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CHOICE AND BOUNDARY PROBLEMS IN LOGERQUIST, HUMMERT, AND KUMHO TIRE

D.H. Kaye*

Two general propositions permeate the law governing the admissibility of testimony from a qualified, scientific expert. First, like all expert testimony, scientific evidence must be relevant and helpful to be admitted into evidence. Second, in contrast to all other expert testimony, scientific evidence must be scrutinized to ensure that it is suitably scientific. The two major forms of this strict scrutiny are the general acceptance requirement, created from whole cloth in 1923 in Frye v. United States,

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and the scientific soundness requirement, stitched together from various phrases in the Federal Rules of Evidence in 1993 in Daubert v. Merrell Dow Pharmaceuticals, Inc.2 The former excludes scientific testimony that rests on methods or techniques that are not shown to be generally accepted in the relevant scientific community. The latter excludes scientific testimony that rests on methods or techniques that are not shown to be valid in that they have not survived testing and scrutiny in the scientific community. Both standards seek an assurance of “evidentiary reliability,” but Daubert requires courts to inquire directly into whether the science in question is sound by examining a constellation of factors, while Frye treats acceptance as a surrogate for soundness.

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1. 293 F. 1013 (D.C. Cir. 1923). It has been said that the general acceptance standard enunciated in Frye “is nothing more than the familiar market test relocated into a different marketplace” and “a minor adaptation of a major theme.” 1 MODERN SCIENTIFIC EVIDENCE: THE LAW AND SCIENCE OF EXPERT TESTIMONY § 1-2.2, at 6 (David L. Faigman et al. eds., 1997) [hereinafter MODERN SCIENTIFIC EVIDENCE]. The major theme is that “the marketplace determined whether valid knowledge existed by endowing it with commercial value.” Id. at 3-4. However, while commercial success in a calling that required special skill or knowledge could (and usually did) qualify a witness as an expert, it is not obvious that courts in earlier centuries viewed commercial acceptance as a sine qua non. Furthermore, looking for acceptance of theories among a professional group is itself an unprecedented shift from any previous focus on the purchasing public. See id. at 6.


3. Id. at 590 n.9; State ex rel. Collins v. Superior Court, 644 P.2d 1266, 1282 (Ariz. 1982) (“Frye... [is] a general test of reliability.”).
Much has been written about the merits, pedigree, and operation of these standards. Each has its strengths and weaknesses, its friends and foes. Selecting one of the standards is the "choice problem" that confronts courts (or legislators) concerned with the admissibility of scientific evidence. For many years, however, attention to the content of the strict scrutiny standard overshadowed an important and logically prior question: When should trial judges, as gatekeepers of evidence, demand general acceptance, scientific soundness, or the like, for expert testimony? This can be called the "boundary problem" for scientific evidence. Within the boundary of "science," the evidence must pass strict scrutiny; outside the boundary, the usual relevance standard applies.

Of late, the difficulty of locating this boundary has engaged the explicit attention of many courts. This article discusses three recent opinions that confront the boundary problem. In Kumho Tire Co., Ltd. v. Carmichael, the United States Supreme Court finessed the issue by holding that all expert testimony is subject to strict scrutiny.


6. Of course, the choice may extend to still other standards. See, e.g., id.; Paul C. Giannelli, Scientific Evidence in Civil and Criminal Cases, 33 Ariz. St. L.J. 103 (2001). Most that have been proposed, however, are variants of these two.

7. Justice Blackmun introduced the metaphor of federal judges as "gatekeepers" into the literature on scientific evidence in Daubert. 509 U.S. at 597. The phrase has become so ubiquitous that there now are references to the "science" of gatekeeping. John M. Conley & David W. Peterson, The Science of Gatekeeping: The Federal Judicial Center's New Reference Manual on Scientific Evidence, 79 N.C. L. Rev. 1183 (1996). However, the phrase has no special meaning. In applying the rules of evidence and procedure to exclude testimony, judges have been gatekeepers both before and after the adoption of evidence codes.

8. E.g., Compton v. Subaru of Am., Inc., 82 F.3d 1513, 1519-20 (10th Cir. 1996) (Daubert not applicable to engineer's expert opinions, based on general principles and experience, on design defect in automobile roof); Iacobelli Constr., Inc. v. County of Monroe, 32 F.3d 19, 25 (2d Cir. 1994) (trial court erred in applying Daubert to expert on construction site conditions, contract documents, and project results); Kuhn v. Sandoz Pharm. Corp., 14 P.3d 1170, 1179 (Kan. 2000) ("differential diagnosis" not subject to Frye); Reese v. Stroh, 907 P.2d 282, 286 (Wash. 1995) (testimony of doctor that protein replacement therapy would have been effective, based on practical experience and acquired knowledge and unsupported by statistically significant clinical or epidemiological studies, should not be analyzed under Daubert); see also D. Michael Risinger & Michael J. Saks, Science and Nonscience in the Courts: Daubert Meets Handwriting Identification Expertise, 82 Iowa L. Rev. 21 (1996); Christopher Slobogin, Psychiatric Evidence in Criminal Trials: To Junk or not to Junk?, 40 WM. & MARY L. Rev. 1 (1998); Teresa S. Renaker, Comment, Evidentiary Legerdemain: Deciding When Daubert Should Apply to Social Science Evidence, 84 Cal. L. Rev. 1657 (1996).

testimony must meet the very general "reliability" standard announced for scientific evidence in *Daubert*, but that not all the factors used to ascertain scientific validity might apply or that they might apply differently to other areas of expertise.\(^\text{10}\) In *Logerquist v. McVey*,\(^\text{11}\) a majority of the Arizona Supreme Court excoriated *Kumho Tire* and *Daubert*, praised (somewhat faintly) *Frye*, yet refused to apply heightened scrutiny to psychiatric testimony about the retrieval of repressed memories of sexual abuse. In insulating the expert's testimony from review under *Frye* or *Daubert*, the Arizona court followed its earlier, even more puzzling decision in *State v. Hummert*.\(^\text{12}\) Like *Logerquist*, *Hummert* pays lip service to *Frye* while ignoring its strictures when they seem too burdensome. In particular, *Hummert* holds that testimony about the frequency of DNA types that ignored the cautions urged by the majority of the scientific community was admissible because it was based on the personal experience of the experts.\(^\text{13}\)

This article criticizes the treatment of the boundary problem in *Logerquist* and *Hummert*. It begins with a description of the United States Supreme Court's approach to the problem in *Kumho Tire*. Part I shows that, contrary to the impression created in the *Logerquist* opinion, *Kumho Tire* distinguishes between scientific and engineering testimony that "rests upon scientific foundations" and other categories of expert testimony that reflect other types of knowledge or skill. As a result, although *Daubert's* emphasis on screening out testimony that has not been subjected to adequate scientific testing and professional scrutiny applies to all such testimony, *Kumho Tire* leaves open the possibility that a lesser showing of adherence to professional or other standards might suffice for testimony from nonscientific witnesses.

Part II turns to the Arizona cases. It briefly describes the mixed history of *Frye* in Arizona and identifies some weaknesses in the *Logerquist* court's arguments for *Frye* over *Daubert*. However, it concludes that the choice problem may be less important than the court maintains.

Part III considers the exception to strict scrutiny that the court invoked to sanction the admissibility of dubious scientific testimony in *Logerquist* and *Hummert*. Despite the sweeping descriptions of the exception given the opinions themselves, I first argue that *Logerquist* should be limited to the use of expert testimony about scientific studies to counter testimony that science rejects (or has not yet accepted) a theory or hypothesis. I then maintain that the exception applied in *Hummert* is best seen as a "private data" exemption

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10. Id. at 149-52.
11. 1 P.3d 113 (Ariz. 2000).
13. Id. at 1195.
from strict scrutiny for simple observations that are readily understood by nonscientists and introduced to help the jury evaluate the significance of other admissible evidence. However, I argue that even this exception is problematic, and I suggest that a better solution to the choice and boundary problems might be to step outside the Frye-Daubert box by adopting a sliding scale that would attend to the use to which the evidence is put and the degree to which it has been shown to be valid and accurate for that use.\textsuperscript{14}

Although the article delves into the Arizona cases, the topics it addresses are of deep and immediate national interest. The issues and arguments roiling in these cases are and will continue to be sources of confusion and controversy across the nation. These cases show that the transition from exclusive reliance on the general acceptance standard to the scientific soundness standard is far from complete. They reveal that the meaning and implications of “applying Daubert” to nonscientific or expert testimony have yet to be fully understood. And the Arizona cases advance an approach that is a variation on what courts in many jurisdictions do when they wish to avoid the confines of Frye or Daubert. Careful analysis of these matters is timely, if not overdue.

\section{Kumho Tire and Daubert}

\textit{Kumho Tire Co. v. Carmichael}\textsuperscript{15} is a product liability case that arose in response to a fatal automobile accident caused by a tire failure.\textsuperscript{16} The district court excluded an engineer's testimony that a manufacturing defect led to a separation between the tire tread and an internal structure known as a steel-belted carcass, causing a blowout. This court applied the standard for scientific evidence described in Daubert to find that the engineer's analysis of his “visual inspection” of the tire lacked a sound “scientific basis.”\textsuperscript{17} However, the Court of Appeals for the Eleventh Circuit reversed the resulting summary judgment on the theory that “‘a Daubert analysis’ applies only where an expert relies ‘on the application of scientific principles,’ rather than ‘on skill- or experience-based observation.’”\textsuperscript{18}

\begin{itemize}
\item \textsuperscript{14} This approach is described more fully in 1 MCCORMICK, supra note 5, \S 203.
\item \textsuperscript{15} 526 U.S. 137 (1999).
\item \textsuperscript{16} For an opinion presaging Kumho Tire, see Diviero v. Uniroyal Goodrich Tire Company, 919 F. Supp. 1353 (D. Ariz. 1996).
\item \textsuperscript{17} \textit{Kumho Tire}, 526 U.S. at 146.
\item \textsuperscript{18} \textit{Id.} (quoting Carmichael v. Samyang Tire, Inc., 131 F.3d 1433, 1435-36 (1997)).
\end{itemize}
In an opinion written by Justice Breyer, the Supreme Court reversed the court of appeals and held that the district court’s exclusion of the engineer’s analysis was not an abuse of discretion.¹⁹ Every Justice agreed that Federal Rule of Evidence 702 means that a witness testifying as an expert must present expert “knowledge.”²⁰ After *Kumho Tire*, Rule 702 was amended to incorporate the gloss placed on it in *Daubert* and *Kumho Tire*. Rather than speculation and that “where such testimony’s factual basis, data, principles, methods, or their application are called sufficiently into question, . . . the trial judge must determine whether the testimony has ‘a reliable basis in the knowledge and experience of [the relevant] discipline.’”²¹ Finally, the Court wrote that in making the determination that the expert was providing specialized knowledge that was sound enough to assist the trier of fact, the trial judge “may consider several more specific factors [enumerated] in *Daubert*, [including]:

—Whether a ‘theory or technique . . . can be (and has been) tested’;
—Whether it ‘has been subjected to peer review and publication’;
—Whether, in respect to a particular technique, there is a high ‘known or potential rate of error’ and whether there are ‘standards controlling the technique’s operation’; and
—Whether the theory or technique enjoys ‘general acceptance’ within a ‘relevant scientific community.’”²²

In short, *Kumho Tire* insists on “a valid . . . connection to the pertinent inquiry as a precondition to admissibility”²³ of all expert testimony, but it discerns no universal solvent for ascertaining the validity of putative expert knowledge.²⁴ Some assurance of validity is required even from “experts in drug terms, handwriting analysis, criminal modus operandi, land valuation,

¹⁹. Only Justice Stevens dissented, and even he joined most of the majority opinion. He would have remanded the case to the court of appeals to decide whether the trial court had abused its discretion under the principles outlined in the majority opinion. *Id.* at 159 (Stevens, J., concurring in part and dissenting in part).

²⁰. *Id.* at 147. The Rule stated that “[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.” *Id.* (quoting FED. R. EVID. 702).

²¹. *Id.* at 149 (quoting Daubert v. Merrell Dow Pharm., 509 U.S. 579, 592 (1992)).

²². *Id.* at 149-50 (quoting *Daubert*, 509 U.S. at 592-94).

²³. *Id.* at 149 (quoting *Daubert*, 509 U.S. at 592).

²⁴. The Court stated that “the trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable. That is to say, a trial court should consider the specific factors identified in *Daubert* where they are reasonable measures of the reliability of expert testimony.” *Id.* at 152.
agricultural practices, railroad procedures, attorney’s fee valuation, and others, but in such situations the details of Daubert may not apply and it is unclear what Kumho Tire does demand. Thus, complaints that Kumho Tire usurs the jury’s function of considering the weight to accord to reasonably probative expert evidence may be exaggerated, and claims that

25. Id. at 150 (citing Brief for United States as Amicus Curiae at 18-19, n.5).
26. Id.
27. The three concurring Justices who also joined the majority opinion cautioned that “[although] . . . 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.” Id. at 158 (Scalia, J., joined by O’Connor, J., and Thomas, J., concurring). But which cases are these? How can we tell whether real expertise exists unless the theories, techniques, and their practitioners have been subject to meaningful testing? It is all well and good to insist “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.” Id. at 152. But what if the field itself lacks “intellectual rigor”? In a tantalizing but undeveloped passage, the Court remarks that “it will at times be useful to ask even of a witness whose expertise is based purely on experience, say, a perfume tester able to distinguish among 140 odors at a sniff, whether his preparation is of a kind that others in the field would recognize as acceptable.” Id. at 151. Should it be enough for the proponent of the testimony of the perfume sniffer to show that this expert did what other perfume testers would do? Or should the proponent also have to demonstrate that the profession can distinguish among 140 odors at a sniff? For discussions of such questions, see Margaret A. Berger, The Supreme Court’s Trilogy on the Admissibility of Expert Testimony, in REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 9 (Federal Judicial Center ed., 2d ed. 2000); 1 MODERN SCIENTIFIC EVIDENCE, supra note 1, § 1.34 (2000 Supp.); D. Michael Risinger, Defining the “Task at Hand”: Non-Science Forensic Science After Kumho Tire Co. v. Carmichael, 57 WASH & LEE L. REV. 767 (2000); Michael J. Saks, The Aftermath of Daubert: An Evolving Jurisprudence of Expert Evidence, 40 JURIMETRICS J. 229 (2000).
28. See Logerquist v. McVey, 1 P.3d 113, 128 (Ariz. 2000) (“[T]he Supreme Court [held] that the existing rule [702] incorporated a reliability screen, authorizing the trial judge to determine reliability (and eventually, in Kumho, essential [sic] credibility) of a qualified expert’s testimony as a prerequisite for the jury’s determination of the same issues.”). Although Logerquist cites a speech by Professor Richard Lempert in this regard, Professor Lempert supports a requirement of validation for many forms of nonscientific expert testimony:

The issue that the court granted certiorari to resolve [in Kumho Tire] was whether trial judges should play the same “gatekeeper” role [described in Daubert] when expert evidence was largely experimentally based, as when it was more traditionally scientific. Here, I think the Court got it right. At least so long as the expert’s field is one requiring technical knowledge of a type that might be validated by science (compare a tire expert with, for example, an expert on fly fishing), the judge’s role should be the same.

Richard O. Lempert, The Jury and Scientific Evidence, 9 KAN. J.L. & PUB. POL’Y 22 (1999). His complaint is that the Kumho Tire Court erred in its application of this principle: [When I first read the trial judge’s decision in Kumho Tire and the Court of Appeals’ decision that reversed the trial judge, I thought that this was a “junk science” case, and it had been correctly decided. But after reading the briefs from both sides, looking for what seemed to be the likely facts, I began to think that the plaintiff’s evidence in Kumho Tire was not “junk science” at all. It turns out that the methods used by the plaintiff’s expert were the same as those used by the defendant’s expert; they just reached different conclusions.}
Kumho Tire applies "the Daubert [rule] . . . to all opinion evidence" may be misleading. When it comes to engineering analysis that "rests upon scientific foundations," however, Kumho Tire strongly suggests that the central considerations articulated in Daubert—the extent to which a theory or technique has been tested and subjected to critical scientific inquiry—are vital. And under Daubert itself, when it comes to the scientific foundations of the testimony of scientists and technicians, these fundamental inquiries cannot be sidestepped.

In Logerquist, however, the Arizona Supreme Court elected to follow neither Daubert nor Kumho in resolving the choice and boundary problems for scientific testimony. The remainder of this article inspects the reasoning offered in support of this result, finds it wanting, and recommends yet a third framework for handling expert scientific testimony.

II. THE CHOICE PROBLEM: LOGERQUIST'S DEFENSE OF FRYE

In Logerquist v. McVey, a woman sued her pediatrician, alleging that decades earlier, he sexually abused her when she was between eight to ten years old. She averred that her memory of the abuse was triggered when she watched a television commercial featuring a pediatrician. She sought to

Id. at 26.  
29. Logerquist, 1 P.3d at 124.  
30. It would be fairer to say that there is no "Daubert rule." Inasmuch as Justice Blackmun's opinion for the Court in Daubert outlines general principles, it is a broad standard rather than a specific rule. See generally Pierre Schlag, Rules and Standards, 33 UCLA L. Rev. 379 (1985) (distinguishing rules from standards); Kathleen M. Sullivan, Foreword: The Justices of Rules and Standards, 106 Harv. L. Rev. 22 (1992) (analyzing constitutional rules and standards). Regardless of nomenclature, Kumho Tire only requires the trial court to "determine whether [questionable expert] testimony has a reliable basis in the knowledge and experience of the relevant discipline." Kumho Tire, 526 U.S. at 149 (internal quotation marks omitted). That in the process the judge "may consider" the illustrative factors for scientific evidence enumerated in Daubert hardly amounts to a radical or extravagant extension of "the Daubert rule." 31. Kumho Tire, 526 U.S. at 150.  
32. The Kumho Tire Court intimates that trial judges should be fairly demanding, as was the district court in Kumho Tire itself. The Court pointedly observes that [S]ome of Daubert's questions can help to evaluate the reliability even of experience-based testimony. In certain cases, it will be appropriate for the trial judge to ask, for example, how often an engineering expert's experience-based methodology has produced erroneous results, or whether such a method is generally accepted in the relevant engineering community.  
Id. at 151.  
33. 1 P.3d 113 (Ariz. 2000).
introduce expert psychiatric testimony that severe childhood trauma, including sexual abuse, can cause a repression of memory, and that in later years this memory can be recalled accurately. At a pretrial hearing, plaintiff produced a clinical psychiatrist who ran a treatment center for patients who “suffer from the psychological effects of trauma” and who “conducted numerous studies on the nature of the human response to trauma, including specifically on memory processes in responses.” He squared off against a research psychologist called by the defendant who “testified there were serious flaws in the many studies supporting repressed memory and cited other studies finding trauma usually enhances memory rather than causes amnesia.”

The research psychologist won this debate. The trial court determined that the “theories advanced by Plaintiff’s experts are not generally accepted in the relevant scientific community of trauma memory researchers” and excluded “expert testimony of Plaintiff’s alleged repressed memory, and Plaintiff’s theory that such evidence can be recalled with accuracy.”

On an interlocutory appeal, the state supreme court vacated the order. Justice Feldman’s majority opinion criticized the United States Supreme Court’s reasoning in Daubert and Kumho Tire, and concluded that even if the only sensible scientific position on the psychological phenomenon that the expert would attest to is “well founded . . . skepticism,” “a witness so well qualified and experienced [must] be permitted to testify on an issue beyond the experience of the average juror.” Nevertheless, much of the majority opinion consists of dicta seeking to justify adhering to Frye rather than switching to Daubert as both parties and two thoughtful dissenting opinions urged.

34. Id. at 117 (quoting letter from Dr. Bessell van der Kolk to plaintiff’s counsel).
35. Id. at 115.
36. Id. For surveys or comments on the research literature, see, for example, American Psychological Association Working Group on Investigation of Memories of Childhood Abuse Preface to the Final Report, 4 PSYCHOL. PUB. POL’Y & L. 931 (1998); Kenneth S. Pope, Pseudoscience, Cross-Examination, and Scientific Evidence in the Recovered Memory Controversy, 4 PSYCHOL. PUB. POL’Y & L. 1160 (1998); Robert Timothy Reagan, Scientific Consensus on Memory Repression and Recovery, 51 RUTGERS L. REV. 275 (1999); Stephen L. Wasby & David C. Brody, Studies of Repressed Memory and the Issue of Legal Validity, 21 LAW & HUM. BEHAV. 687 (1997).
37. Logerquist, 1 P.3d at 115.
38. Id. at 134.
39. Id. at 118.
40. Justice Feldman (formerly the court’s Chief Justice) wrote the majority opinion, which was joined by Chief Justice Zlaket and Vice Chief Justice Jones.
41. Justice Martone skillfully dissected the majority opinion to discover that “there are almost no views or opinions expressed in the majority opinion that I share.” Id. at 140 (Martone, J.,
Even though this portion of the opinion was superfluous to the decision, the issue is likely to recur. This section therefore evaluates the Arizona Supreme Court’s repeated defense of Frye. Part A reviews the history of the Frye standard in the state. Part B examines the reasons offered in Logerquist for retaining Frye.

A. Frye in Arizona: A Brief History of Crime

The opinions of the Arizona Supreme Court invoking Frye call to mind the grammatically offensive advertising campaign depicting men and women with black eyes holding cigarettes and saying, “Us Tareyton smokers would rather fight than switch!” The court did not find Frye attractive enough to mention until 1962. In that year, it “adopted” the general acceptance standard quite casually in State v. Valdez, which determined that in the thirty-nine years following Frye, “the lie-detector . . . has been developed to a state in which its results are probative enough to warrant admissibility upon stipulation.” Inasmuch as the court pointed to no valid scientific studies or papers indicating that the polygraph was capable of detecting deception, this initial experience with Frye was not encouraging.

Nevertheless, the Arizona Supreme Court used Frye sensibly from 1979 to 1984. At this time, the author of the Logerquist opinion became a dissenting). In a penetrating dissent, Justice McGregor agreed “with much of Justice Martone’s dissent,” id. at 140, but wrote separately to deplore “the tendency of the decision to isolate Arizona’s courts from the mainstream of judicial analysis,” id., and to suggest that even if Frye sufficed in the past, a more flexible standard “best responds to the challenges facing courts today.” Id. at 141.

42. 371 P.2d 894, 896-98 (Ariz. 1962).
43. Id. at 900.
44. See KAYE, supra note 4, at 283-84:
The improvement that the Valdez court discerned in polygraphy consisted of a “conservative estimate” derived from experiments that established that “5 percent or less is the margin of error.” 371 P.2d at 900. The accompanying footnote reads: “These statistics are taken from Dean Wicker’s discussion of Inbau’s experiments regarding accuracy of the polygraph. See 22 Tenn. L. Rev. at 713.” Inspection of the Tennessee Law Review article reveals that the sole support for this “conservative estimate” comes from a 1953 article by an attorney describing the remarks in a 1948 book by another attorney who served also as director of a crime laboratory. There is no indication in the article of a single experiment. The 5% figure comes from the director’s impression of “several thousand examinations” covering “a period of sixteen years.” Wicker, The Polygraphic Truth Test and the Law of Evidence, 22 Tenn. L. Rev. 711, 713 (1953).
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staunch defender of the general acceptance standard. In State ex rel. Collins v. Superior Court, police investigating a series of eighteen similar rapes in west Phoenix hypnotized seven witnesses to enhance their recall of the rapist. However, the rapist was located when, wearing a mask and carrying a pistol, he approached an unmarked police car in which a male and female officer in plain clothes were sitting. The trial judge granted defendant's motion to preclude testimony from the seven hypnotized witnesses. On an interlocutory appeal, the supreme court ultimately held that only such testimony that could be demonstrated to be based on memories held prior to hypnosis could be used at trial. Following several earlier opinions, Chief Justice Feldman's supplemental opinion finds a lack of general acceptance of the conclusion that hypnosis accurately enhances recall. In addition, the opinion brazenly insists that "Frye has been in use for almost 60 years without the development of any alternative as a general test of reliability. No such alternative has been seriously suggested in the cases or in the literature, nor does any occur to this court."  

Four years later, in State v. Superior Court, the Chief Justice penned a less impressive opinion for the court announcing that the "horizontal gaze nystagmus test" for intoxication satisfied Frye. In reaching this result, the court defined the "scientific community" to include "highway safety professionals" and undertook its own undiscerning study of the scientific literature.  

memories are accurately improved without undue danger of distortion, delusion or fantasy, we feel that testimony of witnesses which has been tainted by hypnosis should be excluded in criminal cases.\(^46\); Lemieux v. Superior Court, 644 P.2d 1300 (Ariz. 1982) (same result in civil case); Scales v. City Court, 594 P.2d 97 (Ariz. 1979) (preserving breathalyzer sample not generally accepted).  

46. 644 P.2d 1266 (Ariz. 1982).  

47. Id. at 1282. Of course, Frye had played no role in Arizona for the first forty years of the case's lifetime, and the standard had never been used before it sprang from the brow of the federal court of appeals in 1923. Furthermore, there were decades worth of opinions and scholarship proposing alternatives to the general acceptance standard. See, e.g., Symposium, Proposals for a Model Rule on the Admissibility of Scientific Evidence, 26 JURIMETRICS J. 236 (1986); Rules for Admissibility of Scientific Evidence, 115 F.R.D. 79 (1987); Symposium on Science and the Rules of Evidence, 99 F.R.D. 187 (1983); E. Donald Elliot, Toward Incentive-Based Procedure: Three Approaches for Regulating Scientific Evidence, 69 B.U. L. REV. 487 (1989).  

However, the Chief Justice's remarks came in response to McCormick's suggestion that Frye be abandoned in favor of weighing probative value against prejudicial impact. Apparently, he did not consider a sliding scale in which the degree of general acceptance and scientific validity would be weighed against the difficulty of the jury's understanding the nature and limitations of the science and any resulting tendency to overvalue the evidence to constitute a "general test."  


49. Id. at 182.  

50. Id. at 180.  

51. See KAYE, supra note 4, at 84.
However, the use of Frye did not become truly contentious in Arizona until 1993, immediately after the United States Supreme Court in Daubert endorsed a variation of the alternatives to the general acceptance test that had been in use for some time in a number of state and federal jurisdictions. At that point, the Arizona court no longer could deny the existence of an alternative "general test of reliability," and in State v. Bible,52 the Arizona Department of Justice urged the supreme court to abandon Frye in favor of Daubert's more flexible scientific soundness standard. Richard Bible had been convicted of kidnapping, molesting, and murdering a nine-year-old girl in Flagstaff. Part of the mountain of evidence against Bible was the testimony of a scientist from Cellmark Laboratories that DNA in a bloodstain on Bible's shirt matched the girl's DNA and that this DNA profile would be seen in a randomly selected Caucasian with a probability of only one in many millions or billions.53 In a murky opinion by the Chief Justice, the supreme court held that the trial court erred in admitting the probability estimates because the procedures that Cellmark used to arrive at them were "flawed" and "not generally accepted in the relevant scientific community."54 Because the opinion fails to perceive the precise contours of the scientific debate over the population genetics of DNA profiles and misstates the scientific testimony in the trial record, however, the application of Frye is unpersuasive.55 Likewise, the court's defense of Frye is unconvincing. Although the court properly hesitated to decide an issue that had not been fully briefed,56 the Bible opinion also insists that "[t]he field of DNA testing is probably the worst subject to use to decide whether or how to refine, replace, or abolish Frye."57 This was so, the Chief Justice wrote, because (1) DNA identification is a "complex scientific field"; (2) "the technology is still evolving"; (3) the evidence has "[an] aura of infallibility"; (4) "the principles are [not] easily demonstrable in the courtroom"; (5) "the scientists themselves have yet to settle on uniform testing techniques or protocols";

52. 858 P.2d 1152 (Ariz. 1993).
53. Id. at 1185-86.
54. Id. at 1188-89. The court addressed the admissibility of this evidence even though it determined that the evidence did not affect the outcome of the trial. Id. at 1193.
55. See D.H. Kaye, Bible Reading: DNA Evidence in Arizona, 28 ARIZ. ST. L.J. 1035, 1043-57 (1996). In State v. Hummert, 933 P.2d 1187 (Ariz. 1997), the court apparently conceded that the expert testimony in Bible does not support the view—reiterated in State v. Johnson, 922 P.2d 294 (Ariz. 1996)—that the database in Bible was admittedly "flawed." The Hummert court further acknowledged that the opinions in Bible and Johnson may contain other mistakes. 933 P.2d at 1194. "Given the complexity of the science and mathematics," however, the court remained unperturbed. Id. If it was guilty of misapprehending the science and distorting the record in its past opinions, then "so be it," for "those mistakes 'did not affect the results.'" Id. at 1194-95.
56. Bible, 858 P.2d at 1183.
57. Id.
and (6) "the science in this area can have a direct and forceful dispositive effect." 58 Unfortunately, the opinion failed to explain why any one of these facts militated in favor using Frye rather than Daubert to assess the reliability of DNA or any other scientific evidence.

The state pressed the argument for the scientific soundness standard of Daubert again in State v. Johnson. 59 The court curtly rebuffed the proposal but was more accommodating toward DNA evidence under Frye. It held that the "ceiling principle"—a variation on the "basic product rule" deemed inadmissible in Bible—was generally accepted, and hence computations obtained with this method were properly admitted in the trial of an alleged rapist. Superficially, Johnson leaves Bible intact. 60 But the reasons that Johnson gives to think that the "ceiling method" is acceptable actually establish that the basic product rule—and not the ceiling method—provides reasonable probability estimates. 61 However, the Johnson court failed to recognize this because it misread the scientific literature and mischaracterized fundamental concepts of population genetics and statistics. 62

The court's third round in its bout with DNA evidence is State v. Hummert. 63 In this brutal rape case, the court held that testimony that

58. Id.
59. 922 P.2d at 294.
60. The "basic product rule" questioned in Bible was not used in Johnson, and the Johnson court did not endorse it. See id. at 296.
61. See Kaye, supra note 55, at 1059-73.
62. Id. A more convincing opinion would have relied on the scientific work published after Bible to conclude that the assumptions behind the basic product rule had achieved general acceptance for many forensic situations. Id. at 1066, 1068. In State v. Hummert, 933 P.2d 1187 (Ariz. 1997), the court suggested that it did not pursue this approach because the necessary scientific literature then did not exist. In particular, it professed ignorance of a 1996 report of the National Academy of Sciences that concluded that various alternatives (including the basic product rule in many cases) were preferable to the ceiling method. Id. at 1192 (Feldman, J., stating that it was only "[subsequent to the Johnson opinion [that] the NRC updated its 1992 report]."

63. 933 P.2d 1187 (Ariz. 1997). Later cases on DNA testing are State v. Tankersley, 956 P.2d 486 (Ariz. 1998), and State v. Sharp, 973 P.2d 1171, 1179 (Ariz. 1999). Tankersley holds PCR-based HLA-DQA testing admissible under Frye, and Sharp reiterates that the older form of VNTR testing is admissible. Tankersley, 956 P.2d at 489-95; Sharp, 973 P.2d at 1179. Another subsequent development to Hummert was the escape of Steven Hummert from a medium security prison, where he was serving a life sentence. He was spotted in the Arizona State University College of Law library and was captured weeks later, while shoplifting at a grocery store in
ignored the cautions urged by the majority of the scientific community was admissible. To reach this result, the court reasoned that the general acceptance requirement for scientific evidence simply did not apply to the problematic scientific testimony in the case. It also dismissed the possibility of a modest reform in the process of preparing opinions that might have avoided some of the errors that undermine its opinions in Bible and Johnson.

The case does not instill confidence in the Arizona courts' use of Frye as an effective tool to guard against invalid (or unvalidated) scientific testimony.

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64. Hummert, 933 P.2d at 1195; see also infra Part III.

65. Id. In Hummert, the court also lost sight of the meaning of the statistics introduced in conjunction with DNA evidence. Compare Bible, 858 P.2d at 1185 n.18, with Hummert, 933 P.2d at 1189.

66. In Kaye, supra note 55, at 1075-77, I suggested that "[c]ourts should consider instituting . . . prepublication review by scientists of opinions that address scientific controversies or that include mathematical or statistical analyses that originate with the court." The purpose of such review would not be to decide cases, but only "to screen for scientific accuracy the final drafts of opinions on controversial scientific developments." Id. at 1075. The proposal expressly contemplated the involvement of the parties and noted the importance of "avoiding ex parte communications." Id. at 1075 n.172. Although this procedure might have avoided the publication of certain errors in Hummert itself, the court summarily disposed of the idea:

Such a process would, of course, make life easier for the members of this court, but unlike courts exercising original jurisdiction, we have no provision for masters to vet draft appellate opinions. We hesitate to think of the comments from litigants and counsel who discover that their case has been effectively decided by an "impartial" group of scientists whose identity was not revealed to them, before whom they could not appear, and to whom they could address neither argument nor question.

933 P.2d at 1195.

This response not only distorts the proposal to seek scientific input, but also ignores the following: (1) a similar procedure has been used by at least one distinguished jurist without untoward effects (Kaye, supra note 55, at 1065 n.134); (2) the Arizona Supreme Court writes its own rules; and (3) courts have inherent power to adopt procedures that are reasonable and necessary to the fulfillment of the judicial function, even on an ad hoc basis. See, e.g., State v. Superior Court, 275 P.2d 887, 889 (Ariz. 1954); In re Fuchsberg, 426 N.Y.S.2d 639, 646-47 (N.Y. Ct. on Judiciary 1978) (New York practice allows justices to "consult[ ] with law professors" with "notice to the parties"); FELIX F. STUMPF, INHERENT POWERS OF THE COURTS: SWORD AND SHIELD OF THE JUDICIARY (1994).
B. Logerquist on Frye, Daubert, and Kumho Tire

In *State v. Bible,* the Arizona Supreme Court conceded that "Frye . . . has significant shortcomings" and remarked that "[Daubert] provide[s] persuasive reasons for rejecting or modifying Frye when applying the Arizona Rules of Evidence." In *Logerquist v. McVey,* the same court, in an opinion written by the same Justice, insisted that "Frye . . . is a necessary and generally helpful rule. We have not yet seen any reason to conclude that the rule . . . needs liberalizing [or that] . . . its application should be broadened . . . ." Which opinion is right? Paradoxically, neither.

*Daubert* provides no persuasive reasons for rejecting or modifying *Frye* (although such reasons exist), and *Daubert* neither liberalizes nor broadens *Frye*. The scientific soundness standard of *Daubert* is different, but not necessarily any more or less demanding, than the general acceptance standard of *Frye*. Sometimes, *Daubert*’s direct focus on validity will allow a court to admit evidence that has yet to be generally accepted by the scientific community. In other cases, it will permit a court to exclude evidence that has achieved general acceptance in a field that lacks rigorous standards. Whether it is desirable to shift the focus from general acceptance to validity can be debated, but *Daubert* does nothing to advance that debate. Rather, the *Daubert* Court rejected *Frye* on the sole (and unconvincing) ground that the wording and purpose of the codification of the law of evidence effected by the federal rules extirpated the declining but still entrenched *Frye* doctrine.

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68. *Id.* at 1181.
69. *Id.* at 1182.
70. 1 P.3d 113 (Ariz. 2000).
71. *Id.* at 129 (Feldman, J.).
72. The wording, structure, and history of the rules do not compel this result. To the contrary, it is reasonably clear that those who drafted and adopted the rules had no idea that they were rejecting *Frye*. Professor Giannelli makes this point quite powerfully in Paul C. Giannelli, *Interpreting the Federal Rules of Evidence*, 15 CARDOZO L. REV. 1999, 2017 (1994). I might add an anecdote that is consistent with his correspondence with the late Professor Ed Cleary, who served as the reporter for the Advisory Committee that drafted the federal rules. I once asked Professor Cleary why there was no mention of *Frye* in the Advisory Committee Note to Rule 702. After all, other committee notes offered concise and accurate summaries of the common law and usually were explicit, indicating when a departure from the common law was intended. Professor Cleary said, in substance: "No one brought it up, and I was not about to." The drafters had other battles to fight, such as the proposed rules on privilege that Congress rejected. The reporter, I gathered, was disinclined to enlarge the theater of combat.

Neither is the general acceptance test inherently inconsistent with the general purpose and thrust of the rules. The rules generally admit evidence when its costs are not out of proportion to its benefits, but scientific evidence usually is costly in terms of the time and cognitive demands it places on jurors. The requirement of showing scientific acceptance of such evidence can be
These observations do not mean that Daubert was wrongly decided. But they do suggest that the Court’s analysis of the wording of the rules provides a superficial answer to the problem of choosing between Frye and some other standard for scientific evidence. In addition, as Bible and Logerquist observe, the Supreme Court’s interpretation of the federal rules is not binding on a state court’s interpretation of the state’s rules.73

Thus, the state courts should be filling the justificatory gap in the Daubert opinion. They should be identifying and assessing the advantages and disadvantages that each standard offers. If one is substantially more advantageous than the other, it should be adopted. If the two are about equally attractive, then Justice McGregor’s concern for uniformity74 may tip the balance in favor of adopting the Daubert framework. If an alternative to both would better promote the wise use of scientific evidence, then it deserves serious attention.75

In bold, the disappointing feature of Logerquist’s adherence to Frye is not that a state court might prefer Frye to Daubert. A significant minority still do. Rather, it is that the Logerquist court does so little to establish that Frye is substantially superior to Daubert. A summary of the arguments advanced in Logerquist makes this clear.

1. Some Commentators Have Criticized Daubert

Logerquist begins its defense of Frye with the observation that “leading commentators and authorities in the field of evidence have criticized [Daubert].”76 That there are some critical reviews of Daubert is hardly surprising—scholars are quick to criticize virtually any Supreme Court

understood as a specific crystallization of the need for expert evidence to “assist the jury” in FED. R. EVID. 702 and to have adequate probative value under FED. R. EVID. 403.

73. Logerquist, 1 P.3d at 127-28; Bible, 858 P.2d at 1183. More difficult to understand is Logerquist’s suggestion that “cases such as Hummert, 188 Ariz. at 119, 933 P.2d at 1187; Johnson, 186 Ariz. 329, 922 P.2d 294; and Bible, 175 Ariz. 549, 858 P.2d 1152” bar the Arizona Supreme Court from deciding that the failure to mention general acceptance in ARIZ. R. EVID. 702 implicitly dispenses with Frye in favor of an alternative like Daubert. 1 P.3d at 128. That earlier state cases failed to construe the words of Rule 702 the way the United States Supreme Court does should not keep the court from examining that argument anew. This is especially so when one considers that rather than parse the meaning of Rule 702, Bible merely insisted that “this is not the case to determine whether Arizona should follow Daubert” largely because “the argument . . . has not been extensively briefed or argued” and “[t]he field of DNA testing [which also was at issue in Johnson and Hummert] is probably the worst subject to use to decide whether or how to refine, replace, or abolish Frye.” 858 P.2d at 1183.

74. See supra note 41.

75. See infra Part III.

76. 1 P.3d at 125.
opinion. However, with respect to legal scholarship, the question for a court choosing between Frye and Daubert is what the commentators have to say about the relative merit of the two approaches. After all, scholarly criticism of Frye is at least as strident and widespread as that of Daubert.

Unfortunately, the “leading” authority that the Logerquist court quotes at some length offers no guidance on whether the general acceptance standard of Frye is superior to the scientific soundness standard of Daubert. The court refers to two volumes of a treatise on federal procedure.77 One volume, written by Professors Charles Alan Wright and Victor Gold,78 identifies advantages and disadvantages of each approach.79 It seems to endorse the premise that heightened scrutiny is desirable to ensure that scientific evidence is valid,80 but it takes no clear position on whether general acceptance or scientific soundness is the better rubric.

The other volume is written by Professors Charles Alan Wright and Kenneth W. Graham, Jr.81 It, too, reaches no conclusion as to the relative merits of Frye and Daubert. Unlike Wright and Gold, however, Wright and Graham vehemently reject the premise of both Frye and Daubert that strict scrutiny of scientific evidence is desirable. Their contempt for both these opinions is palpable, and nothing in their “thought-provoking”82 analysis suggests that Frye is much better than “neo-Frye”83 (their term for Daubert).84 In bold, the commentary that the Logerquist majority presents as critical of Daubert primarily undermines the court’s adherence to Frye.

77. Id. at 125-26.
78. 29 CHARLES ALAN WRIGHT & VICTOR J. GOLD, FEDERAL PRACTICE AND PROCEDURE § 6266 (1997). According to Logerquist, footnote 15 to a 1998 supplement to this volume exemplifies the fact that “leading commentators and authorities in the field of evidence have criticized it [Daubert].” 1 P.3d at 125. But Professors Wright and Gold say just the opposite—that “the Frye test was widely criticized by commentators.” WRIGHT & GOLD, supra, at 266. Similarly, the authorities cited in the note itself do not criticize Daubert.
79. WRIGHT & GOLD, supra note 78, at 266.
80. Id. at 264 (“But judicial interference with the jury’s power to weigh such evidence may be warranted where expert testimony is based on emerging scientific theories that have not gained widespread acceptance within the scientific community. Such testimony presents an additional reliability issue—is it based on principles that are scientifically valid?”).
82. Logerquist, 1 P.3d at 126.
83. See id. According to Wright and Graham, Daubert is “a functional equivalent of Frye.” WRIGHT & GRAHAM, supra note 81, § 5168.1 at 90.
84. The majority quotes three paragraphs from Wright & Graham. Logerquist, 1 P.3d at 126. The first states that both Frye and Daubert are too restrictive and that the use of “summary judgment or directed verdicts” to keep unfounded scientific testimony from juries is inequitable because “corporations and other wealthy defendants [are] the very parties most capable of manufacturing or purchasing questionable scientific opinions.” Id.; WRIGHT & GRAHAM, supra note 81, § 5168.1 at 90-91. This is no argument for Frye over Daubert.
2. Kumho Tire is Wrongly Decided

After this infelicitous discussion of some of the scholarly commentary on Frye and Daubert, Logerquist presents what it thinks is another reason not to switch—that Carmichael v. Kumho Tire Co. was wrongly decided. There are two difficulties with this argument. First, portions of the Arizona court's attack on Kumho Tire are embarrassingly weak. For example, the Logerquist majority thinks that Kumho Tire (and Daubert) are "impossible . . . to reconcile . . . with . . . Barefoot v. Estelle." However, Barefoot did not apply Rule 702 (or any other rule of evidence) to expert testimony. In a sentencing hearing, the state of Texas presented psychiatric testimony to the effect that "there was a 'one hundred percent and absolute' chance that Barefoot would commit future acts of criminal violence." Although the state's psychiatrists did not even examine Barefoot and many psychiatrists have grave reservations about the accuracy of predictions of dangerousness, Barefoot did not argue that such testimony was inadmissible under the state's

The second paragraph argues that " politicized science is prevalent in litigation." Logerquist, 1 P.3d at 126; WRIGHT & GRAHAM, supra note 81, § 5168.1 at 91. "A good example" is said to be " so-called 'DNA fingerprinting,'" which "is left to fast-buck artists willing to exploit a scientific technique for purposes for which it was not originally designed." WRIGHT & GRAHAM, supra note 81, § 5168.1 at 100 n.38. "When the evidence of this technique is offered in court, there are few genuine experts in the forensic use of DNA available to contradict the claims of the sellers of this product" and "(those who are have been subjected to pressure from the F.B.I. that discourages all but the most courageous from making their objections known.)" Id. Whatever one thinks of this invective, the "politics" of science and the suppression of dissent is at least as much a problem for Frye as it is for Daubert.

The final paragraph is another irrelevant critique of summary judgment and directed verdicts combined with the observation that "[m]ulti-factored, 'flexible' tests of the sort announced in Daubert" and used in Rule 403 "are more likely to produce arbitrary results than they are to produce nuanced [sic] treatment of complex questions of admissibility." Logerquist, 1 P.3d at 126; WRIGHT & GRAHAM, supra note 81, § 5168.1 at 91. This might be a reason to favor Frye—except for the fact that Frye has proven quite malleable in practice. See, e.g., MCCORMICK ON EVIDENCE, supra note 5, § 203; Developments in the Law: Confronting the New Challenges of Scientific Evidence, 108 HARV. L. REV. 1481 (1995).

85. See, e.g., Logerquist, 1 P.3d at 125 ("The result reached in Kumho, however, would seem directly opposed to the principle of liberalized admissibility that engendered the abolition of Frye."); id. at 126 ("With all due respect, the argument that . . . affirms the trial judge's . . . finding [that the engineer's testimony was methodologically deficient] reads more like a jury argument than an application of legal principle.").

86. Id. at 126.


88. Id. at 919 (Blackmun, J., dissenting).

89. Id. at 918-19.

90. See id. at 899 n.7 (referring to testimony and studies indicating that psychiatric predictions of future dangerousness were wrong two out of three times). Because it is not a good measure of probative value, this statistic engendered considerable confusion in both the majority and dissenting opinions. See, e.g., KAYE, supra note 4, at 273-75.
Rather, he maintained that a death sentence based on such overstated psychiatric opinions violates the Cruel and Unusual Punishment Clause and that reliance on psychiatric evaluations given in response to hypothetical questions rather than an examination of the individual contravenes the Due Process Clause.

The Court rejected these constitutional claims, saying that it was not disposed to adopt "a constitutional rule barring an entire category of expert testimony." But Barefoot plainly leaves open the possibility that Daubert or Kumho Tire would require exclusion of the expert testimony. Indeed, the Court could not have been much clearer in holding only that the Constitution leaves the choice of the evidentiary standard to the states. The second reason to dismiss the diatribe about Kumho Tire as a basis for sticking with Frye is that the case is largely irrelevant to choosing between Frye or Daubert as a screening test for scientific evidence. If Kumho Tire really is so foolish, if it would produce a burdensome number of pretrial hearings

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91. He could not, for he was seeking a federal writ of habeas corpus. Such a writ is available only for imprisonment based on a constitutional error.

92. Barefoot, 463 U.S. at 899 (emphasis added). It reasoned that inasmuch as "the likelihood of a defendant committing further crimes is a constitutionally acceptable criterion for imposing the death penalty, . . . it makes little sense, if any, to submit that psychiatrists, out of the entire universe of persons who might have an opinion on the issue, would know so little about the subject that they should not be permitted to testify." Id. at 896-97.

93. See, e.g., KAYE, supra note 4, at 275.

94. In dissent, Justice Blackmun pointed to federal circuit court opinions demanding general acceptance or scientific validity for expert scientific testimony. Barefoot, 463 U.S. at 931 n.9. The majority did not question the proposition that the psychiatric testimony might have to meet these standards had it been introduced in federal court or in another state than Texas. Instead, the Court emphasized that it was not describing the law of evidence: "The federal cases cited [by the] dissent as rejecting 'scientific proof' . . . are not constitutional decisions, but decisions of federal evidence law. The question before us is whether the Constitution forbids exposing the jury or judge in a state criminal trial to the opinions of psychiatrists . . . ." Id. at 899 n.6.

95. According to Justice Feldman:

[U]nder Daubert/Kumho each trial judge in any case involving disputed expert testimony would have to review the eight or nine Daubert/Kumho factors . . . in case-specific pretrial testimonial hearings . . . inquiring into . . . all the factors so far identified and any others that appellate courts may yet deem appropriate to save us from juries that have been led or misled down the garden path.

Logerquist v. McVey, 1 P.3d 113, 129 (Ariz. 2000). But Daubert and Kumho Tire do not call for "pretrial testimonial hearings" in "any case involving disputed expert testimony." Id. Under these cases (as under Frye) a trial court need not conduct a pretrial hearing just because a party demands one. See Kumho Tire Co. v. Carmichael, 526 U.S. 137, 149 (1999) (heightened scrutiny is required only "where such testimony's factual basis, data, principles, methods, or their application are called sufficiently into question") (emphasis added); Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 592 (1993) (same). Nevertheless, some district courts have perceived a "push initially by the Supreme Court, then by courts of appeal, then by lawyers, to have a Daubert hearing in virtually every case involving expert testimony." Sam C. Pointer, Jr., Response to
and is anathema to the state's constitution, then the court should not follow it. The court seems blind to the obvious possibility of adopting the Daubert scientific soundness standard for scientific testimony and evaluating nonscientific expert testimony in other ways.

3. Arizona's Experience with Frye is "Not Bad"

Logerquist offers another reason to adhere to the general acceptance standard—"our experience with the Frye rule has not been bad." This is hardly a ringing endorsement of the rule. It would be equally valid to say that the court's handling of scientific evidence—from polygraph testing to DNA typing—under Frye has not been good. At bottom, however, the problems that have surfaced with Frye in Arizona may be more closely related to the minimal scientific literacy shown in cases like Valdez, Superior Court, and Johnson than to the choice of any particular standard for passing on scientific evidence. Still, Logerquist's tepid assessment of the state courts' handling of scientific evidence under Frye provides little support for perpetuating this minority approach to scientific evidence.

In any event, it is time to move from Logerquist's meandering dicta concerning Frye, Daubert, and Kunho Tire to its holding that neither a showing of general acceptance nor proof of scientific validity is necessary for an expert to attest to the phenomenon of repressed memory retrieval. Despite the lip service to Frye, the court concluded that a psychiatrist, as a qualified expert, could testify to the existence and emergence of repressed memories of childhood sexual abuse on the basis of his clinical experience even if no generally accepted scientific basis exists to support his impressions or generalizations. The three Justices who embraced this conclusion


96. According to Logerquist, Arizona could or "would not follow Daubert as interpreted in Kumho" because its "constitution preserves the 'right to have the jury pass upon questions of fact by determining the credibility of witnesses and the weight of conflicting evidence.'" 1 P.3d at 130 (citation omitted). But if the right to trial by jury prevents a judge from excluding expert testimony that has not been shown to rest on a methodology or on experience that produces valid results, it also prevents the judge from excluding expert scientific testimony that has not been shown to rest on a generally accepted methodology. Yet, Logerquist assumes that the constitution is no impediment to applying Frye (or even Daubert) to scientific testimony.

97. Id. at 128.

98. See supra Part II.A.

99. Logerquist, 1 P.3d at 134 (insisting that the only "heightened form of evidentiary scrutiny" should be cross-examination by "able defense counsel" of "[p]laintiff and her witnesses"); see also id. at 134, 135 (Jones, J., concurring) ("I would admit the testimony of Dr. van der Kolk
adduced some surprising arguments. The remainder of this article argues that the Arizona court’s solution is, as the dissenting Justices noted, flawed100 and untenable,101 and it sketches more viable alternatives.

III. THE BOUNDARY PROBLEM

If scientific evidence must clear a hurdle that does not block the path of other expert testimony, the problem of demarcating boundaries arises. What evidence counts as “scientific” for the purpose of Frye, Daubert, or any other such standard? Advocates have implored courts to apply heightened scrutiny to a myriad of claims. Some items, such as agglutination tests for blood groups or the spectrographic analysis of voices, seem indisputably scientific. Courts have not hesitated to apply the special standards for scientific evidence to testimony about such technologies.102 Other testimony, such as the opinion of a psychiatrist that a person’s will is overborne by a compulsion to gamble,103 or the descriptions from a psychologist of the indicia of false confessions,104 seem less easily classified. In these borderline cases, courts have reached apparently conflicting results;105 few opinions

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100. Id. at 136 (Martone, J., dissenting); cf. id. at 140 (because “[t]he theory of repressed memory has not found general acceptance in the scientific community, . . . it was proper . . . to exclude expert opinion testimony on this subject,” and “[t]he majority’s claim to adhere to Frye and yet avoid this result is unfathomable”).

101. Id. at 142 (McGregor, J., dissenting) (“That permitting a jury to hear a credible witness testify about unreliable, invalid ‘science’ somehow assists the truth-finding function [is] . . . untenable.”).

102. E.g., People v. Coleman, 759 P.2d 1260, 1277 (Cal. 1988) (positive reaction of hemostick test for presence of blood improperly admitted when prosecution did not establish that the hemostick was a generally accepted method for detecting blood); Michael R. Flaherty, Annotation, Admissibility, in Criminal Cases, of Evidence of Electrophoresis of Dried Evidentiary Bloodstains, 66 A.L.R.4th 588 (1988).

103. United States v. Lewellyn, 723 F.2d 615, 619-20 (8th Cir. 1983) (finding that a defendant claiming insanity due to pathological gambling must show that the mental health community generally accepts the principles underpinning the theory).

104. United States v. Hall, 93 F.3d 1337, 1341-45 (7th Cir. 1996) (finding that Daubert applies to testimony of social psychologist about confessions).

105. Compare, e.g., Johnson v. Knoxville Cmty. Sch. Dist., 570 N.W.2d 633, 636-39 (Iowa 1997) (trial court properly admitted neuropsychiatrist’s testimony about causes of obsessive-compulsive disorder even when there was “no scientific evidence that OCD traits could be inherited through a parent” because Daubert does not apply to this “specialized knowledge” testimony), with Tyus v. Urban Search Mgmt., 102 F.3d 256, 263 (7th Cir. 1997) (Daubert applies to all expert testimony, including social science, but the details of the showing of reliability vary with the field).
have provided clear or comprehensive explanations of how the line was drawn. The Arizona cases are no exception.

The Logerquist majority offers several reasons for dispensing with proof that a scientific proposition about recovered memories is generally accepted. This section argues that none are satisfactory. It considers the descriptions in Logerquist and Hummert of the exemption from Frye and finds that these are potentially dangerous dicta that far outstrip the facts of the cases. It points the way to a narrower exemption or to a distinctly different approach that would produce more principled results.

A. Novelty

Initially, Justice Feldman writes that although "Frye applies to the use of novel scientific theories or processes to produce results, . . . neither Plaintiff nor her lawyers argue that any scientific principle or process can be used to produce memories that are always or often accurate." To decide whether this observation offers a satisfactory basis for exempting certain scientific testimony from Frye, we must consider both factors—"novelty" and "results." But it is hard to see why scientific testimony should escape the heightened scrutiny that normally is required because it has been around for some time. A Frye objection to the testimony of a geologist predicated on the theory that continents do not drift would be well taken even though the theory is not novel. Indeed, it once was all but universally accepted. Today, the data overwhelmingly support the theory of continental drift.

Of course, it may be easier to realize that serious scrutiny is advisable when a theory is novel, and it may be harder for the opponent of the evidence to establish that a longstanding theory is questionable enough to justify a full blown inquiry into general acceptance. But novelty or familiarity is no touchstone for determining when to apply heightened scrutiny.

B. Results

If we remove the "novelty" requirement for applying Frye, we are left with the notion that the testimony must report "results" of "scientific theories

or processes” to warrant a hard look at its scientific basis. This interpretation seems confirmed by the court’s discussion of *State v. Lindsey* and *State v. Roscoe*. However, limiting *Frye* to “results” testimony is not supported by those cases and is inconsistent with the rationale for *Frye*.

*Roscoe* “held a dog handler’s opinion on the alleged ability of his tracking dog to identify scent long after it was laid down was admissible and *Frye* inapplicable.” To apply that decision to the psychiatric testimony in *Logerquist*, Justice Feldman describes both cases as involving “behavioral evidence,” and he relies on the statement in *Roscoe* that the dog handler’s testimony “was not bottomed on any scientific theory.”

Yet, that was not the reason for not requiring general acceptance of this claim among ethologists or biologists. Rather, the crucial point was that “[n]o attempt was made to impress the jury with the infallibility of some general scientific technique or theory.” Can the same be said of a clinical psychiatrist’s testimony about the phenomenon of repressed memory retrieval?

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108. *Id.*
111. *Logerquist*, 1 P.3d at 120. *Roscoe* describes the evidence in more detail:
Harass II, a pedigreed German Shepherd, had been used to perform certain identification tests. All of the tests were run blind—the dog’s handler . . . was not told in advance which article or location was connected with the crime. The test protocol was as follows:
1. The dog . . . “alerted” to the victim’s scent at [defendant’s] car . . . .
2. The dog . . . alerted [to the victim’s scent] at the place where the [victim’s] bicycle had been found [and] . . . . in the area where the body was found.
3. After [being] . . . taken to a room where five articles of clothing were laid out . . . . the dog alerted at the clothing which had been taken from the victim’s body . . . .
4. After [being] . . . taken to a “line-up” of five bicycles [t]he dog alerted at the bicycle which had belonged to the victim . . . .
700 P.2d at 1318. Interestingly, such consistently accurate performance might well have satisfied *Kumho Tire*. However, it seems that the blind tests might never have taken place. Years later, the handler was “revealed as a charlatan [who] gave similar testimony in numerous criminal cases around the country.” *State v. Roscoe*, 910 P.2d 635, 640 n.1 (Ariz. 1996).
112. *Logerquist*, 1 P.3d at 119.
113. *Id.* at 120 (quoting *Roscoe*, 700 P.2d at 1319).
114. *Roscoe*, 700 P.2d at 1319; see also *id.* at 1320 (relying on the “‘lesser potential prejudicial impact’ of dog identification evidence than one would expect from the ‘seemingly flawless evidence’ based upon mechanical or scientific instruments”) (citation omitted); *State ex rel. Collins v. Superior Court*, 644 P.2d 1266, 1285 (Ariz. 1982) (“Because ‘science’ is often accepted in our society as synonymous with truth, there is a substantial risk of overweighting by the jury. The rules concerning scientific evidence [including the *Frye* rule] are aimed at that risk.”) (quoting M. UDALL & J. LIVERMORE, 1 LAW OF EVIDENCE § 102, at 212 (2d ed.1982)).
as established though his "diagnoses of dissociative amnesia or post-traumatic stress disorder... together with the extensive literature on the subject?" The chasm that separates the dog handler's observations of his dog's reactions from the psychiatrist's testimony is not bridged by the claim that both are "not offered as a product of the application of some accepted scientific process, principle, technique or device." Roscoe merely establishes that testimony from a nonscientist about nonscientific matters is not subject to a test designed for scientific evidence.

Lindsey also fails to support the notion that testimony about science that is not generally accepted is exempt from Frye if it does not include the result of a particular scientific test. This case "dealt with the question of expert testimony regarding behavior patterns of victims of in-home incestuous-type child molesting." Under Lindsey, "expert testimony that explains recognized principles of social or behavioral science [that] the jury may apply to determine issues in the case" is admissible "where the facts needed to make the ultimate judgment may not be within the common knowledge of the ordinary juror." Thus, in suitable cases, experimental psychologists may testify to a well established body of knowledge as to the conditions under which eyewitnesses are prone to err, and clinical psychologists may describe validated or generally accepted "syndromes" to explain such facts as a battered woman remaining with the man who repeatedly assaults her or an abused child retracting an accusation.

However, Lindsey does not intimate that Frye is inapposite to a scientific theory simply because it is offered to provide background information rather than "results." In speaking of "recognized principles of social or behavioral science," Lindsey respects the logic of Frye. Frye, along with Daubert, rests on the concern that the trier of fact will place undue reliance on seemingly scientific testimony. That danger is significant when the testimony reveals the result of a superficially impressive analytical test; but it

115. Logerquist, 1 P.3d at 115.
116. Roscoe, 700 P.2d at 1320 (quoted in Logerquist, 1 P.3d at 120).
117. Logerquist, 1 P.3d at 119 (internal quotation marks omitted).
120. Lindsey, 720 P.2d at 74.
121. See Roscoe, 700 P.2d at 1319 ("The rationale for this standard is probably the fear that jurors will accord scientific evidence too much weight because of its 'aura of special reliability and trustworthiness' and will fail to consider the possibility that evidence based upon the particular scientific principle in question may be incorrect.").
remains significant when the testimony reveals a scientific theory intended to influence the jury’s thinking. 122

Nonetheless, there is a kernel of sense behind the observation that the testimony in Logerquist involves a general proposition rather than an instrumental reading or the like. Suppose that plaintiff testified that she suddenly remembered the abuse that occurred so long ago and that defendant responded with testimony that scientists do not accept the fact that such memories are usually real. Under the trial court’s order, plaintiff could not provide a rebuttal witness to explain that at least some scientists believe that memories can be repressed and later recovered accurately. 123 Allowing the plaintiff’s expert to testify in response to the defendant’s denial of the phenomenon is a defensible result, for the rebuttal use of the scientific testimony seems much less prejudicial than introducing it in plaintiff’s case-in-chief to show that her long dormant memories are likely to be accurate. In addition, referring to scientific literature merely to show that there is some support in the research literature for the view that some recovered memories are not false is a more valid use of the research. A narrow, focused opinion articulating an exception to Frye in these terms would have been more persuasive. 124 In contrast, the background-results dichotomy promulgated in Logerquist insulates too much invalid or inadequately validated science from judicial scrutiny.

122. See, e.g., Flanagan v. State, 625 So.2d 827, 828 (Fla. 1993) (even when presented as background information, “this type of testimony must meet the Frye test, designed to ensure that the jury will not be misled by experimental scientific methods which may ultimately prove to be unsound”), cited with approval in Hadden v. State, 690 So.2d 573, 578 (Fla. 1997):

[We] will not permit factual issues to be resolved on the basis of opinions [about the child sexual abuse accommodation syndrome that] have yet to achieve general acceptance in the relevant scientific community; to do otherwise would permit resolutions based upon evidence [that] has not been demonstrated to be sufficiently reliable and would thereby cast doubt on the reliability of the factual resolutions.

123. The Logerquist court did not overlook this consideration. See 1 P.3d at 118.

124. A more general analysis would adjust the requisite degree of validity to the specific use to which the evidence is put. See MCCORMICK, supra note 5, § 203; Robert P. Mosteller, Syndromes and Politics in Criminal Trials and Evidence Law, 46 DUKE L.J. 461, 463-64 (1996) (proposing that behavioral generalizations generally should be admissible “to support credibility by showing that apparently aberrational conduct was normal for individuals who have had certain experiences” but not “to diagnose the causes of criminal conduct or to determine whether that conduct occurred” because “the evidence is far more likely to be scientifically valid” for the former purpose). However, the Arizona Supreme Court remains committed to the all-or-nothing Frye approach—an approach that does not focus on validity.
C. Personal Knowledge

Finally, Logerquist suggests yet a third possible basis for drawing the boundary between scientific evidence (that must rest on generally accepted theories) and nonscientific judgments (that need not rest on accepted theories). In a summary of its opinion, the court writes that:

Frye is applicable when an expert witness reaches a conclusion by deduction from the application of novel scientific principles, formulae, or procedures developed by others. It is inapplicable when a witness reaches a conclusion by inductive reasoning based on his or her own experience, observation, or research.125

We may call this the “personal experience” exception to Frye. According to Logerquist, a court cannot invoke Frye to exclude testimony about a general phenomenon as long as the scientist-witness performed his own experiments or other studies—no matter how far they depart from the accepted canons of scientific research—to arrive at the generalization or theory.

This formulation has one positive feature. It repairs slightly the even wider hole cut into the heart of Frye in State v. Hummert.126 Because the “personal experience” exception is articulated more fully in Hummert, I start with an analysis of that case. After describing the testimony in Hummert, I criticize the “personal knowledge” exemption as articulated and applied in Hummert and as refined in Logerquist.

1. The Expert Testimony and the Supreme Court’s “Personal Knowledge” Exception in Hummert

The events that led to the conviction of Steven Hummert began in the very early morning of a summer’s day in 1989.127 At 3:30 a.m., a nineteen-year-old woman returned to her home in Tempe from a dance club. A man approached, put a gun to her head, and forced her to the yard of a nearby

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125. Logerquist, 1 P.3d at 133. The distinction between “deduction” and “induction” in this passage is difficult to sustain. See, e.g., Brian Skyrms, Choice and Chance: An Introduction to Inductive Logic 41-48 (2d ed. 1975).
127. The facts as stated here are taken from the appellate court opinion in State v. Hummert, 905 P.2d 493 (Ariz. Ct. App. 1994), and from the Arizona Supreme Court’s opinion in Hummert, 933 P.2d at 1189.
house. He raped her. When he started strangling her, she bit his forearm. He beat her into unconsciousness.

Ample evidence pointed to Hummert. The woman had seen a red Honda CRX with a grey out-of-state license plate and an emblem shaped like Texas at two intersections as she was driving in the neighborhood. She saw the car parked in the street as she was attacked and observed the numbers 939 on the license plate. Hummert owned such a car. He had a wound on his forearm. He told police that he was at a party when the rape occurred, but the other party goers reported not only that he left at 2:00 a.m., but also that he asked them to say that he left at 4:00 a.m. His pubic hair matched one of four hairs taken from the victim’s underpants, and DNA from a semen stain matched his DNA.28

The DNA testing was performed by the FBI using VNTR profiling at four loci.29 Tests of the semen showed bands at these loci that lined up with the DNA in Hummert's blood sample, but the victim's DNA also contained one or two matching alleles at one of these loci. This overlap posed a problem in interpreting the four-locus match.30 To simplify matters, the FBI treated the results as if it had simply obtained a three-locus profile in a sample of DNA from a single person.31

When the trial court excluded basic product rule estimates of the frequency of the incriminating three-locus profile in the population, an FBI examiner testified that such a match is “rare” and meant that “[e]ither you're brothers, identical twins, or that would be a very unique experience.”32

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128. Conventional blood group testing was inconclusive.
129. Human DNA is organized into chromosomes, which are long molecules of DNA packaged in proteins. A locus is a location on a chromosome. The portion of the DNA at a locus chosen for forensic purposes generally varies from one person to another. VNTRs are portions of DNA that differ in length. Each measurably different VNTR is called an allele. See generally, e.g., NATIONAL RESEARCH COUNCIL COMMITTEE ON FORENSIC DNA SCIENCE: AN UPDATE, THE EVALUATION OF DNA EVIDENCE (1996) [hereinafter NRC II]; KAYE, supra note 4.
130. Most people have two distinct alleles at each locus. (One is inherited from the father, the other from the mother.) The Hummert opinion reports that “[t]he FBI . . . found that . . . the victim shared the same allele” at one locus, but it does not reveal whether only one allele was found at that locus. 933 P.2d at 1189. The presence of at least one allele from the victim raises the possibility that DNA from some of the woman’s cells could have been present in the semen stain. (Laboratory procedures to separate male and female fractions of samples are not always successful.) If the stain was indeed a mixture, and if the man’s alleles at the fourth locus were not detectable in the stain, then any man who possessed only the alleles from the other three loci could match the DNA from the underwear.
131. Hummert, 933 P.2d at 1189. There are other ways to analyze the statistical import of matches within mixtures of DNA. See, e.g., State v. Garcia, 3 P.3d 999 (Ariz. Ct. App. 1999); NRC II, supra note 129, at 130; B.S. Weir et al., Interpreting DNA Mixtures, 42 J. FORENSIC SCI. 213 (1997).
132. 905 P.2d at 499. The examiner was Lawrence Pressley. Id.
second expert, a geneticist and epidemiologist from the University of California at Berkeley, went further.\textsuperscript{133} She testified that “one can, by carefully choosing particular parts of the DNA that vary a lot between people, uniquely identify every person with just a sample of each person’s DNA.”\textsuperscript{134} As the court of appeals observed, “[b]oth experts also essentially testified that a ‘match’ over three probes has always meant that the compared samples came from the same individual or from an identical twin.”\textsuperscript{135}

The supreme court described the expert testimony differently. It perceived no testimony that science had established that three-locus VNTR matches demonstrated uniqueness. Writing for the court,\textsuperscript{136} Justice Feldman downplayed the expert testimony, remarking that “[a]t trial, the judge admitted evidence of the match, the criteria for declaring a match, and opinions that Defendant was not excluded by the DNA tests.”\textsuperscript{137} Later, the opinion recognizes that more was involved—but not much more: “[the] . . . conclusions . . . in this case [came] strictly from personal knowledge and study.”\textsuperscript{138}

The court held that such “personal knowledge” testimony need not meet the usual tests for scientific evidence:

The experts in this case did not testify to conclusions based on the application of Cellmark’s statistics and database but only to their own experience. Having made the DNA examination according to recognized scientific principles and finding a match at three loci, the experts claimed that because of the unique nature of each person’s DNA, they had never before seen a three-loci [sic] match from unrelated individuals. On the basis of their own experience, they believed such a random match would be very uncommon. The trial judge did not err in admitting this evidence of the experts’ own work and experience and the opinions reached on that basis.\textsuperscript{139}

The court concluded that:

[T]he apparent trappings of science, the \textit{Frye} rule, and scientific recognition need not cloud the courts’ views. Although compliance

\textsuperscript{133} The geneticist was Mary-Claire King. \textit{Id.} In 1995, she and her laboratory moved to the University of Washington. \textit{See Putting the Puzzle Together, at} \url{http://www.washington.edu/alumni/columns/sept96/king3.htm}.

\textsuperscript{134} 905 P.2d at 499.

\textsuperscript{135} \textit{Id.}

\textsuperscript{136} Justice Martone concurred separately. 933 P.2d at 1195.

\textsuperscript{137} \textit{Id.} Justice Feldman also wrote for the court in its previous DNA cases (\textit{Bible} and \textit{Johnson}) as well as \textit{Logerquist}.

\textsuperscript{138} \textit{Id.} at 1192.

\textsuperscript{139} \textit{Id.} at 1193.
with Frye is necessary when the scientist reaches a conclusion by applying a scientific theory or process based on the work or discovery of others, under Rules 702 and 703 experts may testify concerning their own experimentation and observation and opinions based on their own work without first showing general acceptance. Such evidence need only meet the traditional requirements of relevance and avoid substantial prejudice, confusion, or waste of time.\footnote{140}{Id. at 1195 (quoted in part in Logerquist, 1 P.3d at 123). The court prefaced these remarks with the clause "[w]e hold here that . . . ."
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In the next section I show that this broadly written exemption of "personal knowledge" from the demands ordinarily placed on scientific evidence is too generous. Furthermore, I demonstrate that the experts' testimony in Hummert was not based just on "their own work" and that claims for uniqueness of a three-locus match are not generally accepted in the scientific community.

2. Personal Knowledge and Private Data

Exempting all personal research from the strictures of Frye v. United States\footnote{141}{293 F. 1013 (D.C. Cir. 1923).} cannot be correct. Imagine that a psychologist named William Marston testifies that personal experimentation, observations, and opinions based on his own work in measuring systolic blood pressure justify the conclusion that the defendant truthfully denied committing the murder with which he was charged. If Frye excludes anything, it excludes that testimony—for that was the very testimony proffered in Frye. Frye teaches that there must be agreement in the relevant scientific community on the inductive theory that systolic blood pressure is a valid indicator of deception—not just a sincere belief based on a researcher's personal experience.

Yet, Dr. Marston's testimony would seem to be admissible under the supreme court's summary of its holding in Hummert. That summary states that "compliance with Frye is necessary when the scientist reaches a conclusion by applying a scientific theory or process based on the work or discovery of others."\footnote{142}{933 P.2d at 1195 (emphasis added).} Marston's testimony is confined to "[his] own experimentation and observation and opinions based on [his] own work."\footnote{143}{Id.}
Such testimony, *Hummert* announces, is admissible “without first showing general acceptance.”

Despite the court’s description of its “holding,” *Hummert* stands for a different, and narrower point. Like *Logerquist*, it deals with a generalization from an expert that a jury could use in assessing other evidence. Such evidence may be labeled “interpretive evidence” whose function is to explain “primary evidence.” In *Logerquist*, the primary evidence was the plaintiff’s testimony that she recovered her memory. In *Hummert*, it was a three-locus VNTR match. In *Logerquist*, the primary evidence is lay testimony; in *Hummert*, it is scientific evidence, but it is admissible under *Frye*, since the type of DNA testing used is generally accepted as an aid to identification. The pivotal issue in both cases, then, is the admissibility of the interpretive evidence—the experts’ description of what science (or personal scientific experience) reveals about the meaning or significance of the primary evidence. Thus, the *Hummert* exception should be confined to interpretive evidence, as the court seemed to realize in *Logerquist*.

Furthermore, the *Hummert* exception involves a specific type of interpretive evidence. A forensic scientist making an identification from trace evidence might testify in three ways: (1) “There is a match”; (2) “There is a match, and I have never encountered a match between two different people”; and (3) “There is a match, I have never encountered a

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144. *Id.*

145. The concurring opinion comes closer to the mark:

This case is unlike *Bible* and *Johnson* because it involves a qualitative, not quantitative, description of the significance of a match. The experts in this case testified that they had never seen two samples from unrelated donors that matched over three probes, that the possibility of a random match was “rare,” and that DNA can “uniquely identify” a person. These conclusions were based upon their own scientific experience. Neither expert relied upon a controversial scientific principle. I agree with the court, therefore, that *Frye* is not applicable. The experts’ opinions concerning the “uniqueness of DNA” and their personal experience are admissible under Rule 702, Ariz. R. Evid. The data supporting their opinions are admissible under Rule 703, Ariz. R. Evid. *Id.* at 1197 (Martone, J., concurring). But this formulation is not quite right either. Claiming that a characteristic is “unique” or “rare” is not overtly quantitative, but the distinction between the qualitative and quantitative cannot be what is at work here. If the conclusion that a characteristic has a given probability of being present in a randomly selected person is not obtained via a generally accepted mode of scientific reasoning, then that conclusion must be excluded under *Frye*. Likewise, if the conclusion that a characteristic is rare or unique is not obtained via a generally accepted mode of scientific reasoning, then that conclusion also must be excluded under *Frye*. In other words, *Frye* applies to the qualitative as well as the quantitative in science.


147. See *State v. Kunze*, 988 P.2d 977, 983 (Wash. Ct. App. 1999) (law enforcement consultant professed “personal belief was that human ears are sufficiently unique to support a
match between two different people, and science has shown that different people never match.\textsuperscript{148} Hummert proceeds as if the case involved only the second category of expert testimony.\textsuperscript{149} It rejects special scrutiny for testimony about the uniqueness of identifying characteristics based entirely on the accumulated observations of the testifying scientists or technicians.\textsuperscript{150} Given this understanding of the testimony, Hummert does not establish a broad, "personal knowledge" exception to the normal demand for general acceptance of scientific evidence.\textsuperscript{151} Rather, it is a "private-data-set" exception that allows experts using generally accepted methods to report on their experiences. This exception is not patently absurd,\textsuperscript{152} but it may be unwise to admit private data sets without the special scrutiny given other aspects of scientific testimony.\textsuperscript{153} 

positive identification in an appropriate case, and that the latent print left on a [a] door "match[ed] exactly" the exemplars taken from" defendant).

148. Id. at 982-83 (police evidence technician at a Frye hearing testified affirmatively in response to the question "do you have an opinion as to whether . . . the uniqueness of the human ear as a basis for personal identification is a notion that is generally accepted in the Netherlands and elsewhere amongst those engaged in forensic identification?").

149. Hummert, 933 P.2d at 1192 ("[the] . . . conclusions . . . in this case [came] strictly from personal knowledge and study").

150. See id. at 1193 ("Having made the DNA examination according to recognized scientific principles and finding a match at three loci, the experts claimed that . . . they had never before seen a three-loci [sic] match from unrelated individuals.").

151. This much is confirmed by Justice Feldman's references in Logerquist to "deduction" as opposed to induction. See supra note 125 and accompanying text.

152. Because it is less expansive than some sweeping exception for "personal experience," it meets the concern expressed by the Court of Appeals in Hummert that the exception would swallow the rule. That court wrote:

The trial court appeared to conclude that the testimony was unobjectionable because the experts couched their opinions in terms of their personal experience as scientists. We believe that this approach is nothing more than a subtle evasion of Frye. If such testimony were admissible, any expert could express an opinion regarding matters not generally accepted by the relevant scientific community merely by framing it in terms of his or her own observations.

905 P.2d 493, 499 n.2.

153. In addition, even if the private data set exemption were acceptable, it would not dispose of the objectionable expert testimony in Hummert. That testimony went beyond statements like "I have looked at hundreds of three-locus profiles and never seen a match." The two experts there asserted, in substance, that a three-locus VNTR match is sufficient to identify every human genome on the planet. Their assertions expressed an opinion that the broader scientific community regarded as a premature extrapolation. In fact, one expert was herself a member of the National Academy of Science committee that later wrote that "an expert should—given with [sic] the relatively small number of loci used and the available population data—avoid assertions in court that a particular genotype is unique in the population." NATIONAL RESEARCH COUNCIL COMMITTEE ON DNA TECHNOLOGY IN FORENSIC SCIENCE, DNA TECHNOLOGY IN FORENSIC SCIENCE 92 (1992). Moreover, these testifying experts apparently relied not merely on personal experience, but also on their understanding of theories of human population genetics for such statements. It seems hard to
The Supreme Court in *Hummert* supplied a brief justification of the private-data-set exception:

This testimony is governed not by the application of *Frye* but by Arizona Rules of Evidence 702 and 703. See *State v. Roscoe*, 145 Ariz. 212, 219, 700 P.2d 1312, 1319 (1984). "Frye-ing" scientific evidence is necessary when application of a scientific technique is "likely to have an enormous effect in resolving completely a matter in controversy." *State ex rel. Collins v. Superior Court*, 132 Ariz. 180, 199, 644 P.2d 1266, 1285 (1982), quoting M. UDALL & J. LIVERMORE, LAW OF EVIDENCE § 102, at 212 (2d ed. 1982). However, when the expert gives testimony that "only helps a trier to interpret the evidence . . . it will be received on a lesser showing of scientific certainty." *Id.* As we stated in *Roscoe*, "[t]he weight of the evidence did not hinge upon the validity or accuracy of some scientific principle; rather, it hinged on [the expert's] credibility, the accuracy of his past observation . . . the extent of the training . . . and the reliability of his interpretations. . . ." *Roscoe*, 145 Ariz. at 220, 700 P.2d at 1320; *McCormick on Evidence* § 203, at 871, nn.27 and 28 (J.W. Strong et al. eds., 4th ed. 1992).

This passage makes only two arguments. One is that strict scrutiny is required only when the truth of the seemingly scientific testimony depends "upon the validity or accuracy of some scientific principle." If this merely means that evidence that is unrelated to any scientific principle is outside the scope of the strict scrutiny reserved for scientific evidence, it is unobjectionable. If it means that a researcher's personal experience with a scientific instrument should not receive strict scrutiny, it is untenable. Systematic study under well-defined conditions structured to eliminate bias in making and recording measurements rather than personal impressions of how things work are the hallmark of sound science. That is the difference between modern evidence-based medicine and centuries of nostrums. To press the point, suppose that a forensic scientist uses an ordinary, optical

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154. 933 P.2d at 1193. In *State v. Roscoe*, from which various phrases were plucked, the court held that testimony about the behavior of a trained dog was admissible without regard to the general acceptance within the scientific community of the ability of dogs to identify scents. See *supra* Part III.B. 155. *See generally* HANS ZEISEL & DAVID H. KAYE, PROVE IT WITH FIGURES: EMPIRICAL METHODS IN LAW AND LITIGATION 1-14 (1997).
microscope to measure the mean radius of curvature of human hairs. On this basis, the scientist claims the ability to individualize—that is, to identify the source of a human hair to exclusion of all other people. The prosecution offers the opinion of this scientist, arguing that the use of a microscope to magnify objects like hairs is generally accepted, and the expert can give an opinion based on the private data set acquired from personal experience with this generally accepted instrument.\textsuperscript{156} The tautology that the legal tests for scientific evidence do not apply to evidence that is not scientific is of no use in deciding whether the state should have to show general acceptance of the proposition that the microscopic analysis can individualize hairs.

Likewise, some forensic scientists or criminalists are prepared to testify that they can identify individuals from “earprints”\textsuperscript{157} or “lip prints.”\textsuperscript{158} Is there no need for Arizona courts to consider whether the generalization that no individuals have identical earprints or lip prints has achieved general acceptance in the scientific community?\textsuperscript{159} Under Hummert and Logerquist, a strong argument can be made that this testimony is exempt from Frye because (1) the comparisons come from a generally accepted scientific method for making physical comparisons (analogous to characterizing differences in DNA fragments or to making clinical observations about patients who have experienced psychological trauma); (2) testimony that the prints never match unless they come from the same person is based on the personal experience of the analyst; and (3) the questionable testimony is not an analytical result, but the product of inductive reasoning used as background to explain the significance of the analyst’s finding that the prints are indistinguishable.

Now, the justices who subscribed to the Hummert opinion might be tempted to respond that general acceptance \textit{would} be required because the truth of the hair examiner’s testimony or the ear or lip print analyst’s conclusions does depend “upon the validity or accuracy of some scientific principle,” namely, that the radius of curvature is an individualizing characteristic for hair, or that the combination of physical features used in ear and lip comparisons is also individualizing. But that response, while

\begin{itemize}
  \item \textsuperscript{156} Cf. McGrew v State, 682 N.E.2d 1289, 1290 (Ind. 1997) (expert testified that no scientific principles are involved in microscopic examinations of the medulla, cortex, cuticle, root, tip, cortical fusi, ovoid bodies, pigment, thickness, gaping, and condition of hair).
  \item \textsuperscript{157} See State v. Kunze, 988 P.2d 977 (Wash. Ct. App. 1999) (holding that the extensive record below failed to show earprint identification to be generally accepted in forensic science).
  \item \textsuperscript{158} See People v. Davis, 710 N.E.2d 1251 (Ill. Ct. App. 1999) (holding that the unopposed testimony of a police “lab forensic scientist” and a police document examiner showed lip print identification to be generally accepted in forensic science).
  \item \textsuperscript{159} It probably has not. See Kunze, 988 P.2d 977; Mark Hansen, The Fine Print: Courts Split on Admissibility of Lip, Ear Impression Evidence, A.B.A. J., Oct. 2000, at 18.
\end{itemize}
entirely reasonable, eviscerates the private-data-set exception. That exception, as articulated and applied in *Hummert*, insists that a researcher's own studies rest not on the validity of a scientific principle, but on "[the expert's] credibility, the accuracy of his past observation . . . the extent of the training . . . and the reliability of his interpretations."160 If the hair examiner's testimony that the radius of curvature is individuating implicates a scientific principle, then so does the testimony of the DNA analysts in *Hummert* that a three-locus match narrows the field to identical twins. The rationale that no scientific principle is involved cannot justify the private-data-set exception.

The court's other rationale is that strict scrutiny is required only "when application of a scientific technique is 'likely to have an enormous effect in resolving completely a matter in controversy,'" which is not the case "when the expert gives testimony that 'only helps a trier to interpret the evidence.'"161 This difference underlies the background-results dichotomy of *Logerquist*,162 but the notion that dubious interpretations or generalizations are so rarely or mildly prejudicial that they need not be screened is far from self-evident. Does the court think that statements about the uniqueness of DNA profiles have little effect on jurors who must determine the source of a bloodstain? What of a homicide case in which an earprint found on the victim's door163 or a lip print on the sticky side of some duct tape164 is the only physical evidence linking the defendant to the crime? Although testimony about uniqueness "only helps a trier to interpret the evidence," it also is "likely to have an enormous effect" in such cases. When this happens, the court's rationale for dispensing with *Frye* evaporates.

IV. CONCLUSION

*Hummert* and *Logerquist* do not adequately demarcate the boundary between science and nonscience. Like blind men who are unable to form a

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161. At best, this argument is elliptical. Stated more fully in the case of DNA evidence, it proceeds as follows: (1) the reason for strict scrutiny is that scientific evidence tends to overwhelm jurors because it is dense and impenetrable but enveloped in an aura of infallibility; (2) testimony about how often DNA analysts encounter matching profiles is easily understood; therefore, (3) rigorous testing or general acceptance of the analysts' claims as to the rarity of a profile is unnecessary.
162. See supra Part III.B.
coherent description of an elephant on the basis of touching very different anatomical features like the trunk and the legs, the opinions of the court touch on one after another feature that might justify some relaxation of the demands of Frye in some situations. Yet, it is all but impossible to combine these disparate features into a coherent principle of law. In large measure, this reflects the difficulty of the boundary problem itself. If Frye or Daubert is applied strictly, the pressure to admit seemingly worthwhile expert testimony that is not well validated or whose accuracy is difficult to gauge sometimes is difficult to resist. But articulating and justifying a reasonable and comprehensive rule as to when to release scientists or technicians from Frye’s grip is no easy task. In any event, it is not one that the courts in Arizona or elsewhere have performed.165

Perhaps there is a better way. Given the Logerquist’s majority distaste for Kumho Tire’s call for serious judicial screening of all expert testimony,166 one might wonder why the court does not move to a sliding scale that considers the nature of the science in question, the uses to which it is put, the degree of general acceptance, and various other factors to determine admissibility of both scientific and nonscientific expert testimony.167 This “relevancy-plus approach,”168 which is favored by several of the authorities169 and cases170 on which the Logerquist court relies, “offers a more honest and sensitive basis for making admissibility decisions than the more cramped tests that have characterized this area of the law of evidence.”171 It is doubtful that the Logerquist doctrine will prevail in Arizona, but as long as the court limits its vision to a choice between Frye and Daubert, the boundary problem will remain unsolved.

165. See 1 MCCORMICK, supra note 5, at 735 (“Courts in Frye and Daubert jurisdictions have been forced to draw (and tempted to manipulate) an often obscure line between ‘scientific’ evidence and other expert or lay testimony.”).

166. This is the reading of the case advanced without much explanation in Logerquist. See supra Part II. The holding in Kumho Tire is narrower, and the contours of the reasoning are ambiguous. See supra Part I.

167. One explanation might be that neither party in Logerquist suggested that possibility, since each believed its interests were better served by Daubert.

168. 1 MCCORMICK, supra note 5, § 203, at 733, 737.

169. See id.; 22 WRIGHT & GRAHAM, supra note 81, § 5168 at 76.


171. 1 MCCORMICK, supra note 5, § 203, at 737.