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EXPERTISE AND THE *DAUBERT* DECISION

Ronald J. Allen*

Trials in the Anglo-American tradition were originally the means by which conventional disputes were resolved. The original mode of trial gathered together individuals with knowledge of local affairs to decide notorious disputes. The existence of disputes was part of conventional knowledge, as was the knowledge necessary to resolve them. The local conventions determining borders or access to bodies of water or the proper maintenance of property were truly conventions, and thus known throughout the relevant community. As times changed, various forces coalesced to force modification in the self-informing aspect of juries, but the result was modification rather than rejection. Contrary to today's conventional beliefs about legal decision making, juridical decision makers, judge or jury,¹ are still almost exclusively self-informing. The current belief that fact finders must come with a blank slate is false in every respect save one.

The belief is false in the technical sense that knowledge about the litigated event is typically not a disqualification; only knowledge that would qualify a person as a witness disqualifies the person as a juror.² The conventional belief about the necessary ignorance of jurors is false in a deeper sense. Juridical decision makers come to trial with a vast storehouse of knowledge, beliefs, and modes of reasoning that are necessary to permit communication to occur simply and efficiently. Everyone in court is expected to speak the same language; rarely do trials have lexicographic diversions to elaborate on the definitions of the words that witnesses, lawyers, or judges use.

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¹ Henceforth "jury" usually means judges as well.

² For example, a case that I was involved in had a jury that was fully aware that my client had been convicted of the exact crime he was being tried for in another state. The jurors selected testified on *voire dire* that they would be able to set that knowledge aside and decide the case on the evidence presented, and thus they qualified as jurors. *Heath v. Alabama*, 474 U.S. 82 (1985).

Everyone is expected to have a firm grip on the nature of reality and the existence of causal relationships (whatever Hume might have thought of the justification of such beliefs). Everyone is expected to be able to engage in orderly reasoning, whether deductive, inductive, or even on occasion abductive, and to be able to perceive the relationship between evidence and propositions, between cause and effect. Everyone is expected to be able to understand what the witnesses say, to perceive the connection between what they say and the matters under investigation at trial, and to make reasoned judgments about the credibility of witnesses. Less well known, everyone is expected to be able to fill in the evidentiary gaps at trial that result from many factors (including that individual witnesses always know more than they can express) by drawing inferences based on one's own experiences to give flesh to the bones of testimony.

Over time litigated matters became more complex, and the gap of ignorance separating the fact finders from the witnesses increased. More and more frequently what witnesses said had to be explained to make it understandable. A case may depend on the conventions of a certain business or industry rather than the conventions of the society at large, and jurors will often need to be informed of those conventions. A witness may not speak English, and thus the testimony must be translated.³ The case may involve a technical vocabulary that, like a foreign vocabulary, must be made accessible to those lacking the technical training. As such cases became more common, we continued to adhere to the traditional model of fact finding. The parties were merely obligated to explain a little bit more, to put the juror in a position to understand what the witnesses were saying, and thus to decide the case in an intelligent fashion.

Are there any cases that cannot be accommodated within the traditional model? Do some cases present issues for decision that defy the ability of fact finders to understand them? Perhaps the answer to these questions is "no." Perhaps with enough time and resources, jurors can be sufficiently informed so that they can decide intelligently all litigated cases. Yet now another set of questions lurks in the shadows: At what cost is this knowledge purchased, and is the bargain a wise one? Would resources be better used elsewhere? Who should decide on what "better" use of resources may be available? These are the questions that the Supreme Court

³ Apparently a party can insist on it being translated. In *Hernandez v. New York*, 111 S. Ct. 1859 (1991), the Supreme Court upheld the exclusion of Spanish-speaking jurors in a case in which some witnesses would testify in Spanish on the ground that the jurors might not accept the translator's rendition of the testimony.

faced, whether consciously or not, in the recent case of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,⁴ and they are the questions that I address in this essay.

The answer to the first question, whether there are cases that defy the ability of fact finders to understand them, seems clear enough upon reflection, even though it may be counterintuitive, and the answer is surely "no." The deficits of juridical fact finders are not cognitive; they are informational. Judges and jurors lack knowledge about various branches of human inquiry, as we all do, but there is little reason to believe that, with instruction, they could not adequately master the relevant fields.⁵ Ironically, and again counterintuitively, jurors, because they sit on juries, are probably better able to master the relevant subjects than judges. The issue is not whether every single juror understands adequately every single issue, but whether the jury adequately understands.⁶ With the wealth of talent almost always contained in even a randomly selected group of six to twelve individuals, it would be a remarkable case that truly defied their collective cognitive abilities. I do not deny that such a case might occur, but I do deny that such a low probability event is of much significance to social planning.⁷

This argument may not be just counterintuitive; it may appear to be disproven by common experience. Many ideas, especially in their youth, are extremely difficult to grasp. A good example is Einsteinian relativity theory, which was understood by only a small handful of individuals for a considerable time following its creation. But, I don't know of any case that required for decision an understanding of general relativity theory, and I know of no analogous

⁴ 113 S. Ct. 2786 (1993).

⁵ Bear in mind that the question is not whether the jury ends up understanding all there is to know about a field, or even knows as much as does any particular expert. The question is whether the jury knows or can learn enough for rational deliberation.

⁶ If not every juror adequately understands, "deference" will obviously occur in the jury room, with the more baffled jurors deferring to the ostensibly less baffled ones. Nonetheless, at least decision will have been moved from outside the juridical process to back inside it, whether for good or for ill.

⁷ Richard Epstein implies that the very low probability, worst case scenario should be influential in determining social policy. Richard Epstein, *Judicial Control over Expert Testimony: Of Deference and Education*, 87 Nw. U. L. REV. 1156 (1993). Perhaps he is right, but at a minimum the implications of the competing worst case scenarios must be considered. In his example, a single irrational jury verdict may indeed put a company out of business or result in a drug being removed from the market, but that is the worst case scenario only if we already know that liability should not be imposed. If liability should be imposed, which is the competing worst case, then denying liability will leave numerous deserving plaintiffs uncompensated. This raises directly the political objectives served by a litigation system, an issue I do not wish to explore. I wish to stay with the simplifying assumption that plaintiffs and defendants are *a priori* indistinguishable.

case, one involving string theory, for example. Perhaps there is one, but again it would be the exception that proves the rule.⁸

General relativity theory is not the only difficult idea to grasp. Many individuals find calculus and probability theory obscure, for example, and both are often integral to trials. But many people do not find mathematics at this level obscure. In determining whether a jury possessed the necessary tools for rational decision, again the question is not whether all jurors do; it is whether the jury does. Nor is the question whether the jury already knew enough about calculus or probability; it is whether they could learn enough. Moreover, if a case posed an issue requiring a certain technical or mathematical capacity, that capacity could be a condition of serving on the jury. This would make the seating of a jury no more difficult than doing so in a notorious case.

The real objection to this argument is not that it is wrong; the real objection is that it would be too costly. I certainly agree that educating jurors adequately to decide intelligently cases with complicated issues would be costly. In many instances, the jurors would literally have to go to school, or at least have the school brought to them. One can easily imagine cases that would require months of instruction before jurors would be competent to decide intelligently. It is, however, much more difficult to find cases that would defy this educational process, which brings us full circle.

But the circle produces a paradox. There are many cases that do not involve scientific or technical questions but do require months of instruction so that the jury can understand them. In these cases we do not permit juror deference to juridical outsiders such as experts; we require the parties to connect the case through evidence to the experience of the jurors. Why, then, do we flirt with, and perhaps adopt, a more deferential mode when something comes into court labeled "expert testimony"?⁹ If I am right, the

⁸ Similarly, that experts like witnesses know more than they can communicate does not disprove my point. Experts may very well develop intuitive skills that could not be imparted to a jury. Still, the question is whether those skills matter for rational decision in any particular litigated case. If deciding a case actually reduced to a choice between the hunches of experts that cannot be further explained, it most likely does not belong in the conventional system of litigation.

⁹ Deference and education are not analytically distinct entities; they are opposite points on a spectrum. Jurors will virtually never see true "raw" data at trial. Deference occurs to some extent whenever a jury decides a witness has testified truthfully. See, e.g., Richard Lempert, *Experts, Stories, and Information*, 87 Nw. U. L. REV. 1169 (1993). Still, the extent of deference, or of education, is a variable; one can have more of one and less of the other. This is particularly obvious when one considers a case involving not just reporting of sensory experience ("The light was red.") but the drawing of inferences ("In light of these studies, I am of the opinion that Bendectin causes birth defects."). In

cognitive questions are highly similar, even if not identical, in both sets of cases. The economic questions are truly identical. In all cases, parties must take into account the costs of presenting their cases, and responding to their opponents' cases, in determining their optimal strategy. This variable is independent of the conventional/expert distinction. The economics of public subsidy are also highly analogous if not identical. All trials have public subsidies, such as the cost of the courthouse and various governmental salaries. From the public point of view, a subsidy to a six-month trial that involved educating the jury about calculus is no different from the subsidy to a six-month bank fraud trial. If there is a difference, it favors the subsidy in support of the instruction in calculus, as that might lead to social benefits that are very difficult to see flowing from the educational effort directed toward the jury in a bank fraud case.

Perhaps the difference between complex conventional cases and cases that call for expert testimony is that the latter demand expertise that is missing from the former. People do possess specialized nonconventional knowledge about mathematics, economics, toxicology, oncology, and so on. Perhaps no one possesses expertise about complex conventional cases such as bank fraud or criminal conspiracies. Perhaps so, but this argues not for our current system of presenting competing versions of expertise at trial, but instead for a form of judicial notice.

If expertise exists and can be identified with the certainty that the existence of Lake Michigan outside my window can be, trials should not pause over it. Its lessons should be taken as true, and the fact finder so constricted. Whether in any particular case there is expertise in this sense should be easy to determine by judges or legislatures, and its implications mined for what they are worth. We would defer to such knowledge just as we defer to the indisputable knowledge that Lake Michigan is outside my window. We would not litigate whether Lake Michigan is outside my window; that would simply waste resources. If expertise does exist, we waste resources each time (at least beyond the first or after conditions have changed) that we litigate the issue.

the typical case, the jury is supposed to be able to understand the reasoning process that led the witness from observation to conclusion. Understanding may bring either acceptance or rejection, of course, and the decision will be made by the jury's own lights. Often with experts there is no expectation that the reasoning process can be understood. Thus, acceptance or rejection cannot occur by the jury's own lights, and thus we see a much larger dose of deference. How well a witness' analytical process can be understood is again clearly a variable. Some can be understood completely, some partially, and some not at all. The legal question is the significance of this variable.

We not only waste time when we litigate the existence of expertise; we also deliberately engage in nonsensical activity. One of the reasons to litigate the existence of expertise is to provide opinions to which jurors can defer. This is the opposite of education, of course. Jurors are not expected to understand the relevant fields of inquiry; they are simply to decide which expert to believe. How is this to be done intelligently without understanding the relevant fields? This question, which reverberates over the increasing use of expertise at trial, has no satisfactory answer, precisely because the two points cannot be reconciled. It is painfully obvious that jurors (and judges) who do not know enough about the relevant fields of knowledge to decide intelligently cannot decide intelligently which expert to believe among those providing competing versions of that field.¹⁰ Obversely, if jurors can decide intelligently about which expert to believe, they can with a little more education reason intelligently about the matters in issue, so that deference to the expert is not necessary.

Out of this cauldron of concerns emerge three competing methods of handling expert testimony, each with its own strengths and weaknesses:

The Normal Approach: Expert testimony can be treated just like any other testimony, which means for it to be relevant it must be understandable by the fact finder. To make an expert's testimony understandable will require the jury to be educated about the relevant matters, and thus the "normal approach" collapses into adopting an education model. The difficulty is cost, especially that cost may skew decision toward those with greater resources. The more impecunious a party, the less able he or she will be to provide the necessary educative function, or to respond to an opponent's case. The latter point is another detrimental aspect of our system's failure to make parties bear the true cost of their cases, which includes the opponent's cost of responding. Without cost shifting, a wealthier party can make the cost of suit too high for the opponent. Adopting the normal approach to expert testimony would exacerbate this problem by tending to make cases involving expertise more protracted. Offsetting this factor in part is that higher costs are a laudable disincentive to sue or an equally laudable incentive to agree to resolution in other, less costly, forums.

The Deference Model: Fact finders can be required to defer to established expertise. The advantages are obvious. Those with the

¹⁰ Consequently, even if my view of the cognitive capacity of juries is rejected, the present system still is nonrational, and thus the central problem remains.

ability to decide rationally make the decision, costs are reduced, and consistency in decision is advanced. If the decisions about expertise are correct, accuracy in decision should be advanced as well. The disadvantage is the resultant extension of official orthodoxy, which removes decision from the jury and trial judge to some higher level court or legislature. Also, if the decision about expertise is incorrect, consistency of decision will remain, but the decisions will be consistently wrong.

The Adversary Model: Parties can choose whether to educate the jury, or convince them to defer to an expert. This leaves the whole matter up to the parties, save only for the admissibility decision of judges. That admissibility decision, in turn, would have to be made in anticipation of either education or a request for deference. Again, the advantages are obvious. The parties know their dispute and their resources better than anyone else, and are in the best position to make choices that optimize their interests. The difficulties are that the cost of education will tend to make deference more attractive and that deference cannot occur rationally with any great frequency. The reduction in the likelihood of rationality is at odds with the essence of the common law mode of trial—the pursuit of factual accuracy through rational deliberation. Indeed, there is a high irony here. In a case in which the parties are employing a deference mode, the mere admission by the trial judge of competing expert views without requiring full explanation of those views, including instruction on the underlying field of inquiry, ensures that decision will be nonrational if not irrational. Only if a juror could see clearly that one side was right and the other wrong would nonrationality be avoided; but if that were so, the judge would admit only the one version and exclude the other. If reasonable people could rationally disagree about which expert is right, they in addition would be able to understand the underlying dispute, and thus deference would not be needed. Note also what a dramatic qualification of the normal rules of relevancy deference entails. Normally a party must explain the relevance of evidence by adequately connecting the evidence to the fact finder's understanding. With experts in a deferential model, one party can shift that cost of explanation to the opponent by producing an unexplained opinion.

As this brief presentation demonstrates, the use of expert testimony poses fundamental challenges to the common law system of adjudication. This explains in part the remarkable controversy over expert testimony even as expert testimony is becoming ever more

prevalent at trial.¹¹ Another part of the explanation is that the implications and corrosive effects of the deference/education distinction have only recently been identified and subjected to analysis.¹² An example is that the controversy over the *Frye* rule¹³ has focused almost exclusively on its implications for judicial control over the admission of expertise, with not a word written until recently recognizing that *Frye* encourages a system of deference. Similarly, those who support a reading of the Federal Rules of Evidence that discards the *Frye* rule have not done so because of the resultant encouragement to the educational function. They have done so instead because of the ambiguities in the rule, and the well founded belief that it has lost touch with modern science. Nonetheless, lurking here is the fundamental question of the nature of litigation: To what extent is rational deliberation the hallmark of adjudication?

The *Daubert* case presented all these issues to the Court. The Court dealt with only a few of them, one really, and that in a fairly unenlightening way. The Court recognized that the *Frye* rule was dead, but it resurrected the rule immediately following the burial. The opinion reflected no recognition that what was at stake was not just a technical rule of evidence but a conception of trial, and thus the implications of its decision for rational deliberation were completely unaddressed. As for its reasoning, in the insightful language of one of my students, "the Supreme Court replaced a judicial anachronism with a philosophical one."¹⁴ The Court, in short and as it usually does, left the law more or less as it was; and to the extent there was change, the change was slightly for the good, as I will now explain.

The plaintiffs in *Daubert* suffer from limb-reduction birth defects allegedly caused by their mothers' use of Bendectin during pregnancy. The affirmative scientific support for their assertion came solely from animal studies and chemical structural analyses of the

¹¹ Evidence of the intense controversy currently brewing over expert testimony is contained in the November 1993 Newsletter of the AALS Evidence Section. The editors compile recent scholarship on the field of evidence. Of 55 professional articles, at least 19 could be identified from the title as investigating some aspect of expert testimony.

¹² Ronald J. Allen & Joseph S. Miller, *The Common Law Theory of Experts: Deference or Education*, 87 Nw. U. L. Rev. 1131 (1993). This article is followed by five interesting comments by Edward J. Imwinkelried, Richard A. Epstein, Paul R. Rice, Richard Lempert, and Ronald L. Carlson.

¹³ *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

¹⁴ Christopher Kamper, *Paradigms Talking Past Each Other: Expert Testimony and Problems of Translation* (1993) (unpublished manuscript, on file with *The Journal of Criminal Law & Criminology*). This paper was written under my supervision in partial satisfaction of the requirements for Advanced Problems in Evidence.

chemical.¹⁵ A number of epidemiological studies of the effect of Bendectin have been done, but none of them found statistically significant correlations between the use of Bendectin and birth defects. Undeterred, the plaintiffs offered a reanalysis of the data of the epidemiological studies by well credentialed experts.¹⁶ In essence, their argument was that the structure of standard epidemiological studies favors reducing Type I errors at the expense of making more Type II errors.¹⁷ A Type I error is an erroneous finding of a causal relationship where there is none between the drug and birth defects, and a Type II error is an erroneous finding of no causation. Each of the studies used the standard confidence level of 95%, which means that the chances of erroneously rejecting the null hypothesis (and thus erroneously concluding that there is a causal link) is less than 5%.¹⁸ But accepting such a standard increases dramatically the probability that the conclusion of no causation is false. For example, by one calculation, even if Bendectin caused a doubling in the rate of birth defects, the probability that the published studies would have yielded a statistically significant outcome is less than 20%.¹⁹

The skewing of mistakes against erroneous findings of causation may seem odd to lawyers, but is plausible in the context of science. In tests such as those involving Bendectin, the issue generally is whether the drug causes a particular result, such as increasing the chances of birth defects. Causation of this sort is virtually always highly complex, and thus essentially random outcomes occur relatively frequently making it difficult to sort out the precise effect of a single variable. This is the standard difficulty of arguing from correlation to causation. In order to protect against an erroneous finding of causation, most quantitative sciences have set high standards for their experiments, such as the 95% confidence level. That data do not meet this standard, and thus that the null hypothesis is not rejected, does not mean there is no causal link; it means that this experiment did not find one, judged by the 95% confidence level. Other experiments may come out differently.²⁰

The contemporary approach to experimentation is driven in

¹⁵ *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 113 S. Ct. 2786, 2791 (1993).

¹⁶ *Id.* at 2792.

¹⁷ Brief for Petitioners at 8-10, *Daubert* (No. 92-102).

¹⁸ *Id.* at 9.

¹⁹ *Id.* at 9-10.

²⁰ There was more to the statistical presentation in the case than I have dealt with here. I am merely trying to demonstrate in stark but nonetheless accurate fashion the collision between the worlds of law and science. For a more complete treatment of the statistical evidence in the case, see Michael D. Green, *Expert Witnesses and Sufficiency of*

part by one of the significant traits of modern science, which is the emphasis on falsifiability. Following Popper,²¹ experimental results are often oriented toward falsifying rather than verifying hypotheses. The null hypothesis in the Bendectin studies is that Bendectin does not cause birth defects. The studies did not give good ground to reject that hypothesis; it was not falsified. It was not, however, proven true. All a careful scientist would say is that it was not falsified by the data. This makes sense in the context of science because there is no scientific statute of limitations. The concern is to get a good approximation of reality over the long run. From that perspective, erroneous findings that some proposition is supported are worse than conclusions that no significant results were obtained. Erroneous findings of support would tend to generate belief in the truth of the proposition, which in turn may infect the research program, whereas erroneous findings of no support will primarily generate further efforts at falsification.

Or at least so goes one aspect of the modern scientific self-conception. The legal self-conception is quite different, and herein lies the most interesting aspect of the Bendectin litigation. In the law, the typical civil case involves two indistinguishable parties fighting over some good. As there is no reason to distinguish them *a priori*, the law imposes a decision rule of a preponderance of the evidence that is designed to generate about the same number of erroneous verdicts for plaintiffs as for defendants.²² The law assumes that an erroneous rejection of the null hypothesis that defendant is not liable (thus erroneously finding for the plaintiff) is equivalent to an erroneous rejection of the hypothesis that defendant is liable (thus finding for the defendant). Two hundred dollars erroneously in plaintiff's hands is difficult to distinguish from two hundred dollars erroneously in defendant's hands.

Now we can see how dramatically the worlds of quantitative science and the law clash. The law wishes to scatter errors equally over the parties; science wishes to reduce the number of false findings of significant results. The true analogy is thus not between the law's treatment of ambiguity in civil cases and science's use of significance testing; the true analogy is between findings of guilt in criminal cases and obtaining significant results. The criminal law skews error in favor of the hypothesis of no criminal liability, just as quantitative

Evidence in Toxic Substances Litigation: The Legacy of Agent Orange and Bendectin Litigation, 86 NW. U. L. REV. 643 (1992).

²¹ KARL POPPER, *OBJECTIVE KNOWLEDGE: AN EVOLUTIONARY APPROACH* (1972).

²² Or perhaps to minimize the total number of errors. This nuance does not affect the textual analysis.

science skews errors in favor of findings of no causal link. The dissymmetry between civil cases and significance testing is what led the plaintiffs to argue that, properly understood, the results of the epidemiological studies on Bendectin actually support the conclusion of causation, if the law's burden of persuasion in civil cases is employed rather than that of science. If lower confidence levels are employed in analyzing the Bendectin data, different, and "significant," results are obtained. This argument is highly analogous to the legal principle that acquittal of a criminal charge is not in any sense *res judicata* of a related civil claim. Merely because one fact finder found a reasonable doubt about a criminal claim does not preclude another fact finder from finding the claim to be true by a preponderance of the evidence.²³

This is a very good argument, and it is one of the arguments that the Supreme Court should have addressed, for it goes to the heart of the clash between the legal and scientific worlds.²⁴ Regrettably, the Court focused on two other, considerably less important, matters. The lower courts ruled in favor of the defendants on two interrelated grounds. First, that the general acceptance standard of *Frye v. United States*²⁵ governed the admissibility of expert testimony in federal court, and second that the standard could not be met with evidence of reanalyses of data that had not previously been published and subjected to peer review.²⁶ The deep conceptual issue of the defining characteristics of litigation was overlooked in the Court's unenlightening, but thankfully not positively harmful, discussion of the general acceptance standard.

The Court reached the rather obvious conclusion, especially obvious in light of the Court's consistently deferential treatment of

²³ For example, in *Dowling v. U.S.*, 493 U.S. 342 (1990), the defendant was acquitted of a criminal charge. In a subsequent case, the act that formed the basis of the previous charge was proffered under the prior bad act doctrine. *Dowling* argued it was inadmissible because of the prior determination of innocence. *Id.* at 342-44. The Court held to the contrary, because of the differential standards of proof involved. *Id.* at 354.

²⁴ The Court should also have addressed the question of the difference between the admissibility and the sufficiency of the evidence. As the textual discussion points out indirectly, arguments about significance levels are analogous to arguments about burdens of persuasion. The admissibility question is different; it is essentially the question of relevance. Evidence is relevant if a reasonable person could be influenced by it. Thus, epidemiological studies that are significant at any level should be admissible, unless this kind of evidence is going to be treated differently from all other evidence. Whether the plaintiff's entire case, including the scientific studies, is sufficient is a different question, and in fact is the one the Court should have addressed.

²⁵ 293 F. 1013 (D.C. Cir. 1923).

²⁶ See *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 727 F. Supp. 570, 572 (S.D. Cal. 1989); *aff'd* 951 F.2d 1128, 1129 (9th Cir. 1991).

the Federal Rules of Evidence,²⁷ that the Federal Rules, in particular Rule 702, superseded the *Frye* rule. Rule 702 provides a quite pragmatic justification for the admission of expert testimony: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training or education, may testify thereto in the form of an opinion or otherwise."²⁸ No mention is made here of the general acceptance standard; the explicit standard is whether knowledge of virtually any kind is likely to assist the trier of fact. As the Court recognized, *Frye* did not survive the Federal Rules of Evidence.

Frye was not long interred; immediately following the announcement of its demise came the resurrection. To say that "scientific knowledge" that may be helpful to the trier of fact is admissible is not to say what "scientific knowledge" is. In an effort to help the lower courts that must now administer whatever Rule 702 stands for, the Court examined the nature of "scientific knowledge." In doing so it both largely adopted, although in different terminology, the *Frye* rule, and engaged in an anachronistic discussion of the philosophy of science, one that has really remarkable implications if taken seriously.

As for the meaning of scientific knowledge and the *Frye* rule, the Court noted four criteria that will help guide the lower courts in making determinations of the admissibility of proffered expert testimony. Three of them either restate or are derivative of *Frye*, and the fourth is merely a quite sensible admonition that is consistent with, even if not strictly derivable from, *Frye*. The first criterion is whether the subject matter may be tested:

Ordinarily, a key question to be answered in determining whether a theory or technique is scientific knowledge . . . will be whether it can be (and has been) tested. "Scientific methodology today is based on generating hypotheses and testing them to see if they can be falsified; indeed, this methodology is what distinguishes science from other fields of human inquiry."²⁹

The Court, in short, has adopted Karl Popper's conception of science.³⁰ Regrettably, as my student pointed out and as I discuss below, this is where the Court simply replaced a judicial anachronism

²⁷ See, e.g., *Green v. Bock Laundry Mach. Co.*, 490 U.S. 504 (1989); *Bourjaily v. United States*, 483 U.S. 171 (1987). See also Edward J. Imwinkelried, *A Brief Defense of the Supreme Court's Approach to the Interpretation of the Federal Rules of Evidence*, 27 IND. L. REV. 267 (1993).

²⁸ FED. R. EVID. 702.

²⁹ *Daubert*, 113 S. Ct. at 2796 (quoting Green, *supra* note 20, at 645).

³⁰ POPPER, *supra* note 21.

with a philosophical one. More to the present point, attempts to falsify propositions virtually exclusively take place within normal scientific endeavors, which means within the context of generally accepted scientific canons.

The Court's second criterion is "whether the theory or technique has been subjected to peer review and publication."³¹ In addition to ruling out almost all legal knowledge as "scientific," this guideline again will tend to limit material to that which is generally accepted; rarely does unaccepted "science" get published. Third, in determining whether data is sufficiently reliable to be admitted, a court may also look to general acceptance.³² The first two standards restate general acceptance; the third adopts it explicitly. The fourth is merely that rate of error in scientific techniques is a prudential consideration to be taken into account in the admissibility determination, a factor that if not taken into account by "scientists" would seriously undermine the "general acceptance" of their work.

And so *Frye* lives, although in the guise of "guidelines" rather than "rule." The change from the language of rules to that of guidelines is probably positive, although not dramatically so. It reduces the hiding places for judges, and will force them to focus somewhat more explicitly on whether proffered testimony will be helpful, which is to the good. Three difficulties remain, however. The first is the Court's curiously unquestioning acceptance of Karl Popper's philosophy of science, which perhaps is primarily of interest for its reminding us once again that the Court is best when it sticks to law. The second is that Popper's theory has quite remarkable implications, such as suggesting that one of the most prevalent forms of expert testimony is not admissible, at least not as "scientific" testimony. Third, the Court completely failed to address in any meaningful way how the lower courts are supposed to implement the set of criteria the Court identified. I take these points in turn.

The Court adopted uncritically the view that Popperian falsifiability is at the heart of modern science. The Court is clearly correct that a substantial amount of what everyone would agree is scientific activity is designed to test hypotheses by subjecting them to potentially falsifying experiments. Nonetheless, the Court expressed no awareness of the controversial nature of Popper's views, nor that much of what goes on in science is not captured by them.

Popper attempted to formulate a response—a confession and

³¹ *Daubert*, 113 S. Ct. at 2797.

³² *Id.*

avoidance really—to Hume’s shattering insight that inductive logic could not lead to justified knowledge. Hume’s insight is simple to explain. Much of knowledge is based on induction, on the summing up of individual observations into general causal rules. When a human observes something, however, the very question often is whether that something is a function of a general causal relationship. Yet, we can never see causal relationships; all we can see is the individual observation. To infer from individual observations that a causal law is operating is to assume that causal laws exist, which is precisely what the question is. That a bowling ball knocked down the pins this time does not permit the inference that it will next time because general causal laws are operating, for that is what we are trying to determine. Only by assuming there are general causal laws can we infer that a causal law is instantiated by our observation of the bowling ball, yet to make such an inference is to go in a circle. From the assumption of general causal laws, we infer general causal laws. All such induction goes in a circle, and it is a vicious one:

[A]ll inferences from experience suppose, as their foundation, that the future will resemble the past and that similar powers will be conjoined with similar sensible qualities. If there be any suspicion that the course of nature may change, and that the past may be no rule for the future, all experience becomes useless and can give rise to no inference or conclusion. It is impossible, therefore, that any arguments from experience can prove this resemblance of the past to the future, since all these arguments are founded on the supposition of that resemblance.³³

How then can we explain the progression of scientific knowledge? More basically, how can we understand science? Popper’s answer was to concede Hume’s point that one cannot possess justified inductive knowledge that a theory is true, but Popper countered that one can determine through empirical testing that it is false. The role of the scientist, according to Popper, is to make bold hypotheses that lend themselves to empirical tests for falsification. For example, if we can logically deduce from some hypothesis *A* that *B* must be true, we can then test for *B*. If *B* is not true, then neither is *A* (if *A*, then *B*; *not-B*; therefore, *not-A*). If *B* is true, we still do not know much about *A*, except that it has survived this one test of falsification. If we are able to determine all conceivable tests of falsification, and if *A* withstands them all, we might actually stumble onto knowledge that is as justifiable as the human condition permits.

Popper’s work was extremely important to the philosophy of

³³ DAVID HUME, *AN INQUIRY CONCERNING HUMAN UNDERSTANDING* 24 (Eric Steinberg ed., 1977).

science in the middle part of this century, and it certainly captures aspects of scientific endeavor, but it has problems as well. Most significantly, it suffers from the very problem it was designed to avoid. Popper was attempting to avoid the problem of inductive inference, of assuming that the future will be like the past, but his theory requires just that inference. Suppose *A* is hypothesized, and *B* is a logical derivation of *A*. Suppose further that *B* is falsified by some well run empirical test. That can be taken as a falsification of *A* only if we assume that running similar tests in the future will come out as did the one in the past—yet that is just the assumption that we are trying to avoid. Popper's theory thus does not give a good reason to reject a hypothesis for precisely the Humean reason.

Nor does it give a good reason to accept one. Consider two hypotheses, *A* and *X*. Suppose *A* has been falsified by disproving *B*, its logical derivative. We have no reason to believe *X* is true, and we have a lot of reason to believe that eventually *X* will be falsified, too. Why then prefer *X* to *A* even provisionally? Our knowledge is simply the result of the fortuity of our tests, our present insight, or our ability to test one hypothesis now rather than the other. Popperian theory thus gives us neither a reason to reject nor accept a hypothesis.

Popper's theory is also an inadequate description of science and scientists. Scientists do not believe that all they know are negatives; they believe they know a lot of positive truths, and are learning more every year. Most scientific work is designed to expand the reach of scientific theories, to extend them into new domains, rather than to falsify them. We were not building the particle accelerator in Texas to falsify quantum theory; we were building it to find the top quark, and thus to better understand the basic structure of matter. Nor is science characterized by bold theories following falsifying results. Hardly ever does a falsifying experiment result in the jettisoning of a scientific theory; only if scientists cannot rework their present theory to explain the anomalous results, and if a better alternative is in sight, do scientists give up on a theory.³⁴

In the latter part of this century, a deep conceptual challenge has arisen to Popper's theory. Thomas Kuhn recognized that in most periods of science, scientists do indeed behave as though their

³⁴ For example, what has come to be known as the Michelson Morley experiments essentially disconfirmed Newtonian mechanics, and led to the theory of relativity. The community of scientists did not discard Newtonian theory, however. The Michelson Morley experiments were, in one scientist's words, "a cloud on a clear day." See Imre Lakatos, *Methodology of Scientific Falsification and the Research Programmes*, in *CRITICISM AND THE GROWTH OF KNOWLEDGE* 91, 159-165 (Imre Lakatos & Alan Musgrave eds., 1970).

activity were governed by a set of rules, but after diligent search no such rules could be found. The very deductive structure necessary for Popper's theory defied identification, even though after science has progressed the resultant knowledge is often expressed in deductive forms.³⁵ Kuhn found instead exemplars, common problems of theory application that seemed both to create the boundaries of a field of inquiry and to contain within them much of the cognitive content of the field.³⁶ Kuhn's theory has itself proven highly controversial,³⁷ but whether right or wrong it has largely displaced falsificationist views as the object of philosophical inquiry in recent decades.³⁸ Whatever the cause, the genius and more importantly the limits of Popper's work are now clearly recognized. It was an enormous leap forward, and certainly captures an aspect of scientific endeavor, but to equate it with "science" is to be oblivious to three decades of developments in the philosophy of science.

Perhaps the most curious implication of the Court's sanguine discussion of falsifiability is that its adoption as the hallmark of "science" excludes a substantial portion of what is presently admitted as expert testimony. One of the most prevalent forms of expert testimony is psychiatric testimony, much of which is heavily Freudian. Little of Freudian psychiatry has been put to empirical testing, both because of the resistance of its practitioners and because many of its tenets defy falsifying experiments, as is true of many counseling therapies. There have also been virtually no studies comparing the effectiveness of psychotherapy to no intervention at all.³⁹ Indeed, Popper saw the debunking of Freudian psychiatry (along with Marxism) as one of the benefits of his work.⁴⁰ The debunking does not stop with psychiatry, however. Many sciences cannot construct falsifying experiments. Both macro- and micro-economics are examples where the task is often difficult, although not always impossible.

³⁵ See, e.g., Norwood R. Hanson, *The Logic of Discovery*, 55 *J. Philosophy* 1073, 1079 (1958).

³⁶ Thomas S. Kuhn, *Postscript*, in *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* 187 (1970).

³⁷ See generally PAUL HOYNIGEN-HUENE, *RECONSTRUCTING SCIENTIFIC REVOLUTIONS: THOMAS S. KUHN'S PHILOSOPHY OF SCIENCE* (1993); *WORLD CHANGES: THOMAS KUHN AND THE NATURE OF SCIENCE* (Paul Horwich ed., 1993).

³⁸ Ian Hacking, in his review of Robert Nozick's new book *The Nature of Rationality*, refers to himself, somewhat tongue in cheek to be sure, but only somewhat, "as the last of the true Popperians." Ian Hacking, *What's Best*, 16 *LONDON REVIEW OF BOOKS*, Jan. 27, 1994, at 17.

³⁹ For an interesting review of the status of Freudian psychiatry, see Frederick Crews, *The Unknown Freud*, *NEW YORK REVIEW OF BOOKS*, November 18, 1993, at 61; and the responses to Crews in a subsequent issue, *NEW YORK REVIEW OF BOOKS*, Feb. 3, 1994, at 34-43.

⁴⁰ POPPER, *supra* note 21, at 33-38.

Other examples are sociology, anthropology, and astronomy. History, of course, is clearly left out of the circle of science in Popper's view. We cannot rerun the French Revolution without Louis XVI to see what might happen. Nor are historical speculations about the intent of the framer's readily amendable to falsifying experiments.

Perhaps the Court meant to signal that empirically untested counseling therapies were no longer to be admitted. Perhaps it meant to cast into doubt the admissibility of historical research, or at least to suggest that it was not admissible as science. More likely, perhaps the Court was not fully aware of what it was doing and the implications of the ideas with which it was dealing. There is no intimation in *Daubert* that the Court was attempting to revolutionize the substantive content of expert testimony. Moreover, what good does falsifiability do at trial? Trials demand positive knowledge, just the kind that Popper thought would come only after every conceivable test has been done. The question in the Bendectin litigation is whether the drug did or did not cause the birth defects, and the decision had to be made at trial rather than at some indefinite time in the future when all falsifying tests have been run.

Third, what are the lower courts to do now? I predict that they will continue to apply the *Frye* rule under the disguise of the Court's new vocabulary.⁴¹ I predict this because the Court's opinion simply ignored the issue that is presently informing the use of and fueling the controversy over expert testimony. That issue is the tension between the conventional understanding of trials that demands that fact finders be educated about the relevant facts and the use of experts that anticipates a large dose of deference to their opinions. The most regrettable aspect of the Court's opinion in *Daubert* is that it lost an opportunity to discuss this legal issue because of its flirtation with philosophical speculations about the nature of science. Having not discussed the issue that drives contemporary problems, the Court's decision will largely leave those problems unaffected and undisturbed.⁴²

⁴¹ My colleague, Jon Waltz, pointed out that *Daubert* is likely to have a more dramatic effect on litigants than courts. *Daubert* can be read broadly and narrowly, and presumably will be read differently by different judges. That is likely to lead to inconsistency in application, and thus to forum shopping by litigants.

⁴² I also predict that trial courts will incorrectly continue to make the sufficiency determination in the guise of the admissibility determination. See *supra* note 23. Yet another interesting aspect of this area is the special treatment that "scientific evidence" gets in this regard. The explanation, I think, is that trial judges are admitting evidence that they know they and jurors cannot be expected to understand. Such evidence should not be admitted unless the trial judge is willing to let a verdict rest on it, and so the admissibility decision becomes a sufficiency decision. This all confirms the entrenchment of a deference mode of decision at the trial court level.

The pressures that over time have resulted in modification of the litigation process to permit large amounts of deference to experts continue to operate. First is the added cost of actually educating fact finders so that they may follow the reasoning of the expert in the same way the fact finders can follow the reasoning of a lay witness (thus essentially converting an expert into a lay witness). There is in addition the lottery effect. If reasons need not be given in detail for opinions, one has a chance of a lottery-effect jury verdict if the trial judge qualifies a witness as an expert. The only likely effect of *Daubert* will be to transmute the present mechanical invocation of the *Frye* test into a more ostensibly subtle but in fact largely identical process of qualification. In addition to expressing a conclusion about general acceptance, federal trial judges will now include what will become an equally mechanical statement that the expertise will be helpful to decision. What else can they do? The Supreme Court did not take its opportunity to tell trial judges to admit purported expertise only if the basis of the expertise were understandable, as it could and should have done. Trial judges will thus continue to look for a justification to defer to expertise, and they will continue to find it in the general acceptance of that expertise in generally accepted bodies of knowledge.

I do not mean to say that *Daubert* will prove to be a completely irrelevant decision, although I do believe it will largely become so. Telling the lower courts not to mechanically invoke "general acceptance" may prove marginally helpful, but none of the important questions in the case were addressed. The conflict between the demands of education and deference were ignored, as was the conflict between the assumptions of the law and the assumptions of quantitative science. Indeed, if anything the dichotomy between deference and education was reinforced by the Court's opinion. The list of criteria provided by the Court is only relevant to a system willing to defer; by providing the list, the Court, although I am sure unintentionally, gave sustenance to deference.⁴³

In my opinion, the most regrettable aspect of *Daubert* is that the Court seemed quite unaware of the implications of admitting data without a basis for believing that the data can be understood. By doing so, it seems to be putting its stamp of approval on undeliberative and nonrational legal decision making, which I think to be the

⁴³ This is also why the Court's limitation of its discussion to "scientific" evidence is unproblematic. The other kinds of information listed in Rule 702 are unlikely to require deference; information of those types can be explained. A car mechanic can qualify as an expert under the rule, but few would claim that such expertise would defy the cognitive capacity of fact finders.

antithesis of the law's aspirations. Jurors or judges who cannot understand the reasoning of a witness can only accept or reject the witness' conclusions, but neither acceptance nor rejection will occur rationally. The choice will not be made because a fact finder understands the reasoning and sees either its cogency or its flaws; it will be made for some other reason. And the set of "some other reasons" is, from the point of view of the law's aspirations, filled with unsavory characters.

Perhaps there is no (feasible) alternative. Perhaps the cost of truly educating the fact finders would be too high, or perhaps my skepticism about the point does not dispose of concerns about the cognitive capacity of fact finders. If either is true, the answer again is obvious: Unless I am also wrong about the core aspiration of litigation being decision through rational deliberation, the common law form of decision making should not be employed.