departs from the principles of corrective justice—in particular the causation requirement.³⁸⁸ Yet, if each defendant is held liable only for her share of the risk exposure, there is no conflict with the corrective-justice view. It still must be proven that each defendant caused the risk exposure that possibly led to the manifested injury, and liability is for such risk exposure, rather than the manifested injury. If the defendant can establish that she did not contribute to the manifested injury—that is, that the risk that she created could not have led to the manifested injury—the courts absolve her from any liability.³⁸⁹

383. Wright, *supra* note 2, at 1814, 1816-21, 1825.

384. See *Borel v. Fibreboard Paper Prod. Corp.*, 493 F.2d 1076, 1094-96 (5th Cir. 1973), *cert. denied*, 419 U.S. 869 (1974); *McAllister v. Workmen's Compensation Appeals Bd.*, 69 Cal. 2d 408, 413-15, 418-19, 445 P.2d 313, 315-16, 318-19, 71 Cal. Rptr. 697, 699-700, 702-03 (1968); *M'Ghee v. National Coal Bd.*, 1973 Sess. Cas. 37 (H.L. 1972); *Clarkson v. Modern Foundries*, [1957] 1 W.L.R. 1210 (Leeds Assizes); Wright, *supra* note 85, at 1194-1211 & n.221. In a prior article, I stated this point less carefully. See Wright, *supra* note 2, at 1814.

385. See sources cited *infra* notes 386, 388.

386. See, e.g., *Sindell v. Abbott Labs.*, 26 Cal. 3d 588, 610-13, 607 P.2d 924, 936-38, 163 Cal. Rptr. 132, 144-46, *cert. denied*, 449 U.S. 912 (1980); *Martin v. Abbott Labs.*, 102 Wash. 2d 581, 604-07, 689 P.2d 368, 382-83 (1984); *Collins v. Eli Lilly Co.*, 116 Wis. 2d 166, 191-95, 197-200, 342 N.W.2d 37, 49-51, 52-53, *cert. denied*, 469 U.S. 826 (1984); *supra* note 273.

387. See *Sindell*, 26 Cal. 3d at 612-13, 617, 607 P.2d at 937, 940, 163 Cal. Rptr. at 145, 148; *Martin*, 102 Wash. 2d at 604-06, 689 P.2d at 382-83; *Collins*, 116 Wis. 2d at 193-200, 342 N.W.2d at 50-53. For further discussion of these cases, see Wright, *supra* note 2, at 1818-21.

388. See, e.g., *Sindell*, 26 Cal. 3d at 617, 607 P.2d at 940, 163 Cal. Rptr. at 148 (Richardson, J., dissenting); *Namm v. Charles E. Frosst & Co.*, 178 N.J. Super. 19, 33-34, 427 A.2d 1121, 1128 (1981); H.L.A. HART & T. HONORE, *supra* note 13, at 102, 424; Schwartz & Mahshigian, *Failure to Identify the Defendant in Tort Law: Towards a Legislative Solution*, 73 CALIF. L. REV. 941, 941-42, 957-65 (1985). See generally Bush, *supra* note 332, at 1507-18 (claiming that liability for risk exposure is an abandonment of the principle of individual responsibility).

389. See *Sindell*, 26 Cal. 3d at 612, 607 P.2d at 937, 163 Cal. Rptr. at 145; *Martin*, 102 Wash. 2d at 605, 689 P.2d at 382; *Collins*, 116 Wis. 2d at 197-98, 342 N.W.2d at 52.

The DES cases, although relied upon by the mathematical probabilists and the legal economists as support for their probabilistic views of causation, do not actually fit with either view. It seems fairly clear in these cases, contrary to the assumptions of the mathematical probabilists and the legal economists,³⁹⁰ that the courts will not hold a defendant liable for the full amount of the manifested injury, rather than a proportionate amount based on the risk exposure that possibly led to the manifested injury, even if the defendant created more than half of the risk.³⁹¹ The mathematical probabilists have to depart from their usual emphasis on minimization of errors and instead evince a concern over a systematic "bias" in the distribution of errors between plaintiffs and defendants to account for the proportional liability in these cases.³⁹² Similarly, the legal economists rely on the systematic effects in these cases to justify a shift from the usual all-or-nothing liability to proportional liability.³⁹³ Yet, as in the more routine cases, they are unable to specify a unique efficient rule in a hypothetical static semi-ideal world of perfect information and risk-neutrality, or to specify any rule that will produce efficient levels of activity and care in the dynamic real world of imperfect information and risk aversion.³⁹⁴

One final group of cases needs to be discussed. These are the single-incident alternative-causation cases, in which the plaintiff cannot establish which of two or more tortious actors caused the manifested injury. Many mass-exposure cases, such as the DES cases, are simply extrapolations of these single-incident cases. In the standard example, two hunters negligently fire their guns in the direction of the plaintiff, the plaintiff is injured by a single pellet, and it is impossible to determine which gun fired the pellet that caused the injury. Some courts have allowed the plaintiff, if

390. See Fraser & Howarth, *supra* note 58, at 144; Kaye, *Limits*, *supra* note 236, at 508, 514; Robinson, *supra* note 58, at 732-33; Shavell, *supra* note 266, at 588.

391. Eli Lilly & Co. may well have contributed to more than half of the risk exposure in many of the DES cases. See Levine, *Gilding the Lilly*, TRIAL, Dec. 1984, at 18, 19-20. In this light, it is interesting to note how carefully the *Sindell* court phrased its statements on causation of the manifested injury. The court observed that an inference of causation based on probability would fail "if we measure the chance that any one of the defendants supplied the injury-causing drug by the number of possible tortfeasors." *Sindell v. Abbott Labs.*, 26 Cal. 3d 588, 603, 607 P.2d 924, 931, 163 Cal. Rptr. 132, 139 (1980) (emphasis added); *see id.* at 611-12, 607 P.2d at 936-37, 163 Cal. Rptr. at 144-45.

392. See, e.g., Kaye, *Limits*, *supra* note 236, at 502, 508-09, 514-15. Daniel Farber would adhere to the error-minimization goal, while avoiding under- or over-deterrence of defendants, by providing full compensation for the manifested injury to the "most likely victims" (those with the highest levels of risk exposure), while denying any compensation to those who also suffered the manifested injury but were exposed to (perhaps only marginally) lower levels of risk. Farber, *Toxic Causation*, 71 MINN. L. REV. 1219, 1220-21, 1243-51 (1987). This proposal sacrifices corrective justice for an abstract interest in error minimization. None of the victims can prove causation of the manifested injury, and hence none is entitled to compensation for the manifested injury. On the other hand, each can prove causation of risk exposure that possibly led to the manifested injury, and hence, with a possible exception for de minimus levels of risk, each has an equally meritorious claim for proportionate recovery for such risk exposure.

393. See, e.g., Landes & Posner, *supra* note 346, at 425-26; Landes & Posner, *supra* note 10, at 123-24 & n.33; Schwartz, *supra* note 16, at 644-45 & n.14; Shavell, *supra* note 266, at 588-89 & nn. 4, 5 & 9, 606-07 & n.29.

394. See Landes & Posner, *supra* note 346, at 425-31; Shavell, *supra* note 266; Wright, *supra* note 85, at 1194-1211.

he joins both hunters in the lawsuit, to hold them both jointly and severally liable for the manifested injury by shifting the burden of proof on causation to them, on the ground that it is better to have the loss fall on the negligent hunters than on the innocent plaintiff.³⁹⁵

This approach may not seem too troubling in situations in which there are only two tortious actors, each equally likely to have caused the injury, and both of them are before the court and will split the liability under the modern contribution rules. Yet the rationale quickly becomes troubling when the number of tortious actors increases, especially when not all of them are before the court or when some of them are insolvent. In these situations, one of the tortious actors may be liable for an amount that greatly exceeds her share of the total risk exposure, despite the lack of proof that she caused the manifested injury. Indeed, it is precisely when these sorts of cases arose—for example, the DES cases—that the courts abandoned joint liability for the manifested injury and turned to several, proportionate liability for the risk exposure that possibly led to the manifested injury.³⁹⁶

There should not be liability even under the risk-exposure approach when it has not been established that the defendant behaved tortiously. For example, if a defective product injures the plaintiff, naked statistics can be used to calculate the relative risk exposure that was tortiously created by the different manufacturers who marketed the defective product if, as in the DES cases, there is separate evidence establishing which manufacturers behaved tortiously by marketing a defective product. Yet, just as the naked statistics cannot be used to establish that any manufacturer actually caused the manifested injury, they also cannot be used to establish that any manufacturer behaved tortiously.³⁹⁷

A couple of cases seem to hold otherwise. In *Kramer v. Weedhopper of Utah, Inc.*,³⁹⁸ an Illinois intermediate appellate court held, over a vigorous dissent,³⁹⁹ that the plaintiff could avoid summary judgment although the only evidence implicating the defendant as the distributor of the defective bolt was that it supplied ninety percent of the bolts used by the company from which the plaintiff purchased his ultralight airplane kit.⁴⁰⁰ However, the court emphasized the stringent requirements for granting a summary judgment and implied that the plaintiff might have to introduce additional evidence at the trial.⁴⁰¹

Similarly, in *Kaminsky v. Hertz Corporation*,⁴⁰² the court also allowed the

395. *E.g.*, *Summers v. Tice*, 33 Cal. 2d 80, 86-88, 199 P.2d 1, 4-5 (1948).

396. *See* *Wright*, *supra* note 2, at 1816-18.

397. *See, e.g.*, *Guenther v. Armstrong Rubber Co.*, 406 F.2d 1315, 1318 (3d Cir. 1969); *Kamosky v. Owens-Illinois Glass Co.*, 89 F. Supp. 561, 562-63 (M.D. Pa.), *aff'd*, 185 F.2d 674 (3d Cir. 1950); *Sheffield v. Eli Lilly & Co.*, 144 Cal. App. 3d 583, 596-98, 192 Cal. Rptr. 870, 877-78 (1983); *Welch v. Coca-Cola Bottlers' Ass'n*, 380 S.W.2d 26, 28-30 (Tex. Civ. App. 1964).

398. 141 Ill. App. 3d 217, 490 N.E.2d 104 (1986).

399. *See id.* at 223, 490 N.E.2d at 108 (Stamos, J., dissenting). Justice Stamos has since been elevated to the Illinois Supreme Court.

400. *Kramer*, 141 Ill. App. 3d at 222, 490 N.E.2d at 107-08.

401. *See id.* at 220-22, 490 N.E.2d at 106-08.

402. 94 Mich. App. 356, 288 N.W.2d 426 (1979).

plaintiff to survive a motion for summary judgment, although the only evidence implicating the defendant as the owner of the truck that caused the injury was that it owned ninety percent of all trucks with the Hertz logo and colors.⁴⁰³ Yet the court was not willing to rely on a naked statistical evidence rationale. It instead argued that the defendant was responsible for all trucks with Hertz logos on the highway, whether or not the defendant owned the particular truck that caused the injury, unless the defendant proved that it did not own the truck:

In the interest of justice, we feel that any business organization which permits a commercial conveyance to operate on the public highways prominently proclaiming its name owes a duty to the public to stand by that voluntary, self-advertising proclamation. That responsibility, of course, is not absolute. The named firm may introduce evidence indicating lack of control or ownership.⁴⁰⁴

The logic of this argument is hard to ascertain. What is the supposed content of the "self-advertising proclamation"? The court explicitly states that "there was no reliance on the part of the plaintiffs."⁴⁰⁵ Why then must the defendant "stand by" its "self-advertising proclamation"? If the defendant must stand by its proclamation, why can it avoid liability by disproving ownership? Why does the defendant's provision of *more* identifying information than is usually provided by errant trucks, cabs, and cars broaden its duty to other users of the highway? Would the court prefer that Hertz trucks go on the highway unmarked, like most highway traffic, so that it would be harder for plaintiffs to identify the owners?

The court suggests that the burden of introducing evidence of ownership should shift to the defendant because the defendant allegedly has better access to information that might enable it to identify the truck that was at the fateful spot at the fateful time.⁴⁰⁶ This is unlikely. People who lease trucks do not file any route map or itinerary, much less one as detailed as would be required for such an identification. On the other hand, if this information does exist, it should be just as available to the plaintiff, through the discovery process, as it is to the defendant. If there is reason to believe that the defendant is withholding information or was unreasonably operating in such a way as to make identification difficult, that could provide a justification for reversing the burden of proof.⁴⁰⁷ But neither of these considerations seems applicable in either of these two cases.

The risk-exposure cases have tested the boundaries of tort liability, and hence understandably have generated varied judicial responses and

403. *Id.* at 358, 288 N.W.2d at 427.

404. *Id.* at 359, 288 N.W.2d at 427.

405. *Id.* at 358, 288 N.W.2d at 427.

406. *Id.* at 360-63, 288 N.W.2d at 428-29.

407. *See, e.g., In re "Agent Orange" Prod. Liab. Litig.*, 597 F. Supp. 740, 828-29 (E.D.N.Y. 1984); *Ybarra v. Spangard*, 25 Cal. 2d 486, 490, 494, 154 P.2d 687, 689, 691 (1944), *discussed in Wright, supra* note 2, at 1821; *cf. Sawyer v. United States*, 148 F. Supp. 877, 880 (M.D. Ga. 1956) (noting, in case rejecting implicit naked statistical evidence on identity, that defendant was not purposely withholding evidence and had made a diligent effort to identify the negligently operated plane).

considerable academic debate. Yet, with rare exceptions, the results in the cases are consistent with the traditional corrective-justice view. Increasingly, as the courts pay greater attention to the content of and distinctions among the relevant concepts, the reasoning behind the results also reflects the corrective-justice view.

VII. CONCLUSION

As I stated at the beginning of this Article, most of the current confusion in tort and evidence scholarship results from a failure to pay sufficient attention to the distinctions and relationships among a fairly small number of fundamental concepts—primarily causation, responsibility, and the various types of probabilities. The currently fashionable legal academic camps—the Critics, libertarians, legal economists, and mathematical probabilists—seek to expand and use this confusion to undermine the traditional corrective-justice view of tort law. They are the modern tenders of the bramble bush.

In this Article, I pruned the bramble bush. I emphasized the fundamental distinction between causation and responsibility that is clouded by superficial semantic analysis. I elaborated and defended the NESS test of causation that underlies judges' and jurors' intuitive causal judgments. I criticized the notion of "probabilistic causation," which has been offered by the legal economists, the mathematical probabilists, the Critics, and some of the libertarians as an alternative to the true concept of causation. I described the causal basis of proof and defended, in the light of that causal basis, the courts' distinction between probative particularistic evidence and *ex post* causal probabilities and nonprobative naked statistics and *ex ante* causal probabilities. Finally, I used the conceptual distinctions elaborated in the previous parts to clarify the proper approach in the risk-exposure cases, and I demonstrated that the results and, increasingly, the reasoning in these cases are consistent with the corrective-justice view.

After its pruning, the bramble bush does not seem nearly as chaotic as when we first encountered it. Its strong limbs can now be seen through the remaining brambles. Llewellyn himself, the original master of the bramble bush, no doubt would be pleased with this discovery. Like many others who lived through World War II and its antecedents, Llewellyn retreated from his former skepticism on rights and principles. In the 1951 edition of *The Bramble Bush*, he emphasized the necessity of recapturing the "Grand Tradition" of the common law: the elaboration and revision of concepts and rules through consciously principled decisionmaking informed by the ideal of justice.⁴⁰⁸

408. See K. LLEWELLYN, *supra* note 4, at 8-10, 157-59. See generally K. LLEWELLYN, *THE COMMON LAW TRADITION* (1960).

