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DESIGN LITIGATION AND THE STATE OF THE ART: TERMINOLOGY, PRACTICE AND REFORM

EDWARD T. O'DONNELL*

I. INTRODUCTION

UNLESS TRIAL and appellate judges enforce the limitations on the designer's liability which are embodied in the concept of the "state of the art," jurors may impose the standards which prevail at the time of trial on work which was done at an earlier time or they may expect the product to be perfect. These risks are particularly acute in a period such as the present, in which governmental standards and public expectations of safety both grow more demanding each year.

The character of the critical evidence in product litigation presents an additional, related danger. The opinion testimony of the professional, specialized witness probably is indispensable if judge and jurors are to understand the technical points at issue, but by its very nature that testimony should inspire a degree of skepticism. Too often, however, the prestige of the witness and the impressiveness of his unfamiliar jargon overawe laymen and obscure the fact that he has never tested the device which he argues would have prevented the accident.

We suggest that rather than ignore these problems, or bemoan them ineffectually, the judiciary should accept the fact that the decision to venture into the area of scientific and technological controversy carries with it a duty to reconcile the law with the essentials of the scientific method. Some courts already have begun to do so. For instance, suggestions that the manufacturer's obligation to design a safe product necessarily must be limited by the state of the art are common in negligence, warranty and strict liability

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[1] We agree.

[627]
decisions alike. Unfortunately these statements usually are dicta rather than holdings. Worse, the authors of the opinions seldom explore the ramifications of their remarks or even define their terms.

There also is a more fundamental problem. In spite of their vagueness, most appellate pronouncements on the subject are reasonable in principle; and trial judges may well think they are following this moderate approach if they speak of the importance of practicality, cost and marketability. But many unwittingly reverse the burden of proof and adopt a more radical approach in practice, if not in theory, by permitting the verbal ritual—unsupported statements of opinion by paid partisans—to take the place of evidence concerning these practical limitations. It is understandable that courts are reluctant to involve themselves more deeply in unfamiliar and time consuming technical matters. Yet the application of legal principles to technology is the essence of product litigation: the issues are difficult and important precisely because they arise at the uneasy border between engineering, law and public policy. The judge who attempts to separate those elements artificially may distort both legal and scientific principles and upset the balance among competing policy goals as well.

One reason for the unsatisfying superficiality of the law in this area may be that the issues seem deceptively simple when they are isolated from the evidentiary problems of an actual case. It is one thing to discuss these matters in the abstract, but quite another for court and jury to apply the apparently straightforward formulae to the technical, economic and social decisions which the manufacturer faced during the design process.

Consider for instance, a hypothetical case in which a defendant designed and built an automobile in 1972. Three years later, the rear of the vehicle was demolished by a far larger car which struck it at high speed. The driver, who was not wearing his seat belt, was thrown forward and seriously injured. At trial in 1978, his expert, a former aeronautical

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2 See Spurlin v. General Motors Corp., 528 F.2d 612, 617, rehearing denied, 531 F.2d 279 (5th Cir. 1976); Hoppe v. Midwest Conveyor Co., 485 F.2d 1196, 1202 (8th Cir. 1973) (comparative designs of similar and competitive machines are relevant to proof of defective design); Schneider v. Chrysler Motors Co., 401 F.2d 549, 557 (8th Cir. 1968) (“Standards of design and manufacturing skill must be consonant with the state of the art...”); Holmgren v. Massey Ferguson, Inc., 394 F. Supp. 910, 917 (D.N.D. 1974), rev’d on other grounds, 516 F.2d 856 (8th Cir. 1975); Cardullo v. General Motors Corp., 378 F. Supp. 890, 893 (E.D. Pa. 1974), aff’d, 511 F.2d 1392 (3d Cir. 1975); Evancho v. Thiel, 297 So. 2d 40, 43 (Fla. Dist. Ct. App. 1974); Ellithorpe v. Ford Motor Co., 503 S.W.2d 516, 519 (Tenn. 1973).

3 This hypothetical is a composite of aspects of several cases involving different technical issues. We have edited and “fictionalized” the testimony in the interest of clarity and in deference to the fact that some of the cases are still being litigated. Accordingly, none of these statements should be considered to be either an admission or a claim by any actual manufacturer, plaintiff or individual expert or as a dissertation on the engineering problems involved in the “30 G” seat.
engineer now self-employed as a consultant on product safety, testifies that the design of the first vehicle was defective because the seat flexed when struck from behind. He says that this instantaneous back and forth motion catapulted the victim forward much as an ejection seat might, a phrase which he repeats for the jury's benefit.

The expert goes on to assert that the defendant could have eliminated the risk of such an accident if it had used a "30 G seat." That design employs titanium and costly high-alloy steels, as well as a great deal of bracing, to achieve a degree of strength and rigidity far beyond that of the conventional seat. Its use has been proposed for use in aircraft from time to time; for instance, an article in the proceedings of the University of New Hampshire School of Design described the general approach in 1965. He concludes by stating his opinion that the 30 G design would have been technically feasible and produceable at reasonable cost in 1972 so that it was "within the state of the art."

Under cross-examination, the expert concedes that 30 G seats never have been mass-produced and, in fact, never have been used in any automobile. A few experimental high-performance aircraft did incorporate the design in the late 1960's and early 1970's but since none of the planes crashed, the seat's ability to protect the occupant in such an event never has been demonstrated. In addition, the expert never has personally conducted any tests on the seat and he knows of no statistics which would either prove or disprove the theory that it was safer than the conventional design. Nevertheless, he refuses to modify his opinion that the conventional seat should not have flexed under the circumstances of the collision and that the alternative approach he discussed was within the state of the art.

In rebuttal, the defense experts point out that while the 30 G seat might reduce the dangers of flexing under certain circumstances, the nature of the design would increase other risks. For instance, the unusual rigidity would protect the occupant who was fully braced in anticipation of a collision but it might produce more severe whiplash injuries if he did not expect the collision and was leaning forward or slouched, rather than braced—and the latter circumstances are at least as likely to occur as the former. Furthermore, in order to achieve rigidity, the 30 G design eliminates the normal hinges between the back and the seat cushion. As a result, every time a person had to get in or out of the rear seat area, he or she would have to lift the entire front seat up and push it forward. In the opinion of

* The objective was to produce a seat which would protect the occupant up to "30 G's," i.e., thirty times the normal force of gravity. This level was chosen because it was thought to be the highest which the human body could withstand under any circumstances.
the defense experts, this is a significant inconvenience. More important, this aspect of the design could create a hazard; a rear seat occupant who had less than normal strength, e.g., a child or an elderly person, might not be able to get out of the car quickly in the event of an emergency such as a fire. The extra bracing at the sides of the seat also makes it awkward for the occupant of the 30 G seat itself to get in and out; that problem is exacerbated by the necessity for additional padding to cover the braces; and the bulk and weight of the padding in turn diminish the usable space within the vehicle.

The defense experts say it is their conclusion that the size and complexity of the special seat would mean a car with the dimensions of the defendant's product could only carry two occupants unless it had four doors. Thus, a four-door sedan could be built or, theoretically, a two-seat sports car (which the manufacturer in fact does not believe could be sold in large enough quantities to be profitable). But neither a two-door sedan nor a "hatchback" would be practical; and if those popular models were removed from the line, the vehicle could only have been sold in significantly smaller quantities, which would increase its unit price. They add that various automobile manufacturers have experimented with seats based on the concept from time to time, but it has not been perfected, and using it would have added hundreds of dollars to the cost of the defendant's vehicle which was designed to be as simple and lightweight as possible in order to compete in the low price market.

It is undisputed that in 1972 no governmental standard required that passenger car seats equal the performance of the 30 G model. Indeed, the standards which were effective permitted seats to flex as much or more than did those in the defendant's car.

On appeal, the issue is whether the opinion of the plaintiff's expert concerning the state of the art is sufficient to support the verdict in spite of the concessions he made under cross-examination and the testimony of the defendant's experts. The appellate court's task will be complicated by the fact that while appellant and appellee both use the term, they may have significantly different ideas as to its significance.

II. THE TERM "STATE OF THE ART" AND SOME OF ITS MEANINGS

Although the expression originated in scientific circles, an informal survey suggests that engineers and designers understand "the state of the art" to mean approximately what the laymen would gather from the dictionary definition: "contemporaneous practical skill in performance exercised by
the designers of products. In any event, the dictionary definition seems as acceptable a starting point for discussion as any, provided that those who use the phrase realize that it may have secondary meanings and nuances for lawyers.

A. The Opposing Extremes

The defense bar occasionally uses "the state of the art" as a shorthand reference to the general idea that the custom which prevails in an industry sets the standard for due care and the "reasonably safe" product. In the remote past, this was thought to mean that if the evidence showed that the manufacturer used the approach which all or the majority of its competitors used, it could not be liable. Few are hardy enough to argue that position today except in the instance in which industry practice is uniform because of governmental regulation or where the plaintiff claims punitive damages from a defendant whose conduct conformed to prevailing trade practice. It is a cliche that the standards prevailing in an entire industry can be too low. There is, however, considerable support for the more limited argument that one who claims that an entire industry has been negligent should have to satisfy a rigorous standard of proof and that compliance with the normal practice of the industry should create a strong presumption in the defendant's favor.

6 See Raleigh, supra note 5, at 258.
7 See, e.g., Maxey v. Freightliner Corp., No. CA 3-76-1204-6 (N.D. Tex. April 21, 1978). In Maxey, a $10,000,000 punitive damage award was set aside because the truck design was common to the entire industry and was not attacked by a regulatory agency. The court held that these factors far outweighed the defendant's failure to test or use the supposedly superior alternate design.
8 It is important to keep in mind the distinction between the rare situation in which the "state of the art" is offered as an affirmative defense and the more common and important situation—to which we devote most of our attention in this article—in which the concept serves as one of the limits of "defect" or "due care." In the former, the product is "defective" for some valid reason, and the defense is only that other products are made in the same way, i.e., equally defective. It is not surprising that modern courts are not receptive to this defense. In the latter situation, an accident has occurred and the issue is whether the product involved was defective or whether the manufacturer failed to exercise due care. The question of what others have done is directly relevant to the basic question of what reasonably could have been done. As we shall see, the courts give far more respect to the suggestion that practicality, cost, and other relevant factors be considered than they give to the simple suggestion that conformity is a defense.
The most extreme interpretation of the phrase from the opposite point of view, that of the plaintiffs' bar, holds that when the judge and jury set the required level of performance, they can take into account all of the thinking of the most advanced practitioners of the basic sciences in addition to the principles and techniques recognized in the industry or in comparable fields, *i.e.*, they are free to decide that anything a scientist might think was possible in theory or under laboratory conditions was part of the state of the art, regardless of practicality in engineering or business terms.9

This schematic view is, of course, misleadingly simple. Many of the constituent elements of each approach themselves present problems of definition. Is the passenger automobile business comparable, for this purpose, to the production of trucks, or racing cars, or aircraft?10 And when is technology “known”? Does the state of the art include all that the journeyman would be expected to know or does it also extend to leading professional articles or to even obscure monographs reposing in university libraries?11 Moreover, the majority of cases fall between the two extremes. Most courts have rejected the defense view over the years, at least in its extreme manifestation, and while lawyers often resort to the radical plaintiff's view in argument, we are not aware of any appellate decision which explicitly adopts it. As so often happens in the law, precedent instead tends to cluster around an ill-defined midpoint with an air of “practicality” which is reassuring but perhaps deceptive.12

9 See Raleigh, *supra* note 5, at 253-55.

In addition, some lawyers and commentators speak of a requirement that the defendant's product be “current” with the state of the art. See, *e.g.*, Olson v. Arctic Enterprises, Inc., 349 F. Supp. 761 (D.N.D. 1972). The effect of this requirement is to make the phrase “state of the art” synonymous with “due care.” Apparently a product may be “current” in the sense that it is of “good average quality” in terms of U.C.C. § 2-314(2)(b) without being the ultimate in safety. Note that there is also a colloquial usage in advertising by which a product is said to be “state of the art,” which means that it is the best available.

10 It may be more than a coincidence that the expert who testifies on behalf of a plaintiff against an automobile company tends to have academic credentials and work experience in aeronautical engineering. Perhaps they are so critical because the basic factors of cost, weight and ease of maintenance have a relationship in aircraft far different from that in an automobile. A more practical explanation, of course, is that employment has declined in the aircraft industry. Unable to find work in their own field, a number of engineers have found it highly profitable to set themselves up as experts on automobile design.

11 For instance, Raleigh points out that the basic scientific principles which led to the development of radar in the 1930's were known to physicists as early as 1866. Raleigh, *supra* note 5, at 255.

12 To provide a frame of reference, the author has discussed the secondary meanings of the term which are most representative of the thinking of lawyers and judges. But a caveat is necessary. Because this article sets forth two contrasting extremes and a middle view, the reader may assume that the views we outline schematically as those of the “defendant” and the “plaintiff” are equally radical, albeit in opposite directions, and that the middle view is the path of wisdom. In reality, the author believes that there is a great deal to be said for the “defense” view, although it is largely beyond the scope of this article and, on the other hand, that the plaintiff's view has little merit. Indeed, the latter may seem, at first
B. *The Phrase as it Has Been Used by Most Courts*

This consensus\(^{13}\) has two basic elements. The first is historical perspective. A recent case, *Bruce v. Martin-Marietta Corp.*,\(^{14}\) illustrates the point well. The relatives of passengers who were killed when an airliner crashed in 1970 sued Martin, the manufacturer, in strict liability. The plane was built in 1952. The theory of liability derived from the automobile "crashworthiness" cases:\(^{15}\) the allegation was not that any defect in the plane caused it to go down, but that the seats broke loose and burned when it did crash. When the defendant moved for summary judgment, the plaintiffs relied on an affidavit by an aircraft accident investigator that seats which were in common use in 1970 would have remained in place, reducing the hazard of fire in this "otherwise survivable" accident. Both the trial judge and the circuit court flatly rejected that suggestion and held that the manufacturer could not be liable simply because superior seats existed eighteen years after it had designed and sold its product. Judge Breitenstein found it self-evident that the design should not be measured by the standards of a later period in which advances in technology might have made possible or even commonplace things which could not have been done by the most able designer at the earlier time: "A consumer would not expect a Model T to have the safety features which are incorporated in automobiles today."\(^{16}\)

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\(^{14}\) 544 F.2d 442 (10th Cir. 1976).

\(^{15}\) See Larsen v. General Motors Corp., 391 F.2d 495 (8th Cir. 1968). Note that the doctrine is not universally accepted. See Evans v. General Motors Corp., 359 F.2d 822, 824 (7th Cir.), cert. denied, 385 U.S. 836 (1966).

\(^{16}\) 544 F.2d at 447. Other courts have used even more descriptive language to express the same idea. E.g., Dean v. General Motors Corp., 301 F. Supp. 187, 192 (E.D. La. 1969) ("Monday morning quarterback"). See also Balido v. Improved Mach., Inc., 29 Cal. App. 3d 633, 640, 105 Cal. Rptr. 890, 895 (1973), where the court said: "Strict liability for deficient design... is premised on a finding that the product was unreasonably dangerous for its intended use, and in turn, the unreasonableness of the danger must necessarily be derived from the state of the art at the time of design."

The point may seem a mere truism that is too obvious to merit discussion. Unfortunately, it is not. The California Supreme Court has recently stated in a products liability case that the jury was free to evaluate a design in the light of "hindsight." Barker v. Lull Eng'r Co., 143 Cal. Rptr. 225, 239, 573 P.2d 443, 457 (1978).
The "state of the art", however, has a second aspect, equally important but far less clear-cut. The phrase serves as part of the qualitative standard as well as a reference to the time dimension; the question is not merely when an alternative approach was feasible, but whether there ever was a viable alternative at all. This aspect of the concept is far more diffuse and difficult to define than the time dimension, but a number of opinions offer significant insights. For example, in *Larsen v. General Motors Corp.*, the Eighth Circuit emphasized the distinction between the possible—meaning that which could be done using existing technology, at least if a wholly disproportionate share of available resources were devoted to the problem—and that which is practical and useful:

[U]nder the present state of the art an automobile manufacturer is under no duty to design an accident-proof or fool-proof vehicle or even one that floats on water, but such manufacturer is under a duty to use reasonable care in the design of its vehicle to avoid subjecting the user to an unreasonable risk of injury. . . .

*Olson v. Arctic Enterprises, Inc.*, placed greater emphasis on the necessities that the alternative be perfected and that the novel design which improves safety under some circumstances not be used as a measure if it also would make the product more dangerous under other circumstances or interfere unduly with its ability to function. In that case, the plaintiff fell from a moving snowmobile. His foot was injured when it caught in a metal track. At the trial of his negligence and warranty claims, his counsel argued that a rubber track would not have injured the boy as severely and that such tracks and other modifications were within the state of the art in 1966. The trial judge, sitting without a jury, ruled in favor of defendants. The "crashworthiness" principle applied, he held, but even *Larsen v. General Motors* had to be subject to limitations: "To refuse to consider the 'state of the art' as the key to the operational aspects of a snowmobile would be to hold the manufacturer liable for merely marketing a functional product—in effect placing absolute liability upon such manufacturer."

His recognition of the fact that the product must be functional as well as safe also led Judge Benson to place considerable emphasis upon the testimony for the defense that the use of more shielding around the track—one approach urged by the plaintiff's expert—would not have been practical. The idea was a simple one which obviously was "known" at the time the

17 391 F.2d 495 (8th Cir. 1968).
18 Id. at 502.
19 349 F. Supp. 761 (D.N.D. 1972). In this case both the design and accident occurred in 1966.
20 Id. at 765.
21 Id. at 764-65.
design was done, but it would have tended to make the snowmobile bog down excessively in normal snow conditions.

Going a step further, the same opinion indicated that even if an alternative approach were workable, the defendant would not necessarily have a duty to adopt it. There was testimony that some manufacturers had installed hand holds on their snowmobiles but that Arctic had not. The judge, however, rejected this as a basis for liability because of the defense expert's testimony that hand holds increase the risk that a rider who is thrown will be entangled in the machine and that flexible handles, which did eliminate that danger, had not been available at the earlier time when the snowmobile was designed.22

The character of the proof was even more important in Maxted v. Pacific Car & Foundry Co.,23 a strict liability suit brought by the driver of a logging tractor-trailer who was injured when the vehicle "jack-knifed" and rolled over. The plaintiff's expert criticized the design on several grounds, the most important being the absence of a device which would have enabled the operator to jettison the trailer if it began to tip. During discovery the expert conceded that no such device had been used on any truck and that he had developed the idea himself when he was commissioned by the plaintiff's counsel years after the actual vehicle had been designed. But when the defendant moved for summary judgment the expert submitted an affidavit asserting that the "jettisoner" would have been "well within the state of the art" at the time the truck was designed. The Wyoming Supreme Court nevertheless affirmed the entry of summary judgment as to this part of the case,24 reasoning that the plaintiff had failed to produce any evidence that the proposed "safer" design would work at all, much less that it had been perfected five years earlier.

C. A Synthesis of the Prevailing View

The cases which we have discussed thus far, as well as other characteristic design litigation decisions, concentrate upon a few of the circumstances of an individual accident and do not offer a general synthesis. Nevertheless, they involve a few relatively straightforward ideas, and it is possible to discern the rough outline of the doctrine.

The state of the art begins with the question of bare technological possibility. The defendant cannot be penalized for not doing that which no

22 Id. at 765-66.
23 527 P.2d 832 (Wyo. 1974).
one could do. But there clearly are other considerations as well. In *Lolie v. Ohio Brass Co.* the Seventh Circuit held that even under strict liability, the plaintiff's burden of proof in design defect cases includes "proof that, *inter alia*: (1) the product as designed is incapable of preventing the injury complained of; (2) there existed an alternative design which would have prevented the injury; and (3) in terms of cost, practicality and technological possibility, the alternative design was feasible." This necessarily must be so if the constant assurances in the product liability reports that the manufacturer's liability is not that of an insurer are to mean anything. Moreover, the alternative technique or device on which the proof of design defect depends must be "practical" in the relevant context, *i.e.*, it must be usable in the mass-produced product in question or, at the least, in another product which is legitimately comparable to it. The fact that it could work well in a different product with a different purpose or a more sophisticated operator proves nothing.

The costs of producing a product using the alternative design, and of research and development with the objective of increasing safety, also impose practical constraints:

- Price is also a factor to be considered, for, if a change in design would appreciably add to cost, add little to safety, and take an article out of the price range of the market to which it was intended to appeal, it may be "unreasonable" as well as "impractical" for the Courts to require the manufacturer to adopt such change. . . . 

By the same reasoning, marketability is also a legitimate factor. A manufacturer must build a safe product, but it also has to sell the device to the general public. Thus it cannot dismiss aesthetics and subjective consumer preferences any more than it can ignore cost.

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26 502 F.2d 741 (7th Cir. 1974).

27 Id. at 744.


30 Id. at 1072-73. See also Garst v. General Motors Corp., 207 Kan. 2, 484 P.2d 47 (1971).
Finally, while the existence of an alternative design is a necessary condition to liability, it is not sufficient in and of itself. An alternative technique may be within the state of the art, but that does not mean a manufacturer who does not use it necessarily is negligent or its product defective.\textsuperscript{31} The alternative, while permissible, may not be as safe as the original design when its performance under a variety of conditions is taken into account. For example, in \textit{Korli v. Ford},\textsuperscript{32} the plaintiff had introduced expert opinion testimony that rear-hinged automobile doors were more dangerous than front-hinged doors in the circumstances of that particular accident; but the appellate court held that testimony to have been neutralized by other evidence which showed that the front-hinged door would have been more dangerous in the event of fire and in other common situations. Accordingly, it entered judgment in the defendant's favor. Similarly, in \textit{Arctic Cat} the court placed considerable emphasis on testimony that although rubber tracks might have done less damage to the boy's foot when it became entangled in the snowmobile, that type of track also was more likely to break and the greater risk of a broken track in turn increased the danger that the snowmobile's operator might be stranded in the wilderness.\textsuperscript{33}

Moreover, even proof that an alternative product is safer in some or all respects would not compel the conclusion that competing products were defective or negligently made. The courts have emphasized again and again that the manufacturer does not have any duty to produce "the ultimate in

\textsuperscript{31} For example, in \textit{Weakley v. Fischbach & Moore, Inc.}, 515 F.2d 1260 (5th Cir. 1975), the defendants and third-party plaintiffs asserted a claim against a manufacturer of plant equipment and showed that an alternative design had been available which would have prevented the accident which caused the plaintiff's injuries. Nevertheless, the court affirmed a verdict for the manufacturer, stating: "It is one thing to show that the defendant might have designed a safer product: quite another to show that the product he did design was unreasonably dangerous." 515 F.2d at 1267. Similarly, in \textit{McClung v. Ford Motor Co.}, 333 F. Supp. 17 (S.D. W. Va. 1971), \textit{aff'd}, 472 F.2d 240 (4th Cir. 1972), \textit{cert. denied}, 412 U.S. 940 (1973), the plaintiff demonstrated that there were other steering wheel designs which would not have caused his injury. The trial court in \textit{McClung} still granted a summary judgment for the defendant, stating:

To be actionable... the vehicle, alleged to have been of a design that makes it unfit for its intended use, must have been of such design and structure as was at variance with, or contrary to, the accepted body of scientific knowledge possessed by the average mechanical or structural engineering personnel in the profession having to do with the manufacture of subject vehicle.


\textsuperscript{33} Olson v. Artic Enterprises, Inc., 349 F. Supp. 761, 765 (D.N.D. 1972). This would subject the rider to risks such as frost bite, wild animals, etc.
safety" and, were there no such precedent, common sense would require some such limitation on liability. Otherwise every manufacturer but one would be liable for failing to produce a product as safe as that which the plaintiff chose to single out as the “best” in the industry, and even that paragon could expect that another plaintiff would soon charge that some other aspect of his product was not as safe as that of a competitor.

These principles, of course, are but indicators of the most general sort, not a set of precise guidelines. Moreover, they often overlap. If one were devising a vocabulary for future design litigation, without regard to what has occurred in the past, the strongest single argument for the extreme plaintiff's interpretation might be that reader and commentator would not have to deal with an awkward bundle of interrelated considerations if the “state of the art” consisted of a single factor such as technological possibility. But desirable as such a clarification might have been when the courts first began to grapple with design controversies, it would not be an accurate statement of the precedent which in fact did develop.

Moreover, a “single factor” definition might well be unworkable and misleading in the very cases which would be most important to the public. In theoretical work, or even in the design of highly sophisticated research vehicles, the emphasis is upon the discovery of new principles, and matters such as cost, ease of manufacture and suitability for use by relatively un-

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34 Henderson v. Ford Motor Co., 519 S.W.2d 87, 93 (Tex. 1974). See also Weakley v. Fischbach & Moore, Inc., 515 F.2d 1260, 1267 (5th Cir. 1975) (defendant not obliged to design the safest possible product); Evans v. General Motors Corp., 359 F.2d 822, 824 (7th Cir.), cert. denied, 385 U.S. 836 (1966) (manufacturer is under no duty to make his product accident-proof or foolproof); Royal v. Black & Decker Mfg. Co., 205 So. 2d 307, 310 (Fla. Dist. Ct. App. 1968); Garst v. General Motors Corp., 207 Kan. 2, 20, 484 P.2d 47, 61 (1971); Jones v. Hutchinson Mfg., Inc., 502 S.W.2d 66, 69 (Ky. 1973); Foster v. Marshall, 341 So. 2d 1354, 1361 (La. App. 1977) (manufacturer is not expected to design its products with components that never wear out); Seward v. Natural Gas Co., 8 N.J. 45, 51, 83 A.2d 716, 719 (1951) (there is no duty for the manufacturer “to use the ultimate in scientifically perfect equipment or appliances with the hope that foolhardy action by human beings would be prevented”).

35 In fact, this is exactly what does go on even though this is not expressed by the courts or by the commentators. Time and time again, a plaintiff charges that a manufacturer should be liable because it did not use the technique which one of its competitors used. Even though the plaintiff and the court dutifully say that the manufacturer is not held to produce the ultimate in safety, they treat the assertion that the competitor’s product is “safer” as a sufficient basis for liability. This is a contradiction in terms unless one assumes that the competitor’s approach is actually safer, and accepts the premise that one competitor’s safer approach is a fair standard to use in judgment of the defendant’s approach. If there is a practical difference between this and holding the manufacturer to a duty of producing a product as safe as any other offered by anyone else in the world—“the ultimate”—it has not yet been fully explained.

36 E.g., some manufacturers often are attacked for placing the gasoline tank in the rear where it is said to be vulnerable to a rear-end collision; while others are attacked for placing it in the front where it is said to be vulnerable to a front-end collision.
skilled operators in a variety of environments are properly eliminated from consideration. But these latter factors are of the essence when a consumer product is designed.\textsuperscript{37}

Nevertheless, it would be unrealistic to pretend that the courts have used the term in a truly coherent manner. When one reads an opinion in a design controversy, it often is a fair question just what the reference to the "state of the art" means. All that can be said with any confidence is that the phrase embodies something more than "possibility" in purely technological terms and something less than all of the factors which must be considered on the issue of liability. In the main, this confusion probably has not been harmful. Semantic niceties aside, it is a hopeful sign that the phrase is part of the background of product litigation. Even if they do not always articulate the point clearly, the majority of trial lawyers and judges apparently appreciate the fact that matters such as technical feasibility, cost and ease of maintenance impose limitations on a manufacturer no matter how devoted to safety its designers may be.\textsuperscript{38} Unfortunately, however, a few courts have suggested that the state of the art can be ignored in strict liability cases.

III. THE MINORITY VIEW THAT THE STATE OF THE ART IS NOT RELEVANT TO STRICT LIABILITY

A. A Narrow Reading of the California and Illinois Precedent

There are cases in two important jurisdictions which, it is usually assumed, hold that the state of the art cannot be given any consideration in a strict liability case. If that reading is correct, these cases represent a change in the nature of design litigation. But when the sweeping assertions are read closely and in context, there seems to be at least a possibility that the vagueness of the prevailing terminology has misled the courts into saying far more than they intended. For example, \textit{Horn v. General Motors Corp.}\textsuperscript{39} was a strict liability suit brought by a woman who was injured when her car hit a concrete abutment. As Mrs. Horn was struggling to avoid the crash, her hand brushed across the horn cap located in the center of the steering wheel. It flew off; when she was thrown forward by the impact of the collision, her face hit three sharp retaining prongs which had been shielded while the cap was in position. In upholding a verdict for the plaintiff, the California Supreme Court said that there was no neces-

\textsuperscript{37} Purely theoretical research which ignores the practical factors may seem totally unrelated to the normal products liability suit, but plaintiffs sometimes argue that it should be controlling. For instance in \textit{Foster v. Ford Motor Co.}, No. 77-2352 (N.D. Tex. Mar. 31, 1977), \textit{appeal docketed}, No. C.A. 75-61 (5th Cir. Aug. 16, 1977), an engineer from NASA successfully argued that the company should have used the technology of rocket ships on automobiles and even tractors.

\textsuperscript{38} See cases cited note 30 supra.

\textsuperscript{39} 17 Cal. 3d 359, 551 P.2d 398, 131 Cal. Rptr. 78 (1976).
sity that she prove the design of the Chevrolet horn cap fell short of the prevailing state of the art in the industry; and, in the process, the court generalized that the “state of the art” is not a limitation on strict liability for design defects. The opinion, however, also reveals that a defense expert had admitted that the horn cap could have been screwed into place, as the plaintiff’s expert argued it should have been, and that the increased cost, if any, would not have been significant. Thus the defendant’s own witness had conceded two of the more basic elements of any design defect claim: (1) a safer alternative design was technically feasible and (2) it could have been used without an unreasonable cost penalty. Moreover, there was no question of technological advance comparable to that which is usually involved in cases in which the doctrine of the state of the art plays a role.

This suggests that beneath the luxuriant dicta the court only held that the fact other automobile manufacturers used prongs instead of screws to solve the relatively simple problem of fastening a horn cap to a steering column was not a defense once the defendant’s expert conceded that the latter technique was practical. This, in turn, would amount to nothing more than the familiar rule that conformity to industry practice is not an absolute defense—a holding far less revolutionary than one which abolished the concept of the state of the art altogether.

The Illinois Supreme Court dealt with a more substantial technical issue in Cunningham v. MacNeal Memorial Hospital, but that opinion also does not necessarily require the sweeping interpretation which it has been given. The plaintiff claimed that she had contracted serum hepatitis from a blood transfusion. The court held that the allegation stated a valid cause of action even though it was undisputed that a small percentage of those who receive blood transfusions will contract hepatitis in spite of every precaution which any hospital could use to eliminate that risk. The state of medical technology was no defense, the court wrote, because to permit a defendant to escape liability simply because it had been as careful as possible would obliterate the distinction between negligence and strict liability.

40 Id. at 367, 551 P.2d at 402, 131 Cal. Rptr. at 82.
41 Id. at 367, 551 P.2d at 401-02, 131 Cal. Rptr. at 81-82.
42 See note 27 supra.
43 See cases cited in notes 23 and 24 supra.
45 Id. at 452-53, 266 N.E.2d at 902.
46 Id. at 452, 266 N.E.2d at 902. The court stated:
To allow a defense to strict liability on the ground that there is no way, either practical
Here again, close reading of the text raises a question as to the extent to which the court intended its statements to alter fundamental law. The plaintiff had appealed from a judgment on the pleadings, a fact which Judge Culbertson emphasized when he explained why the transaction should be deemed a sale rather than a service. Moreover, he referred to the same procedural point when he ruled that the hospital could not rely on Comment k to section 402A of the Restatement (Second) of Torts. That provision prohibits liability for the sale of drugs and other products which by their very nature are incapable of being made safe—language which on its face would seem to apply to blood plasma which cannot be made less dangerous. The judge, nevertheless, concluded that the "defective" nature of the plasma distinguished it from hydrophobia serum (rabies vaccine), the example given in Comment k. The serum, although necessary to the cure of a terrible disease, is itself likely to produce harmful side effects because of its very nature, not because it is "defective" or contaminated in any way. In contrast, the complaint said that the plasma was "defective"—so, he suggested, it would be "defective" for purposes of appellate review of a judgment on the pleadings aside from the considerations of policy which led him to the same result.

or theoretical, for a defendant to ascertain the existence of impurities in his product would be to emasculate the doctrine and in a very real sense would signal a retreat to a negligence theory.

48 47 III. 2d at 456, 266 N.E.2d at 903-04.
49 The precise extent to which the procedural context of the case controlled the result is not clear. That influence cannot be dismissed as negligible, however, because the court's analysis of the policy considerations begs the question. Judge Culbertson did not discuss the example given in the Restatement, Pasteur vaccine for rabies. Although it is necessary for the treatment of the terrible disease, the serum itself is likely to produce harmful side effects, even if it is not "impure" or "defective." Blood plasma, on the other hand, will not cause hepatitis in the recipient unless it is contaminated with the hepatitis virus. From this premise, he asserted that "there can be no question" that blood containing hepatitis virus is "defective." But in fact there seems to be an entirely legitimate question as to whether blood containing hepatitis virus should be deemed "defective" for purposes of strict liability law in view of the lack of any technology which could eliminate the danger. The distinction between a product that may cause harm because of an unpredictable reaction in the user and one that causes harm because of the unavoidable presence of a disease-causing organism is an artificial one at best and it is unclear why it should dictate the result of the case. Under the peculiar fact pattern of the blood cases, it can reasonably be said that blood which is obtained through a careful selection of donors and properly stored is not unreasonably dangerous. Blood transfusions, like rabies vaccine, are often necessary to preserve life, and can justifiably be performed even though there is an attendant risk. See Restatement (Second) of Torts, § 402A, Comment K (1965). But the most important flaw in the court's opinion was its failure to consider the important policy issue involved. If liability is imposed without regard to any available technology which could have been employed to make the product safer, there is nothing a manufacturer or seller can do to avoid it; in effect, absolute

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This approach gave the Illinois Supreme Court a simple way to decide the case. Once one assumes that plasma or any other product is defective, it follows, in purely verbal terms, that due care would not protect the manufacturer from liability under section 402A. But the fact that the result seems to have been influenced by a procedural point as much as by the court's analysis of the policy factors, should reduce its precedential value.

B. A Critique of the Broader Interpretation of Horn and Cunningham

Ours, of course, is a consciously restrictive reading of these cases. The majority of lawyers and judges who have considered the matter have thought that Cunningham and Horn do represent a broad new principle, and that interpretation would not make the cases wholly unprecedented aberrations.50

That broader interpretation, however, seems to show a lack of perspective. In order to create an additional distinction between two theories, negligence and strict liability, the courts apparently are willing to ignore the necessity that the manufacturer's duty be limited by the reasonable expectation of the consumer, the very basis for strict liability.51 If, for instance Mrs. Cunningham knew of the danger of infection from the plasma, how liability is imposed, and the manufacturer or seller becomes an insurer, despite the many judicial assertions to the contrary.

Since the potentially far-reaching effect of Cunningham appears not to have been considered by the court, its weight as precedent may be substantially curtailed in future cases. Indeed, there is Illinois precedent for recognizing evidence in regard to the state of the art. See cases cited note 47 supra.


For the most part, these latter cases simply have repeated the Illinois Supreme Court's dicta without analyzing the question further. Gelsumino v. E.W. Bliss Co. is a representative example. There a punch press operator lost several fingers when he slipped on an oil smear. Falling, he grabbed the press's die and, at the same time, inadvertently triggered the foot pedal which operated the mechanism. The pedal, like those on all comparable machines, was only partially shielded. Relying on Cunningham, the Court of Appeals said that conformity to the state of the art was not a defense to a claim against an unreasonably dangerous product. In the final analysis, the Court in reversing the summary judgment seemed to have only held that the fact that the technique in question was the same as that used by others in the industry did not preclude a jury issue. Such a ruling rejects the extreme defense view, but it does not necessarily reject any or all of the ideas embodied in the more moderate consensus.

could she, as a reasonable consumer have "expected" the product to be as "safe" as it would have been if that risk did not exist? Yet the clarification of the distinction between negligence and strict liability is merely desirable at most, while consistency with the very basis of the doctrine would seem to be essential.

Moreover, there is an even more basic question. The desire for doctrinal elegance is laudable, but is it sufficient to justify the elimination of limitations on design liability as fundamental and intuitively necessary as considerations of cost, practicality and function? Strict liability itself, after all, is not the product of any such rigorous logic. On the contrary, it evolved slowly as judges chipped away at defenses and other aspects of the warranty law, not because they perceived any fallacies or conceptual weaknesses in warranty doctrine but because they sought to achieve a desirable policy goal: the protection of the consumer in situations where his lack of experience or lack of bargaining power placed him at a serious disadvantage. If, then, the doctrine is not a response to an intellectual imperative but, rather, an attempt to carry out the most general of policy goals, there is no reason to sacrifice other considerations of policy—such as fundamental fairness—to the pretense that strict liability has a profound and sacrosanct theoretical basis.

Indeed, it seems ironic that the same jurisdiction which expresses its concern over the lack of meaningful standards in modern product liability law is one of the leaders in the attempt to eliminate the state of the art as one such standard—and that it acts in the name of intellectual purity. The California Court of Appeals has called upon the lower courts to guard against "extravagant claims of defective design so that the good in product protection against injuries resulting from abuse and misuse is not drowned in a sea of unmeritorious demands for payments of the wages of recklessness and folly." The Supreme Court of the same state, distressed at the confusion which had developed at the trial level, later set forth a list of factors which it urged trial judges to include in the jury charges on the nature of a defect. In principle, the effort at clarification is commendable. Yet,

52 Conversely, if she did not know of the risk, the case might properly be analyzed in terms of the duty to warn. But anything it said about the state of the art would be even more clearly dicta.


55 Barker v. Jull Eng. Co., 573 P.2d 443, 143 Cal. Rptr. 225 (1978). Among the factors named by the court were: "the gravity of the danger posed by the challenged design, the
citing Horn, the court discussed matters of cost, feasibility and the like—precisely those matters which Horn had been thought to have eliminated from design cases by its statements concerning the state of the art. It remains to be seen whether the court truly intended to overrule that aspect of Horn.

C. The Incentive Rationale

The apparent inconsistency of the California decisions is but one manifestation of a broader problem. The suggestion that the state of the art is not a limitation upon the manufacturer’s liability makes the law incomprehensible to the designer or engineer who finds his work under attack. He is left with the dispiriting counsel that it does not matter that he complied with the regulations that the government has imposed upon him or that neither he nor any other engineer knew of any additional steps which would have made the product safer. His employer is still liable.

To be frank, of course, even the relatively conservative doctrine which we discussed earlier is more pious exhortation than meaningful standard. Essentially, all that these cases say is that the designer must attempt to balance matters such as cost, performance and marketability. Any sensible designer or layman knows that much without legal advice. It would require a dozen pages to convey to the general reader the enormity of the gulf between these generalities and the complex process by which thousands of skilled technicians spend years on the design and production of a product such as an automobile. But when a judge says, or seems to say, that these factors are not even to be taken into consideration, he severs all communication between himself and the persons whose conduct he is attempting to regulate. What, after all, are the courts telling us when they announce in Horn and Cunningham that the state of the art is not relevant—that manufacturers must do something which is not possible yet—or useful—or worth the cost?

Some have sought to rationalize the basic approach of cases like Horn and Cunningham by suggesting that the higher the standard to which an industry is held, the greater the “incentive” it will have to invest in re-
search and development and, accordingly, that the product should not be judged by the state of the art which prevailed when the manufacturer was designing it but by that which had evolved by the time of the trial months or years later.\footnote{See Brody v. Overlook Hosp., 121 N.J. Super. 299, 306-07, 296 A.2d 668, 672 (L. Div. 1972), rev'd on other grounds, 127 N.J. Super. 331, 317 A.2d 392 (App. Div. 1974), aff'd, 66 N.J. 448, 332 A.2d 596 (1975). See also Shapo, A Representational Theory of Consumer Protection: Doctrine, Function & Legal Liability for Product Disappointment, 60 VA. L. REV. 1109, 1137 (1974) [hereinafter cited as Representational Theory]; 41 TENN. L. REV. 357, 364 (1974).} Fortunately, scholars already have suggested the weaknesses of the economic assumptions upon which those suggestions are based.\footnote{See W. PROSSER, HANDBOOK OF THE LAW OF Torts, § 97, at 650, n.93 (4th ed. 1971). See also R. POSNER, ECONOMIC ANALYSIS OF LAW §§ 6.10-6.11 (2d ed. 1977); Epstein, supra note 7, at 659, and Plant, Strict Liability of Manufacturers for Injuries Caused by Defects in Products - An Opposing View, 24 TENN. L. REV. 938, 943 (1957).} Thus rather than duplicate these efforts, we will limit ourselves to articulating some additional reasons why the “incentive” argument is unrealistic.

To be fair, it is possible for the law to exert pressure which will require a manufacturer to spend more money on research and development, and this, in turn, presumably may “advance” the state of the art in some instances, e.g., exhaust emissions and fuel economy in the automobile industry. But that can only happen when it is logical for the manufacturer to expect those expenditures to accomplish something; this might occur in the controlled circumstances of a carefully designed administrative program, but it cannot in common law litigation.

An administrative agency can impose specific requirements which become effective after those who must meet them have had a reasonable amount of time to prepare. Consequently, a manufacturer (and ultimately the purchaser) of the product must bear a great deal of expense, much of it wasted, but at least it can make an effort to comply with a known standard. The “incentive” theory assumes that this is also true in litigation, i.e., that the manufacturer, like the lawyer or the legal commentator, can devote resources and attention to a single case, or at the most, to a few well-defined classes of accidents. But, as Professor Henderson has suggested, that premise in turn depends on a misleading oversimplification of the process of design and the host of interrelated judgments and compromises which it necessarily involves.\footnote{Limits of Adjudication, supra note 1, at 1558.}

Moreover, a large manufacturer knows that it must expect dozens or even hundreds of lawsuits each year and that they will be based on a variety of theories, some legitimate and some not. This means that it cannot concentrate its resources on any single problem, or even a few, as it can when the question is compliance with administrative standards. Worse, once the element
of time is removed from the equation, the entire concept of the state of the art is virtually meaningless, and the manufacturer's potential liability, already formidable, becomes limitless. If one jury can hold against the manufacturer on the theory that it should have used technology which did not exist until the time of trial, there seems to be no particular reason why another jury could not hold it liable for failing to go even further into the fourth dimension. Moreover, any jury could impose that liability for any aspect of the design which might be involved in any accident on the theory that the manufacturer always could have done more than was feasible and practical if it had devoted some undefined "additional amount of resources" to research and development on every conceivable characteristic of its products. Thus the effective standard would be perfection, whether or not the courts chose to continue to deny the fact.

Judgments of this sort would not foster safety. Far from being chastened or inspired by the rhetoric of corporate responsibility, manufacturers logically would begin to think of common law litigation as one of the random hazards of life against which they cannot protect themselves. This would not lead them to defy the courts or ignore their duties to the public. But the lack of coherent judicial standards would leave them no choice but to act in accordance with their own concepts of practicality and right and wrong, together with whatever regulations the executive branch and Congress may impose upon them. Such a situation must tend to undermine the intellectual respectability of the common law and, ultimately, its moral authority, a consideration which may be more important than the supposed need to maintain the theoretical difference between negligence and strict liability in design litigation.

IV. A Requirement That Claims for an Alternative Design Be Supported by Empirical Evidence

In spite of Horn and Cunningham, the majority view is still that the state of the art must necessarily be one of the limits of a designer's duty. This may suggest that the law has avoided doctrinaire extremism and once more muddled through to a common sense solution. Unfortunately, there is no cause for even such muted celebration.

The same judges who speak of the "state of the art" in terms of practicality, marketability and similar factors often undermine their own reasoning by permitting the plaintiff to "prove" his assertions concerning those questions by a verbal ritual rather than by meaningful evidence. In a case

like our hypothetical, the plaintiff's counsel asks his witness whether he
thinks that some technique or device was "within the state of the art" and
perhaps, if the lawyer is of a cautious or painstaking nature, whether the
expert believes that the "improvement" could have been produced at a
reasonable cost and would have been technically feasible at the time the
actual product was developed. To no one's surprise, the witness answers
"yes" to each question, sometimes adding confidently that it could have
been built for less than ten dollars (or twenty or a hundred). The lawyer
then has the expert testify that it is his conclusion that the product fell
short of "acceptable design practices" or "reasonable engineering standards".

The witness does not explain how he knows any of this. Usually he
has never been responsible for producing such a product—improved or
unimproved—and he is "bootstrapping"; neither the government nor trade
groups nor academic writers have established any objective rules as to the
aspect of design in question and the "standards" to which he refers are his
own subjective views. More remarkable still, the witness may never have
tested the "improvement" he discusses so glibly. Thus the critical opinion
depends entirely upon the unexplained and subjective thinking of the
"expert" unsupported by tests or any other empirical evidence.

Moreover, the situation often is far more extreme—the expert may
well admit that most manufacturers do not use his technique or, for that
matter, that no manufacturer in the world ever has used it. In either case,
he pits his opinion, unsupported by tests or any objective standards, against
that of the majority of manufacturers and the engineers whom they employ
and, often, the unanimous opinion of every manufacturer in the industry
as well.

All too often, none of this matters as long as the witness and the lawyer

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61 This type of testimony suggests that all that is involved is the cost of adding some "off-
the-shelf" item and, perhaps, an arbitrary percentage for overhead. In reality, as Professor
Henderson has pointed out, the change in one aspect of the vehicle often will involve a
whole train of additional modifications. Limits of Adjudication, supra note 1, at 1570-72.
The added cost in turn will affect marginal cost, average cost and the volume sales.
It would require a fairly elaborate treatise to explain the matter fully. For our purposes it
suffices to say that the matter of cost is a highly complex one and that the expert should not
be permitted to offer a dollar figure unless he has a basis for his calculations.

62 E.g., in Turner v. General Motors Corp., 514 S.W.2d 497 (Tex. Civ. App. 1974), the
plaintiff's expert attacked the automobile industry's failure to use roll bars or roll cages in
its products. He admitted that no mass-produced automobile manufactured in the United
States had ever come equipped with such a design, and on a global level only West German
Porsche Targa used such a design in all its cars. Nonetheless, the plaintiff was allowed to
recover on this meager showing. See also Havlick v. Ford Motor Co., 351 So. 2d 1050, 1052
(the plaintiff used foreign luxury cars to prove the state of the art for an American economy
car).
have recited the litany. The jury is left to decide whether an expert made his claims in good faith. If they choose, they are free to place some weight upon the fact that the alternative device has never been tested, but they are equally free to ignore it; the question has no particular significance as far as many judges are concerned. In the balance of this paper, we will argue that testing — or its absence — should matter a great deal.

Several commentators who share this general concern already have argued that the law should be changed by statute.\(^6^3\) We suggest, as an alternative, that the courts could make the requirements of proof more meaningful and fair if they were to apply basic common law principles which already exist or, at most, extend them slightly. They need merely require that a litigant who wishes to have his expert testify that a technique is within the state of the art first lay a foundation for that testimony,\(^6^4\) by evidence of testing or some comparable empirical proof that the proposed design actually would be practical and effective. If the proponent does not satisfy that threshold requirement, the testimony should be considered to be speculative as a matter of law and, therefore, not admissible.\(^6^5\)

### A. The Divergence Between Science and the Law

Unless he is a defense specialist, the odds are high that a lawyer will react to the hypothetical we set forth earlier by saying that the plaintiff’s case may well be weakened by admission or gaps in the expert’s reasoning,

\(^6^3\) Suggested legislative reforms include the proposal of the Defense Research Institute for a uniform state of the art statute. See *State of the Art—Post-Accident Modification—Industry Standards*, 44 INS. COUNSEL J. 295, 297-98 (1977). See also *Limits of Adjudication*, supra note 1, at 1574-77; *Representational Theory*, supra note 57, at 1378.

\(^6^4\) FED. R. EVID. 703, 705.

but those failings go merely to the weight of the evidence, not its admissibility, so that the whole matter must be left to the wisdom of the jury. 66

To an engineer or designer, however, it is a mockery to submit a complex technical matter to a jury of laymen on the basis of an uncorroborated, conclusory statement. To them, any inquiry into the state of the art begins with the question of whether the proposed alternative actually does work. If it does, it is at least a possible approach and the device later may prove to satisfy the additional requirements of cost, marketability and the like. But if the design does not work, that is the end of the matter. Similarly, it seems obvious to those who lack the benefit of legal training that the best way to learn whether a device works is to try it out — not to accept the assurance of its inventor that it will work, no matter how fervent and sincere he may be.

It follows that no responsible scientist could conceive of treating an untested proposal as "within the state of the art" for any important purpose — other than testimony under oath — simply because an individual favored it, no matter how highly qualified he might be. Since Francis Bacon, the scientific method has required that any hypothesis be tested and that the results, in turn, be verified by other workers in the field before they can be accepted as part of the relevant body of learning. 67 Testing is the essence of the process, not an afterthought to be used or dispensed with as a matter of convenience.

B. Legal Precedent for the Requirement

The lawyer's assumption that a court must take a lenient approach to expert testimony more often results from reverence for tradition or vague recollection of case law than from careful analysis. Indeed, when one reads them closely, even leading decisions in this area sometimes prove to mean something significantly different from the propositions for which they are routinely cited.

For instance, the principle that conformity to industry practice is not

66 See, e.g., Amador Beltran v. United States, 302 F.2d 48, 52 (1st Cir. 1962) (admission by the expert that he may have been mistaken in his opinion did not render his testimony inadmissible). See also Raney v. Honeywell, Inc., 540 F.2d 932 (8th Cir. 1976). The lawyer's faith that the jurors can choose between conflicting experts on the basis of their demeanor on the stand, of course, tends to baffle or amuse the scientist. The fact that one witness may sweat or be unable to stare at the jury while he answers a question is wholly extraneous to the technical issue.

an absolute defense is seldom even questioned. But the classic precedent for that proposition also suggests that the balance between the interests of the plaintiff and the defendant in such a controversy requires an approach much like the one we advocate. In *The T. J. Hooper* Judge Learned Hand said that:

A whole industry may unduly lag in the adoption of new and of available devices. It never may set its own tests, however persuasive be its usages. Courts must in the end show what is required; there are precautions so imperative that even their universal disregard will not excuse their omission... On the other hand, he did not say that a case could go to a jury on no basis other than the conclusory testimony of one witness contradicting the prevailing opinion of experts in the field. The case, in fact, did not involve a jury or present any state of the art issue at all.

The Hooper was a tug which took several barges to sea in 1928. Caught in a storm, some of the barges sank. The Weather Bureau had broadcast several warnings against the storm and several tugs which were equipped with radios had put back into harbor. The cargo owners sued the line which owned the Hooper, claiming that she also should have taken refuge. At trial, her master testified that had he received the message, he would have turned back. There was a radio on his vessel, but it was broken. The owners neither supplied nor maintained it. Only one other tugboat line did furnish radios. The other lines, like the defendant, apparently expected their crew to have radios aboard, partly as personal equipment and partly for entertainment.

Judge Hand affirmed the trial judge’s award of damages and approved his ruling that the owner was not excused because other companies also had not installed reliable radios. But there was no issue in the case concerning the cost or feasibility of such equipment; on the contrary it apparently was undisputed that by 1928 radio sets suitable for use by coastal tugs were available at small cost and reasonably reliable. Further, a point which is often forgotten, Judge Hand explicitly said that the defendant who does what its peers also do normally will not be liable; and his ruling against the Hooper’s owners resulted from the exceptional circumstance that there was clear-cut evidence that the supposedly superior technology worked — the fact that other tugs were using radios successfully and, in fact, had received the critical storm warning.

68 60 F.2d 737 (2d Cir. 1932).
69 Id. at 740.
70 Id.
The defendant in our hypothesis could have little objection to the principle which can be drawn from the case. Although the dangers of collusion seem exaggerated, it probably would not be wise to give any industry the power to set its own standards. It is fair to permit the plaintiff to base his case on the opinion of an individual expert even if the defendant has conformed to the practice in his industry—provided that opinion has a foundation of empirical evidence.

A number of other cases offer more direct support for this suggestion. To begin, acid comments about the quality of the testimony upon which the plaintiff relied are commonplace in the product liability reports. True, the same judge often goes on to affirm the verdict in spite of an obvious lack of confidence in the expert—or even, on occasion, to create a new rule of law in order to permit a plaintiff to recover in spite of his expert. But some courts have held that the opinion of the plaintiff’s expert was not sufficient to support the verdict because he had failed to include statements that the alternative design he favored was within the state of the art, or technically feasible, or that it could be mass-produced at reasonable cost, or that it would have significantly reduced the risk of the accident in question.

Other decisions focus upon the general requirements for expert testimony, emphasizing that the witness cannot speculate and that his testimony can have no weight if it contradicts some physical fact or law of science. Some of these cases hold that the expert’s conclusion can have no value for the jury.

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71 Presumably the vigilant “private attorneys general” of the plaintiffs’ bar would attack any unreasonable standard.


78 See case cited note 17 supra.
unless it is supported by a foundation of facts and coherent reasoning; a few come still closer to our point by suggesting strongly that testing is, or should be, an essential prerequisite to the expert's right to testify under certain circumstances. The Third Circuit, for instance, recently remanded a "second collision" case and suggested that the trial court consider requiring proof of testing in the re-trial. Similarly, in Jones v. Hutchinson Mfg., Inc., the Kentucky Court of Appeals affirmed the dismissal of a strict liability action in which the plaintiff's expert had testified that it was his opinion that a child would not have been injured if a small grain elevator had borne a protective shield such as that he described. Although it recognized the principle that an entire industry could be negligent, the court held that possibility to be irrelevant because the plaintiff had never tested or built the equipment he described and the design the defendant had used was universal in its industry.

The Wyoming Supreme Court also made it clear in Maxted v. Pacific Car & Foundry Co. that it was not satisfied with the expert's verbal assurances that the "jettisoning" device he proposed for logging trailers was practical. The fact that he had prepared a model of the device, as well as extensive drawings, did not fill the gap left by the absence of testing:

From our view of the record, to hold that the evidence here submitted was proof of a standard of care or duty upon these manufacturers would be to cast upon them a burden of clairvoyance which it is doubtful . . . . Nostradamus could meet.

Garst v. General Motors Corporation may be the best example of a holding that an expert's testimony was not sufficient to support a verdict even though it did include a net conclusion and subsidiary propositions concerning the state of the art. There an assistant professor of mechanical engineering, studying for his Ph.D., testified that it was his opinion that the design of a large construction scraper was defective because the brakes were not sufficiently shielded against mud and its steering system lacked "enough" hydraulic power. A jury found in favor of the decedent's estate. One justice of the

80 See, e.g., Lash v. Noland, 321 So. 2d 104 (Fla. Dist. Ct. App. 1975), where the court relied on the tests performed on a golf-cart's brakes prior to trial.
81 Huddell v. Levin, 537 F.2d 726, 737 (3d Cir. 1976), but note that the tests apparently would measure the performance of the actual design, not a proposed alternative.
82 502 S.W.2d 66 (Ky. 1973).
83 527 P.2d 832 (Wyo. 1974).
84 Id. at 836.
Kansas Supreme Court argued that the expert's criticisms of the design and some company documents expressing reservations about the steering system were sufficient to create a conflict of experts. The majority, however, analyzed the testimony more closely. They found that the design used was standard in the industry, that the witness had never tested the various "improvements" which he proposed, that they had never been used in equipment of the type in question, and that the testimony of the defense experts showed that each such proposal had significant practical drawbacks. Ultimately, the majority held that the fact that the expert thought the scraper should have stopped or turned more quickly and that he believed a theoretical design would have been an improvement was not a sufficient basis for the jury's verdict; they set aside the award of $118,000.

C. Some Practical Considerations

These cases show that our proposal is consistent with the basic principles of evidence and of appellate review. We would be less than candid, however, if we did not concede that there is not yet any explicit requirement in the prevailing case law that a plaintiff's expert test every alternative he proposes. On the contrary, many courts tend to dismiss any attack upon the adequacy of the evidence in a design controversy, simply assuming that an expert's conclusion must be sufficient to create a jury issue regardless of what he may have omitted or conceded during his testimony. The California Supreme Court, hardly a conservative bastion, has warned that this general tendency is so widespread that modern litigation is in danger of evolving back

86 Id. at 23-25, 484 P.2d at 63-64 (Fatzer, J., dissenting).
87 Id. at 23, 484 P.2d at 63. Also note that more than one case has subjected a manufacturer to punitive damages because it did not conduct its "crash tests" or their equivalent. See Owen, Punitive Damages in Products Liability Litigation, 74 Mich. L. Rev. 1257, 1341 (1976), citing Smith v. Cessna Aircraft Co., No. 70-9255-L (93d Jud. Dist. Ct. Dallas County, Tex., Nov. 26, 1972), noted in 16 A. Trial Law. Am. News Letter 30 (1973). See also Sabbich v. Outboard Marine Corp., 60 Cal. App. 3d 591, 131 Cal. Rptr. 703 (1976). It seems surprising, then, that the courts seem to assume that the decision by the plaintiff's expert not to conduct any tests has no legal significance at all. Surely that incongruity at least should prevent recovery in the inevitable case in which a plaintiff, relying on the theory of an expert who has conducted no tests of his own proposed design (or only a cautious and perfunctory laboratory exercise) seeks punitive damages from a defendant on the theory that it did not test its design thoroughly enough.


The Melia case is criticized in Note, Manufacturers' Liability for Design Defects, 56 Neb. L. Rev. 422 (1977). The author points out that the Circuit Court of Appeals upheld a verdict on the basis of expert testimony that a door lock was "defective" even though there was no testing of the alternative design and there was no evidence of the statistical likelihood of the side-swiping impact which caused the door to open in the accident.
into something akin to a "medieval trial by oath."\(^{89}\) Yet, while decisions of the sort the court criticized are commonplace, they usually are dicta or wholly unexplained fiat rather than carefully reasoned holdings. Nothing in the basic nature of product liability doctrine, or that of appellate review, requires such an approach. Indeed, without a requirement of foundational facts, litigation simply is not likely to produce responsible answers to difficult technical issues.

The expert's testimony concerning an alternate design usually is the most important part of the plaintiff's case; millions of dollars may change hands because of his claims, to say nothing of the damage to the reputation of the manufacturer and its designers which follow an adverse verdict. Yet neither the plaintiff's expert, the trial judge, the appellate judges nor anyone else will ever know whether that alternative design actually would work if it has not been tested. This is not the way serious business is done in the world. Consider the different manner in which comparable questions are treated under the National Traffic and Motor Vehicle Safety Act.\(^{90}\) It is no secret that the National Highway Traffic Safety Administration and the automobile companies sometimes differ over the proper procedures for testing and the proper criteria for test equipment.\(^{91}\) But, in a broader sense, the situation is at least comprehensible to an engineer or a businessman. For better or worse, the government has set out, at least in certain instances, to hold manufacturers to a particular level of performance by setting standards in advance, and it intends to impose sanctions if they fall short of that level; it necessarily follows that the product must be tested in order to see if it does meet those criteria. This might seem too obvious for comment were it not the conventional assumption that there is no such requirement when a private plaintiff seeks to recover from one of the same automobile companies in a common law action.

D. The Partisan Critic and the Design Process

The assumption that no testing is necessary also ignores the unique


\(^{91}\) See Chrysler Corp. v. Department of Transp., 472 F.2d 659 (6th Cir. 1972). See also Pac-car, Inc. v. N.H.T.S.A., No. 75-1017 (9th Cir. April 17, 1978) (holding N.H.T.S.A. truck brake standard invalid for lack of thorough testing).
power of the technical expert in a product law suit and the temptations that power can create. In relatively recent years, a whole new occupation has developed: the witness for hire. The back pages of bar association journals usually list a variety of "consultants" who are available to testify in product liability cases anywhere in the country for a fee. One critic of the automobile industry, in fact, recently ran a large advertisement in a legal newspaper inviting one and all to attend a "special nite" [sic] for lawyers and legal secretaries at Tiffany's, "California's most exciting private club." He was giving the party, the text explained, so that he, a "top expert witness", could show "how to win" and "how to expand 'accident' cases into 'product liability' cases." Complimentary hors d'oeuvres were to be served at eight followed by a "products liability rap session" and "car crash test movie from nine to ten". There would then be "mixing, libations and dancing until 2:00 a.m. — no admission charge."

Sponsoring a cabaret may be the entrepreneurial spirit at its best, but it is not the action of the traditional disinterested fact witness. On the other hand, the attempt to generate business is not surprising or even unusual save for its comic directness. A plaintiff's lawyer, of course, might say that the stork does not bring the expert defense witness either. That is true, but beside the point. Defense experts vary in terms of skill and character just as do plaintiffs' experts, the principle is the same. The hired witness long ago evolved into a professional, no doubt limited by scientific ethics as to some of the things he can or will say, but still a person whose livelihood, like that of the lawyer, depends upon his prowess in advocating the cause of the person who pays him.

Lawyers and judges, of course, know this, but jurors often do not. In the melodrama which the plaintiff's lawyer presents at trial, the outside expert is the hero. Chosen in part for his appearance and speaking ability and presented as more intelligent or more "safety conscious" than those who work in the industry, he usually describes some approach which is beguiling in its simplicity. In some instances, he actually may have superior insight. But more often, he merely talks about general considerations which are obvious to designers. Furthermore, the defendant may not have adopted the ap-

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93 The standard we propose would apply to a defense expert as well as to a plaintiff's expert. It would be a less significant restraint upon the defense expert, however. As we have seen, the plaintiff's witness is often thought to be at liberty to speak in terms of hypothetical "improved design" which has never been used. The defense expert, instead, must discuss a design which has been worked out in full, embodied in a prototype, tested, mass-produced and subjected to usage under actual conditions and by a large number of actual consumers. This imposes a natural discipline. The fact that the plaintiff's expert is not subject to the same discipline is the main reason a requirement of testing is needed.
approach he suggests for any of a number of valid reasons: the concept may have been tried and found wanting by the defendant or other manufacturers; or it may not be suited to the characteristics of the defendant's particular product; or it may be that no one has ever proved the existence of the advantage which the expert claims. The process by which an automobile or any other consumer product is designed, after all, is not like a geometry problem or anything else which can be dealt with satisfactorily on the level of pure abstraction. It is, instead, an intensely pragmatic matter. In theory, a novel design approach may be entirely appropriate but when it is put to the test of actual usage, it may be plagued with unforeseen problems of cost, suitability for mass production or even safety.\(^4\) As a result, it is not at all difficult for a "consultant" to propose some approach which may seem plausible and to cut a figure before the jury. But outside the special world of product litigation, he will not accomplish anything by such soliloquies. Until he builds the device and subjects it to testing under a reasonably representative range of circumstances, he and every person active in the field will know that he is speculating and nothing more.

The individual expert, of course, cannot be criticized if he decides to avoid testing his proposal. As long as the law permits the case to go to the jury on the basis of his abstract theory, he would be derelict in his duty to the lawyer who hires him and the client who pays him if he needlessly ran that risk. If his approach did work, that fact would add nothing to his theory; if it did not work, his theory would be destroyed.

E. Barriers to Self-Defense

Given the importance of empirical testing, one might ask why the manufacturer does not conduct the tests itself in order to dispel the misleading impression. One answer is that the plaintiff bears the burden of proof,\(^5\) and he should have to conduct the tests rather than leave it to the manufacturer to attempt to disprove some novel hypothesis. But even if the manufacturer wishes to assume this burden as a matter of self-defense, the dynamics of the trial often would hamper his efforts. The plaintiff

\(^4\) See text accompanying notes 42-43 supra.

\(^5\) The tendency to speak of a "state of the art" defense may mislead some into thinking that the question is one of an affirmative defense. Occasionally it is, but far more often the issues are part of the plaintiff's case. The products liability plaintiff, much as any other plaintiff, must prove certain facts in order to establish a prima facie case, and also to satisfy the overall burden of persuasion which he or she bears when and if the case reaches the jury. See generally Nicklaus v. Hughes Tool Co., 417 F.2d 983, 986 (8th Cir. 1969). Several cases have expressly placed the burden concerning state of the art issues on the plaintiff. See, e.g., Lolie v. Ohio Brass Co., 502 F.2d 741, 744 (7th Cir. 1974); Cardullo v. General Motors Corp., 378 F. Supp. 890, 893-94 (E.D. Pa. 1974), aff'd, 511 F.2d 1392 (3d Cir. 1975); Baker v. Chrysler Corp., 55 Cal. App. 3d 710, 715, 127 Cal. Rptr. 745, 748 (1976). See generally Huddell v. Levin, 537 F.2d 726 (3d Cir. 1976).
presents his case first, and many judges permit him a great deal of flexibility. The defendant, on the other hand, necessarily must react to whatever charges the plaintiff chooses to bring against it during the trial — charges which are often significantly different from those which were advanced even at late stages of discovery. As a result, any tests the defendant might conduct in reliance upon what it had been told in interrogatories, depositions or even the pre-trial conference might well be outdated by the time of the trial. In addition, the “improved” approach is often too speculative and ill-defined for anyone to test, let alone someone who has just heard of it. For these reasons, self help is not a fair substitute for the protection the law should give.

Moreover, the tradition of judicial lenience to the plaintiff’s expert has a corollary. In practice if not in theory, many courts seem to impose an unduly restrictive standard when the defendant offers a test. That insistence upon excellence would be admirable were it consistent. Unfortunately, it is not, and as a result the situation frequently degenerates into absurdity. The plaintiff, of course, is correct when he says that the defendant’s test does not reproduce every aspect of the actual accident or, when an advance in the state of the art is at issue, that the test does not duplicate every danger to which the new design might be subjected in actual usage. No test is perfect. The process necessarily is selective, and the court must make a judgment in each instance, just as the scientist must. However, even an imperfect test usually is better than no test.

Unfortunately, some courts seem to have lost sight of that simple proposition. Often, the trial judge accepts the argument that minor discrepancies in testing procedures are important enough to exclude the defendant’s tests, supposedly in the interest of scientific accuracy. Yet the net result is that the jury hears about the plaintiff’s hypothetical alternative design, does not receive the benefit of any evidence whatsoever concerning tests, and is left to guess whether or not the device works at all.

96 Some judges do protect the defendant against late changes in theory, but others do not. We speak of what often happens in practice, not what would happen if the rules always were enforced.

97 Many defense lawyers believe that judges reject tests offered by the defense which they would permit if offered by a plaintiff. This, of course, is an impression only, supported by cases such as Pohlod v. General Motors Corp., 40 Mich. App. 583, 199 N.W.2d 277 (1972), but not by any systematic survey. On the other hand, it is more than “sour grapes” or a belief that judges are “plaintiff-oriented.” A judge who was entirely fair-minded may still give the plaintiff greater leeway, believing that the defense has greater knowledge and resources and, therefore, is in a better position to demonstrate the weaknesses in the plaintiff’s test by cross-examination, while the plaintiff would not be able to do the same to a defense test. In reality, however, the plaintiff’s lawyer often has resources available to him as great or greater than those available to the defense counsel. Moreover, the basic idea that a plaintiff’s counsel should be entitled to some form of advantage may be outdated.
F. Some Arguments Against a Requirement of Testing

Many of the arguments which might be offered against the requirement of an empirical foundation do not seem overwhelming. To begin, the courts simply might not believe that any test of a proposed design could be sufficiently reliable to be useful — by analogy to the traditional attitude toward lie detectors. Clearly, however, this is not the situation. Plaintiffs often base their cases against manufacturers on the results of tests, either those the defendant has conducted itself during the design process or their own. Thus there is a considerable body of law concerning the requirements for testing, and no one seems to suggest that the matter is beyond the capacity of courts and juries.

There also is no reason to believe that the jury's opportunity to assess the demeanor of a witness eliminates the need for this evidence. The question is not whether one expert or the other is lying — a matter of the type which the law traditionally does entrust to jurors' intuitive reactions. It is, instead, whether a particular approach to the design of a complex mechanical device will work significantly better than another approach. The expert, like any other advocate, may well believe what he is saying while saying it, but the fact remains that no one will know whether he is right unless his proposal is put to the test.

The question of practicality is more difficult. If there were no way to provide the jurors with evidence on the question of whether the alternative device did or did not work, the unsupported opinion which is now fashionable might have to suffice. But in fact, the courts could obtain that evidence if they chose to do so. Almost every such claim can either be verified or put to rest by some form of testing or other empirical evidence. Indeed, it would seem that an assertion which could not be tested would be speculative by definition. Yet it would not be reasonable to require individual plaintiffs and their lawyers to match the testing programs which manufacturers conduct. In theory, this is precisely what they should have to do if they claim to have superior competence in the design and manufacture of consumer goods, but the financial burden presumably would be prohibitive except in some class actions. Fairness, then, requires some compromise.

The task is substantial, but the general outline of a solution seems plain enough. If a plaintiff's counsel believes that full scale testing of the alternative design would be unreasonably expensive or impractical for some other reason, he or she should have to satisfy the trial judge of that fact by


99 See, e.g., Creekmore v. Crossno, 259 F.2d 697, 698 (10th Cir. 1958); Knapp v. Arizona Highway Dep't., 56 Ariz. 54, 57, 104 P.2d 180, 181 (1940).
an argument based on the specific circumstances of his case; he should be obligated to offer some alternative in lieu of that evidence. One such alternative might be a program of limited testing carefully designed to explore the characteristics of the product which are significant in the individual lawsuit. If even this were impractical, he might resort to a showing that the design already is in use by others in the industry, a technique which has been a part of the lawyer's repertoire for years. Or, if the device had not been tried in the industry, the plaintiff might be able to persuade a court that it had been used in some field which was legitimately comparable. Finally, counsel could also try to elicit admissions from defense witnesses, the technique so successful in the *Horn* case.

In any event, much of the burden of the effort would not fall upon the widow or orphan, or even the consumer advocate. Most design cases are brought by sophisticated lawyers, for contingent fees which range between thirty and fifty percent of the total recovery. These are high stakes and they already have led to the development of the professional witness with his "independent testing laboratory" and to the growth of clearing houses through which plaintiff's lawyers who have similar cases exchange documents and other information. This suggests that the plaintiffs' bar would continue to be as active under the new regime as it was under the old, simply because it has a powerful economic incentive.

V. CONTINUING REVOLUTION — OR ORTHODOXY?

Many judges, of course, are conscious of the reasons why a plaintiff should have to provide a factual foundation for his expert's claims; but they ignore them, believing that the nature of product liability law requires that the plaintiff be allowed to succeed with evidence of far lower quality than that which would be required in other areas of law.101

That idea, stated or unstated, is often the basic premise from which a court proceeds to analyze any new issue. Indeed, it is one of the paradoxes of product liability law that courts which proudly and correctly believe themselves to be in the vanguard of change often offer little or no reason for those changes except this traditional, unexamined preconception. For example, the California Supreme Court recently pointed out in *Barker v. Lull Engineering Corp.*102 that a manufacturer is an expert in its own field almost by

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100 In assessing such arguments, of course, the court should keep in mind the approach it would take if the positions were reversed and the manufacturer were attempting to defend itself against an accusation of defective design by suggesting that it was excused from any responsibility to test the new device because of delay or expense.

101 One exception might be worker's compensation. Note that while the standards of proof in the compensation field are reduced, the amounts which the plaintiff can recover also are limited.

definition. That fact, however, counted against the defendant; the court proceeded to reason that since the manufacturer knew far more about its product than the plaintiff, it should have to prove that the design was not defective. The court offered no further explanation as to why it was over-ruling a thousand years or so of precedent that it is the plaintiff who bears the burden of proof—other than to add, almost as an aside, that the change would reduce the "onerous burden a plaintiff faces in a design case." So it would. But is not the real question whether the further reduction of the plaintiff's burden should be an end in itself? When earlier cases such as Escola v. Coca Cola and Henningsen v Bloomfield Motors began to reduce the qualitative standard of proof, plaintiffs probably did find it difficult to prove just how a manufacturer had erred even when it was clear that the product had not performed its function safely. The small amounts at stake logically would have imposed limits on their trial preparation and, even though it was never proved, the fact that most engineers and scientists worked for corporations may have had an effect similar to the "conspiracy of silence" which the victims of medical malpractice are said to face. But at some stage in the development of every legal doctrine, the pendulum swings too far. We suggest that product litigation has reached that point. The once revolutionary frame of mind which led courts to cut through privity and other artificial and traditional barriers has become rigid orthodoxy; and the reasoning which it produced is no longer realistic.

The case of an exploding Coca Cola bottle or a new car which swerves off the road is far less complex than many design cases in which the "failure", if any, is attenuated and debatable. Furthermore, as the decades have passed, the plaintiffs' bar has grown in sophistication and power and an entirely new profession—the itinerant technical witness—has developed. At the same time, the amount of money at stake in product cases has grown exponentially. Thus the claimant and his lawyer now have every opportunity to prepare and try their case as thoroughly as any other litigant and they can expect hundreds of thousands of dollars, if not millions, when they suc-

104 573 P.2d at 456, 143 Cal. Rptr. at 238.
105 Id. at 455, 143 Cal. Rptr. at 237.
108 For an historical analysis of the process of attenuation, see Epstein, supra note 7, at 650-53.
ceed. By the same token, the dramatic growth of the verdict casts doubt on the assumption that such an award can be passed on as a routine cost of business. The evidence is mounting that this type of litigation is changing the relationship between companies and their insurers and that the specter of million dollar judgments accompanied by virtually unlimited punitive damage awards will increase that distortion.

In short, every tide must turn. The time has come for reconsideration, at the least, of the relatively limited question of the foundation for an expert’s conclusion as to the state of the art. The suggestion may be inconsistent with the prevailing dogma. But if so, that would seem to call for reassessment of the broader question of evidentiary standards in product litigation rather than the casual dismissal of the proposal for reform.

To a lawyer, the suggestion that an expert witness should have to lay a foundation of empirical evidence if he asserts that an alternative design is within the state of the art may seem novel. Yet to the engineer it is a pathetically tentative first step. The proposal is not that judges or jurors abdicate their roles in favor of arbitrators who are themselves skilled designers or that there be any other fundamental change in the nature of the trial. We ask only that the courts adopt the bare rudiments of the scientific method, if they feel it their duty to attempt to decide scientific and technical controversies, and that partisan experts be held to the standards of scientists if they are to be treated as scientists.

The specific evidentiary requirement would be a modest one. Many plaintiffs already meet that standard, and others could satisfy if by a number of means. As we ourselves have argued, results in practice sometimes are different from those which the theoretician projects. We would not expect the change to stop the growth of product litigation or even to deter any but the marginal lawsuit. It would be, however, a simple but significant step toward making the trial of a state of the art issue a meaningful inquiry rather than what it often is now, a mere ritual which a “trial-wise” professional witness can defeat with contemptuous ease.

109 The “spreading the loss” rationale seems inconsistent with the assumption that the standards of proof should be low in product litigation. Arguendo, it may be proper for the loss to be included as a cost of business, but that is only so when the business has caused the loss. If the plaintiff has caused the loss himself, permitting him to recover by winking at scanty evidence decreases his incentive to behave carefully and subjects the manufacturer to an unfair burden. That risk is multiplied when several defendants are involved, i.e., a manufacturer and one or more suppliers. If the standard of evidence is reduced, the cost resulting from the injury may well be assigned to one or the other manufacturer, but it will come to rest on a speculative or even random basis so that the expense may be added to the price of the wrong product. For a more extended critique of the “spreading of the loss,” see Epstein, supra note 7, at 659-61.
