

# KUMHO AND HOW WE KNOW

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## I

### INTRODUCTION

In the summer of 1999, the United States Supreme Court issued the last in a trilogy of 1990s cases dealing with the question of the admissibility of expert testimony in federal courts.<sup>1</sup> In *Kumho Tire Co. v. Carmichael*,<sup>2</sup> the Court was asked to decide if the judicial gatekeeping role it set forth in the first of these three cases, *Daubert v. Merrell Dow Pharmaceuticals*,<sup>3</sup> applied only to “scientific” knowledge or to all expert testimony. The court concluded that all expert testimony must be both relevant and reliable before it can be admitted, but that the specific factors set forth in *Daubert* to judge the reliability of scientific evidence may be supplemented and perhaps replaced by other factors when expert testimony is based on “technical” or “other specialized” knowledge.<sup>4</sup> The opinion explicitly recognized that not all expert testimony can be judged by a single standard because not all experts know things in exactly the same way.<sup>5</sup> This point had been colorfully made five years earlier in the Sixth Circuit’s opinion in *Berry v. City of Detroit*.<sup>6</sup>

In *Berry*, while wrestling with the admissibility of the expert testimony of a “sociologist cum sheriff”<sup>7</sup> as to whether the disciplinary practices of the Detroit police department demonstrated a policy of deliberate indifference to the rights of the citizenry, thus giving rise to municipal liability under 42 U.S.C. § 1983, the Sixth Circuit made the following comparison between scientific and non-scientific expert testimony:

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1. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999); *General Elec. Co. v. Joiner*, 522 U.S. 136 (1997); *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993).

2. 526 U.S. 137, 141 (1999).

3. 509 U.S. 579, 597 (1993).

4. Federal Rule of Evidence 702 lists these three types of expert knowledge. The rule reads: “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 opinion or otherwise.” FED. R. EVID. 702.

5. See *Kumho*, 526 U.S. at 141-42.

6. 25 F.3d 1342 (6th Cir. 1994).

7. *Id.* at 1349.

The distinction between scientific and non-scientific expert testimony is a critical one. By way of illustration, if one wanted to explain to a jury how a bumblebee is able to fly, an aeronautical engineer might be a helpful witness. Since flight principles have some universality, the expert could apply general principles to the case of the bumblebee. Conceivably, even if he had never seen a bumblebee, he still would be qualified to testify, as long as he was familiar with its component parts.

On the other hand, if one wanted to prove that bumblebees always take off into the wind, a beekeeper with no scientific training at all would be an acceptable expert witness if a proper foundation were laid for his conclusions. The foundation would not relate to his formal training, but to his firsthand observations. In other words, the beekeeper does not know any more about flight principles than the jurors, but he has seen a lot more bumblebees than they have.<sup>8</sup>

How do aeronautical engineers and beekeepers know what they know? How does their knowledge differ and how is it the same? The insight of the *Berry* opinion is that a satisfactory answer to the legal question of admissibility is in part contingent upon our understanding of the nature of expert knowledge. But this alone is not enough. Admissibility standards are also influenced by the organization of the legal system itself. In this article, I attempt to shed some light on different ways experts (and non-experts) know things and then to offer some thoughts on how this should influence the legal assessment of the admissibility of expert testimony.<sup>9</sup>

In Part II, I review the legal developments leading up to *Kumho*. I give special emphasis to the alternative approaches to admissibility reflected in the *Frye*<sup>10</sup> and *Daubert*<sup>11</sup> tests and to the *Kumho* decision to sweep non-scientific evidence under the *Daubert* umbrella.<sup>12</sup>

Part III addresses two questions: What is the law's implicit epistemology with respect to scientific knowledge, and how does scientific knowledge differ from other forms of knowing? I argue that while there may be differences between intellectual fields along such dimensions as a reliance on individual "experience" as a basis of judgment, and the ability of fields to isolate themselves from political, economic, and social pressures, the differences are often as great within disciplines as between them. Because differences between fields offer limited insight into how we come to know things, I turn to a body of psychological research that finds that people process information in two fundamentally different ways, which I call "rational processing" and "experiential processing."<sup>13</sup> I discuss the nature of these two ways of understanding when people and experts are more likely to use one or the other.

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8. *Id.* at 1349-50.

9. My discussion focuses on witnesses who testify about causal relationships in some form. It has relatively little to say about experts who restrict their testimony to factual assertions. Many non-scientific experts fall into this category. See *United States v. Angelilli*, 660 F.2d 23 (2d Cir. 1981) (dealing with auctioneers).

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

11. *Daubert*, 509 U.S. at 593-94.

12. See *Kumho*, 526 U.S. at 141.

13. See *infra* text accompanying notes 165-196 for definitions of these terms.

Part IV turns its attention back to the courts. I argue that the epistemological needs of the law argue for admissibility criteria that push witnesses strongly in the direction of rational processing and offer some general thoughts about what this means for a variety of admissibility decisions, including the decision whether to admit the testimony of *Berry's* beekeeper.

## II

### LEGAL STANDARDS OF ADMISSIBILITY

#### A. *Frye*

The question of when to trust an expert is as old as expert testimony itself.<sup>14</sup> As David Faigman, Elise Porter, and Michael Saks note, the problem presents a conundrum:

The trial process seeks out expert testimony because the expert, by definition, possesses knowledge that the judge and jury lack. With the benefit of the expert's knowledge, the fact-finder's uncertainty about facts at issue in a case might be reduced and decisions reached more easily and accurately. But precisely because the expert's knowledge is beyond the ken of the judge and jury, they are in a weak position to evaluate whether what an expert is offering is genuine, valid, and helpful.<sup>15</sup>

The most important pre-*Daubert* case to deal with this problem is *Frye v. United States*.<sup>16</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.<sup>17</sup> At the time, this was a novel technique, and there was no community of experts using it.<sup>18</sup> Judge Van Orsdel found a solution in only two pages. The key passage established what has come to be called the "general acceptance

14. See David L. Faigman et al., *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). This article reports the first clear reference to an expert witness called by and on behalf of a party, which 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. & L. 131 (1995).

15. Faigman et al., *supra* note 14, at 1801. Scott Brewer builds on this problem to argue that when confronted with equally matched contrary expert opinions, the non-expert is incapable of choosing between them without engaging in epistemic arbitrariness and thereby violating the "norm of intellectual due process." Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE. L.J. 1535, 1680 (1998). He views *Daubert* as an unsatisfactory solution to this problem. See *id.*

16. 293 F. 1013 (D.C. Cir. 1923). My discussion here borrows heavily from 1 DAVID L. FAIGMAN, ET AL., *MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY* Ch. 1 (1997 & Supp. 1999).

17. See *Frye*, 293 F. at 1013.

18. 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 John B. Chapin, *Experts and Expert Testimony*, 22 ALB. L.J. 365 (1880); Albert S. Osborn, *Reasons and Reasoning in Expert Testimony*, 2 LAW & CONTEMP. PROBS. 488, 489 (Winter 1935). If the court applied a qualification test, the testimony of the 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. EXPERIMENTAL PSYCHOL. 117 (1917).

test.”<sup>19</sup> Expert testimony is admissible when the scientific principle or technique from which it is deduced has gained general acceptance in the particular field to which it belongs.<sup>20</sup>

At the time it was decided, the *Frye* rule went largely unnoticed.<sup>21</sup> *Frye*'s emergence as the prominent standard occurred only in the 1970s, probably because only then did people begin to discuss the proper standard for the admissibility of expert testimony under the new Federal Rules of Evidence.<sup>22</sup> With the adoption of the Rules, the *Frye* test began a slow decline in the federal courts. The test was criticized for being too conservative because it imposes a waiting period while new theories and techniques gain general acceptance.<sup>23</sup> During this waiting period, the law is deprived of valuable information.<sup>24</sup> Others criticized the test for exactly the opposite reason—that it was too liberal 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 testimony would be excluded.<sup>25</sup> Even when a court settles on the relevant field, determining when and whether general acceptance was achieved still presents problems. Another criticism of *Frye* is that it leaves the law at the mercy of the judgment of experts in a given field.<sup>26</sup>

These criticisms and the fact that the reporter's notes accompanying the Federal Rules of Evidence did not even mention *Frye* when discussing the admissibility of expert testimony caused a number of federal circuits to abandon

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19. 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.

20. *See id.*

21. *See* Faigman et al., *supra* note 14, at 1808.

22. *See id.* at 1809.

23. *See id.* at 1816.

24. Some have argued that the conservatism of *Frye* is one of its virtues. For every novel idea that eventually achieves general acceptance, there are many more that do not. If scientists are unable to recognize a breakthrough when they first see it, jurors are unlikely to do better. For a case praising the conservative nature of *Frye*, see *People v. Leahy*, 882 P.2d 321, 325 (Cal. 1994).

25. *See* Paul C. Giannelli, *The Admissibility of Novel Scientific Evidence: Frye v. United States, A Half Century Later*, 80 COLUM. L. REV. 1197 (1980).

26. *See* Faigman et al., *supra* note 14, at 1816.

the test.<sup>27</sup> The Ninth Circuit, however, is one of several courts that concluded that *Frye* did survive the adoption of the rules.<sup>28</sup>

### B. *Daubert*

Jason Daubert and Eric Schuler both suffer from limb reduction birth defects.<sup>29</sup> They sued Merrell Dow, the manufacturer of Bendectin, claiming that the morning-sickness drug, which their mothers ingested during pregnancy, caused their defects.<sup>30</sup> The trial judge granted the defendant's motion for summary judgment.<sup>31</sup> The court concluded that the strongest inference a jury could draw from the evidence was "that Bendectin could *possibly* have caused plaintiffs' injuries," and that even that inference was insufficient to avoid granting the defendant's motion.<sup>32</sup> On appeal, the Ninth Circuit affirmed, holding that the plaintiffs' expert testimony was inadmissible because its underlying methodology diverged substantially from the procedures and techniques generally accepted in the field.<sup>33</sup>

The Supreme Court granted certiorari, primarily to announce the demise of *Frye*.<sup>34</sup> *Frye*'s rigid "general acceptance" standard was held to be contrary to the thrust of the Federal Rules, which were intended to lower barriers to expert opinion testimony.<sup>35</sup> Rule 702 modifies Rule 402's directive to admit all relevant evidence.<sup>36</sup> Relevance and qualifications are not enough: Rule 702 requires reliability as well as relevance; evidence that is relevant but unreliable is inadmissible.<sup>37</sup> This interpretation of Rule 702 requires us to ask what constitutes reli-

27. 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 to be admitted, the evidence must survive the trial court's preliminary inquiry. *See id.* at 1237. In an *in limine* proceeding, the judge should balance the reliability of the scientific principles the expert employed against the likelihood that the evidence may overwhelm or mislead the jury. *See id.* at 1226. In addition, the trial court should examine the "fit" between the proffered scientific testimony and the contested issues in the case. *See id.* Concern with reliability and fit have become cornerstones of post-*Daubert* jurisprudence. The Fifth Circuit set out a similar test for admissibility. *See Christophersen v. Allied-Signal Corp.*, 939 F.2d 1106 (5th Cir. 1991) (en banc).

28. *See United States v. Solomon*, 753 F.2d 1522, 1526 (9th Cir. 1985).

29. *See Daubert v. Merrell Dow Pharm., Inc.*, 727 F. Supp. 570, 571 (S.D. Cal. 1989).

30. *See id.*

31. *See id.* at 576.

32. *Id.*

33. *See Daubert v. Merrell Dow Pharm., Inc.*, 951 F.2d 1128 (9th Cir. 1991). 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.'" *Id.* at 1129-30 (quoting *United States v. Solomon*, 753 F.2d 1522, 1526 (9th Cir. 1985)).

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.

*Id.* at 1130.

34. *See Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 583-87 (1993).

35. *See id.* at 587-88.

36. *See* FED. R. EVID. 402; *Id.* 702.

37. *See Daubert*, 509 U.S. at 589.

ability. In this case, where all the experts purported to be scientists, the Court turned to science for an answer, holding that reliable opinions are those that are arrived at using the “methods and procedures of science.”<sup>38</sup> In footnote nine of the opinion, the Court explained that “[i]n a case involving scientific evidence, evidentiary reliability will be based upon scientific validity.”<sup>39</sup>

*Daubert* did not offer a systematic presentation of what scientists mean when they inquire into “validity,” but it did offer up four factors courts might consider when making a reliability/validity assessment: (1) whether the expert’s theory or technique is falsifiable and has been tested;<sup>40</sup> (2) the reliability of a procedure and its potential rate of error;<sup>41</sup> (3) whether the theory or technique has been subjected to peer review and whether the results have been published;<sup>42</sup> and (4) in a partial resurrection of the *Frye* test, whether the expert’s methods and reasoning enjoy general acceptance in a relevant scientific community.<sup>43</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.”<sup>44</sup> Justice Blackmun wrote that “[t]his 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>45</sup> The “fit” requirement mandates an assessment of whether the expert’s chain of reasoning contains an inferential gap that is too wide.<sup>46</sup>

38. *Id.* at 590.

39. *Id.* at 590 n.9.

40. *See id.* at 593.

41. *See id.* at 594.

42. *See id.* at 593.

43. *See id.* at 594.

44. *Id.* at 580.

45. *Id.* at 591 (citing *United States v. Downing*, 753 F.2d 1224, 1242 (3d Cir. 1985)).

46. Sometimes fit may be understood to refer to the relationship between the general question asked by a line of research and the question in the case. Judge Becker provides an example: “[A]nimal studies may be methodologically acceptable to show that chemical X increases the risk of cancer in animals, but they may not be methodologically acceptable to show that chemical X increases the risk of cancer in humans.” *In re Paoli*, 35 F.3d 717, 743 (3d Cir. 1994).

Courts may also find a lack of fit when the studies presented by the expert simply fail to support the expert’s position. Using the “fit” requirement in this way causes courts to move closer to excluding an expert’s testimony because of the expert’s conclusion. This is something the Supreme Court in *Daubert* specifically cautioned against when it said that the focus of the 702 validity inquiry “must be solely on principles and methodology, not on the conclusions that they generate.” *Daubert*, 509 U.S. at 595.

Most appellate courts downplayed the Supreme Court’s methodology-conclusion distinction. For example, in an important *Paoli* opinion following *Daubert*, Judge Becker himself said that “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*.” *Paoli*, 35 F.3d at 746.

In *General Electric v. Joiner*, 522 U.S. 136 (1997), the Supreme Court ratified Judge Becker’s view: [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

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 was possible under *Frye*, it is also true that this very flexibility makes *Daubert* a more uncertain test that may produce inconsistent admissibility rulings.<sup>47</sup> Moreover, the test depends on a minimum level of judicial competence. Judges who are not able to make an independent assessment of the reliability of proffered testimony are likely either to return to a *Frye*-like standard or to admit the testimony with the thought that the jury can make up its own mind.<sup>48</sup> For better or worse, however, the federal courts are fully committed to *Daubert* and most state courts seem to be following in their wake.<sup>49</sup>

At bottom, the *Daubert* revolution is about the relationship between judges and experts, and 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.<sup>50</sup> The judge should determine whether the proffered evidence is reliable by examining the reasoning and methodology underlying the expert's testimony.<sup>51</sup> As Michael Saks recently noted, "perhaps the purpose of the 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>52</sup>

1. *Daubert and Non-scientific Testimony.* In footnote eight of the *Daubert* opinion, the Court expressly limited its holding to scientific evidence.<sup>53</sup> It noted that Rule 702 applies to "technical or other specialized knowledge" as well but added that its "discussion [was] limited to the scientific context because that [was] the nature of the expertise offered" in the case.<sup>54</sup> In addition, the opinion made clear that the four reliability factors—testability, error rate, peer review

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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.

*Id.* at 146.

47. In *General Electric v. Joiner* and *Kumho Tire Co. v. Carmichael*, the Supreme Court emphasized that appellate courts should apply an abuse of discretion standard when reviewing trial court admissibility decisions. This standard makes it theoretically possible for appellate courts to affirm two trial courts that arrive at opposite admissibility decisions with respect to the same testimony. See *General Elec.*, 522 U.S. at 141; *Kumho Tire*, 526 U.S. at 142. It is too soon to know whether this will become a significant problem.

48. See JOSEPH SANDERS, *BENEDICTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION* 122 (1998).

49. See Heather G. Hamilton, *The Movement From Frye to Daubert: Where Do the States Stand?*, 38 *JURIMETRICS J.* 201 (1998).

50. See Michael J. Saks, *Merlin and Solomon: Lessons from the Law's Formative Encounters with Forensic Identification Science*, 49 *HASTINGS L. J.* 1069, 1139 (1998).

51. 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. See *Daubert*, 509 U.S. at 592-93.

52. Saks, *supra* note 50, at 1139.

53. See *Daubert*, 509 U.S. at 590 n.8.

54. *Id.*

and publication, and general acceptance—are not exclusive.<sup>55</sup> These passages present 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?

Many, perhaps most, courts concluded that *Daubert* applied to non-scientific testimony, but often courts could not agree about the proper role of the *Daubert* factors. *Moore v. Ashland Chemical, Inc.*<sup>56</sup> provides an instructive example. In *Moore*, the appellant was forced to clean up a spill of solvents inside the back of a truck.<sup>57</sup> The trial judge excluded the causation testimony of one of the plaintiff's experts, a specialist in pulmonary, environmental, and internal medicine, that the one-hour exposure caused the plaintiff to suffer from reactive airways dysfunction syndrome (“RADS”).<sup>58</sup> The trial court excluded his testimony on Rule 702 grounds.<sup>59</sup> The plaintiff appealed, and a panel of the Fifth Circuit reversed, ruling that the exclusion was in error.<sup>60</sup> It held that while *Daubert* applied to all expert evidence, the *Daubert* factors are “hard” science methods or techniques that should apply only to experts who profess to base their testimony on “hard” science knowledge.<sup>61</sup> These criteria should not be used to judge the admissibility of a clinical physician's expert testimony.<sup>62</sup> Rather, that testimony should be judged by the principles and methodology of the field of clinical medicine.<sup>63</sup> After an en banc review, the full circuit reversed and reinstated the judgment for the defendant.<sup>64</sup> The en banc opinion turned primarily on a “fit” analysis; however, the opinion does support the use of *Daubert* factors when assessing the admissibility of clinical medical testimony.<sup>65</sup>

The role of the *Daubert* factors has arisen in other areas as well. This occurs most frequently when the expert's testimony is said to rest on her “experience.” Two groups of cases stand out in this regard: those dealing with forensic testimony in the criminal context and those dealing with products liability design defect testimony.

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55. *See id.* at 593-94 n.12.

56. 126 F.3d 679 (5th Cir. 1997), *vacated en banc*, 151 F.3d 269 (5th Cir. 1998).

57. *See id.* at 683.

58. *See id.*

59. *See id.* at 699.

60. The appeal followed a trial on the merits. The case went to trial because the trial court allowed the plaintiff's treating physician to testify on causation. This was a strange pair of rulings because, as the appellate court notes, most of the testimony of the treating physician was based on the tests and assessment of the excluded witness. The jury returned a verdict for the defendant, the plaintiff appealed, and the Fifth Circuit reversed and remanded. This determination resulted in an order granting a rehearing en banc. *See id.* at 716.

61. *See id.* at 682.

62. *See id.* at 701.

63. *See id.*

64. *See Moore v. Ashland Chem., Inc.*, 151 F.3d 269, 279 (5th Cir. 1998).

65. *See id.*



2. *Forensic Evidence. United States v. Starzecpyzel*,<sup>66</sup> one of the first post-*Daubert* forensic evidence cases, rejected a handwriting identification expert's claim to scientific status.<sup>67</sup> Handwriting experts are not practicing science within the meaning of *Daubert* because they do not test their theories, and their findings have unknown error rates.<sup>68</sup> Because handwriting experts are not scientists, *Daubert's* reliability criteria do not apply.<sup>69</sup> Judge McKenna drew an analogy not unlike the beekeeper example.<sup>70</sup> A handwriting expert is like a harbor pilot who learns to do something dependably by experience.<sup>71</sup> He concluded, based on little more than "simple logic," that forgery detection can be performed with sufficient reliability to be admissible.<sup>72</sup> He did, however, craft an instruction to be given in advance of the expert's taking the stand explaining that the testimony was not the result of a scientific process.<sup>73</sup>

The *Starzecpyzel* approach was followed in *United States v. Jones*.<sup>74</sup> Although the Sixth Circuit agreed with Judge McKenna that handwriting experts are not practicing science, it affirmed a trial judge's decision to admit handwriting testimony, in part by arguing that the expert's past experience as a witness was evidence that his testimony was reliable.<sup>75</sup>

3. *Products Liability. Compton v. Subaru of America, Inc.*<sup>76</sup> is one of several post-*Daubert* opinions holding that the *Daubert* factors are inapplicable in a products liability design defect context where expert testimony is based solely upon experience.<sup>77</sup> In *Compton*, the plaintiff's expert testified that the defendant's roof design was defective because it permitted excessive roof crush.<sup>78</sup> The trial court was uncertain as to whether *Daubert* applied.<sup>79</sup> The Tenth Circuit was not: "The language in *Daubert* makes clear the factors outlined by the Court are applicable only when a proffered expert relies on some principle or methodology. In other words, application of the *Daubert* factors is unwarranted in cases where expert testimony is based solely upon experience or training."<sup>80</sup> The *Compton* court agreed that Rule 702 requires the

66. 880 F. Supp. 1027 (S.D.N.Y. 1995); see also *United States v. Velasquez*, 64 F.3d 844 (3d Cir. 1995).

67. "Were the court to apply *Daubert* to the proffered FDE [forensic document examiner] testimony, it would have to be excluded." See *Starzecpyzel*, 880 F. Supp. at 1036.

68. See *id.* at 1038.

69. See *id.*

70. See *id.* at 1029.

71. See *id.*

72. See *id.* at 1046.

73. See *id.* at 1050-51.

74. 107 F.3d 1147 (6th Cir. 1997).

75. See *id.* at 1160. In the aftermath of *Kumho*, however, at least one federal district court has refused to allow the government's handwriting expert to testify that the defendant was the author of a note used in a bank robbery. See *United States v. Hines*, 55 F. Supp. 2d 62 (D. Mass. 1999).

76. 82 F.3d 1513 (10th Cir. 1996).

77. See *id.* at 1518-19.

78. See *id.* at 1516.

79. See *id.* at 1517.

80. *Id.* at 1518.

trial court to make a preliminary finding that proffered testimony is both relevant and reliable,<sup>81</sup> but the Rule offers no guidelines as to how lower courts should go about this task in cases where expert testimony is based on experience.

Although not all courts agreed that *Daubert* was inapplicable to experience testimony,<sup>82</sup> *Compton* was not an anomaly.<sup>83</sup> The Supreme Court finally intervened in this debate in *Kumho Tire Co. v. Carmichael*.<sup>84</sup>

### C. *Kumho Tire v. Carmichael*

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.<sup>85</sup> After the accident, the plaintiffs' expert examined the tire and concluded that the failure was not the result of any abuse.<sup>86</sup> Therefore, he concluded that the failure was caused by a defect in either the tire's design or its manufacture.<sup>87</sup> 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.<sup>88</sup> Carlson did not personally examine the tire prior to rendering his opinion and inspected the tire for the first time approximately one hour prior to his deposi-

81. *See id.* at 1519. In *Talkington v. Atria Reclamelucifers Fabrieken BV*, 152 F.3d 254, 265-66 (4th Cir. 1998), the Fourth Circuit appears to have taken the unusual position that qualifications and relevance, but not reliability, are prerequisites for non-science testimony.

82. For example, the Fifth Circuit concluded that the *Daubert* factors do apply:

We agree for the reasons stated by the Seventh and Eighth Circuits that the Daubert analysis applies to the type of expert testimony presented by Williams. Not every guidepost outlined in *Daubert* will necessarily apply to expert testimony based on engineering principles and practical experience, but the district court's "preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue" is no less important . . . . [T]he nonexclusive list of factors relevant under *Daubert* to assessing scientific methodology—testing, peer review, and "general acceptance"—are also relevant to assessing other types of expert evidence. Whether the expert would opine on economic valuation, advertising psychology, or engineering, application of the *Daubert* factors is germane to evaluating whether the expert is a hired gun or a person whose opinion in the courtroom will withstand the same scrutiny that it would among his professional peers . . . . Further, it seems exactly backwards that experts who purport to rely on general engineering principles and practical experience might escape screening by the district court simply by stating that their conclusions were not reached by any particular method or technique. The moral of this approach would be, the less factual support for an expert's opinion, the better.

*Watkins v. Telsmith, Inc.*, 121 F.3d 984, 990-91 (5th Cir. 1997) (citations and footnotes omitted); *see also Peitzmeier v. Hennessy Indus.*, 97 F.3d 293, 297 (8th Cir. 1996).

83. *See McKendall v. Crown Control Corp.*, 122 F.3d 803, 806 (9th Cir. 1997); *Talkington*, 152 F.3d at 254.

84. 526 U.S. 137 (1999). Between *Daubert* and *Kumho*, the Supreme Court decided *General Electric Co. v. Joiner*, 522 U.S. 136 (1997). In *Joiner*, the Court concluded that trial court 702 rulings should be reviewed under an abuse of discretion standard. *See id.*

85. *See Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433, 1433 (11th Cir. 1997).

86. *See id.*

87. *See id.*

88. *See id.*

tion by the defendant.<sup>89</sup> The defendant moved to exclude Carlson's testimony because it could not satisfy *Daubert*.<sup>90</sup> The trial judge agreed and found that "none of the four admissibility criteria outlined by the *Daubert* court [were] satisfied in this case."<sup>91</sup> Because the expert testimony was the plaintiff's only evidence of defect, the district judge then granted the defendant summary judgment.<sup>92</sup> Plaintiff appealed, arguing that the district court should not have applied *Daubert's* reliability framework because Carlson was not a "scientific" expert.<sup>93</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>94</sup> In an opinion that echoes and relies upon *Compton*, the court concluded that *Daubert* applies only to scientific testimony, that Carlson's testimony was non-scientific, and that the district court therefore erred as a matter of law in applying the *Daubert* criteria.<sup>95</sup>

How did the court determine Carlson was not a scientific expert? Apparently, it allowed him to self-define his status and, based on this self-definition, compared him to *Berry's* beekeeper.<sup>96</sup> Self-definition would have little consequence if the court invoked equally stringent admissibility criteria regardless of whether the expertise is science or experience based. The Eleventh Circuit declared itself prepared to affirm a well-reasoned trial court decision to exclude Carlson's testimony on reliability grounds if, upon remand, the trial court did so without invoking the *Daubert* criteria.<sup>97</sup> However, in another part of the opinion the appellate court noted that

the question in this case is whether Carlson's testimony is based on his application of scientific principles or theories (which we should submit to a *Daubert* analysis) or on his utilization of personal experience and skill with failed tires (which we would usually expect a district court to allow a jury to evaluate).<sup>98</sup>

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89. *See id.*

90. *See id.*

91. *Carmichael v. Samyang Tire, Inc.*, 923 F. Supp. 1514, 1521 (S.D. Ala. 1996).

92. *See id.* at 1524.

93. *See Carmichael*, 131 F.3d at 1435.

94. *See id.* at 1435.

95. *See id.* at 1435-36.

96. The Eleventh Circuit stated:

Although Samyang is no doubt correct that the laws of physics and chemistry are implicated in the failure of the Carmichaels' tire, Carlson makes no pretense of basing his opinion on any scientific theory of physics or chemistry. Instead, Carlson rests his opinion on his experience in analyzing failed tires. After years of looking at the mangled carcasses of blown-out tires, Carlson claims that he can identify telltale markings revealing whether a tire failed because of abuse or defect. Like a beekeeper who claims to have learned through years of observation that his charges always take flight into the wind, Carlson maintains that his experiences in analyzing tires have taught him what "bead grooves" and "sidewall deterioration" indicate as to the cause of a tire's failure.

*Id.* at 1436 (footnotes omitted).

97. *See id.* at 1436 n.9.

98. *Id.* at 1436.

This discussion suggests a more lenient admissibility standard for non-scientific experts.

The trial court never got a second chance. The Supreme Court granted certiorari, reversed the Eleventh Circuit, and held that excluding Carlson's testimony was not an abuse of discretion.<sup>99</sup> The Court provided four reasons why *Daubert's* general reliability requirement applies to all expert testimony.<sup>100</sup> First, the language of Rule 702 makes no relevant distinction between "scientific" knowledge and "technical" or "other specialized" knowledge.<sup>101</sup> Second, although the *Daubert* opinion did restrict itself to "scientific" knowledge, that was only because the issue presented in the case involved scientific expertise.<sup>102</sup> Third, the evidentiary rationale that underlies the gatekeeping requirement is that Rules 702 and 703 give wide latitude to all experts to offer their opinion, latitude that is unavailable to other witnesses.<sup>103</sup> This latitude is premised on the "assumption that the expert's opinion will have a reliable basis in the knowledge and experience of his discipline."<sup>104</sup> Because the Rules grant this latitude to all experts, all must meet the reliability standard.<sup>105</sup> Fourth, a rule that distinguishes between scientific experts and other experts would be very difficult, if not impossible, to administer.<sup>106</sup> No clear line divides one from the other.<sup>107</sup> *Kumho* itself provides a case in point: Based on the notion that engineering testimony rests on scientific foundations, several amicus briefs from engineers and engineering groups argued that engineering is science or is sufficiently science-like that the *Daubert* factors should apply.<sup>108</sup>

The Court adopted a more flexible position:

We also conclude that a trial court may consider one or more of the more specific factors that *Daubert* mentioned when doing so will help determine that testimony's reliability. But, as the Court stated in *Daubert*, the test of reliability is "flexible," and *Daubert's* list of specific factors neither necessarily nor exclusively applies to all experts or in every case. Rather, the law grants a district court the same broad latitude

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99. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (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. See *id.* at 159 (Stevens, J., concurring in part and dissenting in part). In *Wisgram v. Marley Co.*, 528 U.S. 440 (2000), the district court entered a judgment on a jury verdict for plaintiff and denied defendant's motion for a judgment as a matter of law or a new trial. The Eighth Circuit vacated and directed entry of judgment as a matter of law for the manufacturer after concluding the trial court had erred in admitting expert testimony. See *id.* at 445. The plaintiff appealed, arguing the appellate court abused its discretion when it failed to remand the case to the trial court. See *id.* The Supreme Court held that this was not an abuse of discretion and that appellate courts may direct entry of judgment as a matter of law upon determining that after the exclusion, there is no longer sufficient evidence to sustain the verdict. See *id.*

100. See *Kumho*, 526 U.S. at 147-49.

101. *Id.* at 147.

102. See *id.* at 147-48.

103. See *id.* at 148.

104. *Id.* (quoting *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 592 (1993)).

105. See *id.*

106. See *id.*

107. See *id.*

108. See *id.*

when it decides how to determine reliability as it enjoys in respect to its ultimate reliability determination.<sup>109</sup>

Justice Breyer noted that all four of the *Daubert* factors do not necessarily apply even in situations where the reliability of scientific evidence is at issue.<sup>110</sup> A claim may never have been exposed to peer review because the particular issue may never have interested anyone. It would be a mistake, however, to read *Kumho* to say that the trial court may simply ignore the *Daubert* factors in non-science 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>111</sup> In a concurring opinion, Justice Scalia, joined by Justices 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.<sup>112</sup> “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>113</sup> A trial court that fails to justify its decision not to use *Daubert* factors risks reversal.<sup>114</sup>

As it did in its earlier opinion in *General Electric Co. v. Joiner*,<sup>115</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>116</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.<sup>117</sup> Rather, the specific issue was whether this particular tire was defective, as well as the reliability of Carlson’s methods.<sup>118</sup>

Carlson’s theory was that if the vehicle had been overloaded or the tire under-inflated, it would have led to a phenomenon called “overdeflection.”<sup>119</sup> Overdeflection can cause the tire to overheat, which, in turn, can undo the bond that holds the tire tread to the carcass.<sup>120</sup> Carlson described four indicia of over-

109. *Id.* at 141-42.

110. *See id.* at 149-50.

111. *Id.* at 152.

112. *See id.* at 158-59 (Scalia, J., concurring).

113. *Id.* at 159.

114. *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. 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.”).

115. 522 U.S. 136 (1997).

116. *See Kumho*, 526 U.S. at 154. 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,” whether a given cause can ever produce a given effect, from “specific causation,” which asks, did that cause this effect in this particular case? Here, as in toxic tort 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.

117. *See id.* at 153-54.

118. *See id.* at 153.

119. *Id.* at 144.

120. *See id.*

deflection and adopted the rule that if a tire exhibited two of the four, he would say it had been abused.<sup>121</sup> He conceded that the tire exhibited some of these indicia, but he testified that the symptoms were not significant enough to conclude that the tire had been abused.<sup>122</sup>

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.<sup>123</sup> Carlson concluded that there was greater wear on the shoulders, but he also concluded that it was not evenly distributed on both shoulders.<sup>124</sup> Rather, the wear appeared primarily on one shoulder, whereas an overdeflected tire would show equal abnormal wear on both.<sup>125</sup> Therefore, this wear was not evidence of overdeflection.<sup>126</sup>

In another part of his testimony, Carlson was asked how many miles the tire had traveled prior to the accident.<sup>127</sup> 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>128</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 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>129</sup>

Although the Supreme Court did not specifically tie this analysis to a *Daubert* factor, the reference to subjectivity suggests that the Court was questioning the falsifiability of Carlson's theory. The Court also noted that lack of general acceptance of his specific test, as well as of his decision rule that a tire has not been abused unless it exhibits two of his four overdeflection symptoms; moreo-

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121. 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.

*Id.* at 144.

122. *See id.* at 145.

123. *See id.*

124. *See id.*

125. *See id.*

126. *See id.*

127. *See id.* at 154-55.

128. *Id.* at 155.

129. *Id.*

ver, the Court found no general acceptance of an expert's ability to make the very fine distinctions made by Carlson.<sup>130</sup>

The Court was less helpful in offering some insight into what factors, in addition to the four *Daubert* factors, the trial court might use to assess reliability. According to the Supreme Court, 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>131</sup> Carlson's testimony did not measure up to this standard.<sup>132</sup>

Useful though it may be as a way of thinking about the admissibility of expert witnesses, the same intellectual rigor test is not a factor similar to the four *Daubert* factors. Rather, it is a conclusion one may draw after examining the proffered testimony. The Supreme Court came to this conclusion about Carlson only after subjecting his testimony to a *Daubert*-like analysis.<sup>133</sup> Ultimately, *Kumho* does not provide additional factors courts might consider when dealing with non-scientific expertise.<sup>134</sup> We are left with the key question: How should we think about admissibility standards for non-scientific evidence? I believe the answer requires that we first explore *Daubert's* implicit understanding of the nature of scientific knowledge and then turn to the question of how scientific knowledge differs from other knowledge, especially knowledge that is said to be based on experience.

### III

#### SCIENTIFIC AND OTHER KNOWLEDGE

##### A. *Daubert's* Implicit Scientific Epistemology

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

130. *See id.* at 157.

131. *Id.* at 152. The "same intellectual rigor" standard first appears in a pair of Seventh Circuit opinions authored by Judge Posner. *See Braun v. Lorillard Inc.*, 84 F.3d 230, 234 (7th Cir. 1996); *Rosen v. Ciba-Geigy Corp.*, 78 F.3d 316, 318 (7th Cir. 1996). Post-*Kumho* appellate opinions have been quick to incorporate this standard into their opinions. *See, e.g., Black v. Food Lion, Inc.*, 171 F.3d 308, 311 (5th Cir. 1999).

132. As the Court noted:

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."

*Kumho*, 526 U.S. at 157 (quoting *General Elec. Co. v. Joiner*, 522 U.S. 136, 146 (1997)).

133. *See id.*

134. For a similar conclusion, see Edward J. Imwinkelried, *Evaluating the Reliability of Nonscientific Expert Testimony: A Partial Answer to the Questions Left Unresolved by Kumho Tire Co. v. Carmichael*, 52 ME. L. REV. 19 (2000).

the scientific enterprise.<sup>135</sup> The fact that some authors claim that *Daubert* comes closer than *Frye* to capturing the essential nature of the scientific enterprise,<sup>136</sup> while others see it as a fundamentally wrong turn,<sup>137</sup> suggests the substantial diversity of opinion concerning the epistemological underpinnings of science.

Most would agree, however, that *Daubert* offers a relatively unsophisticated view of science.<sup>138</sup> The court's admissibility rulings seem to have proceeded in happy obliviousness to the "science wars"<sup>139</sup> that arguably began with Fleck,<sup>140</sup> flourished with Kuhn<sup>141</sup> and Feyerabend,<sup>142</sup> and have raged for much of the last half century between the defenders of a more traditional, positivist view of science and those critics who emphasize its historical, political, social, and rhetorical aspects.<sup>143</sup> There is a sense in which *Daubert* is on both sides of this divide.<sup>144</sup>

135. See Ronald J. Allen, *Expertise and the Daubert Decision*, 84 J. CRIM. L. & CRIMINOLOGY 1157 (1994); M. Neil Browne et al., *The Epistemological Role of Expert Witnesses and Toxic Torts*, 36 AM. BUS. L.J. 1 (1998); Margaret G. Farrell, *Daubert v. Merrell Dow Pharmaceuticals, Inc.: Epistemology and Legal Process*, 15 CARDOZO L. REV. 2183 (1994); Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 TEX. L. REV. 1 (1995); Randolph N. Jonakait, *The Assessment of Expertise: Transcending Construction*, 37 SANTA CLARA L. REV. 301 (1997); Brian Leiter, *The Epistemology of Admissibility: Why Even Good Philosophy of Science Would Not Make For Good Philosophy of Evidence*, 1997 BYU L. REV. 803 (1997); Sean O'Connor, *The Supreme Court's Philosophy of Science: Will the Real Karl Popper Please Stand Up?*, 35 JURIMETRICS J. 263 (1995); 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).

136. See generally Feldman, *supra* note 135.

137. See generally Farrell, *supra* note 135; Schwartz, *supra* note 135.

138. See Farrell, *supra* note 135, at 2185 ("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."); Joseph Sanders, *Scientific Validity, Admissibility, and Mass Torts After Daubert*, 78 MINN. L. REV. 1387 (1994); Schwartz, *supra* note 135.

139. See IAN HACKING, *THE SOCIAL CONSTRUCTION OF WHAT?* (1999) (discussing disagreements between sociology and philosophy of science about the nature of the scientific enterprise); David S. Caudill, *Law & the Science Wars: Introduction to the Forum*, 23 S. ILL. U. L.J. 545 (1999).

140. See LUDWIK FLECK, *GENESIS AND DEVELOPMENT OF A SCIENTIFIC FACT* (Phoenix ed. 1981) (originally published in 1935) (distinguishing between *vadem ecum*—handbook science—and journal science, which is at the cutting edge).

141. See THOMAS KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* (1962) (arguing the scientific change is a revolutionary process).

142. See PAUL K. FEYERABEND, *AGAINST METHOD: OUTLINE OF AN ANARCHISTIC THEORY OF KNOWLEDGE* (1975) (arguing that every method is as good as, and thus as bad as, every other).

143. See INFERENCE, EXPLANATION, AND OTHER PHILOSOPHICAL FRUSTRATIONS: ESSAYS IN THE PHILOSOPHY OF SCIENCE (John Earmon ed., 1992); PHILIP KITCHER, *THE ADVANCEMENT OF SCIENCE: SCIENCE WITHOUT LEGEND, OBJECTIVITY WITHOUT ILLUSIONS* (1993); BRUNO LATOUR, *PANDORA'S HOPE: ESSAYS ON THE REALITY OF SCIENCE STUDIES* (1999); JARRETT LEPIN, *A NOVEL DEFENSE OF SCIENTIFIC REALISM* (1997); *THE PHILOSOPHY OF SCIENCE* (David Papineau ed., 1996); *SCIENCE AS PRACTICE AND CULTURE* (Andrew Pickering ed., 1992); STEVEN SHAPIN, *THE SCIENTIFIC REVOLUTION* (1996).

144. This article is not the place for a lengthy discussion of current issues in the sociology and philosophy of science, and, in any case, I am not the best person for the task. However, a few observations are in order.

For legal purposes, the key issues in the philosophy of science are epistemological, the justification of claims to scientific knowledge. See David Papineau, *Introduction to THE PHILOSOPHY OF SCIENCE* 1-20 (David Papineau ed., 1996). In the first half of the 1900s, the dominant tradition was the logical empiricism of Rudolph Carnap and Carl Hempel. See *id.* at 1. They used the techniques of formal logic and mathematics to formulate theories of scientific explanation. See *id.* In the 1960s, the logic-based approach was challenged by historically-oriented work of people such as Thomas Kuhn, who ar-



The *Frye* test implicitly places its trust in expert communities as neutral, truth-seeking collectives whose opinions are derived by an acceptable process.<sup>145</sup> *Daubert* is a more skeptical test, decided against a background of an emerging belief that courts were experiencing a growth in “junk science.”<sup>146</sup> *Daubert* 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.<sup>147</sup> In this sense, *Daubert* is consistent with a social constructionist view of science.<sup>148</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>149</sup> This criterion is now mentioned so frequently in federal admissibility opinions that it might be thought of as a fifth factor.<sup>150</sup> The “non-judicial uses” test is a judicial acknowledgment that external pressures may bias expert testimony.<sup>151</sup>

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gued that the presuppositions of logical empiricism bore little resemblance to the reality of scientific practice. *See id.* at 2. Papineau notes that “one by-product of this historical turn was that many became skeptical about the possibility of any objective standards of scientific rationality and came to view theory choices as nothing but expressions of social and institutional pressures.” *Id.* at 2. Others, however, are unwilling to conclude that science lacks all rationality.

Much of the current debate concerning the epistemology of science turns on one’s commitment to scientific realism. *See id.* at 2. Papineau takes realism to involve two theses: an *independence thesis* that our judgments answer for their truth to a world that exists independently of our awareness of it, and a *knowledge thesis* that, by and large, we can know which of these judgements are true. *See id.* Idealists reject the first thesis, the notion of some further world beyond the world as we perceive it. *See id.* Most modern critics of the realist tradition in the philosophy and sociology of science are not idealist. *See id.* 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. *See id.* at 4.

One important conclusion to be drawn from this discussion is that holding a social constructionist view of the scientific enterprise, that is that science is embedded in and influenced by the society around it, does not inevitably compel one to accept an anti-realist, skeptical position with respect to the knowledge thesis.

145. *See Saks, supra* note 50.

146. *See 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 AM. 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 et al., *Breast Implants Revisited: Beyond Science on Trial*, 1997 WIS. L. REV. 705.

147. *See Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 592-93 (1993).

148. *See SCIENCE AS PRACTICE AND CULTURE, supra* note 143; SHAPIN, *supra* note 143; *see also* Mark R. Patterson, *Conflicts of Interest in Scientific Expert Testimony*, 40 WM. & MARY L. REV. 1313 (1999).

149. *See Daubert v. Merrell Dow Pharm., Inc.*, 43 F.3d 1311, 1317 (9th Cir. 1995).

150. The advisory committee notes accompanying the proposed revisions to Federal Rule of Evidence 702 lists 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 non-judicial uses test. *See* STAFF OF STANDING COMM. ON THE RULES OF EVIDENCE, 106TH CONG., PROPOSED AMENDMENTS TO FED. RULES OF EVIDENCE 47 (Comm. Print 1999).

151. 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 phar-

If, however, a social constructionist admissibility test is interpreted to mean that the test reflects a belief that scientific conclusions are *solely* the result of social processes within and outside the scientific community, *Daubert* offers anything but such a test. The opinion requires judges to become sufficiently knowledgeable about scientific methods so they can fairly assess the validity of evidence offered at trial. The requirement that scientific testimony must pass methodological muster reflects a positivist approach that is slanted toward a Baconian view of science.<sup>152</sup> The opinion cites with favor a Popperian view of how to distinguish the scientific enterprise from other forms of knowledge.<sup>153</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 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, that science is socially constructed both in the laboratory and in the wider community, but that the construction is constrained by input from the empirical world.<sup>154</sup> It rejects what he calls a relativist-constructionist position that claims nature has little or no influence on the cognitive content of science.<sup>155</sup>

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>156</sup> Nevertheless, in my judgment, given the ordinary ways in which law consumes science, *Daubert*’s implicit epistemology is defensible. Anti-realists appear to be on rather firm ground when they question the truth of any scientific theory because almost all past theories, from Ptolemaic astronomy to Newtonian physics, are now thought to be wrong. Why, therefore, would one have any faith that current

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macology is done at the behest of and with funding from companies that frequently appear as defendants in litigation concerning the products being studied. See Patterson, *supra* note 148, at 1346. Nevertheless, legal and scientific experts alike note the substantial additional pressures placed on an expert who becomes a party witness in an adversarial system. See Mike Redmayne, *Expert Evidence and Scientific Disagreement*, 30 U.C. DAVIS L. REV. 1027, 1071 (1997).

152. See David Faigman et al., *How Good is Good Enough? Expert Evidence under Daubert and Kumho*, 50 CASE W. RES. L. REV. 645, 667 (2000).

153. See KARL R. POPPER, *THE LOGIC OF SCIENTIFIC DISCOVERY* (1968) (arguing that falsifiability is at the heart of the scientific method).

154. See STEPHEN COLE, *MAKING SCIENCE: BETWEEN NATURE AND SOCIETY* at x (1992). For somewhat similar views, see SERGIO SISMONDO, *SCIENCE WITHOUT MYTH: ON CONSTRUCTIONS, REALITY, AND SOCIAL KNOWLEDGE* (1995).

155. See COLE, *supra* note 154, at x.

156. SHEILA JASANOFF, *SCIENCE AT THE BAR: LAW SCIENCE AND TECHNOLOGY IN AMERICA* 63 (1995).

theories are true?<sup>157</sup> At a more prosaic level, however, scientific methods appear to be superior to their alternatives when it comes to predicting mundane matters such as next week's weather or the effect of a chemical on people who are exposed to it.<sup>158</sup> In both the administrative and the courtroom context, law is most frequently interested in acquiring scientific answers to such practical questions of causation (for example, does exposure to airborne asbestos cause lung cancer) and measurement (for example, what is the alcohol level in a driver's blood). Theoretical questions are frequently of secondary interest, useful, if at all, only insofar as they help courts and regulators to choose among conflicting measurements, extrapolations, or causal assertions.

*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 law's epistemology with respect to science holds that there are a set of (social) practices often given the shorthand name "the scientific method" that increase the likelihood that someone will make positive contributions to knowledge; a set of practices to which scientists themselves frequently point as the sources of past scientific success.<sup>159</sup>

#### B. From Scientific Expertise to the Wider World of Expert Knowledge

In the aftermath of *Kumho*, a central question confronting the justices is the applicability of scientific practices to other fields. *Kumho* resisted any temptation to provide a taxonomy of these patterns of knowledge. The opinion is peppered with passages reflecting on the complexity of expert opinion.<sup>160</sup> Be-

157. See THE PHILOSOPHY OF SCIENCE, *supra* note 143, at 10-11.

158. See ALVIN I. GOLDMAN, KNOWLEDGE IN A SOCIAL WORLD 249 (1999); John Worrall, *Structural Realism: The Best of Both Worlds?* in THE PHILOSOPHY OF SCIENCE, *supra* note 143, at 139 (offering a more ambitious defense of what he calls "structural realism").

159. See GOLDMAN, *supra* note 158. 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.

*Id.* at 250-51.

160. Consider, for example, the following three statements:

- (1) "As the Solicitor General points out, there are many different kinds of experts, and many different kinds of expertise." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 150 (1999).
- (2) The conclusion, in our view, is that we can neither rule out, nor rule in, for all cases and for all time the applicability of the factors mentioned in *Daubert*, nor can we now do so for subsets of cases categorized by category of expert or by kind of evidence. Too much depends upon the particular circumstances of the particular case at issue.

cause the *Daubert* factors may or may not be applicable to each situation, it is apparent that there are no bright lines in *Kumho*.

Repeatedly, however, the Court refers to the one difference that was fundamental to the Eleventh Circuit opinion: expert opinion that “relies ‘on the application of scientific principles’” versus expert opinion that relies “‘on skill- or experience-based observation.’”<sup>161</sup> Experience-based opinion testimony arises in numerous contexts, including products liability cases such as *Kumho*, forensic testimony,<sup>162</sup> and clinical medical testimony.<sup>163</sup>

Although courts and commentators have singled out experience-based judgments for special comment, there have been few systematic discussions about the nature of such knowledge and how it differs from knowledge acquired in other ways. In this section, I turn to a body of social-psychology literature that sheds some light on the nature of experience-based judgments and the potential biases that threaten this and other ways of arriving at an expert opinion.<sup>164</sup>

1. *Types of Reasoning.* Over the last decade, Seymour Epstein and his colleagues have written a number of articles discussing their research on the ways individuals process information.<sup>165</sup> This work is part of a larger body of

*Id.*

(3) “We do not believe that Rule 702 creates a schematism that segregates expertise by type while mapping certain kinds of questions to certain kinds of experts. Life and the legal cases that it generates are too complex to warrant so definitive a match.” *Id.* at 151.

161. *Id.* at 146 (quoting *Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433, 1435-36 (1997)).

162. *See United States v. Jones*, 107 F.3d 1147 (6th Cir.), *cert. denied*, 521 U.S. 1127 (1997).

163. *See Moore v. Ashland Chem., Inc.*, 126 F.3d 679 (5th Cir. 1997), *vacated en banc*, 151 F.3d 269 (5th Cir. 1998).

164. My emphasis on the psychological research on how we process information places this part of the article in the tradition of naturalized epistemology. *See Leiter, supra* note 135, at 805. This tradition can be distinguished from a more analytical epistemology, which tends to view epistemological questions in an apsychological way. From this analytical perspective, logic, not psychology, is the proper basis for epistemological discussions. *See Philip Kitcher, The Naturalists Return*, 101 PHIL. REV. 53, 57 (1992). For an epistemological discussion in the naturalist tradition, see ALVIN I. GOLDMAN, *PHILOSOPHICAL APPLICATIONS OF COGNITIVE SCIENCE* (1993).

165. *See* Veronika Denes-Raj & Seymour Epstein, *Conflict Between Intuitive and Rational Processing: When People Behave Against Their Better Judgment*, 66 J. PERSONALITY & SOC. PSYCHOL. 819 (1994); Seymour Epstein, *The Implications of Cognitive-Experiential Self-Theory for Research in Social Psychology and Personality*, 15 J. THEORY SOC. BEHAV. 283 (1985) [hereinafter Epstein, *Implications of CEST*]; Seymour Epstein et al., *Individual Differences in Intuitive-Experiential and Analytical-Rational Thinking Styles*, 71 J. PERSONALITY & SOC. PSYCHOL. 390 (1996) [hereinafter Epstein et al., *Individual Differences*]; Seymour Epstein et al., *Irrational Reactions to Negative Outcomes: Evidence for Two Conceptual Systems*, 62 J. PERSONALITY & SOC. PSYCHOL. 328 (1992) [hereinafter Epstein et al., *Irrational Reactions*]; Seymour Epstein et al., *The Missing Link in the Paradox of the Linda Conjunction Problem: Beyond Knowing and Thinking of the Conjunction Rule, The Intrinsic Appeal of Heuristic Processing*, 25 PERSONALITY & SOC. PSYCHOL. BULL. 204 (1999) [hereinafter Epstein et al., *The Missing Link*]; Lee A. Kirkpatrick & Seymour Epstein, *Cognitive-Experiential Self-Theory and Subjective Probability: Further Evidence for Two Conceptual Systems*, 63 J. PERSONALITY & SOC. PSYCHOL. 534 (1992); Rosemary Pacini & Seymour Epstein, *The Relation of Rational and Experiential Information Processing Styles to Personality, Basic Beliefs, and the Ratio-Bias Phenomenon*, 76 J. PERSONALITY & SOC. PSYCHOL. 972 (1999).

research on Dual Process Theories in social psychology.<sup>166</sup> Epstein's approach, which he calls Cognitive-Experiential Self-Theory ("CEST"),<sup>167</sup> is particularly appropriate in this context because of the insight it may provide about the nature of scientific and experience-based expert opinion.

According to CEST, individuals have two systems for processing information: a rational system and an experiential system.<sup>168</sup> The rational system operates according to an individual's understanding of rules of logic and evidence. An experiential system processes information more simply. It represents events as concrete exemplars rather than abstract symbols, is shaped by emotionally significant past experiences, and is outcome-oriented rather than process-oriented.<sup>169</sup> CEST contrasts the two systems along a number of dimensions.<sup>170</sup> Most fundamentally, experiential processing is more holistic, associative, and concrete, is more crudely differentiated, and is more likely to rely on stereotypes.<sup>171</sup> On the other hand, rational processing is relatively more analytical, logical, and abstract, and it uses more highly differentiated constructs.<sup>172</sup>

Responses to the well-known Linda Conjunction Problem reveal the nature of these differences.<sup>173</sup> The problem is named after a vignette first used by Aaron Tversky and Daniel Kahneman.<sup>174</sup> Linda is described as a thirty-one year-old woman who majored in philosophy in college, where she was actively involved in issues of social justice.<sup>175</sup> In the typical presentation of the vignette, individuals are asked to rank the probability that Linda is a feminist, a bank teller, or a feminist and a bank teller, among other alternatives.<sup>176</sup> In the original

166. For a set of essays on numerous topics in this area, see DUAL-PROCESS THEORIES IN SOCIAL PSYCHOLOGY (Shelly Chaiken & Yaacov Trope eds., 1999) [hereinafter DUAL-PROCESS THEORIES]; see also Serena Chen & Shelly Chaiken, *The Heuristic-systemic Model in its Broader Context*, in DUAL-PROCESS THEORIES, *supra*, at 73-96; Eliot R. Smith & Jamie DeCoster, *Associative and Rule-Based Processing: A Connectionist Interpretation*, in DUAL-PROCESS THEORIES, *supra*, at 323-36.

167. See Epstein, *Implications of CEST*, *supra* note 165.

168. See *id.*

169. See Kirkpatrick & Epstein, *supra* note 165, at 534.

170. For a complete list of comparisons between the experiential and rational systems and the experimental evidence supporting each comparison, see Seymour Epstein & Rosemary Pacini, *Some Basic Issues Regarding Dual-process Theories from the Perspective of Cognitive-Experiential Self-Theory*, in DUAL-PROCESS THEORIES, *supra* note 166, at 466.

171. See *id.* at 463.

172. Other dual-process models make similar distinctions between these two types of reasoning. For examples, S.A. Sloman argues that the "associative" system operates reflectively, using knowledge of similarity relations as well as general knowledge contained in stereotypes. On the other hand, the "rule-based" system describes the world by employing a logical, hierarchical, and causal-mechanical structure. See Steven A. Sloman, *The Empirical Case for Two Systems of Reasoning*, 119 PSYCHOL. BULL. 3, 3-22 (1996). Chaiken makes similar distinctions between "heuristic" and "systematic" processing. See Chen & Chaiken, *supra* note 166, at 73-96.

173. See Aaron Tversky & Daniel Kahneman, *Extensional versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment*, 90 PSYCHOL. REV. 293, 293-315 (1983).

174. See *id.*

175. A full version used recently in an experiment by Epstein et al., reads as follows: "Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations." Epstein et al., *The Missing Link*, *supra* note 165, at 208.

176. See *id.*

study, Tversky and Kahneman report that eight-five percent of the respondents ranked the conjunction (feminist and bank teller) as more probable than the constituent (bank teller).<sup>177</sup>

People who commit the conjunction fallacy seem to engage in a type of holistic reasoning that attends to the context in which the problem is presented.<sup>178</sup> The extraneous personality information about Linda contributes to the overall context in which the problem is viewed.<sup>179</sup> People who do not commit the conjunction fallacy process the information by first separating out the personality information as irrelevant and treating the remainder of the problem as one of statistical probability.<sup>180</sup>

This conjunction fallacy has proven to be remarkably robust.<sup>181</sup> When people are told of the conjunction rule or are given statistical training shortly before presenting the Linda problem as a group they are much less likely to commit the conjunction fallacy. Even under these circumstances, however, many continue to do so. Apparently, the Linda problem discourages rational processing by presenting the facts in a context-specific, concrete representation form.<sup>182</sup> By doing so, it engages respondents' experiential system, which seeks concrete, context-specific solutions rather than abstract, analytical, context-general solutions.<sup>183</sup>

The experiential system frequently integrates concrete, context-specific information in the form of coherent stories. For example, several investigators have commented on the frequency with which subjects spontaneously provide narrative response to the Linda problem.<sup>184</sup> A relatively common narrative response justifying the violation of the conjunction rule is that "Linda is more likely to be a bank teller and a feminist than just a feminist, because she has to make a living."<sup>185</sup>

Not only do experiential and rational systems differ in terms of holism and concreteness, they also differ at an emotional level. People are more likely to engage the experiential system in emotionally charged situations.<sup>186</sup> In addition, when confronted with a problem, they are likely to engage in experiential processing first.<sup>187</sup> For example, in one experiment where individuals were asked to put themselves in the position of a person "who had an accident when backing out his car from a space that his friend had selected, many reported that their first thought was that the accident was the friend's fault, and that they would

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177. See Tversky & Kahneman, *supra* note 173, at 299.

178. See Epstein et al., *The Missing Link*, *supra* note 165, at 204-14.

179. The effect persists for some even when they are instructed to ignore the extraneous information. See *id.* at 212.

180. See *id.*

181. See *id.* at 204-14.

182. See *id.*

183. See *id.*

184. See Epstein & Pacini, *supra* note 170, at 469.

185. *Id.*

186. See *id.* at 472.

187. See *id.*

feel anger toward the friend. Except for him, I wouldn't have had the accident."<sup>188</sup> As they thought about the issue, their thinking became more rational.<sup>189</sup>

As this last example suggests, individuals are capable of both experiential and rational processing. The Linda problem is notorious in part because it is relatively immune to appeals to rational processing. Even here, however, if individuals are asked to approach the problem from a rational perspective, many do so. Other experiments replicate this result.<sup>190</sup>

One type of processing is not inherently better than the other. Each has its place. Experiential processing has the virtue that it is quick, it is available even when people are under an emotional load, and, in some situations, it may well produce better results than can be achieved by rational processing.<sup>191</sup> As any golfer knows, one's swing rarely, if ever, benefits from a rational, detailed analysis of the variables that produce a good golf shot. The same may be said for other types of performance. "You're thinking about it too much" is typical advice to allow experiential processing to have its way.

For other tasks, however, experiential processing can lead to less accurate judgments, as the Linda conjunction problem indicates. In general, experiential processing is prone to a variety of judgment errors.<sup>192</sup> The Linda problem is an

188. *Id.*

189. *See id.*

190. In one group of experiments, the researchers present subjects with pairs of short vignettes and then asked them how they think the protagonist in the vignette would react, how they themselves would react, and how they would respond if they were giving a "strictly logical response." In each pair of vignettes the protagonist experienced identical outcomes. With respect to a number of the vignettes, the key question was how foolish the protagonist (or they) would feel in each situation. Thus, for example, in one study subjects were told the following pair of stories and then asked their opinion about a sense of foolishness:

Mrs. Crane and Mrs. Tees were scheduled to leave the airport at the same time, but on different flights . . . Each of them drove the same distance to the airport, was caught in a traffic jam, and arrived at the airport 30 minutes after the scheduled departure of their flights. Mrs. Crane was told at her gate that her flight left on time. Mrs. Tees was told at her gate that her flight was delayed and had left just three minutes ago. They both had dawdled for ten minutes before leaving home.

Epstein et al., *Irrational Reactions*, *supra* note 165, at 331-32.

When asked how the protagonists would feel, 81% of the respondents said Mrs. Tees would feel more foolish, 13% said Mrs. Crane would feel more foolish, and 6% said they would feel equally foolish. When asked how they would feel, 80% said they would feel more foolish in the Tee's situation, 10% more foolish in the Crane situation, and 10% said they would feel equally foolish in both situations. *See id.* at 332 tbl. 2. However, when the subjects were asked "to give a strictly logical response" and to "decide who actually behaved more foolishly in terms of bringing about the unfortunate event that occurred," *id.* at 332, 25% said Mrs. Tees, 15% said Mrs. Crane, and 63% said there was no difference. *See id.* at 333 tbl. 2.

Epstein explains this effect and similar effects in other vignettes in terms of the associative principle. People giving experiential responses are more likely to be making an associative connection, that is, dawdling is a more significant factor in the near-miss situation. People giving the rational response are more likely to reflect an awareness that the association of dawdling and lateness is no more significant in one situation than the other. *See id.* at 333.

191. *See* Epstein et al., *The Missing Link*, *supra* note 165, at 213.

192. These errors may be thought of as biases. Some biases are intentional, such as those that are the result of fraud or advocacy. Other biases may be thought of as "hot." They are often unintentional.

example of an association error. A more realistic example comes from a study by Gilovich in which newspaper sportswriters were asked to rate the potential of various hypothetical college players to succeed in professional football.<sup>193</sup> If the player was said to have come from the hometown of an established professional player, he was rated much higher than if he grew up in some other town.<sup>194</sup> A similar error which may occur with experiential processing is called confirmation bias.<sup>195</sup> Hypotheses are tested by exclusively or primarily searching for events that occur when the hypothesis says they should occur. For example, to test whether environmental regulations reduce employment rates, one only cites jurisdictions with strict regulations and high unemployment, and perhaps jurisdictions with low unemployment and lax regulations. When this type of bias occurs, a hypothesis is more likely to be confirmed than disconfirmed, regardless of whether it was correct.<sup>196</sup>

2. *Factors Influencing Types of Reasoning.* CEST and most other dual processing theories assume that people apprehend reality by two systems of information processing, experiential and rational, and that the systems operate in parallel and interact.<sup>197</sup> This does not mean, however, that individuals are equally likely to engage both systems to the same extent in all situations. Many factors may affect the tendency to process information one way or the other, including the psychological characteristics of the individual, whether the decision is about a general trend or a specific event, and the normal way information is processed within an area of expertise.

Dual process theories have grown up within the discipline of psychology. As a result, a fair amount of effort has been devoted to studying psychological characteristics and predispositions that may cause one to be more or less likely to engage in experiential or rational processing. For example, Epstein and his colleagues gave a group of subjects two inventory scales.<sup>198</sup> One, called the

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tional, and even unconscious, but they are directionally motivated because the individual expects or wants an outcome to prevail. Still other biases are "cold." They occur even in the absence of a desire for a certain outcome and in spite of a desire to achieve accuracy. See Robert J. MacCoun, *Biases in the Interpretation and Use of Research Results*, 49 ANN. REV. PSYCHOL. 259, 268 (1998). The Linda conjunction problem may often be a "cold" bias.

193. See Thomas Gilovich, *Seeing the Past in the Present: The Effect of Associations to Familiar Events on Judgements and Decisions*, 40 J. PERSONALITY & SOC. PSYCHOL. 797, 798-801 (1981).

194. See *id.* Another bias that is frequently discussed in legal literature is the hindsight bias. In hindsight, we tend to exaggerate the likelihood that we would have been able to predict the event beforehand. Most discussions of this bias have to do with jury decisionmaking. See Reid Hastie et al., *Jury Judgments in Civil Cases: Hindsight Effects on Judgments of Liability for Punitive Damages*, 23 LAW & HUM. BEHAV. 597 (1999); Susan J. LaBine & Gary LaBine, *Determinations of Negligence and the Hindsight Bias*, 20 LAW & HUM. BEHAV. 501 (1996); Kim A. Kamin & Jeffery J. Rachlinski, *Ex Post ≠ Ex Ante: Determining Liability in Hindsight*, 19 LAW & HUM. BEHAV. 89 (1995); see also Carroll v. Otis Elevator Co., 896 F.2d 210 (7th Cir. 1990).

195. See generally Joshua Klayman & Young-Won Ha, *Confirmation, Disconfirmation, and Information in Hypothesis Testing*, 94 PSYCHOL. REV. 211 (1987).

196. See MacCoun, *supra* note 192, at 269. Arguably, the plaintiff's expert's investigation in *Kumho* suffered from this bias. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151 (1999).

197. See Epstein & Pacini, *supra* note 170, at 462.

198. See Epstein et al., *Individual Differences*, *supra* note 165, at 394.



“Need For Cognition” scale, includes items such as “thinking is not my idea of fun,” and “I would prefer complex to simple problems.”<sup>199</sup> The second scale, called “Faith In Intuition,” includes items such as “I believe I can judge character pretty well from a person’s appearance” and “I believe in trusting my hunches.”<sup>200</sup> People who score high on the Need for Cognition scale were more likely to provide rational responses to vignettes such as the one discussed in note 190.<sup>201</sup> Those who scored high on the Faith in Intuition scale were more likely to give heuristic (associational) responses.<sup>202</sup> However, this effect occurred only when the subjects were asked how they would respond if put in the position of the protagonist in the vignette. The effects largely disappeared when they were asked to assess the situation from a logical perspective.<sup>203</sup> Although people with different psychological makeups differ in their initial response to problems, they are also able to vary their approach according to the perspective they are asked to adopt.<sup>204</sup>

It is a commonplace observation that people often respond differently to specific incidents than they do to general situations. For example, people will devote enormous energy to rescue a specific individual or save a specific life, but will devote less energy to rescue or save an abstract life.<sup>205</sup> Or, in a different context, a surgeon may be willing to accept a failure rate of ten percent for a difficult operation and yet feel anger or guilt in the face of a particular failure.<sup>206</sup> Similarly, in a less serious context, a basketball coach might gladly accept a turnover rate of seven per game prior to the season, but when a particular turnover occurs, he may react very negatively.<sup>207</sup> The difference is also reflected in the confidence we have in our judgments. People generally overestimate the correctness of their judgments.<sup>208</sup> However, this phenomenon appears to occur only when people are asked to assess specific judgments. When asked about their ability on a general task, if they err in any direction, they tend to be underconfident.<sup>209</sup>

CEST offers one way of understanding these results. Specific cases are more likely to arouse a response from the heart on the basis of emotion and gut feelings.<sup>210</sup> In this context, individuals are more likely to engage in experiential

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199. *Id.*

200. *Id.*; see also Pacini & Epstein, *supra* note 165, at 976.

201. See Epstein et al., *Individual Differences*, *supra* note 165, at 397.

202. *See id.*

203. *See id.*

204. *See id.*

205. See Steven J. Sherman et al., *Dual-Processing Accounts of Inconsistencies in Responses to General versus Specific Cases*, in *DUAL-PROCESS THEORIES*, *supra* note 165, at 203, 204; see also GUIDO CALABRESI, *IDEALS, BELIEFS, ATTITUDES AND THE LAW: PRIVATE LAW PERSPECTIVE ON A PUBLIC LAW PROBLEM* (1985) (reflecting on this difference).

206. See Sherman, *supra* note 205, at 210.

207. *See id.* at 204-05.

208. *See id.* at 205.

209. *See id.*

210. *See id.* at 221.

processing. Because this type of processing is associative, narrative, and based on stereotypes, it may not fully consider the evidence supporting rival explanations for a situation. Confirmation bias, discussed above, offers a similar explanation for this effect.<sup>211</sup> This overconfidence result is relevant in the context of expert testimony concerning specific events. Doctors expressing an opinion about whether a substance has caused an injury in a particular individual may be overconfident in their differential diagnosis if they have engaged in experiential processing.<sup>212</sup>

Because of the origins of dual process theories, far less research has gone into studying sociological factors that might influence judgments. It would seem that disciplinary cultures would influence the type of processing that occurs. Popperian falsification via the *modus tollens* syllogism: "If p then q; not q; therefore, not p," is one such cultural value.<sup>213</sup> Other disciplines may not have a commitment to such values, and, indeed, may place greater emphasis on intuition, holistic views, and narrative.<sup>214</sup>

Professional training attempts to instill these values in new entrants. There is relatively little information on the success of such efforts. One exception is a study that examined the effects of graduate training in law, medicine, psychology, and chemistry on the ability of students correctly to solve questions involving verbal reasoning, statistical and methodological reasoning, and conditional reasoning.<sup>215</sup> When they entered graduate school, there were no differences between disciplines in reasoning, except for verbal reasoning, where first-year law students did slightly better.<sup>216</sup> At the beginning of the third year, there were interesting differences.<sup>217</sup> All groups improved in their verbal reasoning, and all but the chemistry students improved in their conditional rea-

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211. See Yakov Trope & Ruth Gaunt, *A Dual-Process Model of Overconfident Attributional Inferences*, in DUAL-PROCESS THEORIES, *supra* note 165, at 161 (distinguishing between "diagnostic" and "pseudo-diagnostic" hypothesis evaluation). Diagnostic evaluation is an orderly and systematic method for assessing the validity of a diagnostic hypothesis that takes into account base-rate information, the accuracy of the immediate symptoms or behaviors, and their diagnostic value regarding the causal hypothesis. *See id.* at 163.

212. Clinicians are not unaware of this danger. See, for example, Paul Meehl's valuable discussion of ways of processing information in the context of psychological diagnosis. He poses a key question for all clinicians: "When shall we use our heads instead of the formula?" PAUL E. MEEHL, *PSYCHODIAGNOSIS: SELECTED PAPERS* 81 (1973).

213. See MacCoun, *supra* note 192, at 269.

214. See generally CATHERINE KOHLER RIESSMAN, *NARRATIVE ANALYSIS* (Qualitative Research Methods No. 30, 1993).

215. See Darrin R. Lehman et al., *The Effects of Graduate Training on Reasoning: Formal Discipline and Thinking About Everyday-Life Events*, 49 AM. PSYCHOLOGIST 431 (1988).

216. *See id.* at 437. First-year chemistry students did not do as well, but this could have been attributed, in part, to the low initial GRE scores for many of the students. When the students who dropped out of the program during the first two years were excluded from the analysis, entering scores of chemistry graduate students were similar to the students in other disciplines. *See id.*

217. The researcher employed both a cross-sectional and a longitudinal design. At the time they tested the first-year students, they also tested students beginning their third year. Two years later, they retested the first-year students as they entered their third year. The results of the two analyses were quite similar. *See id.* at 437-38.

soning.<sup>218</sup> Most dramatic, however, were the students' improvements in statistical and methodological reasoning. Here, the medical, and especially the psychology, students did much better than students in law and chemistry.<sup>219</sup> The researchers then related these results to the curricular content of the first two years of each course of study.<sup>220</sup> The variables examined in this study are not identical to those examined in much of the dual process literature, but the results lend support to the idea that disciplines may have some success in training their practitioners to process information in a more rational or a more experiential manner.

Differences also exist in the procedures disciplines establish to assess and control errors. Arguably, peer review, the use of expert panels, replication of prior research findings, and meta-analysis (combining the results of a number of studies into one analysis) are all organizational attempts to impose rational processing on a field. These institutional arrangements do not guarantee correct results,<sup>221</sup> but they establish a standard of practice for a community of individuals. Whether members of the community will abide by the standards depends in part on the autonomy of the expert's community. Communities of professionals with high levels of reputational autonomy proceed self-referentially. The relevant scientific or technical organization is the primary, if not the sole, source of recognition and reputation.<sup>222</sup> Members of such groups may be reluctant to assess data or adopt positions in a way that is contrary to the canons of their field. When the field, in turn, values norms of objective, disinterested, and skeptical examination of data, its members may be less prone to violate these norms in the service of an advocate. On the other hand, when the group is low on reputational autonomy or when the professional norms of the community do not value objectivity and disinterestedness, there may be less incentive for an expert to resist the adversarial role. However, no field is immune from these pressures, and as Patterson notes, "[w]orking scientists can

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218. *See id.* at 438.

219. Law and chemistry student scores improved less than 10%, medical student scores improved somewhere between 20 and 30%, and psychology student scores improved nearly 70%. *See id.*

220. *See id.* at 438-39.

221. Even where there is a commitment to replication, in practice it is very difficult to achieve agreement that a hypothesis has in fact been falsified, and alternative testing strategies have been proposed. *See* MacCoun, *supra* note 192, at 276. Peer review is premised in part on the idea that groups of individuals will make fewer errors than any given individual. Again, however, this is not inevitable. The likelihood that group decisionmaking will correct individual biases depends on such things as the strength of individual bias and the degree to which a normative framework for recognizing and correcting the bias is shared by group members. *See id.* at 279. A set of fascinating articles has explored this and other issues concerning procedures used in the handwriting area. *See* Andre A. Moenssens, *Handwriting Identification Evidence in the Post-Daubert World*, 66 *UMKC L. REV.* 251 (1997); D. Michael Risinger et al., *Brave New "Post-Daubert World"—A Reply to Professor Moenssens*, 29 *SETON HALL L. REV.* 405 (1998); D. Michael Risinger et al., *Exorcism of Ignorance as a Proxy for Rational Knowledge: The Lessons of Handwriting Identification "Expertise"*, 137 *U. PA. L. REV.* 731 (1989); D. Michael Risinger & Michael J. Saks, *Science and Nonscience in the Courts: Daubert Meets Handwriting Identification Expertise*, 82 *IOWA L. REV.* 21 (1996); Saks, *supra* note 50.

222. *See* STEPHAN FUCHS, *THE PROFESSIONAL QUEST FOR THE TRUTH: A SOCIAL THEORY OF SCIENCE AND KNOWLEDGE* 182 (1992).

and do readily identify peers whom they regard as having become advocates, no longer capable of reading evidence in an even-handed way.”<sup>223</sup>

These cautions aside, it seems fair to conclude that disciplines and areas of knowledge are more or less committed to rational processing, and courts are likely to be confronted with experts using both rational and experiential types of problem solving.<sup>224</sup> The beekeeper’s assertion that it is his experience that bees always take off into the wind may be based on some type of experiential reasoning. Likewise, the harbor pilot’s knowledge of the channel may be based on a holistic assessment of the situation based in part on his stereotypes of the harbor’s bottom. Handwriting experts might purport to have similar capabilities—a certain ability to see a larger picture even as they are hard pressed to describe in detail exactly how they came to their judgment.<sup>225</sup> If so, their testimony has similarities with that of the plaintiff’s expert in *Kumho*, who relied on his subjective judgment to determine that the pattern of tire wear he observed was not consistent with overdeflection.

3. *Summary.* Four conclusions should be drawn from this body of research. First, there appears to be a type of reasoning that can fairly be called experiential. Moreover, we can say more about experiential reasoning than that it is based on experience. It is a type of problem solving that is efficient, holistic, based on typical associations, and often is invoked when a decision must be made quickly or when individual judgment is affected by emotion. Often, it provides a fully sufficient understanding of a situation, but sometimes, as in the Linda Conjunction Problem, it results in judgments contrary to those that are reached by what the dual process theorists call rational processing.

Here, I must offer an important caveat. The psychological literature provides a specific meaning to the idea of experiential information processing. I argue that this is one plausible definition of experience-based testimony. Some may disagree. If so, they might argue that experience witnesses somehow process information in a way that is not captured by either rational or experiential processing. This may be so, but if it is, I believe it is incumbent on those who take this view to explain this third way of understanding. Alternatively, they might argue that much experience-based expertise is reached by a process of rational, not experiential, processing. Insofar as this is the case, it supports the

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223. Patterson, *supra* note 148, at 1334 (alteration in original) (quoting Eliot Marshall, *When Does Intellectual Passion Become Conflict of Interest?*, 257 *SCIENCE*, NEW SERIES 620 (1992)); *see also* MARK A. CHESLER ET AL., *SOCIAL SCIENCE IN COURT: MOBILIZING EXPERTS IN THE SCHOOL DESEGREGATION CASES 120-28* (1988) (discussing experts who self-report that they adopted legal-adversarial norms when testifying in school desegregation cases).

224. The post-modern turn in many fields ensures that some experts will believe that a narrative, subjective, contextual understanding is to be preferred to arguments premised on the idea that objective knowledge of the world is possible. *See* *THE INTERPRETIVE TURN: PHILOSOPHY, SCIENCE, CULTURE* (David R. Hiley et al. eds., 1991); *POSTMODERNISM AND THE SOCIAL SCIENCES* (Joe Doherty et al. eds., 1992).

225. *See* Risinger & Saks, *supra* note 221, at 73.

argument presented in Part IV *infra* that courts should adopt admissibility criteria that are premised on rational processing for all types of expertise.

A second conclusion from the preceding discussion is that people are more likely to engage in experiential reasoning when assessing specific instances than when assessing general cases. When they do so, they are likely to be over-confident in their judgments.

Third, areas of expertise seem to differ in their level of commitment to rational processing. Disciplines vary in the way they train new members, in their norms concerning good research, and in the institutionalized procedures they employ to assess each other's work. This does not mean that every expert opinion reflects the norms of the expert's discipline. Both rational and experiential processing are, in a sense, ideal types. No real world expert opinion perfectly exemplifies either. Not infrequently, experts may go against type, with the "scientist" offering an experiential judgment and the "non-scientist" offering a rational judgment.

This leads us to a fourth conclusion: People are not divided into two groups, experiential system processors and rational system processors. Everybody does both, and not only do they do both, they often do both simultaneously, albeit in different proportions. Everyday judgments by ordinary people may employ many of the rational processes we routinely attribute to scientists. On the other hand, people who hold themselves out to be experts sometimes may arrive at professional opinions based in large part on experiential processing. If the above is correct, how should courts respond to expert opinion based on experience? How should they assess the admissibility of pilots and beekeepers and others? These questions are considered in the next Part.

#### IV

##### CHOOSING ADMISSIBILITY CRITERIA

The preceding analysis challenges the commonly held belief that there is a bright line between scientific and non-scientific knowledge, and that disciplines and their experts may be easily pigeonholed into one of these two categories. If this analysis is correct, I believe it helps us to understand why it has been so difficult to list a set of admissibility criteria for non-scientific experts.

Prior to *Daubert*, courts exhibited a laissez-faire attitude toward the reliability of the testimony of non-scientific experts.<sup>226</sup> In the years following *Daubert*, the courts appear to have been less lenient, but there are still no well-defined objective reliability standards for experience testimony. In a very helpful article on admissibility criteria for non-scientific experts written not long after the decision in *Daubert*, Professor Imwinkelried opines that perhaps the rea-

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226. See Edward J. Imwinkelried, *The Next Step After Daubert: Developing a Similarly Epistemological Approach to Ensuring the Reliability of Nonscientific Expert Testimony*, 15 *CARDOZO L. REV.* 2271, 2281 (1994).

son that courts have not formulated such standards is that it cannot be done.<sup>227</sup> I think that this observation is not far from the mark.

In his article, Imwinkelried suggests two broad criteria that might be used to assess such experience testimony: quantitative restrictions and qualitative restrictions.<sup>228</sup> As I read these criteria, however, they are not substantially different from parts of the *Daubert* test. The quantitative restriction would prohibit opinion testimony based on no experience or on very limited experience, that is, based on very few instances where the expert has observed the phenomenon in question.<sup>229</sup> This restriction reflects a concern that experts sometimes fail to understand the law of large numbers.<sup>230</sup> One flip of a coin cannot tell us whether the coin is biased. Watching five bees take off offers little support for the proposition that bees always take off into the wind. In *Daubert* terminology, the issue usually is one of error rate.<sup>231</sup> Although experts who engage in experiential reasoning may be more prone to this threat to reliability, the requirement that one's judgment be based upon a sufficient number of observations should be applicable to scientific and non-scientific judgments alike.

Imwinkelried's qualitative restriction examples involve the question of "fit."<sup>232</sup> Thus, he concludes by noting that "the trial judge should be empowered to exclude nonscientific expert opinion when the underlying experiences are dissimilar" to the question in the case.<sup>233</sup> Again, this concern should apply equally to experiential and scientific expertise.

In another helpful piece written after *Kumho*, Imwinkelried revisited this question.<sup>234</sup> In this article, he proposes two other factors courts might consider when assessing the admissibility of what he calls "nonscientific" expert testimony: (1) proof that the expert's decision making ability is superior to that of lay persons, and (2) proof of extensive third-party reliance.<sup>235</sup>

As an example of an application of the first factor, Imwinkelried cites the trial judge's determination in *United States v. Starzeczyzel*,<sup>236</sup> that questioned document examination does not qualify as "scientific knowledge."<sup>237</sup> Nevertheless, the trial judge permitted the state's experts to testify because of evidence from one study that document examiners might make fewer errors than lay people.<sup>238</sup> Three things are worth noting about this example. First, the criterion used to judge whether the expert is more qualified than a lay person is the *Dau-*

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227. *See id.* at 2283.

228. *See id.* at 2290-94.

229. *See id.* at 2291.

230. *See* HUBERT M. BLALOCK, SOCIAL STATISTICS 138 (1960).

231. *See* Lehman, *supra* note 215, at 435.

232. *See* Imwinkelried, *supra* note 226, at 2293.

233. *Id.* at 2293.

234. Imwinkelried, *supra* note 134.

235. *Id.* at 32-34.

236. 880 F. Supp. 1027 (S.D.N.Y. 1995).

237. *See id.* at 1029.

238. *See id.*; *see also* United States v. Velasquez, 64 F.3d 844 (3d Cir. 1995).

bert criterion of error rate. Second, the evidence required to make this determination is the type used to judge the reliability of scientific evidence: methodologically sound, falsifiable research.<sup>239</sup> Third, there is an implicit premise in *Starzecpyzel* that even if non-scientific testimony should be assessed in terms of error rate and falsifiability, the threshold for admissibility is lower; that is, the error rate may be higher and the research supporting the expert's testimony may be of lesser quality.<sup>240</sup> Whatever pre-*Kumho* support there may have been for this position, it seems to have received little support in subsequent opinions.<sup>241</sup>

The second factor, extensive third-party reliance, is a useful criterion. As Faigman, Porter, and Saks note,<sup>242</sup> in the nineteenth and early twentieth century, almost all experts sold their expertise in a marketplace other than the courtroom, and this marketplace determined whether valid knowledge existed by endowing it with commercial value.<sup>243</sup> One should note, however, that this is a surrogate index of reliability, similar to peer review, publication, and general acceptance. Sole reliance on this factor would constitute a return to a *Frye*-like rule for assessing admissibility.<sup>244</sup> None of the above is meant to be a criticism of Imwinkelried's useful and sensible discussions; rather, it is intended to indicate how difficult it is to articulate objective admissibility criteria that apply uniquely to experience testimony.

The dual process theory research suggests that we are faced with a fundamental choice. We could develop admissibility criteria that actually reflect the reality of experiential system judgments; that is, criteria that would acknowledge their holistic, narrative, associational, and, to some extent, subjective nature.<sup>245</sup> Such judicial decisions would themselves be rather subjective in nature.

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239. Professor Imwinkelried cites such research as the type of information one would wish to have to assess whether the expert's decisionmaking ability is superior to that of a lay person. See Imwinkelried, *supra* note 134, at 33.

240. See *Starzecpyzel*, 880 F. Supp. at 1029.

241. As noted earlier, in the aftermath of *Kumho Tire*, the district court in *United States v. Hines*, 55 F. Supp. 2d 62 (D. Mass. 1999), refused to allow the government's handwriting expert to testify that the defendant was the author of a note used in a bank robbery. See also *United States v. VanWyk*, 83 F. Supp. 2d 515, 523-24 (D.N.J. 2000) (Expert in forensic stylistics could not testify in prosecution for making threatening communications as to identity of unknown writings, due to lack of scientific reliability of forensic stylistics; there was no known rate of error, no recognized standard, no meaningful peer review, and no system of accrediting individual as expert in field.).

242. See Faigman et al., *supra* note 14.

243. See FAIGMAN ET AL., *supra* note 16, at 2-3.

244. I might add that third-party reliance, like general acceptance, is more useful in determining whether a general method is reliable than it is in determining whether a particular application of the method is admissible. As the court in *Kumho* noted, the difficulty with Dr. Carlson's testimony is not that his visual inspection method is generally unreliable. Rather, it is his application of the method in a particular case that is questionable. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151 (1999). The fact that third parties rely on visual inspection to determine the cause of tire failure is of limited assistance in addressing questions of specific causation.

245. These decisions are subjective in the sense that the bases of such judgments are not easily articulated in terms of a clear systematic set of decision rules others could follow to see if they arrive at the same result. In a sense, the very effort to do so begins to move the judgment away from the experiential system and toward more rational processing.

The alternative is to use a set of objective factors that, when examined closely, would be similar for both scientific and experiential evidence and would require experts to present a rational system analysis of the issues in the case. I support the latter course.

A disadvantage of the objective factors alternative is that it is difficult to define a legally acceptable subjective test. *Daubert* and *Kumho* prohibit the most obvious alternatives. For example, they would not permit experiential experts to testify based solely on a showing that they are qualified, that is, that they have experience in the relevant area, be it beekeeping, piloting, or engineering. Likewise, I believe that these cases bar a return to a *Frye*-like test for experiential testimony, for example, that amongst beekeepers it is generally accepted that bumblebees take off into the wind.<sup>246</sup> Even if this were not the case, the *Frye* test itself may prove to be too restrictive. In *Logerquist v. McVey*,<sup>247</sup> the trial court excluded the testimony of experts proffered to testify as to plaintiff's repressed memory that her pediatrician molested her two decades earlier. Arizona has not adopted *Daubert*, and the trial court excluded the testimony on *Frye* grounds.<sup>248</sup> The Arizona Supreme Court reversed:

Opinion testimony on human behavior is admissible when relevant to an issue in the case, when such testimony will aid in understanding evidence outside the experience or knowledge of the average juror, and when the witness is qualified, as Ariz.R.Evid. 702 requires, by "knowledge, skill, experience, training, or education." To put it simply, *Frye* is inapplicable when a qualified witness offers relevant testimony or conclusions based on experience and observation about human behavior for the purpose of explaining that behavior.<sup>249</sup>

It appears Arizona's solution to "experience evidence," at least in those situations where the expert is not providing specific causation evidence,<sup>250</sup> is to retreat from any reliability criteria.

Even were we able to craft acceptable admissibility criteria that reflect the nature of experiential knowledge, I believe that the epistemological needs of the legal system argue for tests that push experts toward rational processing justifications of their position. The next section discusses those epistemological needs.

#### A. Epistemological Needs of the Legal System

Adjective law regulates claims about the world. The rules of evidence and procedure that perform this task are the law's epistemology. They are "the set

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246. On its face, *Kumho* does not prohibit this approach. A trial judge might conclude, for example, that of the four *Daubert* factors, only general acceptance is an appropriate measure of reliability in a given case and that no alternative factors are appropriate. In my opinion, this would rarely be an acceptable resolution after *Kumho*. It is difficult to imagine a situation where the only affirmative thing one could say of proffered testimony is that others in the field are in agreement. When this is the case, the *Kumho* opinion suggests that the testimony is inadmissible. See *Kumho*, 526 U.S. at 151.

247. 1 P.3d 113 (Ariz. 2000).

248. See *id.* at 118.

249. *Id.* at 123.

250. The *Logerquist* court would not permit the expert to express an opinion on the alleged victim's credibility or the truth of allegations of sexual abuse or rape. See *id.*



of rules and institutions that determine what can be believed with sufficient justification for the purposes of the legal system.”<sup>251</sup> The choice of admissibility criteria for expert evidence should attend not only to the nature of the evidence, but also to the epistemological needs of the legal system. As Professor Leiter observes, the answer to the question of how scientists arrive at truth does not necessarily provide an answer to the lawyer’s question of what criteria judges should use in deciding the admissibility of scientific evidence.<sup>252</sup> We should not prefer an approach to assessing reliability simply because “that’s the way scientists do it” or “that’s the way experience witnesses do it.”<sup>253</sup> Admissibility rules do not tell scientists and non-scientists how to proceed. The rules are for the courts.<sup>254</sup> In my opinion, three facts about courts argue for using admissibility rules that push all witnesses toward rational processing: the adversarial nature of U.S. trials, the nature of jury decisionmaking, and the capabilities of trial court judges.<sup>255</sup>

*1. Adversarial Trials.* Admissibility rules are formulated against the backdrop of the adversarial nature of U.S. trials. In inquisitorial systems in countries such as Belgium, France, Germany, and Japan, the judge plays a large role in the production of evidence.<sup>256</sup> Experts are almost always court-appointed and are asked to submit written reports.<sup>257</sup> Parties may be given the opportunity to object to a particular expert, question the expert about the opinion rendered, or hire their own expert to rebut the court-appointed expert; however, the process is relatively non-adversarial.<sup>258</sup> By way of contrast, our system is one in which the parties generally select, prepare, and present experts. Court-appointed experts are rare.<sup>259</sup> Thus it is more likely that experts will come to the stand with “hot biases.”<sup>260</sup> Such biases are not necessarily intentional, but they are directionally motivated.<sup>261</sup> The experts are more likely to want a certain outcome to

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251. See Brewer, *supra* note 15, at 1540-41.

252. See Leiter, *supra* note 135, at 805, 812-13.

253. *Id.* at 813.

254. *See id.*

255. I do not mean to preclude the consideration of other factors. I do, however, believe that these three are crucial. See Joseph Sanders, *Scientifically Complex Cases, Trial by Jury, and the Erosion of Adversarial Processes*, 48 DEPAUL L. REV. 355 (1998).

256. See generally CAROL A.G. JONES, *EXPERT WITNESSES: SCIENCE, MEDICINE, AND THE PRACTICE OF LAW* 51-52 (1994); John Langbein, *The German Advantage in Civil Procedure*, 52 U. CHI. L. REV. 823 (1985).

257. See Jones, *supra* note 256, at 51-52; Langbein, *supra* note 256, at 824.

258. See Langbein, *supra* note 256, at 824.

259. See Joe S. Cecil & Thomas E. Willging, *Court Appointed Experts*, in FEDERAL JUDICIAL CENTER, *REFERENCE MANUAL ON SCIENTIFIC EVIDENCE* 535 (1994).

260. See MacCoun, *supra* note 192, at 268.

261. *See id.*

prevail.<sup>262</sup> Justice Breyer expressed this concern with respect to the plaintiff's expert's testimony in *Kumho*.<sup>263</sup>

These "hot biases" may, in turn, increase the likelihood of "cold biases."<sup>264</sup> Indeed, the two may merge together to form what MacCoun describes as "warm" biases, influenced by motivation as well as by cognition.<sup>265</sup> These biases are difficult to detect in any case, but especially so when the expert offers only a holistic, summary judgment without a detailed discussion of the factors that produce the judgment. The use of objective, rational admissibility criteria increases the likelihood that unreliable opinion will be excluded.<sup>266</sup>

2. *Jury Decisionmaking*. Leiter argues that many admissibility rules are epistemically paternalistic:

Epistemic paternalism substitutes the rulemaker's judgment about what is epistemically best for agents for their own judgment. Assuming that the primary epistemic value is truth, epistemic paternalism entails designing rules of evidence that are epistemically best for jurors, i.e. that lead them to form true beliefs about disputed matters of fact.<sup>267</sup>

Mirjan Damaska argues that this type of paternalism is a noticeable feature of the American law of evidence. One of the unique aspects of U.S. evidence law is its complex web of exclusionary rules, especially those "intrinsic exclusionary rules" that reject probative information on the belief that its exclusion will increase fact-finding accuracy.<sup>268</sup>

262. *See id.*

263. "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." *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 157 (1999) (citing *General Elec. Co. v. Joiner*, 522 U.S. 136, 146).

264. *See MacCoun, supra* note 192, at 268.

265. *See id.*

266. *See, e.g., Hall v. Baxter Healthcare Corp.*, 947 F. Supp. 1387, 1404-05 (D. Or. 1996). Here, the district court ultimately excluded the testimony of an epidemiological expert who, at an initial admissibility hearing, stated that he was not willing to testify, based on the then-existing 16 epidemiological studies, that silicone implants more likely than not could cause systemic autoimmune disease in women. *See id.* at 1404. However, later, with the release of one additional abstract of an unpublished epidemiological study, the expert reported that he was prepared to change his testimony and say that it is more likely than not that implants cause systemic autoimmune disease. *See id.* at 1405. The abstract itself reports that it included only three women with implants and the authors of the abstract reached a different conclusion than the expert. *See id.* The judge's response to this change of position was perhaps predictable. He said in a footnote, "I find this change in so-called 'scientific opinion' not only suspect but shocking, with no scientific basis to support it. This is exactly the type of 'junk science' that the Supreme Court in *Daubert I* commanded courts to exclude." *Id.* at 1405 n.39. It is not my point to argue whether this expert's testimony should be admitted, but only to note that had the expert been asked simply to present a summary opinion about the relationship of silicone implants and autoimmune disease, it would have been much more difficult to assess his potential bias.

267. Leiter, *supra* note 135, at 814.

268. MIRJAN R. DAMASKA, *EVIDENCE LAW ADRIFT* (1997). For a discussion of two such rules, see Samuel R. Gross, *Make-Believe: The Rules Excluding Evidence of Character and Liability Insurance*, 49 *HASTINGS L.J.* 843 (1998). For an experiment on the effect of withholding some types of information on jury decisionmaking, see Shari Seidman Diamond & Jonathan D. Casper, *Blindfolding the Jury to Verdict Consequences: Damages, Experts, and the Civil Jury*, 26 *LAW & SOC'Y REV.* 513 (1992).

The paternalistic nature of Rule 702 has often been a source of criticism. Here, I do not wish to review the arguments for and against this type of paternalism. I note only that this is a well-entrenched part of our law of evidence and that, given this premise, a factor to be considered when choosing admissibility rules is whether they mitigate jury decisionmaking weaknesses. What is the nature of these weaknesses? Two bodies of research give us some insight into this question. First, there is research examining when juries are likely to engage in central or peripheral processing.<sup>269</sup> In central or systematic processing, people examine the content of a communication to assess its validity.<sup>270</sup> Persuasion is primarily a function of the quality of the arguments presented.<sup>271</sup> On the other hand, in peripheral or heuristic processing, people do not attend to the quality and validity of arguments.<sup>272</sup> Rather, they adopt shortcuts to determine the value of a message. People rely on factors such as the number of arguments (rather than their quality), the attractiveness of the communicator, and the communicator's credentials. When confronted with complex cases, jurors are more likely to engage in peripheral or heuristic processing rather than in systematic or central processing.<sup>273</sup>

Second, there is a large body of research on the "story model" of jury decisionmaking. The "story model" argues that jurors try to understand the evidence by constructing a story.<sup>274</sup> Under this model, jury deliberations are best understood as a matching process whereby the jury imposes a narrative story organization on trial evidence and then compares alternative stories to verdict categories.<sup>275</sup> That is, the jury constructs a story and then matches it against a number of possible legal outcomes, such as first degree homicide, manslaughter, self-defense, etc. The tort analogy to the Pennington and Hastie criminal trial is a choice among the following possible outcomes: not responsible, strictly liable for a defective product, negligent, and grossly negligent (liable for punitive damages).<sup>276</sup> As Dan Simon observes, the "story model does not explicate the

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269. See Joel Cooper et al., *Complex Scientific Testimony: How Do Jurors Make Decisions?*, 20 LAW & HUM. BEHAV. 379, 381 (1996).

270. See *id.*

271. See *id.*

272. See *id.*

273. See *id.* at 390.

274. See Reid Hastie, *The Role of "Stories" in Civil Jury Judgments*, 32 U. MICH. J.L. REFORM 227 (1999); Nancy Pennington & Reid Hastie, *A Cognitive Theory of Juror Decision Making: The Story Model*, 13 CARDOZO L. REV. 519 (1991) [hereinafter Pennington & Hastie, *The Story Model*]; Nancy Pennington & Reid Hastie, *Evidence Evaluation in Complex Decision Making*, 51 J. PERSONALITY & SOC. PSYCHOL. 242 (1986); Nancy Pennington & Reid Hastie, *Explaining the Evidence: Tests of the Story Model for Juror Decision Making*, 62 J. PERSONALITY & SOC. PSYCHOL. 189 (1992); see also W. LANCE W. BENNET & MARTHA S. FELDMAN, RECONSTRUCTING REALITY IN THE COURTROOM: JUSTICE AND JUDGMENT IN AMERICAN CULTURE (1981); James Holstein, *Jurors' Interpretations and Jury Decisionmaking*, 9 LAW & HUM. BEHAV. 83 (1985).

275. See Pennington & Hastie, *Explaining the Evidence*, *supra* note 274, at 191; Pennington & Hastie, *The Story Model*, *supra* note 274, at 532.

276. See Hastie, *supra* note 274.

cognitive processes on which it is based, though it is apparent that it is driven by the holistic processes.<sup>277</sup>

Both of these bodies of research suggest that jurors themselves frequently adopt a more experiential type of processing; this may be more likely when the jury is confronted with complex questions.<sup>278</sup> Lawyers' tactics often enhance the probability that information will be processed this way by making emotional appeals.<sup>279</sup> Some of Epstein's research indicates that experiential processing is more prevalent under conditions of higher rather than lower emotional intensity.<sup>280</sup>

This type of common sense reasoning does not necessarily lead to inferior decisions, and in any case, it is difficult to imagine how to prevent jurors from engaging in behaviors such as "story model" reasoning.<sup>281</sup> The task, therefore, is to assist the fact finder as much as possible to arrive at the best possible result. I believe that jurors are more likely to arrive at correct outcomes if the inputs in their analysis are not themselves holistic accounts. If experts are required to offer rational processing justifications for their opinions, examination and cross-examination of experts may focus on the components of the expert argument. If these components are available for the jury to assess, they may be less likely to err in their own judgment. My argument is that experiential system judgments made by juries are less likely to be in error if they are not constructed from the raw material of earlier experiential judgments by experts.<sup>282</sup>

3. *Judicial Competence.* The question of judicial competence has been at the heart of a number of critiques of the movement from *Frye* to *Daubert*. It is said that judges will attempt to evade the gatekeeping task set out by *Daubert*, or that they will do it badly.<sup>283</sup> Leiter generally favors the movement away from the *Frye* test, but he notes that although *Daubert* may offer a "more scientific approach to admissibility," it also threatens to violate the "ought implies can" principle.<sup>284</sup> He is worried that the judiciary is not prepared to perform the reliability gatekeeping role required of them by *Daubert*.<sup>285</sup> Perhaps the point

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277. Dan Simon, *A Psychological Model of Judicial Decision Making*, 30 RUTGERS L.J. 1, 30 (1998). For a similar assessment, see William Twining, *Narrative and Generalizations in Argumentation About Questions of Fact*, 40 S. TEX. L. REV. 351, 355 (1999).

278. See generally Donald C. Langevoort, *Behavioral Theories of Judgment and Decision Making in Legal Scholarship: A Literature Review*, 51 VAND. L. REV. 1499 (1998).

279. See Epstein & Pacini, *supra* note 170, at 470.

280. See *id.*

281. See Norman J. Finkel, *Commonsense Justice, Psychology, and the Law: Prototypes that are Common, Senseful, and Not*, 3 PSYCHOL. PUB. POL'Y & L. 461 (1997).

282. Unfortunately, I am not aware of any empirical work supporting this assertion. However, Twining notes a number of ways in which holistic reasoning can lead to errors. They include sneaking in irrelevant facts; sneaking in invented or ungrounded facts; suggesting facts by innuendo; appealing to hidden prejudices or stereotypes; making use of dubious analogies; and using good stories to push out true stories. See generally Twining, *supra* note 277.

283. See Erica Beecher-Monas, *Blinded by Science: How Judges Avoid the Science in Scientific Evidence*, 71 TEMP. L. REV. 55 (1998).

284. Leiter, *supra* note 135, at 815.

285. See *id.*

has some merit, although there is scant evidence that judges performed their role under *Frye* with any great distinction. Nevertheless, we should be concerned if *Kumho* requires the trial judge to craft a different set of admissibility criteria for each type of expertise.

Here, I have two related concerns. The first is that any dual test will be very difficult to administer. Just as there is no sharp line between scientific experts and other experts, there is no bright line between rational and experiential reasoning. Indeed, the line is even more vague, for it is possible for us to use either type of reasoning for any problem. The second concern is that some members of the judiciary who are already restive under the demands of *Daubert* might use a separate test to sidestep the gatekeeping duty entirely. The Eleventh Circuit's *Carmichael* opinion suggests this possibility by its comment that if Dr. Carlson's testimony were based solely on his personal experience and skill with failed tires, a *Daubert* analysis would rarely be appropriate.<sup>286</sup> Rather, the jury should be permitted to hear and evaluate the testimony.<sup>287</sup>

I believe it would be better to understand *Kumho* as requiring judges to assess non-scientific testimony in, as nearly as possible, the same way that they currently assess scientific testimony. The judicial task will be made more manageable if in both scientific and non-scientific testimony, the courts assess the expert's reasoning from an objective, rational processing perspective with a single test that will lessen the likelihood that a judge will abdicate the gatekeeping role.

#### B. The Contours of the Test

Practically, what does this mean? How should a court proceed with the assessment of admissibility of non-science experts? The short answer is: as similarly to the method by which they assess scientific experts as is practicable. This means that for all types of experts, the court should focus on the first *Daubert* criterion.<sup>288</sup> This criterion has at its core a concern with methodology. It asks the expert to describe objectively the way in which the hypothesis at issue can be tested and how the expert put the hypothesis to the test. No doubt, philosophers of science may object to the possibility of conducting crucial experiments that test grand theories, but in the quotidian questions experts are asked to address in court, what is required is relatively easy to envision. The hypothetical beekeeper in *Berry* offers a good example.

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286. *Carmichael v. Samyang Tire, Inc.*, 131 F.3d 1433, 1436 (11th Cir. 1997).

287. *See id.*

288. *See Black v. Food Lion, Inc.*, 171 F.3d 308, 311-12 (5th Cir. 1999).

*Kumho Tire* thus does not require district courts to reinvent the wheel every time expert testimony is offered in court . . . . In the vast majority of cases, the district court first should decide whether the factors mentioned in *Daubert* are appropriate. 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.

*Id.*

The beekeeper should be permitted to opine about the relationship between wind direction and flight if he provides a rational processing answer to how he knows that bees always take off into the wind. That is, he must describe the variables involved, the way in which he measures each variable, the number of observations upon which he bases his judgment, and the way in which he controls for confounding variables. In practice, this is far less complex than it sounds. Imagine, at one extreme, that the beekeeper says that his opinion is based on years of casual observations of an indeterminate number, and that his view is reasonable because some other flying things, such as airplanes, generally take off into the wind. Such an opinion is experiential in nature. It is holistic (an overall general conclusion), associational (flying things generally take off into the wind), and crudely differentiated (there is no measurement of wind velocity). Imagine, at the other extreme, that he reports that many years ago he thought he had noticed a general tendency for bees to take off into the wind. Thereafter, he went out of his way to see which way the bees took off in many wind conditions. He discovered that in completely calm air or when there was almost no wind the bees took off in every direction, but as soon as the wind picked up to five miles per hour or so they always seemed to take off in that direction. He even once or twice brought a portable fan to his hives to see if the bees took off into the wind no matter from which direction it came.

The example could go on to make our beekeeper more and more of a rational system processor. At some point, the court would simply stop the Federal Rule of Evidence 104A hearing and permit the expert to testify to opinions that fit the case. A similar analysis would be appropriate for Judge McKenna's harbor pilot.<sup>289</sup> If the question posed to the pilot is the location of a harbor channel at any given time, and if harbor channels are anything like channels on the Mississippi, the pilot could do far worse than Mr. Bixby's detailed, rational system-based instruction of Samuel Clemens.<sup>290</sup> Even a casual reading of the first half of *Life on the Mississippi* provides the reader with a detailed description of the variables that affect the location of channels. Mr. Bixby's instruction does not end with a discussion of the variables that affect the river. He also provides the cub pilot with a long list of diagnostic tools one should employ in making a differential diagnosis about the location of a passable channel at any given moment.

Our trust in Mr. Bixby's diagnoses is enhanced because they are tested daily in the commercial marketplace.<sup>291</sup> If his assessments of the location and depth of the river channel suffered from a very high error rate, he would soon find himself in the ranks of former pilots. Several writers have argued that in such cases, we should be more willing to trust experience testimony because the real world confirms or disconfirms the expert's experiential judgment. For example, when discussing Judge McKenna's comparison of handwriting expertise and

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289. See *United States v. Starzecpyzel*, 880 F. Supp. 1027, 1029 (S.D.N.Y. 1995).

290. See MARK TWAIN, *LIFE ON THE MISSISSIPPI* (1917).

291. See Faigman et al., *supra* note 14, at 1804.

harbor pilot expertise,<sup>292</sup> Randolph N. Jonakait notes that “every time the pilot ventures through the harbor he gets instantaneous feedback about his decisions. He navigates successfully or he runs aground. We can have high confidence that he would have learned about mistakes if he committed them.”<sup>293</sup> And Faigman, Porter and Saks note that

unlike harbor pilots, practitioners of many purely forensic expertises, such as handwriting identification, commonly have no way of knowing whether they have come to the right conclusions in their actual cases. They may know if a jury agreed with them, but they usually have no way of checking to see if they were actually right or wrong, and neither does anybody else.<sup>294</sup>

I do not disagree with these observations, but I would add that even when the expert’s judgment has been tested on the job, it is still appropriate for the court to ask the expert to address the question of error rates. Experience in the world is not a substitute for a rational process explanation of how one has reached an expert judgment. Most important, acquiring knowledge through experience does not prevent an expert from providing a rational process foundation for that knowledge.

Some might argue that the knowledge of pilots and beekeepers is different because they cannot provide a full foundation for their testimony. The *Berry* court implied as much in its original beekeeper example: “In other words, the beekeeper does not know any more about flight principles than the jurors, but he has seen a lot more bumblebees than they have.”<sup>295</sup> However, this criticism is not unique to experience experts. For example, the same frequently might be said of epidemiologists. They have well-designed studies that provide expert information as to whether a given substance causes a given injury. But they do not necessarily know any more about how the substance causes the injury than the juror. The epidemiological evidence that thalidomide caused birth defects existed long before anyone had a clear understanding of how or why this occurred.<sup>296</sup> Even were such knowledge available to some other expert, it might not be part of the expertise of an epidemiologist. There are limits to every expert’s knowledge.

A more serious concern is that there are limits to every field of knowledge. I agree that these limits must be taken into consideration when making admissibility decisions. Here, courts must strike a difficult balance. In his article on non-scientific expert testimony, Imwinkelried provides numerous examples of

292. See *Starzeczyzel*, 880 F. Supp. at 1029.

293. Randolph N. Jonakait, *The Assessment of Expertise: Transcending Construction*, 37 SANTA CLARA L. REV. 301, 342 (1997).

294. 2 DAVID L. FAIGMAN ET AL., *MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY* 88 (1997). For a general discussion of the problem of confirming experience-based expertise when the market for the expert’s opinion is almost entirely the courtroom, see Faigman et al., *supra* note 14.

295. *Berry v. City of Detroit*, 25 F.3d 1342, 1350 (6th Cir. 1994).

296. See Max Sherman & Steven Strauss, *Thalidomide: A Twenty-Five Year Perspective*, 41 FOOD DRUG COSM. L.J. 458 (1986).

non-scientific experts, including farmers, carpenters, and trapshooters.<sup>297</sup> These areas of expert knowledge vary from one another and from formal scientific disciplines in terms of the formal methodological apparatus they have established to assist them with the rational processing of information. It would be very inappropriate for a court to demand of a carpenter the same methodological sophistication it would ask of a chemist. Moreover, some questions permit better data than others. Experts who testify as to questions of specific causation, be they doctors testifying as to whether a specific substance caused an illness in this particular plaintiff, or engineers testifying as to the cause of a specific tire failure, typically have less information to work with than experts who testify as to questions of general causation.

As these examples suggest, courts should not establish thresholds that make the best the enemy of the good. The “same intellectual rigor” test in *Kumho* reflects this idea.<sup>298</sup> The Supreme Court clearly felt that the plaintiff’s expert’s performance in that case fell below the standard of his field.<sup>299</sup> Had his “intellectual rigor” been found to be on par with his fellow engineers, his testimony would have been less suspect. In general, the threshold of admissibility in some areas of knowledge will be higher than in others because more developed areas have better measurement instruments, have more sophisticated methods, and are better able to control for a greater variety of confounding variables that threaten the expert’s hypothesis.

Even within fields, courts may raise the admissibility threshold as capabilities advance. For example, prior to the ability to measure the concentration of alcohol in the bloodstream, driving while intoxicated was criminalized without a precise definition of “intoxication.”<sup>300</sup> As techniques to measure blood and breath alcohol content emerged, the very definition of the offense changed to driving with blood or breath alcohol levels exceeding specified minimums.<sup>301</sup> Under such laws, testimony that once may have been adequate—for example, testimony that the defendant looked like he was drunk and had the odor of alcohol on his breath—may no longer be admitted. What is required is some type of chemical, biochemical, or gas chromatographic test, as well as the testimony of someone skilled in its use.<sup>302</sup> The alcohol testing example reflects a desire on the part of the courts to require better evidence as a field matures. Similarly, the same intellectual rigor test reflects a desire to obtain better evidence than

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297. See Imwinkelried, *supra* note 226, at 2278.

298. See *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 153 (1999).

299. See *id.* at 157.

300. See Robert J. Schefter, *Under the Influence of Alcohol Three Hours After Driving*, 100 DICK. L. REV. 441, 444 (1996) (noting that Pennsylvania passed its first DUI statute in 1909, prohibiting operation of a motor vehicle while intoxicated even without a precise definition of intoxication).

301. See *id.*

302. See ANDRE A. MOENSSENS ET AL., SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES 212, 220 (4th ed. 1995).



the expert is offering when that evidence becomes available.<sup>303</sup> Often, the expert could offer a more rational, less experiential analysis but has not done so.

Some situations may exist where the proffered testimony is so unreliable that the party cannot prevail, yet better evidence is not readily available.<sup>304</sup> It may even be that this failure is not because the expert has failed to employ the same intellectual rigor of those in her field. Nevertheless, exclusion may be in order. The same intellectual rigor test may often be a necessary requirement, but it is not sufficient. As is true with the general acceptance test, meeting the intellectual rigor standard does not ensure admissibility. When an expert's testimony is insufficiently rational in the sense I have used the term in this article, it is appropriately inadmissible.

In my judgment, the courts are already moving toward the approach I have outlined here. For example, in *Willert v. Ortho Pharmaceutical Corp.*,<sup>305</sup> plaintiff claimed her autoimmune hemolytic anemia and Guillain-Barre Syndrome were caused by the antimicrobial medication Floxin that she took for bronchitis.<sup>306</sup> Judge Rosenbaum excluded the plaintiff's expert testimony, which was based entirely on anecdotal case reports mentioned in the medical literature and the temporal proximity between the Floxin prescription and the onset of the plaintiff's ailments.<sup>307</sup> With respect to the first of these two bases, the court noted that because case reports simply describe phenomena without comparison to the rate at which they occur in the general population, they do not exclude other causes.<sup>308</sup> The analysis appears to make connections through association rather than logical considerations, an attribute of experiential processing.<sup>309</sup> As to the second basis of the expert's opinion, the court concluded that "[u]ltimately, the theory devolves into the thesis that because 'B' came after 'A,' 'A' caused 'B.'"<sup>310</sup> From the point of view of this paper, the central problem with both bases of the expert opinion is that they appear to be grounded, to a large degree, on experiential processing. *Willert* comes close to making this point directly when it quotes the Eighth Circuit in *Sorensen v. Shaklee Corp.*<sup>311</sup>

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303. See Faigman et al., *supra* note 152.

304. To use a toxic tort example, "structure-activity" evidence can suggest that a substance causes an injury: The substance to which the plaintiff was exposed has a certain chemical structure, and other substances with similar structures are known to cause similar injuries. If we assume that this is the only evidence connecting exposure to injury, most courts would hold that the evidence is insufficient to support a plaintiff's verdict. This should not mean, however, that the court must allow the plaintiff to put on her case and then rule the evidence is insufficient in response to a motion for a directed verdict. The court can properly rule that there is an inadequate fit between this data and an expert's conclusion that the substance causes an injury and that it is not scientifically sound for an expert to rely solely on structure-activity evidence to draw a causal conclusion. The failure to present a better variety of testimony is fatal in this situation, even though better evidence does not currently exist.

305. 995 F. Supp. 979 (D. Minn. 1998).

306. See *id.* at 981.

307. See *id.*

308. See *id.* (quoting *Casey v. Ohio Med. Prods.*, 877 F. Supp. 1380, 1385 (N.D. Cal. 1995)).

309. See Epstein, *supra* note 170, at 470.

310. *Willert*, 995 F. Supp. at 982.

311. 31 F.3d 638, 649 (8th Cir. 1994).

concerning a temporally based theory of causation: “Instead of reasoning from known facts to reach a conclusion, the expert[] . . . reasoned from an end result in order to hypothesize what needed to be known but what was not.”<sup>312</sup> An outcome focus rather than a process focus is another indicator of experiential reasoning.<sup>313</sup>

*Jaurequi v. Carter Manufacturing Co., Inc.*<sup>314</sup> offers another recent example. There, the court said the following of plaintiff’s engineer in a products liability design defect case:

In the case at hand, Willis was prepared to testify that the corn head was unreasonably dangerous because it lacked awareness barriers. However, Willis has not attempted to construct or even draw the suggested device, much less test its utility as a safety device or its compatibility with the corn head’s proper function . . . . We therefore hold that the district court did not abuse its broad discretion in concluding that the proffered testimony regarding the lack of awareness barriers flunked the reliability prong of *Daubert* . . . .<sup>315</sup>

From the perspective of this paper, one could say that what was wrong with the expert’s testimony was that it was too holistic, associational, and subjective.<sup>316</sup> It looked at a single facet of the product and a single outcome without examining the many other variables that may play a role in deciding whether this was a superior alternative feasible design.

The proposed revision to Federal Rule of Evidence 702 supports this course.<sup>317</sup> The Rule declares testimony to be admissible provided that “the testimony is the product of reliable principles and methods.”<sup>318</sup> The epistemological needs of courts, such as the nature of the adversarial process and the limitations of juries and judges, suggest that the methods in question should involve rational processing.

312. *Id.* at 649.

313. See Epstein et al., *Irrational Reactions*, *supra* note 165, at 329.

314. 173 F.3d 1076 (8th Cir. 1999).

315. *Id.* at 1083–84.

316. See *supra* text accompanying note 171.

317. Absent intervention by the Supreme Court or the Congress, the revised rule will read as follows:

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 opinion or otherwise, if (1) the testimony is based on sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.

H.R. Doc. No. 106-225, at 9 (2000) (revision underlined).

The stated purpose of the drafters of the new rule is to have its language reflect the recent Supreme Court decisions on admissibility. See Committee notes (visited on Oct. 1, 2000) <<http://www.uscourts.gov/review.html>>.

318. *Id.*

## V

## CONCLUSION

Courts and commentators have wrestled with how we should assess the admissibility of non-scientific expert evidence. This issue has been brought to the fore by the Supreme Court's 1999 opinion in *Kumho Tire v. Carmichael*. The court held that, to be admissible, both scientific and non-scientific evidence must be reliable. However, the Court provided few guidelines as to how trial courts should go about the business of assessing reliability in non-scientific areas. In part, this is because of the seemingly infinite variety of "technical and other specialized knowledge" contemplated by Federal Rule of Evidence 702.

In this article, I have argued that although there are disciplinary differences in the way experts attempt to know things, there is also great overlap. The "experience based knowledge" of such people as beekeepers and harbor pilots is not per se different from scientific knowledge. Borrowing from a body of psychological literature on how people process information, I argue that the more fundamental distinction is between rational and experiential processing of information.

The courts could attempt to craft admissibility rules that reflect these different ways of knowing something. I believe, however, that this would be a mistake. The law's own epistemological needs argue for a strong preference for rational processing, meaning that *Daubert's* focus on methodology in the area of scientific expertise should be maintained for non-scientific expertise.

I must confess that the precise outlines of the approach to admissibility argued for here are not sharply defined either in this article or in my own mind. It will take some time to understand exactly what this approach means for particular areas of expertise and to recognize whether there remain some pockets of valuable expertise that cannot be placed within this framework. However, I do take solace in the fact that working such things out is the special genius of judge-made law.