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Author

Grady, Mark F.

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UNAVOIDABLE ACCIDENT

Mark F. Grady*

Abstract:

In negligence law, “unavoidable accident” is the risk that remains when an actor has used due care. The counterpart of unavoidable accident is “negligent harm.” Negligence law makes parties immune for unavoidable accident even when they have used less than due care. Courts have developed a number of methods by which they “sort” accidents to unavoidable accident or to negligent harm, holding parties liable only for the latter. These sorting techniques are interesting in their own right and also provide a way of conceptualizing the relationship between specific negligence and *res ipsa loquitur*, which are two variants of the negligence rule. One judicial sorting technique reveals a paradox of negligence law. New safety technology often reduces the amount of unavoidable accident and simultaneously increases the expected number of “compliance errors,” or routine negligent lapses, that actors will make. Paradoxically, an actor’s use of new safety technology can make it more likely that a court will sort an accident to negligent harm as opposed to unavoidable accident. The article develops these theoretical ideas through a series of graphical illustrations analogous to those of traditional price theory.

* Professor of Law and Director of the Center for Law and Economics, UCLA School of Law. I would like to thank for their assistance Andrea Schrack, Stephanie Plotin, and an anonymous reviewer.

UNAVOIDABLE ACCIDENT

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UNAVOIDABLE ACCIDENT

INTRODUCTION

“Unavoidable accident” is a central concept of negligence law, yet many economic theorists minimize it or even deny its importance.¹ The purpose of this article is to explain how a careful consideration of unavoidable accident leads to a better understanding of both the legal doctrine and the economics of the negligence rule.

This article also seeks to develop a new type of positive economic theory that gives a detailed account of negligence doctrine. Negligence law represents our most pervasive system of safety regulation. I hope that the central contribution of this article will be a set of geometrical tools that simultaneously yield interesting theoretical puzzles related to negligence doctrine and provide the means for solving some of them.

The article is organized as follows. The next section explains a new—or at least uncommon—conception of the positive economic theory of tort, one oriented around doctrinal puzzles. Other positive economic theories about nonlaw subjects (e.g., market behavior) take this form, and there is no reason to believe that the positive economic theory of law should be different. I then examine the legal concept of “unavoidable accident” and how courts implement it when they decide specific negligence and *res ipsa loquitur* cases. As will be argued, courts “sort” accidents between two different zones: negligent harm and unavoidable accident. When we focus on how courts sort accidents between the zones in different cases, we get fresh insight into the similarities and differences

¹ See, e.g., William M. Landes and Richard A. Posner, *Causation in Tort Law: An Economic Approach*, 12 J. Legal Stud. 109 (1983) [hereinafter Landes and Posner, *Causation*] (arguing that “causation can very largely be dispensed with in an economic analysis of torts”); Richard W. Wright, *Actual Causation vs. Probabilistic Linkage: The Bane of Economic Analysis*, 14 J. Legal Stud. 435 (1985) (criticizing economic theories of law fail because of their omission of actual causation issues) [hereinafter Wright, *Actual Causation*]; Robert Cooter, *Torts as the Union of Liberty and Efficiency: An Essay on Causation*, 63 Chi.-Kent L. Rev. 523, 551 (1987) (suggesting that legal cause issues have more to do with philosophy than with the economic analysis of law). But see Thomas J. Miceli, *Cause In Fact, Proximate Cause, and the Hand Rule: Extending Grady’s Positive Economic Theory of Negligence*, 16 Int’l Rev. Law & Econ. 473 (1996) (providing limited theory of causation, but arguing that “virtually from its inception, the economic theory of tort law has maintained that causation is not an important factor in assigning liability for accidental damages”); Giuseppe Dari-Mattiacci, *Errors and the Functioning of Tort Liability*, 13 Sup. Ct. Econ. Rev. 165 (2005) (incorporating cause-in-fact limitation in negligence model); Gerrit De Geest and Giuseppe Dari-Mattiacci, *Soft Regulators, Tough Judges*, 15 Sup. Ct. Econ. Rev. 119, 129-30 (2007) (also incorporating cause-in-fact limitation in negligence model).

between specific negligence and *res ipsa*. This lens in turn allow us better to see a paradoxical aspect of the negligence rule, namely, that negligent accidents usually become *more* common, not less, when safety technology becomes better. Finally, the article examines situations in which courts use the concept of unavoidable accident to decide marginal cases, such as those involving lost chances and alternative causes.

1. POSITIVE THEORY AS THE SOLUTION OF DOCTRINAL PUZZLES

The usual kind of positive economic theory of the law is now a mathematical demonstration that a rule or doctrine is “efficient,” in the sense that it maximizes either social wealth or social utility. These studies, useful though they have been, have perhaps departed from the most traditional methods. Milton Friedman (1966: 7) argued that the basic mission of positive economics is to develop a hypothesis that “yields valid and meaning (i.e., not truistic) predictions about phenomena not yet observed.” Friedman (1966: 10-11) stressed that positive economists would usually test their theories using natural experiments, that is, would usually examine whether their hypotheses explained or failed to explain real-world data. Certainly the most common type of positive economic theory *of the law* fails to meet Friedman’s ideal because the theorist is almost never, if ever, seeking to *predict* a legal doctrine about which the theorist knows nothing.² Instead, the economic theorist of the law has already learned about the legal doctrine and then develops a model that shows whether the doctrine is “efficient” or not.

Outside of law and economics, a more common method is for an economic theorist to notice some anomaly or “puzzle” in the real world—a puzzle that current economic theory either fails to explain or else makes a false or questionable prediction. I submit that this latter conception of positive theory is in many ways more orthodox than Friedman’s theory of how positive economic theory actually progresses.³ In connection with how positive economic *theory* progresses, consider the following two examples.

In *The Wealth of Nations* Adam Smith reported, but did not solve, the famous diamond-water paradox.⁴ Water is apparently more valuable than diamonds, and

² When the positive economic theory of law becomes more advanced, I think we may see this methodology more frequently used. The analyst might predict that a body of law about which he knows nothing will contain, say, a doctrine of contributory negligence or something similar.

³ There is the possibility that Friedman was thinking of applied law and economics, which seems to be a different kettle of fish.

⁴ In his *Wealth of Nations* analysis of value, Smith wrote:

yet diamonds sell for a far greater price than water. The puzzle prompted the Austrian economists' development of marginal utility theory⁵ and ultimately the combination of marginal utility curves with supply curves, which is the solution to the paradox.⁶ Even though the total (social or individual) utility from water must be greater than the total utility from diamonds (we need water to live!), it is easily possible that the marginal utility of diamonds at the limited supply available will be higher than the corresponding marginal utility of water at its own level of supply. This provocative puzzle thus led to the most basic economic theory—the intersection of supply and demand as the determinant of price.

Giffen's paradox was a similarly productive puzzle. Alfred Marshall reported the paradox in the 1895 edition of his *Principles of Economics*.⁷ Robert Giffen had argued that when the price of bread rose, the poor people of England would actually buy more of it because the higher bread prices further impoverished them so that they could no longer afford to buy other food that they had used to vary their diets. Although many economists came to dispute the validity of Giffen's empirical assertion about bread in London (Jensen and Miller), "Giffen's paradox" led to another basic reconstruction of demand theory.

The things which have the greatest value in use have frequently little or no value in exchange; and on the contrary, those which have the greatest value in exchange have frequently little or no value in use. Nothing is more useful than water: but it will purchase scarce anything; scarce anything can be handed in exchange for it. A diamond, on the contrary, has scarce any value in use; but a very great quantity of other goods may frequently be had in exchange of it.

ADAM SMITH, THE WEALTH OF NATIONS (BK. I, CH. IV) 32-33 (U. Chicago Press 1976) (1776). At the time Smith wrote, the paradox itself had a long history, dating back to classical Greece, as Smith knew. See Marian Bowley, *Some Seventeenth Contributions to the Theory of Value*, 30 *Economica* (N.S.) 122, 122-23 (1963); H.M. Robertson and W.L. Taylor, *Adam Smith's Approach to the Theory of Value*, 67 *Econ. J.* 181, 185-86 (1957); S. Kaushil, *The Case of Adam Smith's Value Analysis*, 25 *Oxford Econ. Papers* (N.S.) 60, 61 (1973).

⁵ The two main contributors were Carl Menger and Menger's student, Eugen von Böhm-Bawerk. See George J. Stigler, *The Economics of Carl Menger*, 45 *J. Pol. Econ.* 229 (1937); Emil Kauder, *Genesis of Marginal Utility Theory: From Aristotle to the Beginning of the Eighteenth Century*, 63 *Econ. J.* 638 (1953) (arguing that Aristotle formulated the marginal utility concept long before the Austrian economists but that somehow his formulation was neglected by Smith and others); Emil Kauder, *The Retarded Acceptance of the Marginal Utility Theory*, 67 *Q.J. Econ.* 564 (1953) (similar argument).

⁶ An early geometrical analysis of how an inelastic supply schedule combined with a marginal utility schedule produces exchange value is contained in R.S. Padan, *Marginal Utility and Exchange Value*, 13 *J. Pol. Econ.* 389, 392 (1905).

⁷ See generally Robert T. Jensen and Nolan H. Miller, *Giffen Behavior: Theory and Evidence*, NBER Working Paper No. 13243 (July 2007) <http://www.nber.org/papers/w13243>.

A price increase yields two separate results: a substitution effect (which leads consumption away from the now more expensive commodity) and an income effect (which can lead consumption in either direction).⁸ In an extreme case of the type Giffen and Marshall described, the income effect can overwhelm the substitution effect, thereby producing a positively sloped demand curve in which higher prices for a commodity actually yield higher quantities demanded. Significantly, however, the Giffen paradox was valuable not so much because its solution allowed economists to analyze Giffen goods, of which there seem to be precious few, but because understanding the Giffen paradox allowed a more detailed and confident analysis of the demand for other types of goods.

Karl Popper once said that the philosopher who has merely posed a puzzle or riddle has often made a greater contribution than the one who has ultimately solved it.⁹ Similarly, as these two examples suggest, economics has often made its greatest advances by solving puzzles. The same has *not* been true of the positive economic theory of law. Perhaps the reason for the difference is its current commitment to formal mathematics. Although the day may come when formal mathematical models will solve basic puzzles about the law—and I believe it will—many of today’s outstanding puzzles about legal doctrine seem too difficult for mathematics to solve, at least before we develop *less* formal understandings of these puzzles. Indeed, the impulse to higher math has perhaps led some economists sweep puzzles under the carpet rather than confront them at all. A good example is the familiar assertion that, from an economic point of view, contributory negligence is unnecessary.¹⁰ If a supposedly positive theory

⁸ See JOHN R. HICKS, VALUE AND CAPITAL 26-37 (2d ed. 1946) (decomposing effect of price change into income effect and substitution effect and clarifying analysis with example of hypothetical Giffen good).

⁹ KARL R. POPPER, CONJECTURES AND REFUTATIONS: THE GROWTH OF SCIENTIFIC KNOWLEDGE 184 (2d ed. 1965).

¹⁰ John Brown has written, “The [same] results [that is, the social optimum is a unique noncooperative solution] if the liability rule is changed from the negligence rule with contributory negligence to the negligence rule.” John Prather Brown, *Toward an Economic Theory of Liability*, 2 J. Legal Stud. 341 (1973) [hereinafter Brown, *Economic Theory of Liability*]. Landes and Posner have asserted, “A more subtle point is that negligence does not require a defense of contributory negligence to induce victims to take due care.” WILLIAM M. LANDES and RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF TORT LAW 75 (1987) [hereinafter LANDES and POSNER, ECONOMIC STRUCTURE OF TORT LAW]. Steven Shavell has written, “Notice that the defense of contributory negligence is a superfluous addition to the negligence rule with respect to the objective of inducing victims to act optimally, for it was seen that victims take optimal care when the negligence rule is unaccompanied by the defense.” STEVEN SHAVELL, ECONOMIC ANALYSIS OF ACCIDENT LAW 15 (1987). But see Mark F. Grady, *Common Law Control of*

makes a basic negligence doctrine a “superfluous addition,” doesn’t it call the theory’s falsifiability, and therefore validity, into question? Leading economists have likewise asserted that the actual causation doctrine is superfluous.¹¹

Economic theory has great potential for helping us understand legal doctrine, and not only its economic effects but also its detailed rules and apparent puzzles. The common law is best seen as a grown order similar to markets and natural languages and has evolved over similarly long periods of time.¹² If it is reasonable to look to positive economic theory as a way of clarifying and solving the puzzles of market behavior, it seems equally reasonable that the positive economic theory of tort should do the same for accident law. A major benefit of any good positive theory—about anything—is to focus our attention on aspects of the subject that we might otherwise have missed. In the case of the positive economic theory of tort, the subject matter is not market behavior or even the economic effects of legal rules, but the legal rules themselves.

Instead of adopting the approach I have just outlined, many theories of accident law seem concerned with answering whether accident law, or an idealized version of it, will induce multiple players of a hypothetical game each to select an “efficient”—that is, nonnegligent—amount of precaution. As obvious a social goal as zero negligence may seem to be, it is not at all clear that individuals would maximize their own wealth, or social wealth, by trying to achieve it; moreover, it is far from clear that courts either expect or intend that individuals bound by the negligence rule should always be nonnegligent,¹³ a point that will be developed below. It is in any event common to observe apparently rational actors, such as doctors, engaged in negligent behavior—so common that agency problems and moral hazard cannot be the whole explanation.

Let’s think about positive economic methods in a slightly different way. When it comes to accident law, the almost universal approach of economists and

Strategic Behavior: Railroad Sparks and the Farmer, 17 J. Legal Stud. 15-42 (1988) (arguing that the contributory negligence doctrine can induce “corrective precaution” for others’ prior lapses while at the same time controlling strategic behavior); Mark F. Grady, *Multiple Tortfeasors and the Economy of Prevention*, 19 J. Legal Stud. 653 (1990) (same ideas extended).

¹¹ See Landes and Posner, *Causation* (1983) (arguing that “causation can very largely be dispensed with in an economic analysis of torts”).

¹² See Mark F. Grady, *Positive Theories and Grown-Order Conceptions of the Law*, 23 Sw. U. L. Rev. 461 (1994) and sources cited therein.

¹³ See Mark F. Grady, *Res Ipsa Loquitur and Compliance Error*, 142 U. Pa. L. Rev. 887, 894-906 (1994) [hereinafter Grady, *Res Ipsa and Compliance Error*]; Mark F. Grady, *Efficient Negligence*, 87 Geo. L.J. 397 (1998).

legal economists is to idealize the legal rules as a fundamental part of the analysis. Yet these same economists would rarely think of idealizing price data that their other economic theories seek to explain. Although it is sometimes legitimate to think of idealized legal rules—in fact, we can hardly escape it—aren't the legal rules more like data than theory? Clearly, theory must be abstract, but a better theory should usually explain more factual details than a worse theory, and with the positive economic theory of accident law the “facts” seem to be mostly legal rules.

Finally, as useful as game theory has been, it is unclear that game theory itself either can yield the truly basic economic concepts upon which game-theoretic solutions now depend—concepts such as supply, demand, monopoly, marginal cost, and the like. Accident law and its related economic concepts have never been clarified through the process of thesis and correction that has typified the development of economic theory more generally—mainly before game theory's advent. Too often, game-theoretic approaches to legal doctrine seem to focus our attention on exotic fringe issues and give us the sense that something important is missing. Nevertheless, given all of the important advances and insights that game theory has provided us, it would be quixotic, and worse, to question its legitimacy. We should never forget, however, that in areas beyond accident law, for instance, industrial organization economics, an earlier theoretical period critically empowered many of the leading game-theoretic solutions.

The following paragraphs will argue that negligence problems can be reduced to a set of analytics analogous to supply and demand. We can in fact analyze an airplane crash using techniques similar to those we use for analyzing commodity or factor prices. Nevertheless, just as a blackboard demonstration cannot tell us what the ruling prices of commodities will be, a similar analysis of an airplane crash cannot tell us whether the actual cause was the pilot's negligence or something else. Nevertheless, when we see how the geometry works, it provides fresh insight into the various factors that determine the legal question in which we are ultimately interested, which is usually how to understand a court's determination of liability or no liability. The geometry can also provide fresh insight into nonlegal—at least nondoctrinal—questions, such as how much negligent behavior will predictably flow from different kinds of activities. Moreover, the geometry is far more accessible to noneconomists than many other economic methods.

The approach I'm about to describe uses some of the concepts of my prior work,¹⁴ but extends them another step by developing a general set of geometrical

¹⁴ See, e.g., Mark F. Grady, *A New Positive Economic Theory of Negligence*, 92 Yale L.J. 799 (1983) [hereinafter Grady, *New Positive Theory*]; Mark F. Grady, *Why Are People Negligent?*:

analytics. In addition, I now claim that unavoidable accident *is* the unifying concept of negligence doctrine. It is the provocative puzzle that leads to a new understanding of negligence law, and not just for economists but also for legal scholars as well.

2. HOW WE CAN *MISS* UNAVOIDABLE ACCIDENT

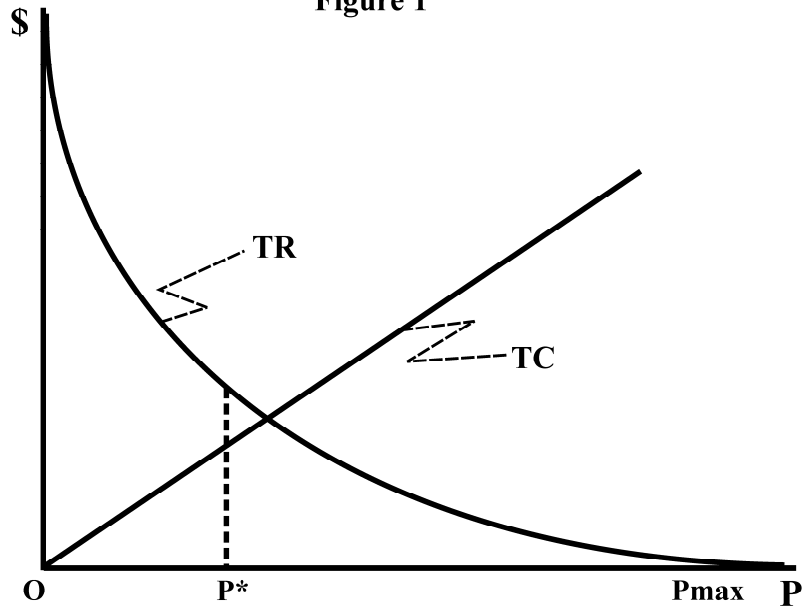
Figure 1 depicts a conventional way of thinking about the negligence problem.¹⁵ The horizontal axis measures units of precaution, and the vertical axis measures some unit of value. The TC curve shows the total cost of precaution at each level, and the TR curve shows total expected harm from accidents—the probability of harm times the magnitude of harm when it occurs—also at each level of precaution. This curve is marked TR because it is conventional in legal circles to call expected harm “risk,” though expected harm is not “risk” in the economic sense.¹⁶ Social cost is the sum of total precaution cost and total risk, which is minimized at P^* , the due care level of precaution. At that point, the downward slope of the TR curve (in absolute terms) equals the upward slope of the TC curve. Social cost is minimized at that point because beyond P^* further units of precaution add more to total precaution cost than they subtract from total risk. That is why to the right of P^* the TC curve’s slope is greater (again in absolute terms) than the slope of the TR curve.

Technology, Nondurable Precautions, and the Medical Malpractice Explosion, 82 Nw. U.L. Rev. 293 (1988) [hereinafter Grady, *Why Are People Negligent?*]; Mark F. Grady, *Untaken Precautions*, 18 J. Legal Stud. 139 (1989) [hereinafter Grady, *Untaken Precautions*]; Grady, *Res Ipsa and Compliance Error* (1994).

¹⁵ See, e.g., Robert D. Cooter, *Prices and Sanctions*, 84 Colum. L. Rev. 1523, 1538-39 (1984) [hereinafter Cooter, *Prices and Sanctions*].

¹⁶ I understand that “risk” in the economic sense often refers to the degree of variance in possible outcomes, for instance, returns on an investment.

Figure 1



The relationship between the two curves on figure 1 reflects diminishing marginal returns to precaution, which is realistic. If we think of auto safety, when we make sure that the steering wheel is securely bolted to the steering assembly, that unit of precaution produces a huge reduction in risk (expected harm). When we then add brakes to the car, which perhaps costs about the same, we thereby subtract another large amount of risk. Ultimately, however, the good opportunities for precaution diminish, so that when we add the tenth air bag, the cost may be about the same as for prior standardized units of precaution, but the risk reduction is small. Before this point, all of the good opportunities for precaution have been exhausted. That is why the downward slope of the TR curve is relatively flat at high levels of precaution. As will be stressed later on, the locations of the TR and TC curves also reflect a particular state of precaution technology as well as a standardized level of information about the future.

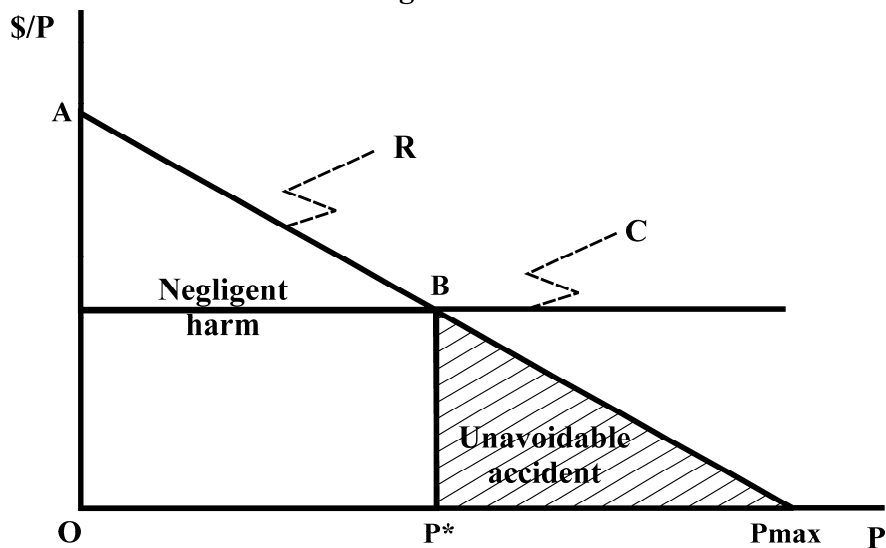
3. HOW WE CAN SEE UNAVOIDABLE ACCIDENT

3.1. THE BASIC ANALYTICS OF CAUSE IN FACT

A less conventional but more useful way to see the negligence problem is on figure 2. The R curve represents the *marginal* (reduction in) risk, and the C curve represents the *marginal* cost of precaution. Each marginal curve measures at different units of precaution the slope of the corresponding total curve. Hence, the C curve is flat because the TC curve on figure 1 has a constant slope, and the R curve declines because the slope of the TR curve becomes less negative at

increasing levels of precaution. The respective areas under the curves between two precaution points equal the increase in precaution cost (under the C curve) and the decrease in expected harm (under the R curve) occasioned by moving from the lower level of precaution to the higher, that is, the total changes over the interval. Hence, the total risk (expected harm) that would be reduced by moving from zero precaution to P^* is the area $OABP^*$. The area of expected unavoidable accident is P^*BP_{max} .¹⁷ “Unavoidable accident” is expected harm that due care would not have prevented, in other words, harm that could *not* be “caused in fact” by negligence. Therefore, on figure 2, it corresponds to expected harm beyond P^* , the due care level.

Figure 2



As figure 2 indicates, “unavoidable accident” really *is* avoidable—by using more precaution than due care (P^*). The counterpart of unavoidable accident is “negligent harm,” which comprises accidents that due care *would* have prevented. Under strict liability, an injurer is liable for both negligent harm and unavoidable accident; under negligence, the injurer is liable only for negligent harm.

Probably because of the courts’ confusing terminology—unavoidable accident really *is* avoidable—some economists have assumed that if an injurer has

¹⁷ This area could understate by a bit the amount of unavoidable accident to the extent that some nugget of totally inevitable harm could exist even after maximum precaution is used. For purposes here, we won’t lose much generality if we assume that the set of precautions that reduces accidents is capable of reducing these accidents to zero, even though the last risk reductions are uneconomic to obtain because marginal cost exceeds marginal risk.

been negligent, that injurer is liable for unavoidable accident in addition to negligent harm,¹⁸ and a few of this latter group have even based their theories on the resulting discontinuity.¹⁹ This is incorrect. Even when an injurer has used less precaution than P^* and has thus committed a breach of duty, it will still be an issue whether reasonable precaution would have prevented the accident. A concededly negligent actor (*i.e.*, one who has committed a breach of duty) often escapes liability—and not through any “judicial error.” Many economists have assumed that the chief difference between the negligence rule and strict liability arises when the defendant has used due care. They say—correctly—that a strictly liable injurer at P^* faces liability for unavoidable accident (accidents unpreventable by due care), but that an actor falling under the negligence rule faces no liability if he uses due care. The actual negligence rule is more radical. Although a strictly liable actor is indeed liable for unavoidable accident, whether

¹⁸ See Brown, *Economic Theory of Liability* (1973: 328) (proposing mathematical model in which an injurer using less than due care is liable both for negligently caused harm and for unavoidable accident); William M. Landes and Richard A. Posner, *The Positive Economic Theory of Tort Law*, 15 Ga. L. Rev. 851, 869-74 (1981) (adopting and extending Brown’s model); LANDES and POSNER, *ECONOMIC STRUCTURE OF TORT LAW* (1987) (same model further extended).

¹⁹ The discontinuity supposedly exists because at a precaution level infinitesimally less than P^* the injurer is liable for an infinitesimal amount of negligent harm plus unavoidable accident, and then when the injurer moves to P^* the liability for unavoidable accident discontinuously disappears. This conception of the negligence rule leaves out the cause-in-fact limitation and makes it too easy for game-theoretic models to yield equilibria in which injurers and victims all choose their respective P^* -precaution levels. See, e.g., William M. Landes and Richard A. Posner, *Joint and Multiple Tortfeasors: An Economic Analysis*, 9 J. Legal Stud. 517, 523-24 (1980) (in joint-care case, imposing liability for unavoidable accident can help induce multiple actors all to use due care); Robert D. Cooter, *Prices and Sanctions* (1984: 1538-39) (drawing pictures of supposed discontinuity and arguing that negligence induces better compliance than strict liability because negligent actor is liable for unavoidable accident but can evade this liability in one discontinuous lump when actor achieves due care); John E. Calfee and Richard Craswell, *Some Effects of Uncertainty on Compliance with Legal Standards*, 70 Va. L. Rev. 965, 975-79 (1984) (drawing pictures of supposed discontinuity and asserting that negligent actor’s ability to avoid liability for unavoidable accident through infinitesimal movement to due care creates sword of Damocles that can induce compliance or even overcompliance with due care standard); David Haddock and Christopher Curran, *An Economic Theory of Comparative Negligence*, 14 J. Legal Stud. 49, 63-66 (1985) (comparative negligence can be more efficient than contributory negligence because former smoothes out discontinuity created by liability for unavoidable accident); Cooter, *Punitive Damages and Deterrence* (1989: 1155-57) (courts’ inability to do cause-in-fact analysis preserves liability for unavoidable accident and reduces need for punitive damages when fewer than all meritorious plaintiffs sue); Steven Shavell, *Liability for Accidents*, NBER Working Paper No. 11781 (Nov. 2005) <http://www.nber.org/papers/w11781> (because of the supposed liability for unavoidable accident, the negligence rule can induce actors to use due care even when they predict that the damages they must pay will be lower than the damages they create).

or not he used due care, an actor subject to the negligence rule, even if negligent, is still not liable for unavoidable accident. The two liability rules are thus perfect opposites.²⁰

Courts must therefore sort accidents between the two zones depicted on figure 2. Again, just to stress the point, courts sort injuries between the two zones even when they know that the defendant has used less precaution than P*. Often a “cause signature”—some trace of the accident or other evidence of what zone the accident belongs to—makes the court’s job easy.²¹ Suppose that the defendant’s levee overflowed after a storm, and the plaintiffs (whose lands were flooded) proved under the Learned Hand formula that the defendant’s levee walls should have been 16 feet high when in fact they were only 10 feet high. Nevertheless, if the (ex post) evidence also indicated that the flood was so large that only a 26-foot wall would have prevented it, the court can sort the injury to unavoidable accident (the area under the R curve beyond P*), and will hold the defendant immune, even though the defendant committed a breach of duty.²² In this hypothetical case the cause signature was the size of the flood, which would allow a court to determine whether a levee of a given size would have saved the day. A cause signature can also inculcate a defendant, as when the evidence shows that the flood was only 11 feet high.

²⁰ The main qualifications have to do with problems of proof. It is of course possible for a negligent defendant to be liable for unavoidable accident if the court makes an error or if the defendant falls under a rule that allocates the burden of proof to him and he fails to carry it. See *Ybarra v. Spangard*, 154 P.2d 687 (1944). Moreover, under some types of strict liability, a defendant may avoid harm for unavoidable accident by showing that the harm resulted from the plaintiff’s own conduct, the intentional act of a third party, or force majeure. Compare *Fletcher v. Rylands*, L.R. 1 Ex. 265 (1866), aff’d, L.R. 3 H.L. 330 (1868) with *Nichols v. Marsland*, [L.R.] 10 Exch. 255 (1875), aff’d, 2 Ex. D. 1 (C.A. 1876). In addition, even a strictly liable defendant will not be liable for some unforeseeable harms. Compare *West v. Bristol Tramways Co.*, [1908] 2 K.B. 14 (C.A. 1908) with *Cambridge Water Co. v Eastern Counties Leather p.l.c.*, [1994] 2 AC 264 (H.L. 1993) (apparently overruling *West*).

²¹ Compare Robert D. Cooter, *Punitive Damages and Deterrence: When and How Much?*, 40 Ala. L.Rev. 1143, 1155-57 (1989) (suggesting that it is often impossible for courts to do cause in fact analysis) [hereinafter Cooter, *Punitive Damages and Deterrence*].

²² The example comes from *City of Piqua v. Morris*, 120 N.E. 300, 303, (Ohio 1918), in which court said:

[I]f a river levee had been maintained at the height of 10 feet, and the custodians of the levee had been warned that flood waters might require a levee 16 feet in height, and they neglected to so increase the height of the levee, and an unprecedented flood should ensue, during which it should appear that a levee 26 feet in height would not have held the flood waters, the parties responsible for the levee would not be liable for negligence in failing to maintain a 16-foot levee, when a 26-foot levee would have been unavailing.

3.2 THE R CURVE AND ITS UNDERLYING ASSUMPTIONS

The R curve depicted on figure 2 subtends the “risk” (expected harm) relevant to courts’ breach-of-duty determinations. The curve itself is based on some amount of ex ante information about the probability and magnitude of perils avoidable by the precaution set arrayed across the P axis. Courts typically call this information “reasonable foresight.”²³ “Reasonable foresight” can change over time, and it is possible for more or better information either to increase or to decrease the R curve. So, if it begins to appear that the earth is warming and hurricanes have become more common, the R curve relevant to the levee example could shift upward so that (with the cost of levees constant) the new due-care level (P*) would be a higher levee.²⁴ Similarly, better (ex ante) information could equally cause the R curve to fall, if it reasonably appears instead that the earth has cooled and hurricanes have become less common. The common *legal* name for the amount of risk subtended by the R curve is “harm within the risk.” This is the “risk” (expected harm) that is relevant to breach-of-duty and cause-in-fact determinations.

When an accident occurs, the harm itself does not literally exist under the R curve because the R curve subtends *expected* harms, not actual harms. Still, the actual accident that *did occur* will normally correspond to an expected harm under the R curve if its probability was “foreseeably reduced”²⁵ by the set of precautions arrayed along the P axis. If a harm does indeed correspond to some expected harm under the R curve (was “within the risk”), a cause-in-fact question is whether due care (P*) would have prevented the harm if we now look at the

²³ See Mark F. Grady, *Proximate Cause and the Law of Negligence*, 69 Iowa L. Rev. 363-449 (1984).

²⁴ Perhaps needless to say the owner of an installed levee system may or may not have an obligation immediately to change that system when the relevant risk has changed. The new risk is most binding on the builder of a new system, though of course the new risk can also require costly retrofitting, as with recent work done to retrofit California buildings against earthquake risk. For an analysis of this issue, see Steven Shavell, *On Optimal Legal Change, Past Behavior, and Grandfathering*, NBER Working Paper No. 13563 (October 2007) (forthcoming J. Legal Stud.).

²⁵ Courts may determine which risks fell under the R curve (and thus “within the risk”) using either an ex ante or an ex post test. Under the ex ante test, the court determines that someone in the actor’s position would not, before the accident, have predicted that this type of harm would result from an omission of the type of precaution in question (that arrayed along the P axis). Under the ex post test, the court notices that no (or little) systematic relationship existed between the type of precaution in question (again, that array along the P axis) and the harm that occurred in this case. See the discussion below.

accident ex post.²⁶ If due care would have indeed prevented the accident, then we also know that it corresponded to an expected harm to the left of P* because P* will eliminate all expected harms “within the risk” to left of P*. Restated, after P* has been used, none of these expected harms to the left of P* exist anymore.

A case commonly mentioned in the early economic literature on negligence causation²⁷ is *Berry v. Borough of Sugar Notch*,²⁸ and these early analysts’ use of the case illustrates the misstep they made in conceptualizing the cause-in-fact doctrine. The *Berry* plaintiff, a streetcar operator, was injured when the defendant borough’s rotten tree fell directly on top of his streetcar. The borough conceded that it possessed a duty to cut down the obviously rotten tree, but argued that the operator was contributorily negligent because he was speeding. The borough said that his excessive speed brought him exactly to the wrong place at the right time. If the operator had been traveling at a reasonable speed (the statutory speed), he would have been someplace else when the tree fell. The argument failed because the court found that reasonable foresight would not have predicted that because of the operator’s excessive speed he would be positioned directly under the tree when it fell.²⁹ The court said it would have been a different case if the tree had fallen in front of the speeding streetcar and the operator was hurt because the excessive speed made it impossible to stop.³⁰

²⁶ Most conventionally, the due care level (P*) defines the margin between negligent harm and unavoidable accident. Nevertheless, under specific negligence analysis, in which the plaintiff alleges some specific precaution untaken by the defendant, it may be possible for the plaintiff to rely successfully on some untaken precaution beyond P* (but still within a band around P*), when the defendant has been negligent. This same untaken precaution then becomes the basis for the court’s cause-in-fact analysis. See Grady, *New Positive Theory* (1983); Grady, *Untaken Precautions* (1989).

²⁷ See Steven Shavell, *An Analysis of Causation and the Scope of Liability in the Law of Torts*, 9 J. Legal Stud. 463 (1980) [hereinafter Shavell, *Analysis of Causation*]; Landes and Posner, *Causation* (1983). Landes and Posner say that they adopt Shavell’s approach to causation, so his article has really been the critical contribution (1983: 111).

²⁸ 43 A. 240 (Pa. 1899). The case is discussed in Shavell, *Analysis of Causation* (1980: 463-64, 469-470); and in Landes and Posner, *Causation* (1983: 119).

²⁹ The court said:

That his speed brought him to the place of the accident at the moment of the accident was the merest chance, and a thing which no foresight could have predicted. The same thing might as readily have happened to a car running slowly, or it might have been that a high speed alone would have carried him beyond the tree to a place of safety.

43 A. at 240.

³⁰ The court said:

If we look back to figure 2 and imagine that the precaution measured on the P axis is now speed, with increasing amounts of P entailing reduced speeds, it becomes clear that suffering a direct hit is not an accident whose probability will be reduced (or be altered at all) by the operator's reducing his speed. Moreover, technically at least, we could see the reason for this lack of "probabilistic causation" as stemming from a lack of information. If "reasonable foresight" entailed clairvoyance, then a probabilistic relationship, and more, *would* exist between the operator's excessive speed and the direct hit. It is because reasonable foresight entails less information than clairvoyance that no "probabilistic connection" exists between excessive speed and direct hits by trees. *Berry* is indeed a highly useful case because it becomes an extreme example of a set of other cases that are only somewhat less extreme.

The famous case of *Palsgraf v. Long Island R.R.*³¹ was similar to *Berry*. There the plaintiff was injured when the defendant's railroad guards failed to use due care in helping a belated passenger board a moving train, fireworks were dislodged, and the explosion toppled scales onto the plaintiff. In both *Berry* and *Palsgraf*, the expected harm that materialized in the plaintiff's harm was not significantly reduced by the set of precautions in question (lower speed or more care helping the passenger board). About both cases it seems natural to say that the accident was not "within the risk." In each the expected harm of what actually happened was beyond the R curve because reasonable foresight would not have predicted any significant relationship between the set of precautions in questions (those used to allege the breach of duty) and what actually happened.

Here, then, is the misstep that the early economic analysts of causation made. They theorized that "no cause in fact" was functionally the same as "harm outside the risk." According to their formal models, the case of the insufficient levee was functionally the same as the excessive speed in *Berry v. Borough of Sugar Notch*. That conception, however, is certainly unfaithful to the legal doctrine and even creates mathematical problems. For if we conceive of unavoidable accident as harm outside the risk (instead of harm within the risk but beyond due care), the

Nor can it be said that the speed was the cause of the accident, or contributed to it. It might have been otherwise if the tree had fallen before the car reached it, for in that case a high rate of speed might have rendered it impossible for the plaintiff to avoid a collision which he either foresaw or should have foreseen. Even in that case the ground for denying him the right to recover would be that he had been guilty of contributory negligence, and not that he had violated a borough ordinance.

43 A. at 240.

³¹ 162 N.E. 99 (N.Y. 1928).

whole concept of the risk relevant to negligence analysis becomes chaotic and ill-defined, as the following discussion will briefly clarify.

Under Steven Shavell's early and influential theory of causation the amount of risk depends on the "state of the world" in which the actor finds himself. How the analyst defines alternative states of the world determines which risks are worth preventing. Shavell made clear, moreover, that his concept of "state of the world" bore no correspondence to any single legal concept of causation.³² For instance, Shavell's example describing *Berry v. Borough of Sugar Notch* has two states of the world that are defined around the event of where the tree fell, whether at the middle of the streetcar route or the beginning.³³ The example illustrates that speeding and not speeding produce the same expected harm because with speeding a tree can hit the streetcar at the end of the route, and with no speeding, a different tree can hit the plaintiff at the beginning on the route. His next example is intended to illustrate cause in fact.³⁴ Here a bicyclist can decide to ride in a park, and, if he does, he can further decide whether to use care. The states of the world are oriented around visibility. In the first state visibility is poor, and the result is that whether the bicyclist uses care or not, an accident still results. When visibility is moderate, the bicyclist's use of care reduces expected harm. Nevertheless, in a third state of the world in which visibility is good, the bicyclist's use of care again fails to reduce expected harm presumably because the pedestrian victim can now stay out of the way whatever the bicyclist does. Shavell says that the scope of liability should include only those states of the world for which using care produces a sufficiently pronounced effect (1980: 481). Thus, Shavell's "scope of liability" principle would exclude liability for cases in which there is no cause in fact, as in his bicyclist in the park example *and* in his case mimicking *Berry v. Borough of Sugar Notch*, and for the very same reason: the actor's use of care produce an insufficiently pronounced effect on safety, either *ex post* or *ex ante*.

³² He gave what he said was a common "decision theory" definition of the concept: "A *state of the world* is a description of the way the world could be which is so complete that it does not leave out any relevant aspect" (1980: 467) (emphasis in original).

³³ Shavell, *Analysis of Causation*, (1980: 469) (Table 2).

³⁴ Shavell, *Analysis of Causation*, (1980: 472-73) (Table 3). The example really fails to illustrate the classic doctrine of cause in fact because Shavell says that the reason that the bicyclist's care makes no difference when visibility is poor is because we should "imagine that if there is no bicyclist about the jogger would trip on a fallen branch and sprain his ankle" (1980: 472). Because a court could not tell after a bicycle accident that the jogger was doomed in any event, there would still be cause in fact, but Shavell wants us to believe that there would not be, so we should accept his view on this point.

Shavell's assertion that cause in fact and proximate cause were economically the same has, at least in retrospect, proved unhelpful. First and foremost, his ideas may have further encouraged economists to believe that the negligence rule contains a significant discontinuity, because—probably partly in reliance on Shavell's theory—they have supposed that no causal limitation of liability exists under the R curve (and its equivalents), when in fact liability does *not* exist for unavoidable accident, which of course *is* under the R curve.³⁵ Yet, according to Shavell and his followers, if a defendant has committed a breach of duty, the defendant is potentially liable both for negligent harm and for unavoidable accident, so long as an accident actually emerges from either zone.³⁶ Second, Shavell's conception of cause, and especially its dependence on different states of the world seems, to have led economists to have embraced a chaotic conception of risk (expected harm).

Shavell's model was that each state of the world possessed a different expected harm curve, and he himself suggested no theory about how courts could formulate the appropriate states of the world for a particular accident scenario except to say that they should exclude states of the world in which the actor's precaution level fails to yield a pronounced effect on risk. The included expected harms are thus defined by both *ex ante* and *ex post* conditions, and the solution of this problem seems to require higher mathematics, as well as a type and quality of information about expected harm that Shavell never made perfectly clear. At some points in his causation analysis it almost seems as though the analyst requires perfect information about the future, or sometimes about past, yet if information is perfect, is it even possible for the concept of "expected harm" (or "probability of harm") to exist? With perfect information, won't harm be either certain or nonexistent?

In a related vein I'd like to answer my critic, Stephen Marks, who has challenged my own conception of the R curve (1994: 287). He argues that my earlier claims about the benign incentive effects of the negligence rule under injurer uncertainty depend upon an unstated assumption, what he called the

³⁵ Shavell's analog to the R-curve is the set of expected harms within the "scope of liability." This neglect of the cause-in-fact limitation existed in Brown's earliest equations, but Shavell's analysis seems to have satisfied many analysts that no causal limitation existed "within the risk."

³⁶ Shavell's model appears to contain an internal inconsistency because it is not clear from it what expected harm lies under the R curve beyond due care (P*). He, like John Brown and Landes and Posner, gives no name to this residual expected harm whose true name is unavoidable accident and whose defining characteristic is expected harm that due care would not have prevented.

“complete ordering assumption.” As Marks explains it, this assumption requires that “all accidents that occur at higher levels of precaution must also occur at lower levels of precaution” (288). Marks nevertheless concedes that my prior work was correct if this assumption is met. Marks’s concerns seem to have been inspired by Shavell’s theory of causation because Marks is certainly correct that my notion of the relevant risk (expected harm) is considerably more orderly than Shavell’s concept. Moreover, Marks’s challenging examples of accidents are similar to Shavell’s examples. Let’s notice, however, that the “complete ordering assumption” *will* be met in the levee example provided above. Small floods that will occur (and will be prevented) with low dam walls will also occur (and will be prevented) at higher levels of precaution (high dam walls). There is thus complete ordering in this example.

In fact, as Marks himself recognizes, something very much like complete ordering of accidents will always result when courts insist that the plaintiff show that the accident was probabilistically related to the set of precautions in question, as my model assumes. I explain more fully in the footnotes below for those who are interested.³⁷

The actual legal concept of risk is both more orderly and more subtle than many economists have noticed. The basic concept of risk relevant to breach of

³⁷ Marks’s central example of a situation where the assumption of complete ordering is *not* met entails various pedestrians that would be struck by a car if a car were traveling at different speeds. This example is functionally the same as *Berry v. Borough of Sugar Notch*. Here is Marks’s description of the example:

Driving fast (\$0 [precaution cost]) puts [persons] A, B, C, and D at risk. Driving more slowly (\$15) puts [persons] E and F at risk, since A, B, C, and D are no longer on the scene and [person] G has not yet arrived. Driving even more slowly (\$30) puts only G at risk. (1994: 297).

Marks then argues from this example that the accidents are “incompletely ordered” because the accident to victims A, B, C, and D, which would be prevented by lower levels of precaution, would not be prevented by a higher level of precaution (driving more slowly) because these victims would be gone by the time that the defendant car arrived, and only E and F could be saved by further precaution.

Marks fails to stress that the very concept of “expected harm” includes the notion that some systematic relationship exists between the precaution set in question and the relevant accidents to be prevented. In any event, as Marks himself points out, the courts exclude some accidents from liability even when cause in fact exists, and he cites *Berry v. Borough of Sugar Notch* for this proposition. At this point, Marks concedes that the existence of the *Berry* type of doctrine would answer most of his issues with “incompletely ordered” accidents (1994: n.14). Marks thus seems to have solved his own problem, because the *Berry* doctrine seems general throughout the United States and other common-law jurisdictions. See Mark F. Grady, *Proximate Cause Decoded*, 50 *UCLA L. Rev.* 293 (2002).

duty (which determines the due care level) is an ex ante concept—a prediction about expected harm made before the accident in question. Then after an accident occurs, several questions arise. The first is whether the defendant was using less precaution than due care (P*). That is the breach of duty question, which can be answered using completely ex ante considerations, such as how much expected harm would have been predicted by a reasonable person standing in the defendant’s shoes ex ante the accident.

If the defendant was using less precaution than P*, the question next arises whether due care (or the untaken precaution alleged to have been the breach of duty) would have prevented the accident. This is an ex post analysis that looks backward from the perspective of the accident that actually occurred with the knowledge of all the factual details that hindsight affords. Would a 15-foot levee have prevented this overflow given that we know ex post the actual size of the experienced flood? If not, then we also know that the accident corresponded to an expected harm under the R curve but to the left of P* (or the alleged untaken precaution). In short, it was unavoidable accident for which no negligence liability exists.

Finally, there is a type of proximate cause issue that is also best analyzed ex post, and this is the question whether any systematic relationship existed between the set of precautions in question (those alleged to have been untaken) and the accident that actually occurred. Indeed, *Berry v. Borough of Sugar Notch*, already discussed, is the outstanding example. Does traveling more slowly systematically reduce the expected harm from a direct hit by tree? I like the concept of “systematic relationship” better than “probabilistic relationship” because the former makes clear that the question being asked takes an ex post perspective. We could not know before the accident that it was going to be a direct hit, but after the accident we can see that no systematic relationship existed between the direct hit that actually occurred and the precautions in question (going slower). This conclusion entails the realization that the actual harm failed to correlate with any expected harm under the relevant R curve. It was harm “outside the risk.” Indeed, under the extended doctrine of the *Palsgraf* and similar cases, if we can see ex post that not much of a systematic relationship existed between the untaken precautions in question and the harm that actually occurred, no proximate cause will exist. The legal doctrine creates at the same time a totally coherent idea of the relevant risk and also an economically subtle concept that faithfully separates the ex ante and ex post perspectives in accident law.

Before moving onto the next topic, let’s notice that the negligence rule embodies two major doctrines: specific negligence and *res ipsa loquitur*. Specific negligence analysis entails one sorting method that is unique to itself: Would the untaken precaution constituting the defendant’s breach have prevented the accident that occurred? Specific negligence analysis nevertheless also uses some

of the same sorting methods used by courts under the rubric of *res ipsa loquitur*. We can better understand both negligence doctrines by seeing how they sort accidents between negligent harm and unavoidable accident—methods the doctrines share and methods they don't.

4. SPECIFIC NEGLIGENCE AND RES IPSA LOQUITUR

In modern times the line between *res ipsa* and specific negligence is not always clear, and the following paragraphs will shed some light on why this is so. Nevertheless, if we go back to the mid-nineteenth century, the courts originally made a clear distinction between the two. Under specific negligence a plaintiff alleges at least one particular untaken precaution and argues that this omission was both a breach of duty by the defendant and a cause in fact of his harm. With *res ipsa loquitur* the plaintiff proves his case through a more inferential process. This traditional view remains a somewhat helpful guide to modern practice, though it is an imperfect guide because a modern plaintiff can sometimes succeed on a *res ipsa* theory even after it has become totally clear what the defendant's untaken precaution was.

For a clear case of specific negligence, think of *New York Central R.R. v. Grimstad*.³⁸ The plaintiff's deceased was the captain of a barge, and one day he fell overboard. Unfortunately, he swam badly, if at all. His wife, who was living on the barge with him, saw his hands briefly above the water and, because the defendant had not installed a life buoy on the barge, went to look for a heaving line to toss him. By the time she returned with the line, he had disappeared beneath the water. The wife, who became the plaintiff in the wrongful death action, argued that the absence of the life buoy was the defendant's breach of duty. The court provisionally accepted this argument, but found cause in fact absent because a life buoy would not have prevented this particular accident. The *Grimstad* accident's cause signature—a man overboard who went almost straight to the bottom—demonstrated that the alleged untaken precaution (a life buoy) would have failed to save the day when we look at the accident *ex post*.

³⁸ 264 F. 334 (2d Cir. 1920).

Figure 3

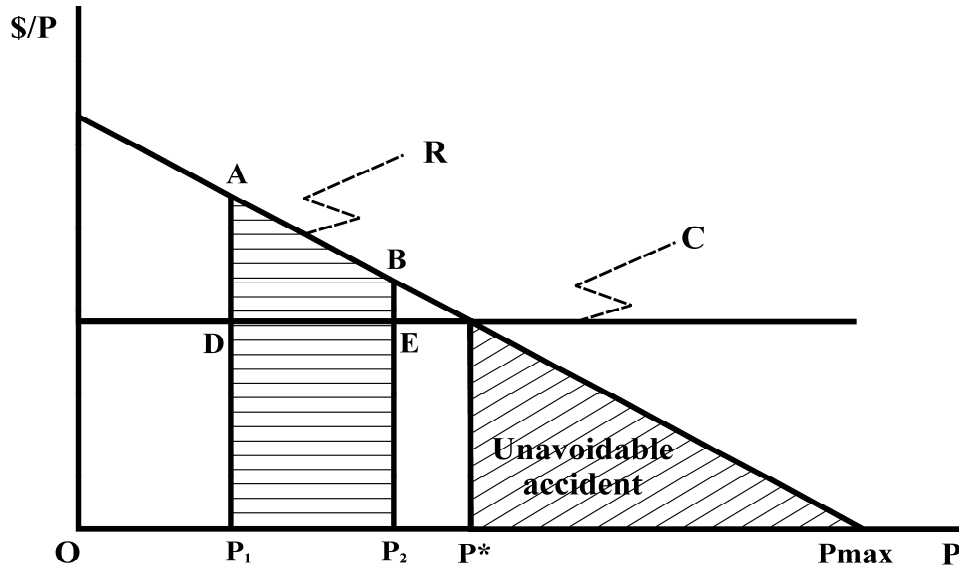


Figure 3 shows a way to put *Grimstad* into a larger frame. Suppose that the defendant's actual precaution level was P_1 , and installing a life buoy in addition to the P_1 precautions (those precautions that the *Grimstad* defendant had *actually* adopted) would place the defendant at P_2 . The ex ante value of a life buoy would be the area P_1ABP_2 , but the cost of installing a life buoy would be P_1DEP_2 , which is less. Hence, under the Learned Hand formula, failing to install a life buoy was indeed a breach of duty. Even though cause in fact has an ex post perspective, we can still locate the accident within one of the areas on figure 3.³⁹ Under the actual circumstances of this drowning (a sailor who went almost straight to the bottom), the court could be fairly sure that a life buoy would not have saved the plaintiff's husband. The accident couldn't, therefore, have been within the horizontally hatched area P_1ABP_2 because that area included *only* accidents that would have been prevented by P_2 (a life buoy). The actual accident was beyond P_2 and probably beyond P^* as well, because the plaintiff had every incentive to allege a cost-justified precaution that would have actually prevented this accident. This missing allegation, combined with the failed proof on the life buoy, suggests that the accident fell within the triangular zone of unavoidable accident.

Let's look back to nineteenth-century England, where *res ipsa* was born, to see how the courts then saw it to be different from specific negligence. Suppose the plaintiff doesn't know and can't find out which precautions the defendant had

³⁹ Compare Wright, *Actual Causation* (1985) (arguing that an ex post perspective on accidents is inconsistent with economic reasoning).

left untaken. This is the situation classically covered by *res ipsa loquitur* and typified by *Byrne v. Boadle*,⁴⁰ the English case that gave the doctrine its name.⁴¹ The plaintiff was walking on a busy street past the defendant's flour warehouse when a barrel of flour fell upon his head. He didn't see what hit him, but witnesses later testified that the barrel fell from the defendant's warehouse. The defendant argued that unless the plaintiff could prove that it had failed to use some specific precaution, which failure was both a breach of duty and a cause in fact, the plaintiff could not recover. In rejecting this argument, Chief Baron Pollock said: "There are certain cases of which it may be said *res ipsa loquitur* [the thing speaks for itself], and this seems one of them." As *res ipsa* has evolved, two key questions have become whether the instrumentality that caused the harm was within the exclusive control of the defendant and whether the accident was the type usually caused by negligence.⁴² As we will see, these questions basically ask whether the accident was probably within the defendant's zone of negligent harm or was instead within the defendant's zone of unavoidable accident or even beyond the defendant's R curve.⁴³

5. THE UNITY OF NEGLIGENCE ANALYSIS

Although the specific negligence and *res ipsa* doctrines are historically different, when we look at modern cases it is often hard to tell where one starts and the other leaves off. Although some courts still make plaintiffs elect between the two "methods of proof," in the twentieth century it sometimes became difficult to tell from an appellate report which type of proof was made at trial and even which doctrine the appellate court used to judge the sufficiency of the plaintiff's proof.

⁴⁰ 159 Eng. Rep. 299 (Exch. 1863).

⁴¹ The English courts had previously applied a similar doctrine to cases in which a passenger was injured aboard a defendant's public conveyance, such as a stage coach or a train. *Byrne* extended these common carrier cases to a broader range of similar accident situations. See, for example, *Christie v. Griggs*, 170 Eng. Rep. 1088 (K.B. 1809) (allowed plaintiff's claims to reach the jury on mere proof that stagecoach wrecked); *Skinner v. London, Brighton & South Coast Ry.*, 155 Eng. Rep. 345 (Exch. 1850) (allowed plaintiff's claims to reach the jury on proof that he was a passenger on the plaintiff's train when it wrecked).

⁴² Another element of the doctrine is that the plaintiff should not have contributed to his own injury. For glosses of the doctrine, see, e.g., *Carpue v. London & Brighton Ry.*, 114 Eng. Rep. 1431 (K.B. 1844); *Scott v. London & St. Katherine Docks Co.*, 159 Eng. Rep. 665 (Ex. 1865); *Larson v. St. Francis Hotel*, 188 P.2d 513 (Cal. Ct. App. 1948). In each of these cases the plaintiff didn't know and couldn't find out what the respective defendants' untaken precautions were.

⁴³ A third possibility is that the accident wasn't under the defendant's R curve at all, as when the defendant had no opportunity to prevent the accident but someone else did.

For this reason, perhaps, some have asserted that the real difference between the two doctrines depends on how much the plaintiff's proof relied on "circumstantial" versus "direct" evidence of the defendant's negligence. That conception is only partially successful as the following two cases show.

In *Anjou v. Boston Elevated Ry.*,⁴⁴ the plaintiff was a passenger on the defendant's elevated railroad, and as he was walking through the station he slipped on a banana peel that was on the platform. The evidence was the banana peel was "black, flattened out and gritty." The court held that this was enough evidence for a jury to find the defendant liable because the condition of the banana peel suggested that the defendant had not inspected and cleaned its platform as often as due care required. The gritty banana peel was more than a cause signature, because it didn't just indicate that the accident was caused by the defendant's breach of duty; it also showed that the defendant committed a breach of duty by leaving the banana peel there so long. For this reason it was a "double signature." Although the plaintiff's proof seemed quite circumstantial in that it depended entirely on the condition of the banana peel, the *Anjou* court did not mention *res ipsa loquitur* or any of its now-conventional elements. Was *Anjou* then a specific negligence case? Even though the plaintiff's evidence was highly circumstantial, it is easy to see the case as falling under specific negligence because the evidence showed a specific untaken precaution by the defendant and causation by that same untaken precaution.⁴⁵

*Newing v. Cheatham*⁴⁶ was virtually the same, but decided under *res ipsa*. In that case the plaintiff brought suit against the estate of the owner-pilot of the aircraft in which her husband was a passenger. The evidence was that the crash investigators discovered the plane to be out of fuel. The weather was clear and there was no indication, from radio traffic or otherwise, that the plane had been in distress before it crashed. Here, the fuel gauge on empty was the double signature: it suggested both that the defendant's pilot had failed to check the fuel and also that this failure was the cause of the accident. Unlike in the banana peel case, most of this court's analysis was cast in terms of *res ipsa loquitur*. Indeed, the court said that the evidence showed *res ipsa loquitur* as a matter of law, which of course meant that no jury would be permitted to say that the defendant was not guilty.

⁴⁴ 94 N.E. 386 (Mass. 1911).

⁴⁵ In *Goddard v. Boston & Maine R.R.*, 60 N.E. 486 (Mass. 1901), which was otherwise the same as *Anjou*, the court nonsuited the plaintiff because there was no evidence whether the banana peel on which the plaintiff slipped was gritty or fresh.

⁴⁶ 540 P.2d 33 (Cal. 1975).

As *Anjou* and *Newing* reveal, specific negligence and *res ipsa* cases often seem cut from the same cloth. A good way to see the similarities and differences between them is to examine the techniques courts use to sort accidents between negligent harm and unavoidable accident. The next major section deals with the most basic sorting techniques, and the following major section deals with more advanced sorting techniques—techniques that are best explained in terms of the ultimate purposes of the negligence system, that is to say, those social purposes we can infer from the evolved structure of negligence law.

6. BASIC SORTING

6.1 THE CLASSIC SPECIFIC NEGLIGENCE METHOD

Still the most obvious way to prove that an injury was negligent harm is to show that some untaken precaution, which was a breach of duty, would have prevented it. In order to see how this technique works, let's examine cases that are similar but come to different results. Consider two drowning cases. In *Grimstad*, which was just mentioned in the last section, the man who fell overboard went almost directly to the bottom. Given that he was able to lift his hands out of the water only briefly, it was fairly clearly that the alleged untaken precaution—installing a life buoy—would not have prevented the accident. By contrast, in *Kirincich v. Standard Dredging Co.*,⁴⁷ which was otherwise similar, the sailor who fell overboard was able to stay afloat for quite a while. Immediately upon hearing his cries for help, two fellow deckhands each threw a heaving line (one-inch diameter) in his direction. They repeated their casts three times and once came within two feet of the spot where he was struggling. The court thought that if the defendant had installed proper lifesaving equipment, which would have been both more buoyant and more accurately thrown, the probability of saving the drowning sailor would have been good. Here the cause signature—that the deceased was able to stay afloat for some time—was inculpatory, whereas the *Grimstad* cause signature—that the deceased went straight to the bottom—was exculpatory.

This classic specific negligence method of sorting injuries depends on the plaintiff's ability to allege a specific untaken precaution,⁴⁸ as well as on the plaintiff's ability to prove a cause signature for that precaution. When the

⁴⁷ 112 F.2d 163 (3d Cir. 1940).

⁴⁸ See Grady, *Untaken Precautions* (1989); Claus Ott and Hans-Bernd Schaefer, *Negligence as Untaken Precaution, Limited Information, and Efficient Standard Formation in the Civil Liability System*, 17 Int'l Rev. Law & Econ. 15 (1997); Allan M. Feldman and Jeonghyun Kim, *The Hand Rule and United States v. Carroll Towing Co. Reconsidered*, 7 Am. L. & Econ. Rev. 523 (2005).

plaintiff does not know enough to allege a specific untaken precaution or when the accident lacks a signature, classic specific negligence analysis does not work.⁴⁹ The plaintiff will have to use some extended form of specific negligence analysis or else *res ipsa*. Those sorting methods are described in the following sections.

6.2 HIGHLY PRODUCTIVE UNTAKEN PRECAUTIONS OR LOW LEVELS OF ACTUAL PRECAUTION

When the alleged untaken precaution was highly productive, it makes it easier for a court to sort the accident to the “negligent harm” category. Let’s again consider two cases. In *Reynolds v. Texas & Pacific Ry.*,⁵⁰ the defendant’s guards rushed the plaintiff down a set of unlighted steps in order to catch a train that was running late. She slipped and dislocated her ankle and alleged the absence of lighting as the defendant’s untaken precaution. The defendant took the position at trial that the cause signature was unclear. The plaintiff weighed 250 pounds, and, the defendant said, “might well have made the misstep and fallen even had it been broad daylight.” The *Reynolds* inculpatory cause signature was less clear than in *Kirincich* where the deceased was able to stay afloat for some time while his shipmates threw him nonbuoyant lines. The *Reynolds* court nonetheless found because it said that the untaken precaution of lighting was so productive when steps are used after dark.

A contrasting case is *Crafter v. Metropolitan Ry.*,⁵¹ where in 1864 the plaintiff slipped on steps at the defendant’s King’s Cross station in London. The alleged untaken precaution was the defendant’s failure to renew the roughness on the thin brass nosing strip on the front of each step, which had worn smooth. Again, the accident lacked a clear inculpatory cause signature because it was certainly possible for someone to trip even with rough brass nosing. Here, however, the court found for the defendant.

Untaken precautions are more or less productive in a purely *ex ante* sense, which it to say that the shaded area P_1ABP_2 on figure 3 can be either wide (if the untaken precaution was productive) or narrow (if the untaken precaution was unproductive). The more productive the untaken precaution was *ex ante* (and thus the wider the horizontally hatched zone on figure 3), the easier the cause in fact

⁴⁹ See Grady, *Res Ipsa and Compliance Error* (1994a: 894-906).

⁵⁰ 37 La. Ann. 694 (La. 1885).

⁵¹ L.R. 1 C P 300 (1866). Holmes discussed the case in his lectures on the common law, though he miscited it as “*Crafton v. Metropolitan Ry.*” OLIVER WENDELL HOLMES, JR., *THE COMMON LAW* at p. 121 (Little, Brown, and Co. 1881).

issue becomes ex post.⁵² The wider the zone defined by the untaken precaution, the more probable it becomes that the accident fell within this zone and not within unavoidable accident. The courts themselves use this logic to explain themselves. The *Reynolds* court stressed that the absence of lighting “greatly multiplie[d] the chances of accident,” whereas the *Crafter* court stressed that about 43,000 persons had passed up the staircase in question, during each month, since the station had opened in 1863, and that no accident had happened there before the plaintiff fell, which would not be expected if rough nosing was highly productive of safety.

As *Reynolds* and *Crafter* suggest, a plaintiff’s ambitious proof of breach of duty can help an otherwise weak proof of cause in fact. Think back to *Grimstad* where the defendant lacked life buoys, but sailor went right to the bottom. If the plaintiff could have proved that the defendant should have installed life nets around the barge, this proof would have eliminated the cause in fact problem. Unfortunately for the plaintiff, however, these nets would probably have been too awkward to have been cost-justified.

As we have seen, a plaintiff may lack a cause signature clearly linking his injury to a particular untaken precaution. Nevertheless, if the defendant omitted multiple reasonable precautions, the case is usually stronger for finding cause-in-fact than if only one reasonable precaution was omitted. The former proof often defines a large zone of negligent harm, whereas the latter proof could only suggest a small sliver—in each case relative to some hypothetically significant zone of unavoidable accident.

Here are two similar cases that Daniel Farber and Saul Levmore once saw as puzzling.⁵³ *Haft v. Lone Palm Hotel*,⁵⁴ and *Smith v. Americana Motor Lodge*.⁵⁵ The cases show how greater negligence by a defendant makes the cause in fact issue easier. The *Haft* plaintiff’s husband and son were found drowned in the defendant’s hotel pool during the off-season in Palm Springs. Neither could swim, and both of their lifeless bodies were subsequently discovered in the water.

⁵² Richard Wright once argued that cause in fact, with its ex post perspective, cannot comfortably fit within an economic theory of tort because economics is concerned with ex ante incentives. See Wright, *Actual Causation* (1985). Nevertheless, a doctrine with an ex post perspective will predictably limit ex ante liability and thereby alter ex ante incentives.

⁵³ These two cases, and whether they can be reconciled, is a legal puzzle that figured into a noteworthy debate between Saul Levmore and Daniel Farber. Compare Saul Levmore, *Probabilistic Recoveries, Restitution, and Recurring Wrongs*, 19 J. Legal Stud. 691 (1990) with Daniel A. Farber, *Recurring Misses*, 19 J. Legal Stud. 727 (1990).

⁵⁴ 478 P.2d 465 (Cal. 1970).

⁵⁵ 113 Cal. Rptr. 771 (Ct. App. 1974).

There were no witnesses, so a cause signature linking their deaths to any particular untaken precaution was also missing. Nevertheless, the *Haft* evidence indicated that the pool lacked just about every precaution that California statute prescribed for hotel swimming pools. There were no depth markings indicating where the deep water began, no 12-foot-long life pole, no telephone numbers to call for help, and no lifeguard or sign warning that a lifeguard was absent, and no sign warning that children should be accompanied by an adult.

Smith v. Americana Motor Lodge was similar except that the decedents were two children who were not guests at the motel. Again, their lifeless bodies were ultimately discovered in the water with no cause signature. The *Smith* pool possessed just about all of the statutory precautions except it was missing a buoyant line dividing the deep from the shallow ends. Although *Haft* and *Smith* both lacked cause signatures, *Haft* was the stronger case because the defendant's lower level of precaution defined a greater zone of negligent harm.⁵⁶ Consistently, the *Haft* defendant was liable, while the *Smith* defendant was not. The geometry solves the puzzle that Farber and Levmore saw.

6.3 DOUBLE SIGNATURES

As already noted above, some accident signatures are double in the sense that the same evidence shows both that the defendant committed a breach of duty and that this breach of duty was a cause in fact of the harm. Courts sometimes analyze these cases under specific negligence and other times under *res ipsa*. Thus, the gritty banana peel upon which *Anjou* plaintiff slipped was a specific negligence case, whereas the *Newing v. Cheatham* plane crash with the fuel gauge on empty fell under *res ipsa*. They were of course both liability cases, which is the critical consistency between them.

Some double signatures speak more loudly of the defendant's negligence than others. When Chief Baron Pollock said "the thing speaks for itself" in the falling barrel case, he was probably referring to a double signature. Certainly, generations of torts scholars and law students have struggled to see the case in that way. Besides gritty banana peels and airplane fuel gauges on empty, here are some other exceptionally clear double signatures leading to negligence liability: a sponge or scalpel left in a surgical patient;⁵⁷ an airplane fuel tank that fell on a

⁵⁶ *Haft* was also stronger for liability than *Smith* because the *Haft* decedents were invitees, whereas the *Smith* decedents were trespassers.

⁵⁷ *Ravi v. Williams*, 536 So. 2d 1374 (Ala. 1988).

fruit stand;⁵⁸ and a patient who woke up from foot surgery with her two front teeth mysteriously missing.⁵⁹

When the falling barrel spoke of the warehouse owner's negligence, as Chief Baron Pollock claimed, it seemed to need more help in making this statement than the other double-signature accidents just mentioned. As we will see in the following subsections, an important key to a case like *Byrne v. Boadle* is to see how to compare the sheer amount of unavoidable accident relative to the amount of expected "compliance error" by the defendant. A bonus is that these same two sorting methods can also help untangle truly hard accidents that leave no intelligible signature except the identity of the defendant's activity.

6.4 UNAVOIDABLE ACCIDENT RELATIVE TO EFFICIENT COMPLIANCE ERROR

6.4.1 THE BASIC CONCEPT.—Courts deciding negligence cases are particularly harsh on routine errors that everyone from time to time makes.⁶⁰ Examples would be a driver's failure to check the blind spot before changing lanes, a doctor's failure to count sponges before the patient is closed, or an auto mechanic's failure properly to fix some system. It's a good thing that these routine errors only rarely cause accidents. Most times when you fail to check your blind spot, you don't cause a collision, even though you have committed a breach of duty. I'll call these mistakes—as I've called them before—"compliance errors." If for a particular activity the courts could estimate the expected harm from unavoidable accident (a zone of immunity) relative to the expected harm from compliance errors (a zone of liability), they could compare the magnitudes of the two and thereby assess the probability that the defendant was negligently responsible for a given accident even if the courts lacked any evidence about the defendant's actual level of precaution. In fact, as Orwellian as the logic might first appear, this technique of implicit comparison is common. Let's look step by step at this last basic sorting method.

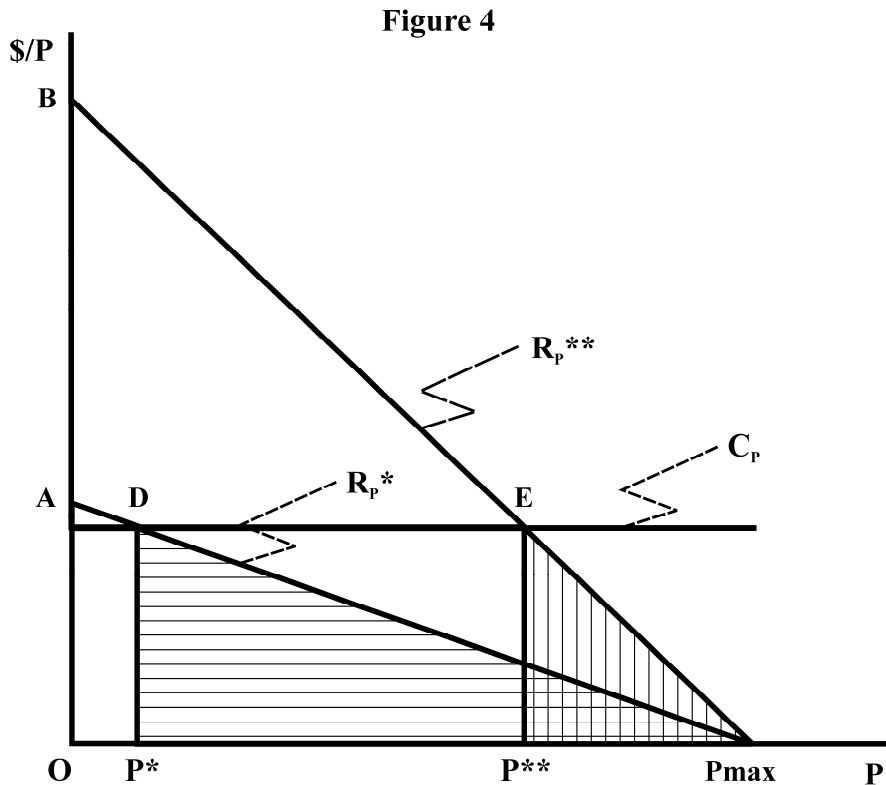
6.4.2 THE PRECAUTION PERSPECTIVE.—The first and most conventional perspective on negligence is the "precaution perspective," which has been the perspective of the prior graphs (figures 1 through 3). Figure 4 depicts two

⁵⁸ *D'Anna v. United States*, 181 F.2d 335 (4th Cir. 1950).

⁵⁹ *Kerber v. Sarles*, 542 N.Y.S.2d 94 (App. Div. 1989).

⁶⁰ See Grady (1994a); John C.P. Goldberg and Benjamin C. Zipursky, *Tort Law and Moral Luck*, 92 *Cornell L. Rev.* 1123, 1144-46 (2007) [hereinafter Goldberg and Zipursky, *Moral Luck*] (presenting and analyzing concept of "compliance luck").

different levels of risk (R_p^* and R_p^{**}) drawn with respect to the precaution P on the horizontal axis. Let's use as an initial frame of reference for figure 4 the famous res ipsa case of *Byrne v. Boadle* together with a hypothetical variation. In the actual *Byrne v. Boadle* case the plaintiff was walking next to the defendant's flour warehouse and a barrel of flour fell on his head. Let's imagine an alternative, hypothetical scenario in which a warehouse stores eiderdown feathers made up into round bales the same size as the *Byrne v. Boadle* flour barrels. There are thus two different risk curves drawn on figure 4, R_p^* (for feather bales) and R_p^{**} (for flour barrels).



Now on this same figure 4, let's think of the precaution that is measured along the horizontal axis as *durable precautions* that last over the time period relevant to figure 4 or *plans to use nondurable precaution* over that same period of time. Thus, different levels of P would entail ropes and jiggerhoists of different qualities together with plans to inspect them and plans to use other types of care when actually lifting barrels or feather bales above the sidewalk below.

Here's what I mean by a plan to use nondurable precaution. Suppose it is reasonable thoroughly to inspect the jiggerhoist once every month and then cursorily before every lift. Even such a simple plan can be demanding in some

situations, for instance, when the warehouse is busy or when a lot of distractions exist. In this “precaution perspective” on negligence, however, I want to abstract away from all special problems of compliance and assume that the costs of complying with precaution plans are always perfectly linear. To comply with the precaution plan 100% (to hit every planned inspection perfectly) costs exactly ten times, no more and no less, than to comply with the precaution plan 10% (to hit only 10% of the planned inspections). Thus, a type of compliance cost is built into C_P , but a type that assumes that the cost of using a nondurable precaution is always the same.

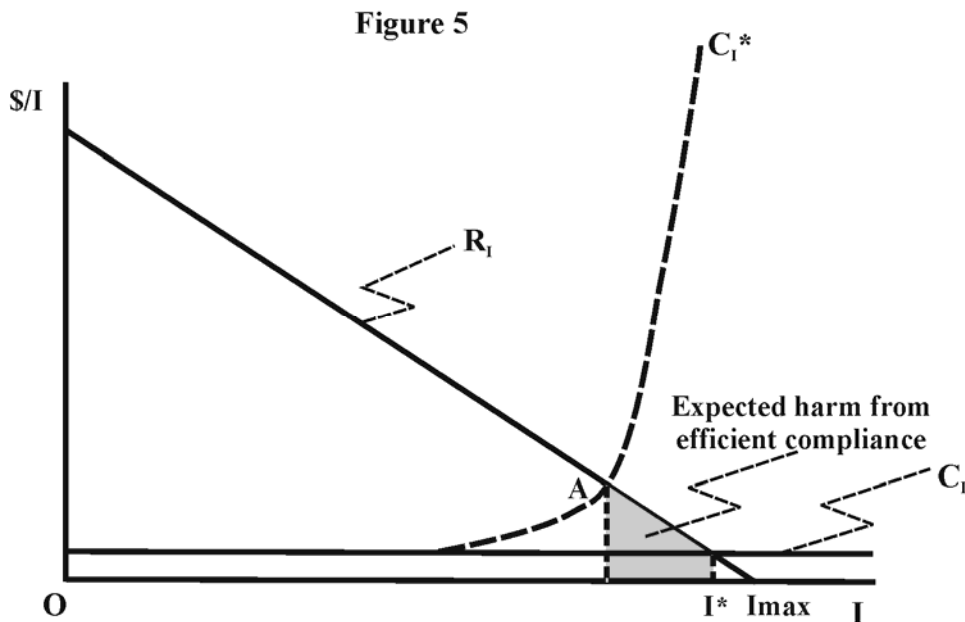
We can see from figure 4 why it should be a stronger *res ipsa* case when a barrel of flour rolls out of a warehouse onto a pedestrian below than when a bale of feathers does so. On figure 4, the R curve for feather bales is R_P^* , which intersects the C_P curve at P^* . As we might expect for feather accidents, a large amount of unavoidable accident (P^*DP_{\max}) exists relative to the potential for negligent harm ($OADP^*$). Unless the plaintiff proves a specific untaken precaution, courts tend to dismiss cases in which the possibilities for negligent harm are small relative to unavoidable accident. Now consider *Byrne v. Boadle* itself, which involved a heavy flour barrel. The marginal cost of precaution remains hypothetically the same, but the R_P curve rises to R_P^{**} because the same precautions when applied to barrels yield much greater reductions in expected harm simply because barrels are heavier and more damaging than pillows. Falling barrels are strong for *res ipsa loquitur* precisely because the area of unavoidable accident ($P^{**}EP_{\max}$) is much smaller than the potential for negligent harm ($OBEP^{**}$). Without knowing anything about the defendant’s actual precaution level, or the nature of the defendant’s untaken precautions, courts can assess some cases to be strong simply by seeing that the amount of unavoidable accident was small relative to the potential for negligent harm. *Res ipsa* cases, and negligence cases generally, are stronger the more inherently dangerous the activity and, especially, as the following paragraphs will show, the more technology has conquered the risks of an inherently dangerous activity.

Although the prior analysis may seem fairly convincing in its own terms, we’ve actually left out something important. We’ve assumed (when we defined the C_P curve) that cost of compliance was linear, which is almost certainly untrue. We get a more precise analysis of *Byrne v. Boadle* and similar cases when we correct this omission, as the next subsection does.

6.4.3 THE COMPLIANCE PERSPECTIVE.—As the prior analysis indicates, many negligence problems can be fully analyzed without any special concern for compliance costs. Whenever an actor has lacked a reasonable durable precaution or a reasonable plan of nondurable precaution, we can fully analyze the problem using only R_P and C_P curves. Assume that an actor has used all reasonable

precautions and therefore is at a point like P^{**} on figure 4. Again, suppose we think of precaution as either *a durable precaution* that lasts over the time period relevant to figure 2 or *a plan to use some nondurable precaution* over that same period of time. Let's imagine that P^{**} on figure 4 includes both an installed fire escape and a plan to inspect that fire escape every month over its working life to make sure that it remains in good order.⁶¹ (This example gives us an easier-to-conceive set of compliance possibilities.)

Given that the defendant has already installed the fire escape and possesses a plan to inspect it every month, figure 5 examines the consequences of following the reasonable inspection plan. On the horizontal axis we now have the compliance rate (I) scaled as a percentage of compliance with the reasonable plan of inspection (once every month). C_I measures the marginal cost of increasing rates of compliance with the plan, under the assumption that each inspection costs the same and, critically, that people face no special cost from perfectly consistent behavior. That flat C_I curve intersects with the R_I curve at I^* , which let's assume equals one inspection a month.



A second C_I curve exists on figure 5, and let's suppose that it reflects the fact that fire escape owners do face special costs from perfectly consistent behavior.

⁶¹ For reasons that will soon appear, the RP curve assumes that actors face no special costs of perfectly complying with their plans of nondurable precaution. Precaution cost is perfectly linear from zero compliance with a plan to 100% compliance with a plan.

This C_I^* is the same as the C_I curve at low levels of compliance, but begins to rise as the fire escape owner begins to approach perfect (100%) compliance with the once-a-month inspection plan. Inevitably, some inspections will be easier to do than others in terms of foregone benefits. Being perfect in one's inspections ensures that some highly valuable opportunities will be foregone. Perfect consistency probably also imposes its own special cost because most people must make special sacrifices in order to achieve it.

Again on figure 5 the shaded area equals the expected harm from what we can call "efficient compliance error" or, sometimes, "expected compliance error." If the actor takes account of his special costs of consistency, he will end up at a point like I_1 , which leaves the shaded areas as the expected harm from accidents that would be avoided at I^* (100% compliance with the once-a-month plan) but which would not be avoided at I_1 (some lower level of compliance because of a positive number of lapses in compliance).

6.4.4 EXTREME CASES.—Let's think about the difference between the R_P curve and the R_I curve. Think of an extreme precaution that is almost perfectly durable—the One-Hoss Shay⁶² of tort. As described by Justice Holmes's father, the deacon built his One-Hoss Shay in 1755. It was uniquely constructed so that each part was extremely durable and no part was weaker than the rest. Hence, throughout the 100 years that it existed, it never needed any maintenance. Nevertheless, although it could not last for ever, it did not wear out in the normal way; instead on its hundredth anniversary, in 1855, it crumbled into a pile of dust. Given that every part was as strong as the rest, this was its logical end, as the poem stressed.

Let's imagine a precaution that is the same as the One-Hoss Shay, a hypothetical fire escape that has been painted so that it never rusts (and never has to be repainted) and whose moving joints have been completely and imperviously sealed. Assume that the fire escape will last for 100 years without any maintenance before it has to be replaced.⁶³

We could still easily imagine R_P and C_P curves for this precaution because the apparatus might extend only to only the second floor or, more ambitiously, to all 40 floors of the building to which it is attached, and the cost and risk would each be different at different levels. With this precaution the C_I curve is almost

⁶² Oliver Wendell Holmes (Sr.), "The Deacon's Masterpiece or the Wonderful One-Hoss Shay."

⁶³ This example has been used before in the theory of capital. See Teddy T. Su, *Durability of Consumption Goods Reconsidered*, 65 Am. Econ. Rev. 148 (1975) and sources cited therein.

undefined because the only compliance required is to replace the fire escape every hundred years.

Conversely, let's think of a precaution that is extremely demanding. Suppose that accidents will be avoided if someone pushes a button once every minute, and that the apparatus to which the button is attached costs one penny. Here the R_i curve will be almost exactly the same as the R_p curve.

6.4.5 COURTS' HARSH TREATMENT OF COMPLIANCE ERRORS.—Let's now examine more realistic cases, which are intermediate between the two extremes just mentioned. Suppose that due care requires that a defendant use a precaution repetitively, as with failing to check the blind spot before changing lanes, counting sponges before closing a patient, or making sure that an aircraft system is properly inspected and repaired. Courts take a dim view of these lapses.⁶⁴ An economist might suppose that if the cost were significant to achieve perfect compliance with plans of nondurable precaution that a "true" negligence standard would only require a reasonable rate of compliance. The problem is that courts cannot easily measure what the defendant's actual rate of compliance was, and except in rare situations they behave as if they don't even want to know.⁶⁵ It

⁶⁴ See Grady, *Why Are People Negligent?* (1988: 302-10); Grady, *Res Ipsa and Compliance Error*, *supra* note 14, at 894-906 (1994); Goldberg and Zipursky, *Moral Luck* (2007: 1144-46) (presenting and analyzing concept of "compliance luck").

⁶⁵ See generally George H. Genzel, Annotation, Admissibility of Evidence of Habit, Customary Behavior, or Reputation as to Care of Motor Vehicle Driver or Occupant, on Question of his Care at Time of Occurrence Giving Rise to his Injury or Death, 29 A.L.R.3d 791 (1970 & Cum. Supp.). See, e.g., *Moody v. Haymarket Associates*, 723 A.2d 874 (Me. 1999) (evidence that building had been accident-free for ten years should have been inadmissible in case in which plaintiff argued that defendant's janitor had failed to put up warning sign and failed to replace mats after he mopped on day plaintiff slipped).

Cal. Evid. Code Section 1104 provides as follows:

Except as provided in Sections 1102 and 1103 [which do not apply to civil negligence], evidence of a trait of a person's character with respect to care or skill is inadmissible to prove the quality of his conduct on a specified occasion.

The drafting notes say that this section codifies *Towle v. Pacific Improvement Co.*, 33 P. 207 (Cal. 1893). In that case the plaintiff sued the defendant for negligently running his team of horses over her. Over the plaintiff's objections, the trial court allowed the defendant to introduce evidence that the defendant's driver, who was in charge of the team, was "a good, first-class driver, careful in handling horses, and that during the four years he had been in the employ of defendant he had never been guilty of any mismanagement or carelessness in the conduct or care of the team." In other words, the defendant introduced evidence that the defendant's driver was maintaining a reasonable rate of compliance. Based on this and other evidence, the jury returned a verdict to the plaintiff. The sole issue for the California Supreme Court was whether this evidence was properly admitted. In holding that it was inadmissible, the court said that it was plaintiff's

would be much more costly for courts to administer a rule that either required a plaintiff to prove the defendant maintained an unreasonably low compliance rate or allowed a defendant to exculpate himself by showing that he did in fact maintain a reasonable rate of compliance and that the error that hurt the plaintiff was highly unusual.

The courts' strict treatment of compliance errors is properly considered a pocket of strict liability within the negligence rule, though some important qualifications exist. Courts sometimes allow juries to absolve defendants of their compliance errors.⁶⁶ Nevertheless, courts also find people guilty of compliance errors guilty of negligence as a matter of law, either by entering summary judgment or judgment n.o.v. for the plaintiff (or defendant if the plaintiff

duty to prove that the defendant's driver had been negligent on this particular occasion, and that the defendant could defeat this proof only by showing that on this occasion that driver was not negligent. See 33 P. at 346. But see *Romeo v. Jumbo Market*, 56 Cal. Rptr. 26 (Ct. App. 1967) (in supermarket slip-and-fall case in which defendant allegedly did not sufficiently monitor condition of floor, defendant allowed to introduce evidence that its store was customarily and habitually kept clean); *Dincau v. Tamayose*, 182 Cal. Rptr. 855 (Ct. App. 1982) (in malpractice action based on defendants' failure to treat and hospitalize earlier, defendants allowed to introduce evidence that their custom was to respond quickly to symptoms allegedly presented by plaintiff's deceased). These last two cases lack significant progeny and seem implicitly limited to their common facts in which it was impossible for these defendants otherwise to rebut the plaintiffs' cases in chief. In fact, the *Dincau* court expressly placed its holding on this ground. 182 Cal. Rptr. at 864. They are thus extensions of the "no eyewitness rule," which in many states provides an exception to the general rule that the plaintiff cannot introduce evidence of the defendant's prior habits of caretaking. See also Cal. Evid. Code Section 1104.

Modern California cases are better represented by *Hiser v. Bell Helicopter Textron Inc.*, 4 Cal.Rptr.3d 249 (Ct. App. 1982) (trial court erred in allowing witness to answer whether he ever saw the pilot operate an aircraft in an unsafe manner, whether he ever observed the pilot operate an aircraft with low fuel, and whether the pilot was the type of pilot that would take off on a 30 minute mission with 35 minutes of fuel); *Jeld-Wen, Inc. v. Superior Court (Keener)*, 32 Cal. Rptr. 3d 351 (Ct. App. 2005) (once defendants admitted vicarious responsibility for driver's negligence, if any, and thereby took negligent entrustment issue out of case, plaintiffs could not introduce evidence about driver's prior bad driving record).

⁶⁶ See *A.C. ex rel. Cooper v. Bellingham School Dist.*, 105 P.3d 400 (Wash. App. 2004) (jury allowed to absolve teacher who lost grip on piñata bat and struck her first-grade student); *Capshaw v. Gulf Insurance Co.*, 107 P.3d 595 (Okla. 2005) (jury allowed to absolve driver who rear-ended plaintiff's stationary vehicle); *Rubenstein v. Ohrbach's Inc.*, 346 P.2d 429 (Cal. App. 1960) (jury allowed to absolve department store employee who pushed heavy cart into customer); *Ala v. Rockefeller Group, Inc.*, 768 N.Y.S.2d 281 (Sup. Ct. 2003) (defendant's employee not negligent as a matter of law for pushing hand truck into plaintiff) (collecting similar cases).

committed the compliance error).⁶⁷ In the cases in which courts have considered whether a jury could absolve a compliance error, three important themes can be discerned. First, if it appears that the plaintiff's request for damages was excessive, courts seem disposed to allowing the jury to forgive a defendant's compliance error that the plaintiff proved.⁶⁸ Second, if it appears that the defendant was especially sympathetic, the court may not allow the jury to forgive his compliance error, but may instead order a new trial or judgment as a matter of law for the plaintiff.⁶⁹ Finally, many compliance errors are regulated by a statutory provision that ostensibly create absolute obligations to "maintain a proper lookout for opposing traffic" or something similar. Especially in this last set of cases, a court is likely, though not certain, to order judgment as a matter of law when a defendant has violated the statute, even when no one could comply with it perfectly.⁷⁰

⁶⁷ See *Bauer v. White*, 976 P.2d 664 (Wash. App. 1996) (defendant surgeon negligent as a matter of law for leaving pin in patient); *Chi Yun Ho v. Frye*, 865 N.E.2d 632 (Ind. App. 2007) (surgeon negligent as a matter of law for leaving sponge in patient); *Asmelash v. Braga*, No H023824, 2003 WL 21437634 (Cal. App.) (jury not allowed to absolve driver who struck pedestrian in crosswalk because driver was negligent as a matter of law); *Bergin v. Grace*, 833 N.Y.S.2d 729 (App. Div. 2007) (attorney negligent as a matter of law for missing filing deadline); *Previs v. Dailey*, 180 S.W.3d 435 (Ky. 2005) (jury not allowed to absolve defendant trucker for striking bicyclist); *Boyd v. Shaw*, No. Civ.A. 85C-JL-72, 1987 WL 764058 (Del. Super.) (defendant negligent for failing to check blind spot); *Plaut v. Allright Parking Management, Inc.*, 795 N.Y.S.2d 576 (App. Div. 2005) (motorist negligent as a matter of law for backing into pedestrian); *Failla v. Amodeo*, 639 N.Y.S.2d 586 (App. Div. 1996) (hunter negligent as a matter of law for failing to see another hunter).

⁶⁸ See *Farnsworth v. Tint*, No. A110435, 2006 WL 877438 (Cal. App. 2006) (jury allowed to forgive compliance error of defendant who backed up and struck plaintiff's stationary vehicle when plaintiff had sought \$38,503 for personal injuries from two- to three-mile-per-hour collision that had only cracked her taillight).

⁶⁹ See *Huetter v. Andrews*, 204 P.2d 655 (Cal. App. 1949) (trial court properly ordered new trial for plaintiff after jury absolved defendant for failing to keep proper lookout and when defendant and his counsel had both wore their Marine Corps discharge buttons to court soon after World War II); *Michelli v. Kern*, 61 Cal. Rptr. 888 (Ct. App. 1967) (trial court properly ordered new trial after jury absolved nurse who had failed to keep proper lookout and struck union official). But see *Espinoza v. Rossini*, 55 Cal. Rptr. 205 (Ct. App. 1966) (jury allowed to absolve sympathetic plaintiff his contributory negligence, and trial court erred in entering judgment n.o.v. for defendants).

⁷⁰ See *Gray v. Brinkerhoff*, 258 P.2d 834 (Cal. 1953) (defendant negligent as a matter of law for violating statute and hitting plaintiff as she was walking in a crosswalk with the light in her favor and jury lacked power to absolve defendant); *Shehtanian v. Kenny*, 319 P.2d 699 (Cal. 1958) (court upheld plaintiff's jury verdict finding defendant negligent for failing to see plaintiff before changing lanes and cited California Vehicle Code provisions ostensibly creating absolute

It is impossible to tell from appellate case reports how often juries actually absolve compliance errors, but I suspect that defendants behave as if it is uncommon for them to do so. In this sense, then, there is strict liability: if you commit a compliance error that causes harm, you will either face judgment as a matter of law or a jury trial and maybe a second jury trial if the first jury absolves you. Moreover, if you are a sympathetic defendant, you may face a higher probability of judgment as a matter of law, though also a higher probability of a jury acquittal, if the court allows it. Although this is not the rule in *Rylands v. Fletcher*, it seems more like strict liability than the orthodox economic conception of negligence, so I'll call it "strict liability" and qualify it appropriately in context.

On its surface, the doctrine requires only "reasonable" precaution, but once a precaution is deemed reasonable, woe betide the defendant who fails perfectly to employ this reasonable precaution and at each of its "reasonable" intervals. As everyone knows, even one miss can yield substantial liability, and the courts rarely grant absolution. The law's compliance obligations are especially unachievable for precautions that have short lives or which for some other reason must be used repetitively, especially at high rates or defined intervals. If these "nondurable" precautions are also productive and for this reason must be used frequently, courts may infer negligent harm simply from the occurrence of the accident. A good name for an inadvertent lapse in using a nondurable precaution is "compliance error."⁷¹ Because liability for compliance errors tends to be strict, a double signature that shows the defendant's compliance error is an especially obvious case of negligence liability. *Anjou v. Boston Elevated Ry.* was such a case (defendant's employees committed compliance error in failing to clean platform of old banana peels), as was *Newing v. Cheatham* (defendant's deceased pilot failed to check whether fuel gauge was approaching empty).

The case of *McGonigal v. Gearhart Industries, Inc.*,⁷² demonstrates how strict the liability for compliance errors can be. The defendant was an assembler

obligations to comply); *Philo v. Lancia*, 63 Cal.Rptr. 900 (Ct. App. 1967) (defendant negligent as a matter of law for violating statute requiring him to keep proper lookout and trial court properly upheld verdict against him). But see *Alarid v. Vanier*, 327 P.2d 897 (Cal. 1958) (violation of statutory duty does not automatically lead to judgment as a matter of law though here it was sufficient to support jury verdict for plaintiff).

⁷¹ A precaution is durable or nondurable from the actor's, not the victim's, point of view. An actor needs to use a nondurable precaution frequently, whereas he can use a durable precaution less frequently. Either type of precaution, if used, can yield equal a benefit for the victim that can be long lasting.

⁷² 788 F.2d 321 (5th Cir. 1986), reconsidered and aff'd on subsequent appeal, 851 F.2d 774 (5th Cir. 1988).

of hand grenades for the U.S. government, and its contract required it to x-ray each fuse. Somehow a defective fuse slipped through its procedures, and the plaintiffs, two army sergeants, were hurt when their hand grenades prematurely exploded. The plaintiffs sued on a products liability theory and a negligence theory. The last nonsettling defendant was the company that inspected the fuses, and the plaintiffs sued it for negligence. This defendant claimed that a prematurely exploding fuse did not show that it had been negligent because, its lawyers said, a few misses were inevitable and reasonable. The trial court adopted this view and directed a defense verdict because the plaintiff had failed to introduce evidence that the defendant had made an unreasonable number of errors, only that it made this one.⁷³ The appeals court reversed, holding that the defendant was strictly liable for its one compliance error.

The strict liability rule for compliance errors is broad.⁷⁴ For instance, in *Anjou v. Boston Elevated Ry.*, the gritty banana peel case discussed above, there was no issue about whether the defendant had a reasonable plan to sweep the platform of debris and just failed reasonably to implement that plan on the one occasion when the plaintiff slipped. The court indicated no interest in that type of evidence. The gritty banana peel was a double signature of that defendant's negligence just the same as the defective fuse was.

If the *McGonigal* defendant had used an automated machine to inspect the fuses and if the machine had missed one defect, the court would probably analyze the case under the Learned Hand formula and ask whether the risk reduction from

⁷³ On this issue, the trial court had erroneously claimed:

[I]f there was an obligation on the part—or duty on the part of the defendant to be 100% accurate, then this case could proceed. But if there is no duty for them to be 100% accurate, if there is a duty commensurate with the danger, if there is a duty to exercise reasonable care in light of the dangers and consequences, then, as I have ruled, that that is the applicable standard in this case

851 F.2d at 324. This was the trial court's understanding of the negligence rule that the appeals court found to be incorrect. Under the ultimate holding, every compliance error, reasonable or unreasonable, yielded liability.

⁷⁴ Some special doctrines exist that allow courts and juries to forgive compliance errors, for instance, the doctrine of "momentary distraction," but these doctrines apply only in very special circumstances, and usually only to plaintiffs who have been asked to correct for a defendant's prior negligence. In a grander sense, the doctrines of comparative and contributory negligence also temper the rule of strict liability for injurer compliance errors because they cast on victims obligations to use corrective precaution when the victims can see that they have been imperiled by a defendant's prior compliance error.

a more accurate machine was worth the cost.⁷⁵ This would be a more generous standard than the rule that courts typically apply to human error. For this reason, negligence law can create an inefficient incentive to substitute too much in favor of durable precaution whose imperfections the courts are more likely to forgive.⁷⁶ In effect, negligence law promotes capital at the expense of labor.

A negligence rule that forgave defendants a reasonable number of compliance errors would be more costly for courts to implement than the actual rule. One compliance error typically looks the same as every other in the sequence, and it would be practically and even conceptually difficult to say which one was a reasonable compliance error and which an *unreasonable* error. High judicial measurement costs are presumably the source of the courts' strict practices.

6.4.6 COMPLIANCE-USING AND COMPLIANCE-SAVING TECHNOLOGIES.—Let's examine how technological changes can affect the flow of negligent accidents that will predictably come from an activity. The economist John R. Hicks developed the distinction between labor-saving and capital-saving technology.⁷⁷ He classified technical change according to its initial effect on the relative marginal productivities of capital and labor. If a new technology increases the marginal product of labor more than the marginal product of capital, it is capital saving. Technology that has the opposite effect is labor saving, which Hicks thought was the more common type. Imagine that the current grain harvesting technology involves sending workers out to the field with scythes to cut the crop, which they then thresh and clean by hand. Now, the combine harvester is invented. This technology would be labor saving because its initial effect would be to reduce the marginal product (silo-ready grain) of labor relative to that of capital because much less labor would now be needed in order to harvest and prepare the crop for storage. We could say equally that the combine technology was capital using.

We can easily adapt this distinction to accidents. Imagine that instead of capital and labor we have durable and nondurable precaution; in fact, durable precaution *is* capital, and nondurable precaution *is* labor. A new technology could

⁷⁵ Some limits exist. If the machine was highly inaccurate, a plaintiff could probably show it was negligence to fail to do the inspections manually.

⁷⁶ The cost of this substitution could (though need not) be smaller than the cost of altering the negligence rule to permit defendants a reasonable number of compliance errors before they are liable.

⁷⁷ JOHN R. HICKS, *THE THEORY OF WAGES* 121-27 (MacMillan and Co., Ltd., 2d ed., 1964).

initially increase the marginal product of nondurable precaution⁷⁸ relative to durable precaution, or it could have the opposite effect. That is, the new technology could either save compliance effort, in which case we'll call it "compliance-saving technology," or it could increase compliance effort if it is a "compliance-using technology."

Most new *production* technologies, especially basic technologies like the combine harvester, seem to be labor-saving. With safety technology the picture is only a bit more complicated. In connection with figure 4, think of the invention of air brakes for railroad trains. This new technology changed the whole activity of railroading and the marginal productivity of nondurable precaution. Trains with air brakes could reasonably run faster, so it became more important for the train crew to keep better and more constant lookouts to see whether anything was in the way.⁷⁹ Also because of the higher travel speeds, the new air brakes probably needed to be inspected more often and more thoroughly than the old brakes because brakes had become more critical. Probably the new air brake systems were more complicated and perhaps more fallible than the old brakes and needed more inspections for that reason as well or for the related reason that the longer trains that air brakes would induce would place more strain on the brake system. In a word, the overall effect of the new air brake technology was almost certainly compliance-using.

Now think of the effect of new air brake technology will have on the risk created by each train, which is a related analysis, though not exactly the same. The train now travels faster, and it becomes harder for people crossing the tracks or walking near the tracks to avoid it. A reasonable plan for the train crew will be to inspect and maintain the brakes more often and to maintain better lookouts because well-maintained brakes timely applied can now prevent many more accidents partly because more and worse accidents can now happen more easily and because more accidents are now preventable. The overall effect was to make a number of harms newly preventable (which is the key concept), so that the R_P curve actually increased over the R_P curve that existed before when trains lacked air brakes.

The C_P curve could actually fall because the price of brake services per mile might drop because a smaller crew may be required to apply the brakes in the

⁷⁸ The marginal product of a new safety technology could be denominated in terms of reduced expected harm.

⁷⁹ See, e.g., *Ohio & Mississippi Ry. Co. v. Stribling*, 38 Ill. App. 17 (1889) (jury entitled to find negligence for engineer's failure to see plaintiff's horse on tracks).

event of need, and perhaps supernumerary brake operators were a significant cost of the old technology. Also, trains will grow in size because they can now be stopped more easily, and this will result in precaution savings because one engineer can now look ahead for a train that carries more freight. Nevertheless, the C_P curve could also rise. The new brakes will make a number of complementary precautions (checking the brakes, servicing the brakes, maintaining a lookout farther down the tracks) more economic and thus more reasonable. As just mentioned, the net effect of all of these changes could be either to increase or to decrease the C_P curve. As we'll soon see, it is indeed possible—though still improbable—that a truly advanced safety technology (compliance-saving technology) will increase the amount of unavoidable accident relative to the potential for negligently caused harm. It's highly unlikely, however, that basic safety technology, such as air brakes, will have this effect, and we'll soon go into the reasons more thoroughly. After all, the purpose of a basic new safety advance is to make present accidents as well as currently unpreventable calamities more reasonably preventable, and not less so. If the implementation of air brakes conformed to this idea, which seems probable, the overall effect was to increase the R_P curve relative to the C_P curve so that the new R_P curve becomes something like R_P^* on figure 4.

For most basic safety improvements (sophisticated vs. crude trains; sophisticated vs. crude nuclear reactors), the usual effect will be to increase the potential for negligent harm relative to unavoidable accident, which is graphically expressed by a rise in the R_P curve relative to the C_P curve (on figure 4). It is perhaps not such a deep paradox when we see that with, say, a sophisticated nuclear reactor more accidents are reasonably preventable than with an older and cruder apparatus. More expected harm now falls within the zone of potential negligent harm, but—again somewhat counterintuitively—not all of the increment to negligent harm comes from the old unavoidable accident.⁸⁰ Some comes from nature because some accidents now preventable couldn't have been prevented at all—even through uneconomic precaution—using the old technology. If this example is unconvincing, think of the invention of the dialysis machine. Although the technology saves lives, it also creates an R curve where none existed before. Many new technologies will reallocate risk between potential negligent

⁸⁰ It is tempting to think that the accidents newly added to negligent harm come from the nugget of totally inevitable accidents that were connected somehow to the old lower R curve. That won't be true, however, when the new safety technology is air brakes, and trains now travel at four times their prior speed. The new technology of air brakes will have caused the whole activity of railroading to change.

harm and unavoidable accident, but often new technologies will also bring entirely new risk into both zones because more accidents become preventable.

It is theoretically possible for both compliance-using and compliance-saving technology to increase the R_P curve relative to the C_P curve. I've already asserted that train air brakes were compliance-using; let's look at an example of compliance-saving technology. Suppose someone invents a new train technology system that rings a bell in the locomotive whenever someone or something is on a collision course with the train and that also rings a bell whenever the brakes are out of order. Although the new system would also have to be inspected, probably the initial effect would be to reduce the marginal productivity of nondurable precaution because at least some inspections and lookouts for obstructions could be eliminated, so this technology would be compliance-saving. Nevertheless, the implementation of this compliance-saving technology will raise the R_P curve because its whole purpose would be to make accidents more preventable, and preventable accidents is exactly what the R_P curve subtends. The effect on the C_P curve is again uncertain, so the technology could either increase or decrease the amount of unavoidable accident. Nevertheless, as we will see, because the technology is compliance-saving, it will reduce the R_I curve and will also reduce the efficient amount of compliance errors so it will almost certainly reduce the flow of negligent railroad accidents. Compliance-saving technology generally weakens negligence cases; that is usually its purpose.

The basic point, however, is that most safety technology, especially basic safety advances, increase the amount of negligently caused harm relative to the amount of unavoidable accident because they also encourage more dangerous behavior and place greater demands on human compliance.

6.4.7 NEGLIGENCE CYCLES.—We can use the concepts just described to see cycles in the strength of negligence cases—cycles that based on common technological changes as an industry develops. Think of the Wright Brothers' airplane. Because this plane was so primitive, the R_P curve was low because not much expected harm was preventable by safety devices, which the plane in any case lacked. We could therefore assume that the cost of precaution was high, so that unavoidable accident was great. Moreover, also because the plane possessed little durable precaution, there were relatively complementary compliance opportunities—no fuel gauge to watch, certainly no radar to watch, and so forth. Hence the efficient amount of compliance error was also low relative to the amount of unavoidable accident—the epitome of a weak negligence case. In early airliner crash cases, some courts held that *res ipsa loquitur* was unavailable, even to plaintiffs who had no other way of proving their cases because the crash had destroyed all evidence of possible specific negligence. These courts generally

emphasized that airliner technology was then so primitive that unavoidable accident was common relative to the possibilities for negligent harm.⁸¹

In the next cycle of technology, basic safety devices were invented and installed on aircraft, especially commercial aircraft. Cockpits were filled with various dials and gauges to measure the aircraft's safe performance; altimeters and radars are similarly invented and installed, and so forth. Moreover, as time passed these devices became better and cheaper. The risk subtended by the RP curve increased by a vast amount because so much risk became preventable. Simultaneously the RC curve dropped, so that the amount of unavoidable accident also fell. Nevertheless, all of these safety devices were compliance-using because they had to be monitored constantly in order to be effective. The efficient amount of compliance error thus increased and became large relative to unavoidable accident, which is the epitome of a strong negligence case. Consistently, in later

⁸¹ See *Cohn v. United Airlines*, 17 F. Supp. 865 (D. Wyo. 1937). The *Cohn* court said:

The Department of Commerce, through its Bureau of Air Commerce, has published documents purporting to deal with accidents in the air and their causes. In publications of July and August, 1935, the causes of accidents attributable to carelessness or negligence are but a small percentage of all the causes which are known in this young but growing enterprise. It is definitely known that the presence of air-pockets, cross-currents, clouds, fog, mists, and a variety of climatic conditions bring about disaster for which no one is responsible, except it might be said that he who assumes to fly must look well to his own fate. Stalling motors frequently bring about failures to negotiate the air. Experience teaches us that this is still common in the automobile motor, which has the same method of propulsion as that of the airplane, but with a much longer period of experimentation and development. Of course, when the motor in an auto stalls it generally causes nothing more serious than disappointment, inconvenience, and vexation to the driver and occupants; but when the motor of an airplane stalls when in the air it is very likely to mean death to the occupants. Only a few of the ordinarily recognized natural hazards of flying which have not yet been definitely overcome, have been mentioned.

17 F. Supp. at 867-868.

Because modern airliners have overcome these hazards *res ipsa* has become much more available to airliner crash plaintiffs.

See also *Herndon v. Gregory*, 81 S.W.2d 849 (1935) (*res ipsa* denied in nonairliner-airplane crash case). But see *Seaman v. Curtiss-Wright Flying Service, Inc.*, 247 N.Y.S. 251 (App. Div. 1930) (error not to charge on *res ipsa* in early airliner crash case, but defendant conceded that aircraft was mechanically "perfect," and independent evidence of pilot error existed).

times courts held that the mere crash of an airliner⁸² or similar aircraft⁸³ created a strong presumption that the cause was negligence.⁸⁴

In our own era, many changes in aircraft safety design seem to be compliance-saving. The airplane actually monitors itself, and effectively rings a bell when a system or environment becomes dangerous. The safety system itself might initiate the control response that in earlier days the pilot would have had to perform manually. This technology almost surely prevents accidents and thus increases the RP curve still more, but it could increase the cost of precaution and perhaps increases the amount of unavoidable accident relative to the possibilities for negligently caused harm. Even if this compliance-saving technology leaves unavoidable accident relatively constant, its main effect will be to reduce the number of compliance opportunities and thereby reduce the amount of efficient compliance error relative to unavoidable accident. If so, negligence against the aircraft's owners and operators would have grown weaker. Without evidence of the owner's or operator's specific negligence, the court might be more inclined to suppose that the accident was due to sabotage or to some cause beyond the owner's or operator's responsibility.

Suppose a nineteenth-century doctor operated on a patient for appendicitis, and the patient died. Unavoidable accident was large because many such patients died even when the doctors and nurses perfectly implemented the most reasonable plans that existed. The safety technology, moreover, was simple so that precaution plans were probably also simple and relatively easy to comply with. With unavoidable accident high and compliance-error accident low, there were probably few successful claims for negligent appendectomies.

Now, in a modern hospital, a similar patient presents with appendicitis, and the doctors again operate with the same unfortunate result—death on the operating table. Unavoidable accident is now small because almost all patients can be saved if the far more advanced reasonable precaution plans of today are perfectly followed. Nevertheless, again because of the advanced nature of these

⁸² Haasman v. Pacific Alaska Air Express, 100 F. Supp. 1 (D. Alaska 1951).

⁸³ Rogow v. United States, 173 F. Supp. 547 (S.D.N.Y. 1959).

⁸⁴ Similarly the crash of an early and primitive elevator created no presumption of a negligent cause, whereas the crash of a modern elevator, by itself, will take a negligence case to the jury. Compare McGrell v. Buffalo Office-Building Co., 47 N.E. 305 (N.Y. 1897) (res ipsa unavailable in early elevator plunge case), with Williams v. Swissotel New York, Inc., 542 N.Y.S.2d 651 (App. Div. 1989) (res ipsa would take the plaintiff's case to the jury based merely on evidence that defendant's elevator plunged).

plans, they will be demanding of human compliance efforts. A whole medical team will have to watch the patient constantly, and use perhaps hundreds of nondurable precautions, if the patient is to be safe. Nevertheless, if this highly demanding and now reasonable plan is perfectly followed, it will be rare for a patient to die (unavoidable accident will be small). Because of the high demands of this modern reasonable plan, compliance errors will predictably occur, and the rate of compliance-error accident will thus be high relative to that of unavoidable accident.

Paradoxically, claims for negligent appendectomies will be stronger in the twenty-first century than they were in the nineteenth century, even when safety technology is better today and today's overall safety investments are larger than they were in the nineteenth century. The better safety technology itself causes increased negligent behavior—not just increased findings of negligence, but increased rates of negligence itself.

Precisely because of courts' harsh treatment of compliance errors, assessing their ex ante probability for the accident at hand becomes a method of sorting injuries between negligent harm and unavoidable accident even when the plaintiff has introduced no evidence at all about the defendant's untaken precaution or precaution level. The more demanding the defendant's nondurable precaution obligations in a particular setting, the more likely it was that the defendant lapsed because more demanding obligations are less economically achievable. This is another reason why *Byrne v. Boadle* was a strong res ipsa case. Moving a barrel above a crowded sidewalk required a large number of repetitive yet highly productive human operations, inspections, and adjustments. Hence, the probability of a compliance error was high. For this reason (together with the large amount of potential negligent harm relative to unavoidable accident), the court was able to infer the defendant's negligence from the mere occurrence of the accident.

7. EXTENDED SORTING

7.1 THE PURPOSES OF THE UNAVOIDABLE ACCIDENT

DOCTRINE

Warren Seavey famously wrote, "Prima facie at least, the reasons for creating liability should limit it."⁸⁵ A less elegant but maybe more accurate substitute is that the reasons for disregarding a limitation on liability suggest why the

⁸⁵ Warren A. Seavey, *Mr. Justice Cardozo and the Law of Torts*, 52 Harv. L. Rev. 372, 386 (1939).

limitation exists in the first place. Courts seem less concerned with causal limitations when the defendant has been deliberately as opposed to inadvertently negligent. This pattern suggests that the reasons for these causal limits come from bad incentives that may be created by comprehensive liability for compliance errors.

Strict liability for compliance errors does yield greater compliance, but increasing compliance rates will almost certainly come at increasing marginal compliance cost. Think of “compliance cost” as a special type of precaution cost that increases according to the rate of precaution and also (in some situations) according to whether repetitive precautions are optimally spaced. Thus, for a nurse to check a diabetic patient’s blood sugar every two hours entails more compliance cost than checking it every day, and checking it exactly every two hours entails more compliance cost than checking it every one and one-half to two and one-half hours. One cost comes from actually doing the checks, and a separate cost comes from making sure that the checks happen every two hours. The latter is “compliance cost.”

The reason for the distinction is that courts try to value precaution cost, but usually behave as if they usually don’t count compliance cost. Again, it is hard for courts to measure a reasonable rate of compliance (how many missed checks are reasonable) as opposed to a reasonable rate of precaution (check this diabetic patient every two hours). For a principal supervising an agent, the distinction is especially obvious. Hospitals must be concerned about whether their nurses are checking the patients often enough, but the compliance rate for which hospitals realistically aim will probably not be the same compliance rate that courts require. Hospitals will anticipate that their staff members will commit some compliance errors because they will find it too costly to reduce these compliance errors to zero. Put more simply, hospitals will expect to be negligent.

The negligence rule probably sometimes induces actors to substitute less effective and more costly *durable* precaution for more liability-prone *nondurable* precaution. As has also been recognized, a negligence rule can also potentially induce inefficiently low activity levels, what Steven Shavell has called “crushing liability” (1980). Courts normally hold that there must be an exact correspondence between the required precaution rate and the experienced compliance rate. Suppose somehow courts could tell the difference between efficient and inefficient compliance errors and imposed liability only on the latter. They would still face a conceptual problem. The efficient compliance rate would depend on a number of factors that seem knowable only in general terms across different accidents. For instance, activity-level reductions that go with higher compliance rates are more costly the greater the economic surplus from the last units of that activity. A lower compliance rate (and hence higher injurer activity levels) is probably more efficient, everything else the same, the better money

damages can compensate for an injury and the more administratively efficient the tort system is relative to alternative compensation systems, such as first-party insurance. Moreover, lower experienced injurer compliance rates would also become more socially preferred the more efficiently victims, or even other injurers, could correct for an original injurer error.

To the extent, however, that the type of “insurance” provided by the tort system is inevitably more costly than private market insurance, or covers losses that victims would never voluntarily insure at actuarial cost, it follows that at some point increasing compliance rates and obligations will fail to pay a social surplus, especially after the marginal cost of increasing perfection begins to rise sharply, as the injurer gets close to the law’s theoretical but impossible goal. Hence, although courts impose strict liability for injuries caused by compliance errors, they also behave as if this strict liability can be extremely problematic. If, for instance, a court can see a substantial probability that an injury was *not* caused by the defendant’s compliance error, it is a reason to make that defendant immune, even though some positive, maybe substantial, probability existed that the defendant’s compliance error did indeed cause it. A similar error is a misjudgment by an injurer or victim about what precautions were reasonable under particular circumstances. It would not make good sense for injurers make these judgments perfectly, but courts often behave as if injurers cannot make a reasonable error. Again, under a hypothetical “true” negligence standard, how would a court assess whether the injurer’s misassessment of his duty was a reasonable or unreasonable error? Again, they usually look exactly the same.

It follows that when the actor’s breach of duty could not have been either a compliance error or a misjudgment about the breach-of-duty standard, which could be seen as another kind of compliance error,⁸⁶ there is less reason for the courts to declare an injury to be unavoidable accident. Injurers usually face lower costs to eliminate their deliberate and knowing breaches of duty than their inadvertent compliance errors, especially their ultramarginal compliance errors. Moreover, courts can also frequently—not always—tell the difference between deliberate negligence and a compliance error, which will not be deliberate (except in an extended sense) but inadvertent. When a deliberate or knowing breach was economic, it usually won’t have been a breach of duty in the first place, as when

⁸⁶ This type of compliance error is not a function of the rate of precaution and may exist even for durable precautions. Under this broader conception, a “compliance error” is simply negligence that may be efficient and might be judged as nonnegligent in a different world in which courts had lower measurement costs.

some special cost or circumstance justified noncompliance.⁸⁷ Although some commentators have criticized the courts' attention to whether a lapse was inadvertent or deliberate, it is really the best way they have to separate possibly efficient lapses from their clearly inefficient counterparts. Unfortunately, the distinction is imperfect because some ultramarginal inadvertent lapses will also be efficient. Nevertheless, half a loaf is better than none.

7.2 DELIBERATE NEGLIGENCE

Basic purposes of the cause in fact limitation seem to be to limit the liability for compliance errors, some of which are efficient, and to limit the liability for possible injurer (and victim) mistakes in assessing how much precaution is required. When an injurer's breach of duty was deliberate, typically neither of these reasons comes into play. Hence, if there is any doubt whether an injury caused by a deliberately omitted precaution was unavoidable accident or negligent harm, it makes sense to weigh this determination against the defendant. Because the defendant's behavior could not have been efficient, it makes little sense to withhold liability. Accordingly, the courts are more likely to find negligent harm when the defendant deliberately, as opposed to inadvertently, failed to use a reasonable precaution.⁸⁸

7.3 STATUTORY BREACHES

As just noted, an important way for an injurer to commit efficient negligence (negligence that society would not really want the injurer to avoid if society had perfect information about his behavior) is to mistake the reasonableness of the untaken precaution, as by making an error in spur-of-the-moment cost-benefit

⁸⁷ *Tedla v. Ellman*, 19 N.E.2d 987 (N.Y. 1939). People with special challenges, for instance, the blind and the deaf, sometimes get special dispensations, but not for their deliberate breaches of duty, again unless special circumstances made reasonable an omission that would ordinarily be a breach of duty.

⁸⁸ See *Morris v. Parke, Davis & Co.*, 573 F.Supp. 1324 (C.D. Cal. 1983) (defendants would be subject to market share liability if plaintiff could prove that they knowingly introduced a dangerous drug into market). See also RESTATEMENT (SECOND) OF TORTS § 501(2), which provides:

The fact that the actor's misconduct is in reckless disregard of another's safety rather than merely negligent is a matter to be taken into account in determining whether a jury may reasonably find that the actor's conduct bears a sufficient causal relation to another's harm to make the actor liable therefor.

See generally Ralph S. Bauer, *The Degree of Moral Fault as Affecting Defendant's Liability*, 81 U. Pa. L. Rev. 586 (1933).

analysis that a plaintiff's lawyer can critique after the error has produced a million dollar injury. If a statute has told the injurer what precautions are reasonable, it is often cheaper for an injurer to avoid an error. His safety consultants can read the statute. For this reason, we would predict that causation issues might become a little less substantial in cases of statutory breaches. Hence, when the owner of a swimming pool disregarded a statutory duty to provide a lifeguard, the courts have discounted the possibility that the lifeguard, if provided, may not have been able to save the plaintiff's deceased.⁸⁹ Nevertheless, this violation seems to have been deliberate in some sense, so there is an overlap between wishing to be harsh on statutory violations and wishing to be harsh on deliberate violations. The presumption of causation seems weaker if the statutory violation could have been inadvertent and therefore possibly efficient.⁹⁰ Moreover, the statutory precaution will not save the day for the plaintiff, if the plaintiff's classic specific negligence proof has failed and if the statutory precaution was relatively unproductive.⁹¹ In addition, if the accident's signature makes it clear that the statutory precaution would *not* have prevented the injury, the defendant will also get judgment.⁹²

7.4 LOST CHANCES

Suppose that the plaintiff or the plaintiff's deceased would not *certainly* have been saved by the defendant's untaken precaution, but would have gained some statistical chance of survival. That proposition is true in an enormous range of cases, for instance, *New York Central R.R. v. Grimstad*, the case in which the plaintiff's deceased went almost straight to the bottom of the harbor before a life buoy probably could have helped him. If through good fortune, the life buoy (which of course was totally absent) had been mounted right within reach, the plaintiff through a lucky pitch might have thrown it directly over her husband's

⁸⁹ See *Rovegno v. San Jose Knights of Columbus Hall Ass'n*, 291 P. 848 (Cal. App. 1930). Other similar cases are *Lindsey v. De Vaux*, 123 P.2d 144 (Cal. App. 1942); *Lucas v. Hesperia Golf & Country Club*, 63 Cal. Rptr. 189 (Ct. App. 1967); *Haft v. Lone Palm Hotel*, 478 P.2d 465 (Cal. 1970).

⁹⁰ See *Wolf v. Kaufmann*, 237 N.Y.S. 550 (App. Div. 1929). In *Wolf* a hallway light burned out in violation of New York's Tenement House Law, but the accident may have occurred during daylight hours when a light fixture would have been superfluous because a window was close to the place where the plaintiff tripped.

⁹¹ See *Smith v. Americana Motor Lodge*, 113 Cal. Rptr. 771 (Ct. App. 1974) (no liability for missing statutory safety rope and buoys dividing shallow end of pool from deep end).

⁹² See *Stacy v. Knickerbocker Ice Co.*, 54 N.W. 1091 (Wis. 1893) (statutory fence, though missing, would not have stopped horses frantic with fright).

outreached hands, and he thereby might have been saved. Given the possibility of that scenario, the defendant's negligence would have deprived the plaintiff of perhaps a one percent chance of survival. No one thinks that this small probability of success would be enough to support liability in this context.

Exactly what the threshold probability should be in the normal type of case probably turns on the cost of false positives relative to false negatives in imposing liability. The false positives are more costly when the defendant's negligence was inadvertent as opposed to deliberate, because then the defendant in the next period has to increase its compliance rate (possibly to inefficient levels) or else reduce its activity level, or possibly substitute otherwise inefficient durable precaution for the nondurable precaution that once yielded liability. When the defendant's negligence was deliberate the cost of a false positive is smaller because in the next period the defendant can easily do more to limit its deliberate negligence. (This will not necessarily be true of a principal, such as a corporation, that has to monitor the deliberate negligence of its agents for whose negligent acts the principal may be liable.)

The *Grimstad* negligence seemed fairly deliberate in that normally life buoys are not left off barges because of inadvertence. Still, it was a case of no liability for the minuscule lost chance. A contrasting case is *Gardner v. National Bulk Carriers, Inc.*,⁹³ which was in many respects similar to *Grimstad*. The plaintiff's sailor was discovered missing on the defendants' S.S. Bulkcrude at about 11:30 p.m. in the evening. The captain ordered the ship to be searched. About an hour later, he got the report back that the sailor was not on the ship and was last seen at 6:00 p.m. The captain decided not to go back and search. The sailor's representative later sued for negligence. The evidence indicated that the some sailors had been found treading water over 50 hours after they had fallen overboard. Although the evidence was divided, the trial court did not believe that there was anything close to a 50% chance that the sailor could have been saved. Still, the court found liability based on the captain's failure to avail himself of the "reasonable opportunity" of a possible rescue.

Suppose that the value of the sailor's life was one million dollars and that a rescue had a 10% chance of success. Then, if the cost of the attempt would be \$40,000 thousand, society would lose \$60,000 surplus if the attempt was not made. Nevertheless, under conventional cause in fact rules, the attempt might then rarely be made because the defendant will know ex ante that the plaintiff would never be able to prove classic cause in fact to percentage approaching a 51% probability (if that is the standard). The special rule in cases like *Gardner* prevents strategizing against the rule. In *Grimstad*, it would be a little less

⁹³ 310 F.2d 284 (4th Cir. 1962).

feasible for the barge owner to withhold the life buoy, based on the knowledge that Mr. Grimstad could not swim, because it could never be sure that someone else who could swim better than he would fall overboard and would be savable by a life buoy. In other words, the *Grimstad* defendant was looking ex ante at a range of different possible injuries many of which would have been avoided by the untaken precaution. The *Gardner* defendant was looking at one injury and could see that there was much less than a 50% chance that the untaken precaution would have been successful, even when it would have (hypothetically at least) produced a social surplus.

A number of older cases of the same type exist. For instance, in *Valentine v. Minneapolis, St. Paul & S.S.M. Ry.*,⁹⁴ the defendant through its negligence started the plaintiff's timber afire. He called some men who separated the burning timber from the timber not yet on fire. At about that time, the defendant tried to save its burning rail cars and parked them right next to the pile of timber that the plaintiff was trying to save. That timber then caught fire from the defendant's burning rail cars. The defendant's attorney maintained that the separated timber was probably doomed in any event—that the plaintiff possessed only a “gambler's chance”—but the jury awarded the plaintiff a verdict anyway, and the appeals court affirmed it. The case seems similar to *Gardner* in that the defendant would have realized that there was a possible surplus from parking its burning cars elsewhere or simply abandoning them, but would not be encouraged to invest in creating this social surplus if it knew that the plaintiff would have to prove by something like 51% that his timber would have been saved but for the defendant's breach of duty.

7.5 ALTERNATIVE CAUSES

Suppose there are two mutually exclusive states of the world, and in only one of them was the defendant's breach of duty a cause in fact of the harm of the plaintiff's harm. When courts assess which of two defendants was probably negligent, they will sometimes impose liability on the one whose nondurable precaution obligations were more onerous. A good example of this doctrine is *Escola v. Coca Cola Bottling Co.*,⁹⁵ where the plaintiff, a server in a restaurant, was injured when a bottle of Coca Cola broke in her hand. The bottle had been manufactured by Owens-Illinois Glass Co., which was not a defendant, and recycled and refilled by the defendant, the Coca-Cola Bottling Co. of Fresno. The court reasoned that the bottle exploded because it had either a visible defect or an

⁹⁴ 118 N.W. 970 (Mich. 1908).

⁹⁵ 150 P.2d 436 (Cal. 1944), rev'g, 140 P.2d 107 (Cal. App. 1943).

invisible defect.⁹⁶ If it was an invisible defect that led to the accident, this circumstance would exculpate the defendant bottling company because it could not be expected to see the invisible. Nevertheless, the court reasoned, an invisible defect would probably have been present at the time of manufacture. The manufacturer, which again was not a defendant, introduced evidence that it used a technique that was relatively undemanding of human attention. Before it left the glass factory, the defendant sampled each mold every three hours and filled it with nine times the normal soft drink pressure. The manufacturer's engineer testified that this test was practically infallible. The court reasoned, however, that every refilled bottle needed to be examined for visible defects. In effect, because this 100% inspection was so much more demanding than the spot inspection required of the bottle manufacturer, the more likely compliance error was in the more demanding process—for which the defendant bottling company was responsible. Although commentators have long debated the *Escola* reasoning, to my knowledge no one has challenged the court's basic assumption that a highly demanding inspection technique is more likely to yield a compliance error than a less demanding technique, presupposing of course, as the *Escola* court itself assumed, that both techniques were themselves reasonable in their different contexts.

A more conventional case was *Novak Heating & Air Conditioning v. Carrier Corp.*,⁹⁷ the plaintiff ordered an air conditioner that was manufactured by one defendant (Carrier Corp.) and shipped by another (Yellow Freight Co.). When the air conditioner arrived damaged, there were again two alternative states of the world: one in which some compliance error by the defendant manufacturer damaged the air conditioner and another in which a compliance error by the shipping company damaged it. There was no cause signature and, unlike *Escola*, no way even to assess the probability of which cause was more likely. The nature of the damage made clear, however, that one or the other had been negligent. You could call this evidence either a "breach signature," or better, a "half signature," because the evidence indicated a breach of duty by someone but did not include a cause signature that would permit a court to say which of two possible companies was responsible for it. In this case, the trial court nonsuited

⁹⁶ The court noted that the defendant could have put too much pressure in the bottle, but since the design limit was nine times the normal beverage pressure, that eventuality would also involve some kind of compliance error by the defendant.

⁹⁷ 622 N.W.2d 495 (Iowa 2001).

the plaintiff against both defendants, which is a common result when only one of two defendants could have been negligent.⁹⁸

A similar scenario is *Summers v. Tice*,⁹⁹ a case in which two hunters went out with their guide, the plaintiff. He instructed them not to shoot if he flushed a bird up ahead of them. He did so, and both negligently shot. They were using the same gauge of shot in their shotguns, and it was impossible to tell ex post which of them fired the shot that destroyed one of the plaintiff's eyes. In this case, there were two half signatures, each attributable to a separate defendant. The court made them joint tortfeasors so that they would tend to split the liability between themselves. The case is different from *Novak* in that each defendant committed a breach of duty, whereas in *Novak* only one did—we just didn't know which one. Hence, the *Summers* rule would not load cost on an innocent actor. Also, the *Summers* negligence seemed more deliberate than the negligence that probably caused the *Novak* damage.

Ybarra v. Spangard,¹⁰⁰ involved yet another half signature. The plaintiff went into the hospital for an appendectomy, and when he awoke from the general anesthetic discovered that his shoulder had suffered a traumatic injury. He sued all of the hospital employees who had custody over him during the time he was unconscious. Although the case was similar to *Novak* in that probably only one of the defendants had committed a breach of duty (pulled the plaintiff's shoulder), the court made them all joint tortfeasors. It stressed that this rule would make the innocent parties want to defect on the guilty one. This objective would not work in the context of the *Novak* case because the innocent defendant was less able in this case than in *Ybarra* to disclose independent evidence that another defendant was guilty. There was no "conspiracy of silence" to pierce. Making both *Novak* defendants jointly liable would yield only uninformative proclamations of innocence.

Finally, the possibility of alternative causes can suggest that the accident was unavoidable accident from the defendant's point of view or maybe not even that. A good illustration is *Paine v. Gamble Stores*,¹⁰¹ a case in which the plaintiffs'

⁹⁸ A similar case was *Garcia v. Joseph Vince Co.*, 148 Cal. Rptr. 843 (Ct. App. 1978), where the plaintiff, a fencer, was poked by his opponent's saber which one of two possible manufacturers had made so skinny that it was able to penetrate his regulation face mask. Thus, as in *Novak*, there was a half signature, and only one of the two defendants could have committed the breach of duty.

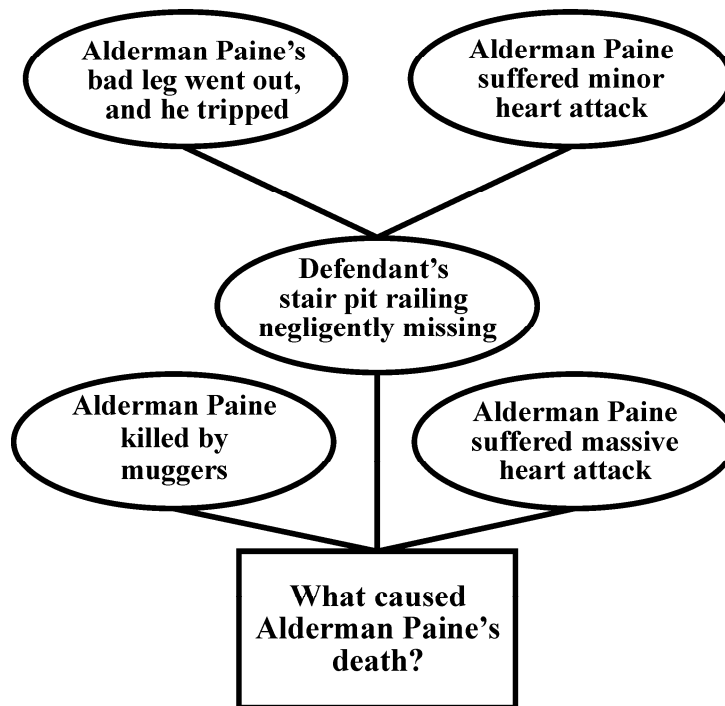
⁹⁹ 199 P.2d 1 (Cal. 1948).

¹⁰⁰ 154 P.2d 687 (Cal. 1944).

¹⁰¹ 279 N.W. 257 (Minn. 1938).

deceased had died under mysterious circumstances. He was a Brainerd, Minnesota, alderman in the 1930s, and his lifeless body was discovered early in the morning of July 12, 1936, at the foot of a stair pit that descended to a basement entrance of the defendant's building in Brainerd. The accident signature was complicated. The railing guarding this stair pit was missing, and everyone assumed that this constituted the defendant's negligence. The deceased had a history of heart disease and also a weak left leg which sometimes gave out, and that at such times he had to grasp something to keep from falling. The dust on the stairs was undisturbed. The investigating police officers testified that they found a perpendicular scratch, which appeared to be freshly made, on the wall of the pit. This scratch was about eight inches below ground level, and seven or eight feet above the bottom of the pit. The setting of a ring on the left hand of the body was missing, and the prongs of this ring which had held the setting in place were also scratched. These circumstances tended to show that the scratch on the wall was made by the ring during the course of the fall. [additional space above and below figure]

Figure 6



The defendant maintained that not enough evidence existed to allow the jury and court to sort the accident between negligent harm and unavoidable accident.

Because the plaintiff relied on a specific untaken precaution, the basic question was whether a railing, if present, would have saved the deceased from dying. In this type of case, a number of alternative causal chains exist, which amount to mutually exclusive states of the world. They are depicted on figure 6 as four ovals circling the defendant's untaken precaution of failing to fix its railing. If the alderman suffered a minor heart attack or if, more probably, his weak left leg gave way, the railing probably would have saved him. Nevertheless, if he suffered a major heart attack or if robbers threw him in the pit, the railing would not have saved him. The court found that the jury was entitled to believe that probably his weak left leg went out and that therefore the accident would have been prevented by having a railing. The plaintiff relied on circumstantial evidence to prove her case, but it was still basically a specific negligence case, like the gritty banana peel case, because the court sorted the accident to negligent harm based on its view that the specific untaken precaution (a railing) would have probably saved the day. Many similar cases exist.

7.6 CONCURRENT SUFFICIENT CAUSES

Finally, there is the rare situation in which two actors have each negligently unleashed two separate forces each of which would have been sufficient to injure the plaintiff in exactly the same way. The classic example is converging fires. A traditional name for this uncommon scenario is "concurrent sufficient causation," though other names have cropped up in the more recent academic literature, for instance, "overdetermined causation"¹⁰² and "duplicated losses."¹⁰³

A typical case in this small set is *Kingston v. Chicago & N.W. Ry.*,¹⁰⁴ where the defendant's locomotive negligently started one fire, and another fire, in a different place, was started by some unknown party. The two fires converged 940 feet north of the plaintiff's fire, and the united fire then destroyed the plaintiff's property. The court also took the fact to be that either fire, by itself, would have been sufficient to destroy the plaintiff's property. The case is unusual because the court held the defendant liable even though its untaken precaution would not have prevented the injury. If the defendant had cured its negligence and failed to start its fire, the plaintiff's property would still have been destroyed in the same way. Steven Shavell has argued that the result is reasonable because with no liability in

¹⁰² See Richard W. Wright, *Causation in Tort Law*, 73 Calif. L. Rev.1735 (1985).

¹⁰³ See David A. Fischer, *Successive Causation and the Enigma of Duplicated Harm*, 66 Tenn. L. Rev.1127 (1999).

¹⁰⁴ 211 N.W. 913 (Wis. 1927).

Kingston, a railroad that had negligently started a fire would acquire an incentive to hire an arsonist to start another one (1980: 495).

8. CONCLUSION

By examining how courts sort injuries between unavoidable accident and negligent harm, we can better see the economic workings of the negligence rule and understand better the incentives it creates. The whole process reveals a variety of provocative puzzles that we can solve using economic analysis.

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