

## LEGAL PERCEPTIONS OF SCIENCE AND EXPERT KNOWLEDGE

Joseph Sanders  
University of Houston Law School

Shari S. Diamond  
Northwestern University Law School and  
American Bar Foundation

Neil Vidmar  
Duke University Law School

In the past half century, expert testimony has played an increasingly important role in American litigation. As the volume of expert testimony has grown, so have issues surrounding its admissibility into evidence. In the past decade, a trilogy of U.S. Supreme Court cases redefined the rules governing admissibility. This article reviews these cases and examines some of the assumptions about expert knowledge implicit in the opinions. It argues that the opinions ask judges to assume the role of scientific methodologists. Together, the 3 opinions reflect what Steven Cole calls a realist–constructivist view of science. Science is socially constructed both in the laboratory and in the wider community, but the construction is constrained by input from the empirical world.

In the past half century, expert testimony has played an increasingly important role in American litigation. As the volume of expert testimony has grown, so have issues surrounding its admissibility into evidence. In the past decade, a trilogy of U.S. Supreme Court cases redefined the rules governing admissibility. The cases and the way their admissibility tests are being applied have proven to be remarkably contentious. The present article offers an overview of the recent Supreme Court cases and examines some of the assumptions about expert knowledge implicit in these legal standards.

### Admissibility Standards: From *Frye* to *Kumho Tire*

#### *Frye*

The question of when to trust an expert is as old as expert testimony itself.<sup>1</sup> The most important pre-*Daubert* case to deal with this problem is *Frye v. United*

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Joseph Sanders, University of Houston Law School; Shari S. Diamond, Northwestern University Law School; Neil Vidmar, Duke University Law School.

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Correspondence concerning this article should be addressed to Joseph Sanders, University of Houston Law Center, 100 Law Center, Houston, Texas 77204. E-mail: jsanders@central.uh.edu

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<sup>1</sup>David L. Faigman, Elise Porter and Michael J. Saks, *Check Your Crystal Ball at the Courthouse Door, Please: Exploring the Past, Understanding the Present, and Worrying About the Future of Scientific Evidence*, 15 CARDOZO L. REV. 1799, 1800 (1994) report the first clear reference to an expert witness called by and on behalf of a part occurred in the case of *Folkes v. Chadd*, 99 Eng. Rep. 589 (1782). For commentary on the history of expert witnesses, see *Learned Hand, Historical and Practical Considerations Regarding Expert Testimony*, 15 HARV. L. REV. 40 (1901); Stephan Landsman, *Of Witches, Madmen, and Products Liability: An Historical Survey of the Use of Expert Testimony*, 13 BEHAV. SCI. & THE LAW 131 (1995).

*States*.<sup>2</sup> The defendant, accused of murder, offered the results of a “systolic blood pressure deception test,” a precursor to the polygraph, as evidence of his innocence. At the time this was a novel technique and there was no community of experts using this technique.<sup>3</sup> Judge Van Orsdel resolved the issue in only two pages. The key passage established what has come to be called the “general acceptance test.”<sup>4</sup> Expert testimony is admissible when the scientific principle or technique from which it is deduced has gained general acceptance in the particular field in which it belongs. Slowly but surely the Frye test became the dominant standard by which to judge the admissibility of expert testimony.<sup>5</sup>

With the adoption of the Federal Rules of Evidence in the 1970s, the Frye test began a slow decline in the federal courts. Criticisms of the test<sup>6</sup> and the fact that the reporter’s notes accompanying the new Federal Rules did not even mention the case when discussing the admissibility of expert testimony caused a number of federal circuits to abandon *Frye*.<sup>7</sup> Other circuits, however, concluded *Frye* did survive the adoption of the rules. The Ninth was one of these circuits.<sup>8</sup>

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<sup>2</sup>293 F.1013 (D.D.Cir. 1923). Our discussion here borrows heavily from Chapter 1 of David Faigman, David Kaye, Michael Saks and Joseph Sanders (EDS.), *Modern Scientific Evidence: THE LAW AND SCIENCE OF EXPERT TESTIMONY* (2nd ed.) (2002).

<sup>3</sup>Prior to *Frye*, most courts sidestepped the conundrum by asking only about the expert’s qualifications and whether the subject matter of his testimony was beyond the range of knowledge of the average juror. See Albert S. Osborn, *Reasons and Reasoning in Expert Testimony* 2 LAW & CONTEMP. PROBS., Oct. 1935 488, 489; John B. Chapin, *Experts and Expert Testimony*, 22 ALB. L. J. 365 (1880). If the court applied a qualification test, the testimony of defendant’s expert probably would have been admitted. Frye’s expert, William Marston, was an attorney and research psychologist who had done empirical research on the physiological correlates of lying. See William M. Marston, *Systolic Blood Pressure Symptoms of Deception*, 2 J. EX. PSYCH 117 (1917).

<sup>4</sup>“Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.” *Frye*, 293 F. at 1014.

<sup>5</sup>See, e.g., *United States v. Skeens*, 494 F.2d 1050, 1053 (D.C.Cir. 1974) and *Reed v. State*, 391 A.2d 364, 368 (Md. 1978) for statements to this effect.

<sup>6</sup>Some criticized the test for being too conservative because it imposes a waiting period while new theories and techniques gain general acceptance. During this time the law is deprived of valuable information. Others criticized for exactly the opposite reason: It was too liberal. This is because of the difficulty of defining the relevant field within which general acceptance must be achieved. If the field is narrowly defined to include the proffered expert and other like-minded individuals, little will be excluded. See Paul C. Giannelli, *The Admissibility of Novel Scientific Evidence: Frye v. United States, a Half Century Later*, 80 COLUM. L. REV. 1197 (1980).

<sup>7</sup>The most influential early circuit court opinion rejecting *Frye* is *United States v. Downing*, 753 F.2d 1224 (3d Cir. 1985). In a case involving expert testimony on eyewitness identification, Judge Becker said that in order to be admitted the evidence must survive the trial court’s preliminary inquiry. In an in limine proceeding, the judge should balance: (1) the reliability of the scientific principles the expert employed against (2) the likelihood that the evidence may overwhelm or mislead the jury. In addition, the trial court should examine the “fit” between the proffered scientific testimony and the contested issues in the case. *Id.* at 1226. Concern with reliability and fit have become cornerstones of post-*Daubert* jurisprudence.

<sup>8</sup>*United States v. Solomon*, 753 F.2d 1522, 1526 (9th Cir. 1985).

## Daubert

Jason Daubert and Eric Schuler both suffer from limb reduction birth defects. They sued Merrell Dow, the manufacturer of Bendectin, claiming that the morning sickness drug, which their mothers ingested during pregnancy, caused their defects. The trial judge granted the defendant's motion for summary judgment.<sup>9</sup> On appeal, the Ninth Circuit affirmed.<sup>10</sup> It held the plaintiff's expert testimony inadmissible because its underlying methodology diverged substantially from the procedures and techniques generally accepted in the field.<sup>11</sup>

The Supreme Court granted certiorari, primarily to announce *Frye's* demise as the sole test for admissibility.<sup>12</sup> It found *Frye's* rigid "general acceptance" standard to be contrary to the thrust of the Federal Rules which were intended to lower barriers to expert opinion testimony.<sup>13</sup> However, the basic rule governing the admissibility of expert testimony, Rule 702, does modify the general evidence rule that all relevant testimony is admissible. Expert opinion evidence must not only be relevant, it must also be reliable; evidence which is relevant but unreliable is inadmissible.<sup>14</sup>

This interpretation of Rule 702 requires us to ask what constitutes reliability. In *Daubert*, where all the experts purported to be scientists, the Court turned to science for an answer. Reliable opinions are those that are arrived at using the "methods and procedures of science."<sup>15</sup> In footnote nine the court added that, "In

<sup>9</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 727 F.Supp. 570 (S.D.Cal. 1989).

<sup>10</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 951 F.2d 1128 (9th Cir. 1991).

<sup>11</sup>The court articulated the *Frye* rule with the following language:

Expert opinion based on a scientific technique "is admissible if it is generally accepted as a reliable technique among the scientific community. . . ."

For expert opinion based on a given scientific methodology to be admissible, the methodology cannot diverge significantly from the procedures accepted by recognized authorities in the field. If it does so diverge, it cannot be shown to be "generally accepted as a reliable technique," and a district court must exclude it.

*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 951 F.2d 1128, 1129–30 (9th Cir. 1991) (quoting *United States v. Solomon*, 753 F.2d 1522, 1526 (9th Cir. 1985)).

<sup>12</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 2792–93, 125 L.Ed.2d 469 (1993). The Court's purpose is revealed by its refusal to grant certiorari in two other Bendectin cases, *Turpin v. Merrell Dow Pharmaceuticals, Inc.* 113 S.Ct. 84 (1992) denying petition for writ of certiorari; *Lee v. Richardson-Merrell, Inc.* 113 S.Ct. 192 (1992) (same), both of which, like *Daubert* resulted in a summary judgment for the defendant. The primary difference between these cases and *Daubert* was the Ninth Circuit's exclusive reliance on the *Frye* rule to justify a summary judgment.

<sup>13</sup>113 S.C. at 2794. In the period immediately following the *Daubert* decision, various interest groups wrote articles designed to put a pro-defense or pro-plaintiff spin on the opinion. Not surprisingly, plaintiff groups picked up on the language in *Daubert* declaring the new rule to be more liberal. See Kenneth J. Chesebro, Taking Daubert's "Focus" Seriously: The Methodology/Conclusion Distinction 15 *Cardozo L. Rev.* 1745 (1994). Most would agree, however, that in practice the *Daubert* test has been more restrictive than *Frye*. For a discussion of the conditions under which each test comes to similar conclusions and the conditions under which their admissibility conclusions diverge, see Faigman et al., *Modern Scientific Evidence* (2d. ed.) pp. 27–28 (2002).

<sup>14</sup>113 S.Ct. at 2795.

<sup>15</sup>*Id.*

a case involving scientific evidence, evidentiary reliability will be based upon scientific validity.”<sup>16</sup>

*Daubert* did not offer a systematic presentation of what scientists mean when they inquire about validity, but it did describe four factors that courts might consider when making a reliability/validity assessment: (a) Whether the expert’s theory or technique is falsifiable and has been tested,<sup>17</sup> (b) the reliability of a procedure and its potential rate of error,<sup>18</sup> (c) whether the theory or technique has been subjected to peer review<sup>19</sup> and whether the results have been published,<sup>20</sup> and (d) in a partial resurrection of the *Frye* test, whether the expert’s methods and reasoning enjoy general acceptance in a relevant scientific community.<sup>21</sup>

In addition, the Court noted that Rule 702 requires that the expert evidence “assist the trier of fact to understand the evidence or to determine a fact in issue.” Justice Blackmun said that “This condition goes primarily to relevance. . . . The consideration has been aptly described by Judge Becker as one of ‘fit.’ ‘Fit’ is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes.”<sup>22</sup> The “fit” requirement involves an assessment of whether the expert’s chain of reasoning contains an inferential gap that is too wide.

As with *Frye*, *Daubert* is not without its critics. If the *Daubert* test allows judges a more active role and provides for a more nuanced analysis than is possible under *Frye*, it is also true that this very flexibility makes *Daubert* a more uncertain test that may produce inconsistent admissibility rulings. Moreover, the test depends on a minimum level of judicial competence. For better or worse, the federal courts are fully committed to *Daubert* and most state courts seem to be following along in their wake. However, a number of states, including California, Florida, and New York, continue to adhere to the *Frye* test.<sup>23</sup>

At bottom, the *Daubert* revolution is about the relationship between judges and experts, between law and science. *Frye* asked judges to acquiesce to the judgment of the relevant scientific community. *Daubert* on the other hand, invites the trial court to make an independent inquiry. The judge should determine whether the proffered evidence is reliable by examining the reasoning and methodology underlying the expert’s testimony. To be sure, the opinion allows judges to make use of surrogate indicia of reliability. Peer review and publication and general acceptance in the scientific community are factors judges may consider, but they are secondary to a direct assessment of the testimony’s scientific validity. As Michael Saks recently noted, “perhaps the purpose of the

<sup>16</sup>113 S.Ct. at 2795 n. 9.

<sup>17</sup>113 S.Ct. at 2796.

<sup>18</sup>113 S.Ct. at 2796–97.

<sup>19</sup>113 S.Ct. at 2797.

<sup>20</sup>*Id.*

<sup>21</sup>*Id.*

<sup>22</sup>113 S.Ct. at 2796. (citing *United States v. Downing*, 753 F.2d 1224, 1242 (3d Cir. 1985)).

<sup>23</sup>See Heather G. Hamilton, *The Movement From Frye to Daubert: Where Do the States Stand?*, 38 JURIMETRICS J. 201 (1998); David E. Bernstein, *Frye, Frye, Again: The Past, Present, and Future of the General Acceptance Test*, 41 JURIMETRICS J. 385 (2001). Bernstein asserts that although less than 20 states have stuck with *Frye*, because they include some of the most populous jurisdictions, they contain almost half the American population. *Id.* at 387.

rules is simply to hold up a target to the courts; call one the *Frye* target and the other the *Daubert* target. The *Frye* ideal says: do whatever the experts tell you to do. The *Daubert* ideal says: figure out the science yourself.”<sup>24</sup>

### *Joiner*

The second case in the Supreme Court trilogy was *General Electric Co. v. Joiner*.<sup>25</sup> In *Joiner*, the Eleventh Circuit held appellate courts should adopt “a particularly stringent standard of review to the trial judge’s exclusion of expert testimony.”<sup>26</sup> Using this standard, it reversed the trial court decision to exclude the plaintiff’s expert opinion, in part because the judge had excluded the experts’ testimony because it “drew different conclusions from the research than did each of the experts”<sup>27</sup> contrary to *Daubert*’s assertion that in making its Rule 702 assessment “the focus, of course, must be solely on principles and methodology, not on the conclusions that they generate.”<sup>28</sup>

The U.S. Supreme Court reversed. It held that with respect to all admissibility decisions the proper level of review is the liberal “abuse of discretion” standard under which a district court’s decision should be overturned only when it is manifestly erroneous.

The Supreme Court also took the opportunity to revisit its terse and perhaps incautious methodology/conclusion distinction. The statement seemed to be in conflict with another part of the *Daubert* opinion where the court noted that Rule 702 requires that the scientific evidence must “assist the trier of fact to understand the evidence or to determine a fact in issue.” The *Daubert* court noted that “This condition goes primarily to relevance. . . . The consideration has been aptly described by Judge Becker as one of ‘fit.’ ‘Fit’ is not always obvious, and scientific validity for one purpose is not necessarily scientific validity for other, unrelated purposes.”<sup>29</sup> Many ‘fit’ analyses in the years following *Daubert* ultimately concluded that the evidence available to an expert does not address the particular disputed fact questions posed by the case,<sup>30</sup> i.e., there was no fit between the data and the conclusions the expert wished to draw. Most courts downplayed the Supreme Court’s methodology–conclusion distinction. For example, in an important *Paoli* opinion following *Daubert*, Judge Becker himself said “we think that [the distinction between principles and methods versus conclusions] has only limited practical import . . . a challenge to ‘fit’ is very close to a challenge to the expert’s ultimate conclusion about the particular case, and yet it is part of the judge’s admissibility calculus under *Daubert*.”<sup>31</sup>

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<sup>24</sup>Michael J. Saks, *Merlin and Solomon: Lessons from the Law’s Formative Encounters with Forensic Identification Science*, 49 HASTINGS L. J. 1069, 1139 (1998).

<sup>25</sup>522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997).

<sup>26</sup>*Joiner v. General Electric Corp.*, 78 F.3d 524, 529 (1996).

<sup>27</sup>*Id.* at 533.

<sup>28</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 595, 113 S.Ct. 2786, 2797, 125 L.Ed.2d 469 (1993).

<sup>29</sup>*Daubert*, 509 U.S. 579, 589–91, 113 S.Ct. 2786, 2795–96, 125 L.Ed.2d 469 (1993).

<sup>30</sup>*In Re Paoli*, 35 F.3d 717, 743 (3d Cir. 1994).

<sup>31</sup>*In Re Paoli*, 35 F.3d 717, 746 (3d Cir. 1994). One large piece of the long and tortured history of the *Paoli* litigation finally came to a conclusion with a jury verdict in favor of the defendants on

In *Joiner*, the Supreme Court basically ratified Judge Becker's view. It noted that conclusions and methodology are not entirely distinct from one another. "[N]othing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence which is connected to existing data only by the *ipse dixit* of the expert. A court may conclude that there is simply too great an analytical gap between the data and the opinion proffered. That is what the District Court did here and we hold that it did not abuse its discretion in so doing."<sup>32</sup>

### *Kumho Tire*

In Footnote 8 of the *Daubert* opinion, the Court limited its holding to scientific evidence. It noted that Rule 702 applies to "technical or other specialized knowledge" as well, but added, "Our discussion is limited to the scientific context because that is the nature of the expertise offered here."<sup>33</sup> In addition, the opinion made it clear that the four reliability factors: testability, error rate, peer review and publication, and general acceptance, are not exclusive.<sup>34</sup> These passages presented two related questions to post-*Daubert* courts: does *Daubert*'s reliability requirement apply at all to non-scientific evidence and, if it does, what role do the *Daubert* factors play in these cases?

Lower court opinions provided conflicting answers to both of these questions in areas such as forensic document examination,<sup>35</sup> clinical medical testimony,<sup>36</sup> and engineering failure analysis in products liability cases.<sup>37</sup> The Supreme Court resolved these questions in *Kumho Tire Co. v. Carmichael*.<sup>38</sup>

In July of 1993, eight members of the Carmichael family were involved in a serious automobile accident when the right rear tire of their minivan failed because the tire tread became separated from its inner steel-belted carcass. After

all claims involving issues of exposure, causation, medical monitoring, and property damages, affirmed on appeal. *In re Paoli Railroad Yard PCB Litigation*, 113 F.3d 444 (3d Cir. 1997).

<sup>32</sup>*Joiner*, 118 S.Ct. at 518.

<sup>33</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. at 590 n. 8.

<sup>34</sup>*Daubert*, 509 U.S. at 593, 594 n. 12.

<sup>35</sup>See *United States v. Starzeczyzel*, 880 F. Supp. (S.D.N.Y. 1995); *United States v. Jones*, 107 F.3d 1147 (6th Cir. 1997, cert denied *Jones v. United States*, 521 U.S. 1127, 117 S.Ct. 2527, 138 L.Ed.2d 1027 (1999)). In both of these cases the court refused to apply *Daubert* criteria to forensic document examiners. But see *United States v. Hines*, 55 F.Supp. 2d 62 (D. Mass. 1999), a post-*Kumho Tire* opinion that did exclude part of the expert's testimony.

<sup>36</sup>See *Moore v. Ashland Chemical, Inc.*, 126 F.3d 679 (5th Cir. 1997), rehearing en banc granted, opinion vacated, 151 F.3d 269 (5th Cir. 1998). In *Moore*, a panel of the Fifth Circuit concluded that the *Daubert* factors did not apply to clinical medical testimony as to whether a toxic exposure caused the plaintiff's injury. The full Circuit reviewed the case en banc and reversed, concluding that the *Daubert* factors might apply.

<sup>37</sup>See, e.g., *Compton v. Subaru of America, Inc.*, 82 F.3d 1513 (10th Cir. 1996), refusing to apply the *Daubert* factors to a products liability design defect case. On the other hand, the Eighth Circuit found that they do apply in *Peitzmeier v. Hennessy Industries, Inc.*, 97 F.3d 293 (8th Cir. 1996).

<sup>38</sup>526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999). Between *Daubert* and *Kumho*, the Supreme Court decided *General Electric Co. v. Joiner*, 522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997). In *Joiner* the court concluded that trial court 702 rulings should be reviewed under an abuse of discretion standard.

the accident, the plaintiffs' expert examined the tire and determined the failure was not the result of any abuse. He, therefore, concluded the failure was caused by a defect in either the tire's design or its manufacture. Prior to his testimony, the expert became ill and transferred the case to his employee, Dennis Carlson, who reviewed the file and confirmed the initial conclusion. Carlson did not personally examine the tire prior to rendering his opinion and he inspected the tire for the first time approximately one hour prior to his deposition by the defendant.<sup>39</sup> The defendant moved to exclude Carlson's testimony because it could not satisfy *Daubert*. The trial judge agreed and found that, "none of the four admissibility criteria outlined by the *Daubert* court are satisfied in this case."<sup>40</sup> Because the expert testimony was the plaintiff's only evidence of defect, the district judge then granted the defendant summary judgment.<sup>41</sup> Plaintiff appealed, arguing that the district court should not have applied *Daubert*'s reliability framework because Carlson was not a "scientific" expert.<sup>42</sup>

The Eleventh Circuit undertook a *de novo* review of the trial court's decision to apply *Daubert* and its decision to exclude the particular evidence under an abuse of discretion standard.<sup>43</sup> It concluded *Daubert* applies only to scientific testimony, that Carlson's testimony was nonscientific, and therefore the district court erred as a matter of law in applying the *Daubert* criteria.<sup>44</sup>

The Supreme Court granted certiorari, reversed the Eleventh Circuit and held that excluding Carlson's testimony was not an abuse of discretion.<sup>45</sup> As to the *Daubert* reliability factors, the Court held that a trial court may consider one or more when doing so will help determine that testimony's reliability.<sup>46</sup> It would be a mistake, however, to read *Kumho* to say that the trial court may simply ignore the *Daubert* factors in nonscience cases. The Court noted that, "a trial court should consider the specific factors identified in *Daubert* where they are reasonable measures of the reliability of expert testimony."<sup>47</sup> In a concurring opinion, Justices Scalia, O'Connor, and Thomas added that the discretion enjoyed by the trial court does not include the discretion to abandon the gatekeeping function or to perform it inadequately: "Though, as the Court makes clear today, the *Daubert* factors are not holy writ, in a particular case the failure to apply one or another of them may be unreasonable, and hence an abuse of discretion."<sup>48</sup> A trial court that fails to justify its decision not to use *Daubert* factors risks reversal.<sup>49</sup>

<sup>39</sup>*Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433, 1434 (11th Cir. 1997).

<sup>40</sup>*Carmichael v. Samyang Tire, Inc.* 923 F.Supp. 1414, 1521 (SDAla. 19967).

<sup>41</sup>923 F.Supp. at 1524.

<sup>42</sup>*Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433, 1435 (11th Cir. 1997).

<sup>43</sup>131 F.3d at 1435.

<sup>44</sup>131 F.3d at 1435–36.

<sup>45</sup>*Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 1179, 143 L.Ed.2d 238 (1999). Justice Stevens dissented to this part of the opinion and argued that the case should have been remanded to the Eleventh Circuit to determine whether the trial judge had abused his discretion. 119 S.Ct. at 1179. (Stevens, concurring in part and dissenting in part.).

<sup>46</sup>119 S.Ct. at 1171.

<sup>47</sup>119 S.Ct. at 1176.

<sup>48</sup>119 S.Ct. at 1179 (Scalia, concurring).

<sup>49</sup>See *Black v. Food Lion, Inc.*, 171 F.3d 308, 311–12 (5th Cir. 1999) ("In the vast majority of cases, the district court first should decide whether the factors mentioned in *Daubert* are appropriate.

As it did in its earlier opinion in *General Electric Co. v. Joiner*,<sup>50</sup> the Court offered a detailed analysis of the excluded expert testimony. According to the Supreme Court, the question in the case was one of specific causation and particular methodology.<sup>51</sup> The issue was not whether it is ever possible for a tire expert to use visual and tactile inspection methods to determine whether a tire is defective. Rather, it was the specific question of whether this tire was defective and the reliability of Carlson's methods with respect to the tire in question.<sup>52</sup>

Carlson's theory was that if the vehicle had been overloaded or the tire had been underinflated, this would have led to a phenomenon called "overdeflection." Overdeflection can cause the tire to overheat which in turn can undo the bond that holds the tire tread to the carcass.<sup>53</sup> Carlson described four indicia of overdeflection and adopted the rule that if a tire exhibited two of the four he would say it had been abused.<sup>54</sup> He conceded that the tire did exhibit some of these indicia, but he testified that the symptoms were not significant.

For example, according to Carlson, one of the symptoms of overdeflection is tread wear on the tire's shoulder greater than tread wear along the tire's center. Carlson concluded, apparently based on a visual inspection of the tire, that there was greater wear on the shoulders, but he also concluded that it was not evenly distributed on both shoulders. Rather, the wear appeared primarily on one shoulder whereas an overdeflected tire would show equal abnormal wear on both.<sup>55</sup> Therefore, this wear was not evidence of overdeflection.

In another part of his testimony, Carlson was asked how many miles the tire had traveled prior to the accident. According to the Supreme Court, he "could not say whether the tire had traveled more than 10, or 20, or 30, or 40, or 50 thousand miles, adding that 6,000 miles was 'about how far' he could 'say with any certainty.'"<sup>56</sup> To this, the Supreme Court responded,

The [trial] court could reasonably have wondered about the reliability of a method of visual and tactile inspection sufficiently precise to ascertain with some certainty

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Once it considers the *Daubert* factors, the court then can consider whether other factors, not mentioned in *Daubert*, are relevant to the case at hand.")

<sup>50</sup>*General Electric Co. v. Joiner*, 522 U.S. 136, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997).

<sup>51</sup>In this respect, the issue in the *Kumho* case is similar to an issue that arises frequently in toxic tort cases. There, as here, courts distinguish "general causation," i.e., whether a given cause can ever produce a given effect, from "specific causation," i.e., did that cause this effect in this particular case. Here, as in toxic cases, plaintiffs who are able to show general causation may still fail to show that it was more likely than not that their particular injury was caused in the manner they allege.

<sup>52</sup>119 S.Ct. at 1177.

<sup>53</sup>119 S.Ct. at 1172.

<sup>54</sup>The court summarized his testimony:

These symptoms include (a) tread wear on the tire's shoulder that is greater than the tread wear along the tire's center; (b) signs of a "bead groove," where the beads have been pushed too hard against the bead seat on the inside of the tire's rim; (c) sidewalls of the tire with physical signs of deterioration, such as discoloration; and/or (d) marks on the tire's rim flange. . . . Carlson said that where he does not find at least two of the four physical signs just mentioned (and presumably where there is no reason to suspect a less common cause of separation), he concludes that a manufacturing or design defect caused the separation.

119 S.Ct. at 1172.

<sup>55</sup>119 S.Ct. at 1173.

<sup>56</sup>119 S.Ct. at 1177.

the abuse-related significance of minute shoulder/center relative tread wear differences, but insufficiently precise to tell “with any certainty” from the tread wear whether a tire had traveled less than 10,000 or more than 50,000 miles. And these concerns might have been augmented by Carlson’s repeated reliance on the “subjective[ness]” of his mode of analysis in response to questions seeking specific information regarding how he could differentiate between a tire that actually had been overdeflected and a tire that merely looked as though it had been.<sup>57</sup>

Although the Supreme Court did not specifically tie its analysis of Carlson’s testimony to the *Daubert* factors, the reference to subjectivity suggests that it questioned the falsifiability and perhaps the error rate of Carlson’s theory. The Court also noted the lack of general acceptance of Carlson’s specific test, his decision rule that a tire has not been abused unless it exhibits two of his four overdeflection symptoms, and questioned Carlson’s ability to make the very fine distinctions that he proffered in his testimony.<sup>58</sup>

The Court did not offer any factors in addition to the four *Daubert* factors the trial court might use to assess reliability. However, it did note that the purpose of the relevancy and reliability requirements under *Daubert* is, “to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field.”<sup>59</sup> In the Court’s opinion, Carlson’s testimony did not measure up to this standard.<sup>60</sup>

The *Daubert* and *Kumho Tire* opinions are interesting from many perspectives. One topic that has received a fair amount of attention is the Supreme Court’s implicit understanding of the nature of scientific and other types of expert knowledge. Most of this discussion has been addressed to *Daubert* and its implicit scientific epistemology. However, because *Kumho Tire* does not offer a different understanding of non-scientific evidence, the discussion can be extended easily to include that case as well.

### *Daubert’s* Implicit Scientific Epistemology

In the aftermath of the *Daubert* opinion, a number of articles have appeared that praise or criticize Justice Blackmun’s understanding of science and the

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<sup>57</sup>119 S.Ct. at 1177.

<sup>58</sup>119 S.Ct. at 1178.

<sup>59</sup>119 S.Ct. 1176. The “same intellectual rigor” standard first appears in a pair of Seventh Circuit opinions authored by Judge Posner. *Rosen v. Ciba-Geigy Corp.*, 78 F.3d 316, 318 (7th Cir. 1996); *Braun v. Lorillard Inc.*, 84 F.3d 230, 234 (7th Cir. 1996). Post-*Kumho* appellate opinions have been quick to incorporate this standard in their opinions. See, e.g., *Black v. Food Lion, Inc.*, 171 F.3d 308, 311 (5th Cir. 1999).

<sup>60</sup>Indeed, no one has argued that Carlson himself, were he still working for Michelin, would have concluded in a report to his employer that a similar tire was similarly defective on grounds identical to those upon which he rested his conclusion here. Of course, Carlson himself claimed that his method was accurate, but, as we pointed out in *Joiner*, “nothing in either *Daubert* or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert.” 522 U.S., at 146.

*Kumho*, 119 S.Ct. at 1179.

scientific enterprise.<sup>61</sup> The fact that some authors claim that *Daubert* comes closer than *Frye* to capturing the essential nature of the scientific enterprise,<sup>62</sup> while others see it as a fundamentally wrong turn,<sup>63</sup> suggests the substantial diversity of opinion concerning the epistemological underpinnings of science.

Most would agree, however, that *Daubert* offered a relatively unsophisticated view of science.<sup>64</sup> The court's admissibility rulings do seem to have proceeded in happy obliviousness to the "science wars"<sup>65</sup> that arguably began with Fleck,<sup>66</sup> flourished with Kuhn<sup>67</sup> and Feyerabend,<sup>68</sup> and have raged for much of the last half century between the defenders of a more traditional, realist view of science and those critics who emphasize its historical, political, social, and rhetorical aspects.<sup>69</sup>

The *Frye* test implicitly places its trust in expert communities as neutral, truth-seeking collectives whose opinions are derived by an acceptable and agreed upon process. *Daubert* is a more skeptical test, decided against a background of

<sup>61</sup>See Margaret G. Farrell, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Epistemology and Legal Process*, 15 CARDOZO L. REV. 2183 (1994); Ronald J. Allen, *Expertise and the Daubert Decision*, 84 J. CRIM. L. & CRIMINOLOGY 1157 (1994); Sean O'Connor, *The Supreme Court's Philosophy of Science: Will the Real Karl Popper Please Stand Up?*, 35 JURIMETRICS J. 263 (1995); Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 TEX. L. REV. 1 (1995); Brian Leiter, *The Epistemology of Admissibility: Why Even Good Philosophy of Science Would Not Make For Good Philosophy of Evidence*, 1997 B.Y.U. L. REV. 803 (1997); Randolph N. Jonakait, *The Assessment of Expertise: Transcending Construction*, 37 SANTA CLARA L. REV. 301 (1997); Adina Schwartz, A "Dogma of Empiricism" Revisited: *Daubert v. Merrell Dow Pharmaceuticals, Inc. and the Need to Resurrect the Philosophical Insight of Frye v. United States*, 10 HARV. J.L. & TECH. 149 (1997); M. Neil Browne, Terri J. Keeley and Wesley J. Hiers, *The Epistemological Role of Expert Witnesses and Toxic Torts*, 36 AM. BUS. L.J. 1 (1998); David Goodstein, *How Science Works*, in FEDERAL JUDICIAL CENTER, REFERENCE MANUAL ON SCIENTIFIC EVIDENCE (2d ed.) (2000).

<sup>62</sup>Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 TEX. L. REV. 1 (1995).

<sup>63</sup>Margaret G. Farrell, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Epistemology and Legal Process*, 15 CARDOZO L. REV. 2183 (1994); Adina Schwartz, A "Dogma of Empiricism" Revisited: *Daubert v. Merrell Dow Pharmaceuticals, Inc. and the Need to Resurrect the Philosophical Insight of Frye v. United States*, 10 HARV. J.L. & TECH. 149 (1997).

<sup>64</sup>See Margaret G. Farrell, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Epistemology and Legal Process*, 15 CARDOZO L. REV. 2183, 2185 (1994) ("Because Justice Blackmun's opinion equivocates between [a positivist and a social constructionist view of science], it sets out contradictory instructions to federal judges faced with submissions of scientific evidence."); Adina Schwartz, A "Dogma of Empiricism" Revisited: *Daubert v. Merrell Dow Pharmaceuticals, Inc. and the Need to Resurrect the Philosophical Insight of Frye v. United States*, 10 HARV. J.L. & TECH. 149 (1997); Joseph Sanders, *Scientific Validity, Admissibility, and Mass Torts After Daubert*, 78 MINN. L. REV. 1387 (1994).

<sup>65</sup>See Ian Hacking, *THE SOCIAL CONSTRUCTION OF WHAT?* (1999).

<sup>66</sup>Ludwik Fleck, *GENESIS AND DEVELOPMENT OF A SCIENTIFIC FACT*. (1979[1935]).

<sup>67</sup>Thomas Kuhn, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS*. (1962).

<sup>68</sup>Paul K. Feyerabend, *AGAINST METHOD: OUTLINE OF AN ANARCHISTIC THEORY OF KNOWLEDGE*. (1975).

<sup>69</sup>Jarrett Lepin, *A NOVEL DEFENSE OF SCIENTIFIC REALISM*. (1997); Bruno Latour, *PANDORA'S HOPE: ESSAYS ON THE REALITY OF SCIENCE STUDIES*. (1999); Andrew Pickering (ed.). *SCIENCE AS PRACTICE AND CULTURE*. (1992); Steven Shapin, *THE SCIENTIFIC REVOLUTION*. (1996); Philip Kitcher, *THE ADVANCEMENT OF SCIENCE: SCIENCE WITHOUT LEGEND, OBJECTIVITY WITHOUT ILLUSIONS*. (1993); John Earman (ed.). *INFERENCE, EXPLANATION, AND OTHER PHILOSOPHICAL FRUSTRATIONS: ESSAYS IN THE PHILOSOPHY OF SCIENCE*. (1992); David Papineau (ed.) *THE PHILOSOPHY OF SCIENCE*. (1996).

an emerging belief that courts were experiencing a growth in “junk science.”<sup>70</sup> It affords relatively less legitimacy to elite authoritative opinions and is less willing to accept the idea that communities of experts are the sole arbiters of specialized knowledge. In this sense, *Daubert* is consistent with a social constructionist view of science.<sup>71</sup>

This increased sensitivity to social, political, and economic pressures that impinge on expert judgment is reflected in a fifth admissibility factor frequently cited in post-*Daubert* opinions: whether experts are proposing to testify about matters growing naturally and directly out of research they conducted independent of the litigation.<sup>72</sup> This criterion now is very frequently mentioned in federal admissibility opinions.<sup>73</sup> The “non-judicial uses” test is a judicial acknowledgment that external pressures may bias expert testimony and the self-reflecting observation that the legal system itself imposes significant pressures on the parties and their experts.<sup>74</sup>

*Kumho Tire* also reflects a concern for the pressures that impinge on expert judgment. The Court’s focus on whether an expert has applied the “same intellectual rigor” as people in her field implicitly recognizes that the pressures of litigation and party witnessing may influence expert testimony.<sup>75</sup>

*Daubert* and *Kumho Tire* implicitly accept the notion that expert knowledge is influenced by the social, economic, and political situation of the expert and expert communities. Nevertheless they reject a radical social constructionist perspective that would argue that expert opinion is *solely* the result of such influences. The opinion directs judges to become sufficiently knowledgeable about scientific methods so that they can fairly assess the validity of evidence

<sup>70</sup>Peter Huber, *GALILEO’S REVENGE: JUNK SCIENCE IN THE COURTROOM* 6. (1991). Whether there is a “junk science” problem is controversial. For a response to Huber, see Kenneth J. Chesebro, *Galileo’s Retort: Peter Huber’s Junk Scholarship*. 42 *AMER. U. L. REV.* 1637 (1993). The issue has resurfaced in the silicone implant litigation. See Marcia Angell, *SCIENCE ON TRIAL: THE CLASH OF MEDICAL EVIDENCE AND THE LAW IN THE BREAST IMPLANT CASE*. (1996); Rebecca S. Dresser, Wendy E. Wagner, and Paul C. Giannelli, *Breast Implants Revisited: Beyond Science on Trial*. 1997 *Wis. L. REV.* 705.

<sup>71</sup>Andrew Pickering (ED.), *SCIENCE AS PRACTICE AND CULTURE*. (1992); Steven Shapin, *THE SCIENTIFIC REVOLUTION*. (1996). See Mark R. Patterson, *Conflicts of Interest in Scientific Expert Testimony*, 40 *WM. & MARY L. REV.* 1313 (1999).

<sup>72</sup>*Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 43 F.3d 1311, 1317 (9th Cir. 1995).

<sup>73</sup>The advisory committee notes accompanying the revised Federal Rule of Evidence 702 list five factors in addition to the factors listed in *Daubert* that courts have considered when deciding whether testimony is sufficiently reliable to be admitted. The first is the nonjudicial uses test. Standing Committee on the Rules of Evidence, Proposed amendments to Federal Rules of Evidence, p. 47. (1999).

<sup>74</sup>See Samuel Gross, *Expert Evidence*. 1991 *Wisconsin Law Review* 1113 (1991).

<sup>75</sup>Patterson notes that external pressures do not come exclusively in the form of research done at the behest of an attorney. For example, a good deal of the research conducted in areas such as pharmacology is done at the behest of and with funding from companies who frequently appear as defendants in litigation concerning the products being studied. Mark R. Patterson, *Conflicts of Interest in Scientific Expert Testimony*. 40 *WM. & MARY L. REV.* 1313, 1346 (1999). Nevertheless, legal and scientific experts alike note the substantial additional pressures placed on an expert who becomes a party witness in an adversarial system. Mike Redmayne, *Expert Evidence and Scientific Disagreement*. 30 *U.C. DAVIS L. REV.* 1027, 1071 (1997).

offered at trial. The requirement that scientific testimony must pass methodological muster is consistent with a belief in some form of scientific realism.

David Papineau notes that much of the current debate concerning the epistemology of science turns on one's commitment to scientific realism.<sup>76</sup> Papineau takes realism to involve two theses: an *independence thesis* that our judgments answer for their truth to a world which exists independently of our awareness of it, and a *knowledge thesis* that by and large, we can know which of these judgments are true.<sup>77</sup> Idealists reject the first thesis, the notion of some further world beyond the world as we perceive it. Most modern critics of the realist tradition in the philosophy and sociology of science are not idealist. Rather, they are skeptics who reject the knowledge thesis and accept the idea that we cannot know the truth about the world although scientific theories might be useful fictions for predictive purposes.<sup>78</sup> One important conclusion to be drawn from this line of analysis is that a commitment to scientific realism does not require one to reject the idea that the scientific enterprise is embedded in and influenced by the society around it. Rather, it simply requires one to believe that it is possible to know the truth about the world.

*Daubert's* focus on methods is a search for some assurance that the expert has given the empirical world a reasonable opportunity to influence and constrain the expert's conclusions. Ultimately, the opinion's scientific epistemology holds that there is a set of (social) practices often given the shorthand name "the scientific method" that increase the likelihood someone will arrive at a correct conclusion about the state of the world and thus make positive contributions to knowledge; a set of practices that scientists themselves frequently point to as the sources of past scientific success.<sup>79</sup>

In this regard, the *Daubert* opinion is not unique. Both legislatures and administrative agencies frequently distinguish the process of science from its products. They accept the constructionist insight that the process of doing science is a social enterprise and is subject to the buffeting, often distorting winds of

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<sup>76</sup>David Papineau, *Introduction*, in DAVID PAPINEAU (ED.) *THE PHILOSOPHY OF SCIENCE* pp. 1–20. Oxford: Oxford University Press. (1996)

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

<sup>78</sup>*Id.* at 4.

<sup>79</sup>Alvin Goldman provides one list of the dimensions of scientific practice that seem to play a role in science's relative success. They are:

- (1) An emphasis on precise measurement, controlled test, and observation, including a philosophy, organon, and technology for more and more powerful observation.
- (2) A systematic and sophisticated set of inferential principles for drawing conclusions about hypotheses from observations of experimental results.
- (3) The marshaling and distribution of resources to facilitate scientific investigation and observation.
- (4) A system of credit and reward that provides incentives for workers to engage in scientific research and to distribute their efforts in chosen directions.
- (5) A system for disseminating scientific findings and theories as well as critical assessments of such findings and theories.
- (6) The use of domain-specific expertise in making decisions about dissemination, resource allocation and rewards.

social, political, economic and legal influences. At the same time, they cling to a realist belief that the products of science may state a truth about the world, or at least something so similar to truth as it is commonly understood at a given point in history that the practical discipline of law does not need to concern itself with the difference.

In sum, *Daubert* adopts what Stephen Cole calls a realist–constructivist view of science, that is, science is socially constructed both in the laboratory and in the wider community, but the construction is constrained by input from the empirical world.<sup>80</sup> It rejects what he calls a relativist–constructionist position that claims nature has little or no influence on the cognitive content of science.

From this perspective, *Kumho Tire* is important because it refuses to adopt a different position with respect to nonscientific evidence. It, too, assumes that expertise is not simply a social construct. Expert opinions may be more or less true and an examination of the nature of an expert's reasoning will assist courts in assessing the merits of an expert's position.

There is a large dose of pragmatism in all of this, of course, and the *Daubert* rule itself has been cited as an example of “the common law's genius for muddling through on the basis of experience rather than logic.”<sup>81</sup>

In sum, the recent Supreme Court opinions on the admissibility of expert opinion testimony adopt the following position concerning scientific knowledge: (a) Scientific and other expert knowledge is strongly influenced by political, economic, and legal influences on expert communities and on individual experts. (b) Nevertheless, scientific knowledge is not simply a social construct. Rather, the opinions adopt a realist position; through the use of proper methods we can know with some degree of certainty which of our judgments about the world are correct. From the point of view of science, this complex and, somewhat contradictory position may leave a good deal to be desired. From the point of view of the legal system, however, the position adopted in *Daubert* and *Kumho Tire* has much to recommend it. It positions the courts in a middle position, agreeing with fundamental premises of scientific epistemology and simultaneously recognizing that scientists and scientific communities share the common human frailties. And, as one might expect, it extends law's empire by making the judge, not the expert community, the final arbitrator of what constitutes acceptable expertise.

This is not to suggest that relying on courts to assume this responsibility will always lead to well-reasoned decisions. In *Daubert*, Chief Justice Rehnquist, concurring in part and dissenting in part, expressed doubts about judicial ability to occupy a science-vetting role:

The Court speaks of its confidence that federal judges can make a “preliminary assessment of the reasoning or methodology properly can be applied to the facts in issue.” The Court then states that a “key question” to be answered in deciding whether something is “scientific knowledge” “will be whether it can be (and has

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<sup>80</sup>STEPHEN COLE, *MAKING SCIENCE: BETWEEN NATURE AND SOCIETY*. p. x (1992). For somewhat similar views see SERGIO SISMONDO, *SCIENCE WITHOUT MYTH: ON CONSTRUCTIONS, REALITY, AND SOCIAL KNOWLEDGE*. (1996)

<sup>81</sup>SHEILA JASANOFF, *SCIENCE AT THE BAR: LAW, SCIENCE AND TECHNOLOGY IN AMERICA*. 63. (1995).

been) tested.” Following this sentence are three quotations from treatises, which not only speak of empirical testing, but one of which states that the “ ‘criterion of the scientific status of a theory is its falsifiability, or refutability or testability.’ ” I defer to no one in my confidence in federal judges; but I am at a loss to know what is meant when it is said that the scientific status of a theory is its “falsifiability,” and I suspect that some of them will be too.<sup>82</sup>

Six years later, in *Allison v. McGhan Medical Corporation*,<sup>83</sup> an 11th Circuit court appeared to express ambivalence while asserting the need to assume the role of gatekeeper:

While meticulous *Daubert* inquiries may bring judges under criticism for donning white coats and making determinations that are outside their field of expertise, the Supreme Court has obviously deemed this less objectionable than dumping a barrage of questionable scientific evidence on a jury, who would be even less equipped than the judge to make reliability and relevance determinations and more likely than the judge to be awestruck by the expert’s mystique. Also a judge may enlist outside experts to assist in this sometimes difficult decision. Using independent court-appointed experts may serve to quell the pseudo-scientist criticism.<sup>84</sup>

The reservations expressed in these two cases about the universal competence of judges to understand the scientific issues are brought home in a recent study by Gatowski and her colleagues.<sup>85</sup> Those authors interviewed 400 state trial court judges, sometimes supplementing the telephone interview with a written questionnaire. The judges, from all 50 states and the District of Columbia, were asked about their attitudes toward the *Daubert* criteria and about the gate-keeping role of the judge.

The overwhelming majority of judges (91%) asserted that gate-keeping was an appropriate role for the judiciary and that the *Daubert* guidelines were useful criteria. In an effort to assess how well judges understood the concepts, the survey then asked judges how they would apply the four *Daubert* guidelines. Although over 90% of the judges seemed to understand the criteria of peer review/publication and general acceptance, their understanding of the other two criteria was poor. Only 6% of the judges gave answers that indicated a clear understanding of falsifiability. Only 4% indicated a clear understanding of error rates.

This survey does not measure how well judges are able to apply criteria in the context of an actual case,<sup>86</sup> nor does it tell us about how well federal judges understand these concepts. The actual written opinions of federal district and appellate courts often exhibit a fairly good understanding of *Daubert* principles. Nonetheless, the survey results highlight the as yet unanswered question of the overall level of judicial competence.

Another unanswered question is whether jurors are better or worse than

<sup>82</sup>*Daubert v. Merrell Dow Pharmaceuticals* 509 U.S. 579 (1993) at 599 [citations omitted]

<sup>83</sup>*Allison v. McGhan Medical Corp.*, 184 F. 3d 1300 (11th Cir. 1999).

<sup>84</sup>*Id.* at 1310.

<sup>85</sup>Sophia Gatowski, Shirley Dobbin, James T. Richardson, Gerald Ginsburg, Mara Merlino, and Veronica Dahir, *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post-Daubert World*. 25 LAW AND HUMAN BEHAVIOR 433 (2001).

<sup>86</sup>*Id.* at 452.

judges in assessing the reliability of expert testimony. Is the assertion made in *Allison*<sup>87</sup> that judges, whatever their deficiencies, will, on average, perform better than juries in evaluating expert testimony correct? The body of available data comparing the performance of judges versus juries is too thin to allow any reasonable judgment, although a review of literature on jury performance with regard to expert testimony indicates that the often asserted claim, repeated in *Allison*, that juries tend to be “awestruck by the expert’s mystique” is not warranted.<sup>88</sup> Similarly, it shows that the judgments of both judges and juries may be affected by heuristics, cognitive short-cuts that influence and sometimes distort decisionmaking.<sup>89</sup> Currently missing is a set of direct comparisons between the reactions of judges and juries to expert testimony based on both claims that would pass muster under *Daubert* or *Frye* and on those that would fail.

We have suggested that *Daubert* struck a reasonable balance between a realist and social constructionist view of science. However, it remains to be seen whether in practice the *Daubert* test, or for that matter the *Frye* test, will produce a similar balance in the allocation of tasks between judge and jury.

<sup>87</sup>*Allison v. McGhan Medical Corp.*, 184 F. 3d 1300 (11th Cir. 1999).

<sup>88</sup>Neil Vidmar and Shari S. Diamond, *Juries and Expert Evidence*, 66 *BROOKLYN LAW REVIEW* 1123 (2001); see also Shari S. Diamond, *Convergence and Complementarity Between Professional Judges and Lay Adjudicators*, in PETER VAN KOPPEN & STEVE PENROD (EDS.) *ADVERSARY AND INQUISITORIAL SYSTEMS: PSYCHOLOGICAL PERSPECTIVES ON CRIMINAL JUSTICE SYSTEMS* (in press).

<sup>89</sup>*Id.*

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