Scientifically Complex Cases, Trial by Jury, and the Erosion of Adversarial Processes

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INTRODUCTION

On the day I was asked to participate in the Clifford Symposium on Tort Law and Social Policy I also checked out of the library Mirjan Damaska's book, Evidence Law Adrift. It was a very fortuitous coincidence, for his book has much to offer those interested in the state of the civil jury in America today.1

Damaska begins his book by discussing some unique aspects of the American law of evidence, including its technical character,2 and its complex web of exclusionary rules, especially those "intrinsic exclusionary rules" that reject probative information on the belief that its exclusion will enhance fact-finding accuracy.3 He notes that historically two reasons have been offered up for the unusual aspects of the American law of evidence. The first, advanced by James Thayer, along with many others, is that the common law's fact-finding arrangements are "the child of the jury system."4 A second and more recent

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1. Mirjan R. Damaska, Evidence Law Adrift (1997) [hereinafter Damaska, Evidence Law Adrift]. I had been planning to read the book for quite some time, not only because it concerned a topic about which I am interested, but also because I believed that professor Damaska's earlier book on comparative legal systems, The Faces of Justice and State Authority, is the best single discussion of the topic since Max Weber. Mirjan R. Damaska, The Faces of Justice and State Authority (1986). In that book, as in Evidence Law Adrift, Professor Damaska brings a rich and nuanced understanding of continental legal systems to his analysis of our own. He allows us to gain sufficient intellectual distance so that we can see the whole forest and not just the individual trees that comprise American trial practice.

2. Damaska notes that the technical character of evidence rules in the United States is reflected in the fact that "there is relatively little an untutored person can extrapolate from his or her ordinary life experience that can be used in forensic proof-taking without much lawyerly intermediation." Damaska, Evidence Law Adrift, supra note 1, at 11-12.

3. Id. at 14.

4. Id.
theory is that they are the child of the adversary system.\(^5\) It seems to Damaska and to me that one does not have to choose between these two explanations, for fact-finding arrangements are indeed influenced by both. The jury, the adversary system, and the law of evidence are closely bound together. What happens to one inevitably affects the other two. One cannot have a useful discussion of the civil jury without placing it in this larger context.

Evidence law, civil juries, and adversarial processes are themselves buffeted by changes in the American legal landscape. In the jargon of science, they are dependent variables, affected by factors such as increasing docket pressures and the mounting costs associated with jury trials.\(^6\) Near the end of his book, Damaska points to two other related factors that promise to force additional changes on the American civil justice system: the growing complexity of fact finding\(^7\) and “the creeping scientization of factual inquiry.”\(^8\) Indeed so. Increasing complexity and the scientization of civil cases are two of the most important and profound changes in civil litigation in the last two or three decades.

In this essay I wish to focus on the impact of these developments on evidence law, juries, and adversarial processes. That is, I wish to treat the increasing complexity and the growth of scientific testimony as the independent variables and examine their effects on the law of evidence, the role of juries, and adversary processes. As Damaska’s book makes clear, however, these three “dependent” variables are themselves interwoven in a complex relationship. Pressures placed on one inevitably affect the other two.\(^9\)

The primary thesis of this paper is that the growth of the use of science in court and the accompanying increase in fact finding complexity have placed pressures on the ability of the civil jury, embedded in an adversarial set of procedures, to correctly resolve disputes. These pressures are nowhere greater than in the trial of complex (often mass) torts that involve the use of scientific experts. For a while it appeared that the legal system might respond to the pressure

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5. Id. at 2.
6. Damaska’s basic argument is that these factors have lead to the erosion of adversarial processes and the marginalization of juries, and this in turn has weakened traditional justifications for unique aspects of American evidentiary rules. Id. at 142.
7. Id. at 140.
8. Id. at 143.
created by these kinds of cases by restricting trial by jury. However, it now appears that something quite different, although equally profound, is occurring. Rather than a substantial diminution of the role of juries in civil cases, the law has altered the evidentiary and procedural rules that surround trials. Specifically, it has altered the evidentiary rules of admissibility, and less obviously, it has taken steps to erode the adversarial nature of trials. More specifically, it has taken steps to weaken party control over litigation by empowering judges and juries to play a more active role in the trial process.

Section I briefly reviews the growth of scientifically complex cases in civil litigation. Section II discusses the problems jurors have in dealing with the expert evidence presented in such cases. Section III discusses the emergence of a new standard for the admissibility of scientific evidence as embodied in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* I argue that the evidentiary changes embodied in this and subsequent opinions can be understood as an attempt to assist jurors with expert evidence by reducing party control over expert testimony. Section IV expands upon this argument by discussing other procedural changes designed to facilitate the jury's task. Taken as a whole, the common theme of these changes is a reduction in the adversarial nature of complex trials. The conclusion summarizes the paper and offers some thoughts about the future of civil jury trials.

### I. THE GROWTH OF EXPERT TESTIMONY

It is commonplace that expert testimony plays an important role in civil litigation, especially in tort litigation. Recently, its ubiquity has been documented in several studies. For example, a study of 529 civil jury trials in California between 1985 and 1986 revealed that experts testified in 86% of the cases and that an average of 3.8 experts testi-
fied in each case. Experts appeared in 100% of the products liability cases. The majority of personal injury cases involved a "battle of the experts," with expert witnesses testifying for both the plaintiff and the defendant.

The widespread use of experts is beyond conjecture. What is less clear is the rate of growth of expert testimony. Michael Green reports that between 1974 and 1989 the number of regularly testifying experts in Cook County (Chicago), Illinois increased 1,540%. More recently, Samuel Gross and Kent Syverud report growth in the number of experts in California civil jury trials between 1986 and 1991. The mean number of experts rose from 3.3 per case in 1985-86 to 4.1 in 1990-91, nearly a 25% increase over this five-year span. These data suggest substantial growth, but we lack comprehensive, systematic data. What is certain is that there is no foreseeable diminution in the use of experts, and that they have now become a mainstay in civil jury trials. To the extent that expert opinions are difficult to comprehend and assess, the prevalence of this type of evidence poses a serious problem for civil trial by jury.

This leads to the central question concerning experts: Is their increased prevalence accompanied by increased difficulty? If the number of experts were increasing but their testimony was on balance easier to comprehend and assess, then this growth would not pose a great comprehension problem for civil juries. Is expert testimony increasingly more difficult? On this question the picture is even murkier. Arguing against increased difficulty is the fact that the majority of experts in court are medical doctors, a traditional area of expertise. On the other hand, it may be that even within categories of

19. Id.
22. Gross & Syverud, supra note 17, at 31-32.
23. Other indirect indicators also suggest a growth in the use of experts in recent years. For example, a number of firms, such as Technical Advisory Service For Attorneys (TASA), are now in the business of providing experts to lawyers for a fee.
24. The growth might pose other problems if it led to longer trials.
25. Gross & Syverud, supra note 17, at 31-32 n.46 (finding that nearly 60% of all experts in California civil cases in 1985-86 were medical experts, and almost all of them were medical doctors). The next largest category is industrial and mechanical experts, and engineers, presumably testifying mostly in product liability cases. Id. at 32. Only 3% of the experts were identified as "scientists." Id. Based on a review of a group of North Carolina cases, Neil Vidmar argues that many malpractice cases do not involve complex scientific questions. Neil Vidmar, Are Juries
experts the comprehensibility of testimony has changed. There is a substantial difference between the difficulty of assessing the testimony of a treating physician testifying that a fall on a slippery floor is what caused the plaintiff to break her arm, and a treating physician testifying that exposure to a pesticide is what caused the plaintiff's memory loss.\textsuperscript{26}

Given the limited evidence now available, one cannot conclude with certainty that the "mean difficulty" of expert testimony in civil cases has gone up. What is more certain is that the absolute number of "hard" cases has increased. Moreover, many of these cases have two other attributes that have magnified their significance. First, many have involved mass torts, and therefore represent a large number of other similar cases, the value of which will be altered by each verdict rendered.\textsuperscript{27} Second, and not unrelated, many of the cases have been tried in federal courts, primarily due to removal under diversity jurisdiction. This forum has given the cases a higher profile than they otherwise might have enjoyed.

In sum, although it seems likely that we are experiencing an overall growth in both the volume and complexity of scientific evidence, there is in fact little systematic evidence on point one way or the other. What is clearer is that at the top there are a greater number of highly visible cases involving complex scientific questions, many involving mass torts such as asbestos exposure and silicone implants. This in turn has generated considerable interest in the question of whether jurors are competent fact-finders when presented with such cases.\textsuperscript{28}

\section{II. Juror Competence}

Current judicial interest in the competence of jurors in complex cases can be traced to complex antitrust litigation in the late 1970s and early 1980s. In \textit{In re Japanese Electronic Products Antitrust Litigation},\textsuperscript{29} the Third Circuit indicated that due process considerations may cause there to be a complex case exception to the right to trial by jury.\textsuperscript{30} This opinion followed academic discussions concerning


\textsuperscript{26} See Kannankeril v. Terminix Int'l, Inc., 128 F.3d 802 (3d Cir. 1997).


\textsuperscript{28} For this discussion, I set aside criminal cases that present difficult scientific questions. It is the case, however, that trials such as that of O.J. Simpson cast further doubt on the jury's capacity to understand complex scientific evidence presented in an adversarial context.

\textsuperscript{29} 631 F.2d 1069 (3d Cir. 1980).

\textsuperscript{30} \textit{Id.} at 1084.
whether the Seventh Amendment protected a right to jury trial in such cases.\textsuperscript{31} Despite substantial literature discussing this issue, the empirical evidence on point is somewhat limited. Here is most of what we know on the topic.

Joe Cecil and his colleagues reviewed a number of studies of juror competence in complex cases.\textsuperscript{32} A Federal Judicial Center study of lengthy civil trials indicates that jurors in such cases found the evidence to be more difficult than did jurors in shorter cases where the evidence was less demanding.\textsuperscript{33} Nevertheless, a majority of both groups of jurors believed that they were able to comprehend the evidence.\textsuperscript{34}

Neil Vidmar reviews several studies assessing the degree to which jury verdicts agree with those of experts independently assessing the evidence in malpractice cases.\textsuperscript{35} One of the more complete studies, conducted by Mark Taragin and his colleagues,\textsuperscript{36} compared jury verdicts on liability against the judgment of negligence made by the insurance company's physician evaluator.\textsuperscript{37} The correlation between the verdicts of the evaluators and juries was statistically significant. Plaintiffs won 21\% of the cases the evaluators rated as "defensible" (i.e. the defendant's behavior was not negligent), 30\% of the unclear cases, and 42\% of the "indefensible" cases.\textsuperscript{38} In a more recent study, Bryan Liang gave eleven anesthesiologists in a primary teaching hospital of Harvard Medical School the facts of twelve malpractice cases involving an anesthesiologist defendant.\textsuperscript{39} In two separate surveys they were asked to assess whether the defendant failed to exercise due care, and these results were compared to actual jury verdicts in the twelve cases. Combining all cases, physician agreement with jury verdicts on the first survey was 58\% and on the second survey was 56\%.\textsuperscript{40}

The results of these studies are, of course, open to various interpreta-

\begin{thebibliography}{99}
\bibitem{32} Cecil et al., \textit{supra} note 31, at 750-63.
\bibitem{33} \textit{JOE S. CECIL ET AL., JURY SERVICE IN LENGTHY CIVIL TRIALS} 38 (1987).
\bibitem{34} \textit{Id.}
\bibitem{35} Vidmar, \textit{supra} note 25, at 903-06.
\bibitem{36} Mark I. Taragin et al., \textit{The Influence of Standard of Care and Severity of Injury on the Resolution of Medical Malpractice Claims}, 117 Annals Internal Med. 780 (1992).
\bibitem{37} These judgments were non-discoverable and therefore presumably represented the physicians' true best estimate of the value of the case. \textit{Id.} at 781.
\bibitem{38} \textit{Id.}
\bibitem{40} \textit{Id.} at 129.
\end{thebibliography}
tions. They indicate that jury verdicts are not random events with respect to the quality of the evidence, but they also suggest that many errors are made. What we do not know is exactly how to assess this result.\textsuperscript{41} We do not know, for example, whether jurors did better or worse on "hard" cases, or whether another fact-finder (a trial judge or even another insurance company evaluator) would do better than the jury.

One of the most ambitious investigations of jury decision-making in complex cases is a report by a special committee formed by the American Bar Association ("ABA") section on litigation.\textsuperscript{42} Researchers studied four complex cases in the areas of sexual harassment, antitrust, insurance fraud, and misappropriation of trade secrets.\textsuperscript{43} The researchers collected data on jury performance by interviewing the judge and attorneys after the trial and the jurors after their deliberation.\textsuperscript{44} They also arranged to have alternative jurors sit through the trial.\textsuperscript{45} The alternates were videotaped as they deliberated and attempted to reach a verdict.\textsuperscript{46} The Committee concluded that jurors do have significant difficulty with large volumes of data, especially when the evidence is not about a topic with which the jurors are already familiar.\textsuperscript{47} In one six-week trade secret case jurors reported they "felt overwhelmed by the technical nature of the evidence.... In post-trial interviews, some jurors could recall nothing about the voir dire, opening statements, or the antitrust aspects of the case...."\textsuperscript{48} The sheer length of trials affected performance, both through exhaustion and through boredom.\textsuperscript{49} Organization also impaired jury comprehension.\textsuperscript{50} Jurors dislike sidebar conferences and the other mundane interruptions that are a normal part of the trial of these cases.\textsuperscript{51} A discouraging note is that in three of the four cases the alternative jurors deliberated to a different verdict from the real jurors.\textsuperscript{52} While the Committee explains this is in part due to the fact that there were fewer jurors in the alternative jury deliberations, this lack of consistency is troubling given that all jurors heard the same case.

\textsuperscript{41} Id.
\textsuperscript{43} Id. at 8.
\textsuperscript{44} Id. at 5.
\textsuperscript{45} Id.
\textsuperscript{46} Id.
\textsuperscript{47} Id. at 25.
\textsuperscript{48} Special Comm., supra note 42, at 25-26.
\textsuperscript{49} Id. at 31-32.
\textsuperscript{50} Id.
\textsuperscript{51} Id. at 33.
\textsuperscript{52} Id. at 59.
One of the studies reviewed by Cecil and his colleagues was conducted by Molly Selvin and Larry Picus. They interviewed jurors in an asbestos case involving four plaintiffs exposed to varying amounts of the mineral and who suffered varying degrees of illness. They found that the jurors misunderstood the development of asbestosis in that they tended to believe that the disease was progressive and fatal, and that, therefore, all four plaintiffs would eventually be as ill as the sickest plaintiff.

In a very useful article, Richard Lempert reviewed the ABA and Selvin and Picus studies along with several other reports of jury performance in complex cases. He employed a three point "defensibility scale" (high, moderate, low) to rate each verdict both on the merits and on the damage award in cases where the plaintiff prevailed. In the thirteen cases he examined, the defensibility of the decision on the merits was rated as high in seven cases, moderate in four cases, and low in two cases. The ratings with respect to damages were less favorable: three of the seven juries which were rated high on the merits were rated low on damages. He also rated the cases in terms of his own sense of the inherent difficulty of the evidence, again on a three point scale: high, moderate, and low. Of the six cases scored as low on inherent difficulty, four juries reached highly defensible verdicts and two reached moderately defensible verdicts. Of the seven trials rated moderate or high on difficulty, three juries reached highly defensible verdicts, two reached moderately defensible verdicts and two scored low on defensibility. The one jury for whom the evidence difficulty was rated high, but whose verdict on the merits was rated as highly defensible, found damage amounts that Lempert rated low on defensibility. Overall, one can conclude from this study that jury performance is more likely to be a problem in those cases that are "complex" because of the technical nature of the evidence. This

54. Id.
55. Id. at 24-25.
57. Id.
58. Id. at 185-88.
59. Id.
60. Id.
61. Id.
62. Lempert, supra note 56, at 185-88.
63. Id.
64. Furthermore, Steven Friedland describes complex cases in which juries experienced comprehension problems. Steven I. Friedland, The Competency and Responsibility of Jurors in De-
conforms to the observation by Cecil and his colleagues that the most difficult type of evidence for jurors is that containing statistical and technical information.65

Generally, studies that have asked jurors specific questions about the actual evidence in their case have uncovered greater comprehension problems than studies that only ask the jurors whether they understood the expert evidence. Such research includes the ABA and Selvin and Picus studies. Similarly, Steven Friedland describes several complex cases in which juries experienced comprehension problems.66 Joseph Sanders interviewed jurors about the testimony of specific witnesses in a complex evidence case involving the drug Bendectin.57 He concludes that the jurors had a weak grasp of the science and that their verdict was indefensible.68

Relatively little experimental work has been done on jury comprehension of complex evidence.69 One recent laboratory study by Joel Cooper, Elizabeth Bennett, and Holly Sukel examines the effect of complexity on the way mock jurors process information.70 The social psychology literature suggests that there are two processes that lead to persuasion.71 In systematic or central processing, people examine the content of a communication to assess its validity. Persuasion is primarily a function of the quality of the arguments presented.72 On the other hand, in peripheral or heuristic processing people do not attend to the quality and validity of arguments.73 Rather, they adopt shortcuts to determine the value of a message.74 People rely on factors

66. Friedland, supra note 64, at 190-91, 197-98.
67. Sanders, supra note 64, at 61.
68. Id.
such as the number of arguments (rather than their quality), the attractiveness of the communicator, and the communicator's credentials.75 Peripheral processing is more likely to occur when there is a lack of motivation to attend to an argument or the ability to process a message is not present.76

Cooper, Bennett, and Sukel test the proposition that the difficulty jurors have in processing complex testimony causes them to engage in peripheral processing.77 That is, the difficulty causes them to add to peripheral cues such as the expert's credentials rather than engage in central processing.78 Mock jurors watched a videotaped trial in which experts presented evidence on whether polychlorinated biphenyls ("PCBs") caused the plaintiff's cancer.79 The experiment manipulated the credentials of the plaintiff's scientific expert and also manipulated the complexity of his evidence.80 Consistent with the researchers' hypothesis, among jurors who heard the high complexity version of the trial, those who received the testimony from a highly credentialed individual were more likely to vote for the plaintiff than those who heard it from the less credentialed expert.81 On the other hand, among jurors who heard the low complexity version, the credentials of the expert did not predict verdicts.82 The researchers interpret this result as evidence that low complexity jurors tended to decide based on central processing, while the high complexity jurors employed peripheral processing.83

The fact that the expert's credentials act as a surrogate for the quality of the expert's argument might cause some to conclude that jurors generally are awed by experts. This, however, does not appear to be the case. The ABA study finds, for example, that the jurors in their four cases were not overly impressed with the experts, and dismissed many of them as "hired guns."84 In fact, the Committee concludes

75. Id.
76. Cooper et al., supra note 70, at 381.
77. Id. at 381-82.
78. Id. at 382.
79. Id. at 384. This and similar questions have been litigated with some frequency. See, e.g., In re Paoli R.R. Yard PCB Litig., 113 F.3d 444 (3d Cir. 1997).
80. The experiment employed what is called a 2 x 2 factorial design. Cooper et al., supra note 70, at 383-86. That is, there were four versions of the experiment (high complexity, high credentials; high complexity, low credentials; low complexity, high credentials; low complexity, low credentials). Each "juror" viewed one of these four versions embedded in a one-hour long videotape of a trial. Id.
81. Id. at 387.
82. Id.
83. Id. at 390.
84. SPECIAL COMM., supra note 42, at 40. This finding agrees with other research on the impact of experts. See the studies summarized in Neil Vidmar, Assessing the Impact of Statistical
that a witness who is perceived to be a hired gun can do positive harm to a party's case.\textsuperscript{85}

Selvin and Picus report a general skepticism if not a negative disposition toward the experts in the asbestos case.\textsuperscript{86} Apparently a frequent jury response to difficult scientific issues is to downplay the importance of the experts and their testimony.\textsuperscript{87} Perhaps the clearest statement of this view is found in one juror's comment in an asbestos case studied by Jane Goodman, Edith Green, and Elizabeth Loftus: "[T]he expert testimony was not a real factor in our decision, except in the very backhanded sense that it lent medical credence to any result."\textsuperscript{88} Such reports suggest that central processing is hampered not only by the complexity of the evidence, but by the lack of motivation of some jurors to fully attend to the testimony of party experts.\textsuperscript{89}

In sum, the interview and experimental data tend to indicate that jurors do have trouble with complex scientific expert testimony. Were no other factors involved, these results would support calls for restricting trial by jury in complex cases. However, many, indeed most researchers, who have studied jury behavior in complex cases argue that the task is made more difficult by the limits placed on jurors by American adversarial legal processes. For example, Cecil and his colleagues note that jurors often operate under less than optimal circumstances: "Many of the difficulties encountered by jurors in civil trials may originate from confusing presentation of factual and legal issues and other needless impediments to their fact-finding task."\textsuperscript{90} They discuss reforms such as bifurcation of trials, jury note-taking, pre-instructions and written instructions, and the use of court-appointed experts.\textsuperscript{91} A review of the cases studied by Lempert indicates that difficulties en-

\textit{Evidence, A Social Science Perspective,} in \textit{The Evolving Role of Statistical Assessments as Evidence in the Courts} 279, 297 (Stephen E. Feinberg ed., 1989). The perception that jurors are overwhelmed by experts simply because they are experts is not true.

\textsuperscript{85} \textit{Special Comm.,} supra note 42, at 40.

\textsuperscript{86} \textit{Selvin \& Picus,} supra note 53, at 27.

\textsuperscript{87} For example, Diamond and Casper, reporting on a laboratory study of jury decision making in a complex antitrust case, noted that, "[L]ack of clarity, that is, perceived complexity and difficulty, discourages the jurors from accepting an expert's position, rather than inducing them to accept it." Shari S. Diamond \& Jonathan D. Casper, \textit{Blindfolding the Jury to Verdict Consequences: Damages, Experts and the Civil Jury,} 26 L. \& Soc'y Rev. 513, 543 (1992); see Michael J. Saks \& Robert F. Kidd, \textit{Human Information Processing and Adjudication: Trial by Heuristics,} 15 L. \& Soc'y Rev. 123, 145 (1980-81) (describing errors in judgment resulting from faulty heuristics people tend to use in order to integrate complex information).

\textsuperscript{88} Jane Goodman et al., \textit{What Confuses Jurors in Complex Cases,} Trial Mag., Nov. 1985, at 68.

\textsuperscript{89} Id.

\textsuperscript{90} Cecil et al., supra note 31, at 765.

\textsuperscript{91} Id. at 766-71.
countered by jurors were enhanced, if not caused by lawyers and judges.92 These voices are joined by many others proposing various ways to improve jury performance through a larger gatekeeper role for judges in keeping invalid science from juries,93 greater use of court-appointed experts,94 and other devices to provide the court with non-party expert opinions,95 special scientific training for judges,96 greater judicial control over the admissibility of expert testimony,97 aids to jury comprehension such as jury note taking and jury questions,98 improved jury instructions,99 pre-deliberation jury discussions,100 and the use of bifurcated trials designed to cause the jury to focus its attention on the difficult causal questions presented in complex cases.101 Even those who conclude that juries are generally doing

92. Lempert, supra note 56.
95. See Lawrence S. Pinsky, The Use of Scientific Peer Review and Colloquia to Assist Judges in the Admissibility Gatekeeping Mandated by Daubert, 34 HOUS. L. REV. 527 (1997).
99. See Joel D. Lieberman & Bruce D. Sales, What Social Science Teaches Us About the Jury Instruction Process, 3 PSYCHOL. PUB. POL'Y & L. 589 (1997) (reviewing the social science research relevant to evaluating the effectiveness of judicial instructions).
101. See Irwin A. Horowitz & Kenneth S. Bordens, An Experimental Investigation of Procedural Issues in Complex Tort Trials, 14 LAW & HUM. BEHAV. 269 (1990) (presenting research on the effect of bifurcation for jury outcomes); Joseph Sanders, From Science to Evidence: The Testi-
a good job seem to conclude that their performance might be improved by some of these changes. As Vidmar notes with respect to his study of jury performance in malpractice cases, "Nothing in the data argues against experimenting with procedural modifications such as bifurcated trials, special verdicts, neutral experts, or special masters to assist the jury."

Academic suggestions as to how to improve legal process often fall on deaf ears when presented to judges and practicing lawyers. In this case, however, the legal system has in fact moved in the directions suggested by academics. The next section talks about the most visible change to date—altering the criteria for the admissibility of expert testimony.

III. Admissibility of Expert Testimony

In 1993, the Supreme Court redirected the law of evidence with respect to expert testimony in Daubert v. Merrell Dow Pharmaceuticals, Inc. The legal issue in the case was a narrow one—whether the Frye general acceptance test for the admissibility of scientific evidence survived the adoption of the Federal Rules of Evidence in the 1970s. The court concluded that it did not. Once it dispensed with the Frye rule, the Daubert opinion devoted its attention to outlining the trial judge’s gate keeping role.

Daubert replaced the general acceptance test with a new test focused upon the issue of scientific validity. The opinion set forth four non-exclusive factors courts could use to assess admissibility: (a) scientific validity (whether the test or theory underlying an expert’s testimony is testable and falsifiable); (b) the error rate associated with a given test (unreliable procedures may merit exclusion); (c) whether the theory or technique has been subject to peer review and whether


104. Frye v. United States, 293 F. 1013 (D.C. Cir. 1923). According to the Frye test, scientific evidence should be admitted only when the scientific principle upon which the expert’s testimony is based is "sufficiently established to have gained general acceptance in the particular field in which it belongs." Id. at 1014.

105. Daubert, 509 U.S. at 587.

106. Id. at 592-95.

107. The Daubert test is centered on the idea of scientific validity. See MODERN SCIENTIFIC EVIDENCE 1-45 (David Faigman et al. eds., 1997); Black et al., supra note 97, at 745; Joseph Sanders, Scientific Validity, Admissibility, and Mass Torts After Daubert, 78 MINN. L. REV. 1387, 1390 (1994).
the results have been published; and (d) in a partial resurrection of the 
_Frye_ test, whether the expert’s methods and reasoning enjoy general 
acceptance in a relevant scientific community.\(^{108}\) In recent years 
many courts have begun to consider a fifth factor, whether the 
expert’s research was created for the purposes of litigation.\(^{109}\)

In addition, the _Daubert_ court noted that Federal Rule of Evidence 
702\(^{110}\) requires that the scientific evidence must “assist the trier of 
fact to understand the evidence or to determine a fact in issue.”\(^{111}\) It 
noted that “[t]his condition goes primarily to relevance. . . . The 
consideration has been aptly described by Judge Becker as one of ‘fit.’”\(^{112}\) 
“‘Fit’ is not always obvious, and scientific validity for one purpose is 
not necessarily scientific validity for other, unrelated purposes.”\(^{113}\) 
Several “fit” analyses in the following years excluded expert testimony 
because the judge concluded that the evidence available to an expert 
did not address the particular disputed fact questions posed by the 
case,\(^{114}\) i.e., there was no fit between the data and the conclusions the 
expert wished to draw.

\(^{108}\) _Daubert_, 509 U.S. at 592-94.

\(^{109}\) See _Daubert v. Merrell Dow Pharm., Inc._, 43 F.3d 1311, 1317 (9th Cir. 1995); _In re TMI Litig. Cases Consol. II_, 922 F. Supp. 1038, 1054 (M.D. Penn. 1996).

\(^{110}\) Rule 702 now reads:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.

_FED. R. EVID. 702._

Recently, the Advisory Committee on Evidence has promulgated amendments to Rules 701, 702, and 703. These changes seek to make explicit what the Supreme Court found to be the implicit meaning of Rule 702. The proposed Rule 702 reads:

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, provided that (1) the testimony is sufficiently based upon reliable facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.


\(^{111}\) _Daubert_, 509 U.S. at 591.

\(^{112}\) _Id._

\(^{113}\) _Id._


[N]othing in either _Daubert_ or the Federal Rules of Evidence requires a district court to admit opinion evidence which is connected to existing data only by the ipse dixit of 
the expert. A court may conclude that there is simply too great an analytical gap be-
Many commentators and indeed many courts have assumed that *Daubert* set a lower threshold of admissibility than *Frye*. In one respect this is true. A theory or technique may not have reached general acceptance and yet would be admissible under *Daubert*. However, it is also true that general acceptance does not insure admissibility if a theory is untested, and courts are less willing to allow experts to draw unsupportable inferences from existing evidence. Rhetoric aside, courts, especially federal courts, are less willing to admit marginal expert testimony than they were pre-*Daubert*. Within the area of toxic torts, where many cases involve complex scientific evidence questions, the courts are much more likely to look behind the assertions of an expert to the data and theories supporting those assertions.

For example, with respect to testimony based on epidemiological research, expert opinion, which is premised on a number of well-designed, large studies that indicate a strong and statistically significant relationship between the exact substance to which the plaintiff was exposed and the exact injury the plaintiff has suffered at a dose rate identical to that the plaintiff is known to have experienced, is always admitted. As each of these factors (number of studies, design of studies, strength of the relationship, statistical significance of the relationship, substance similarity, injury similarity, dose rate similarity) is removed, the value of the epidemiological research is weakened and the admissibility of the testimony becomes more problematical. A few examples from recent cases will indicate the nature of the issues involved.

**Number of Studies:** The number and quality of epidemiological studies is sometimes cited as a reason for an admissibility decision. In *Allen v. Pennsylvania Engineering Corp.*, the court cited a lack of positive epidemiological studies linking Ethylene Oxide ("EtO") exposure to brain cancer as a reason to exclude plaintiff's expert's testimony. Similarly, in *National Bank of Commerce v. Dow Chemical Co.* the court noted there was a single study on the effects of expo-
sure to Dursban on fetal development, and it failed to show a relationship.119

Substance Similarity: The Supreme Court, in its recent Joiner opinion,120 affirmed the trial court's exclusion of plaintiff's experts in part on the basis of the lack of substance similarity.121 Two of the four epidemiological studies relied upon by plaintiffs to show a causal relationship between PCB exposure and cancer in fact had involved other substances.122 One involved mineral oil and did not mention PCBs, while the other involved workers exposed to numerous potential carcinogens, including toxic rice oil that they had ingested.123

Injury Similarity: Plaintiffs frequently allege that a substance known to cause one type of harm has caused them to suffer a different type of harm. Admissibility decisions often turn on the court's assessment of the degree of similarity between the two types of injuries. For example, in Valentine v. Pioneer Chlor Alkali Co., Inc.,124 plaintiffs claimed that exposure to chlorine caused damage to their brain and central nervous system.125 Although chlorine gas is known to be toxic and to do serious damage to an individual's pulmonary system (it is a major component of mustard gas), the court disallowed the testimony of one expert and allowed the testimony of a second only if he could point to specific research linking chlorine gas exposure to neural injuries.126

Dosage: Dosage is often a problem for plaintiffs in cases involving exposures to chemicals in the workplace or elsewhere. Sometimes, the problem is simply one of a lack of evidence. In Allen v. Pennsylvania Engineering Corp.,127 the Fifth Circuit affirmed the exclusion on both Rule 702 and Rule 703 grounds of expert testimony that workplace exposure to EtO caused the plaintiff's decedent's brain cancer, in part because of the difficulty of establishing his workplace

119. Id.
120. Joiner, 118 S. Ct. 512.
121. Id. at 519.
122. Id. at 518-19.
123. Id. at 519. Likewise, in Schudel v. General Elec. Co., 120 F.3d 991 (9th Cir. 1997), the plaintiff's expert testified that the plaintiff suffered from solvent-induced toxic encephalopathy due to exposure to the solvents trichloroethane ("TCA") and perchloroethylene ("Perc") based on studies that involved organic solvents other than TCA or Perc. Id. at 996-97. Following a jury verdict for the plaintiff, the defendant appealed the trial court decision to admit this testimony. Id. at 996. The appellate court concluded that admitting the testimony was in error, noting the plaintiff's expert agreed that the mechanism of neurotoxicity from TCA and Perc had not been demonstrated. Id. at 997.
125. Id. at 668.
126. Id. at 677.
127. 102 F.3d 194, 198 (5th Cir. 1996).
exposure. The court noted, "The experts actually knew more about Allen’s exposure to EtO through his smoking a pack of cigarettes a day than they did about his occupational exposure to the chemical."

Sometimes dosages are known, or can reasonably be estimated, and the exposure experienced by the plaintiff is sufficiently below the known levels of toxicity that a court will conclude expert opinions claiming there is a causal relationship between exposure and the plaintiff’s illness are inadmissible. In Sutera v. The Perrier Group of America, the plaintiff alleged that regular consumption of Perrier sparkling mineral water caused him to contract acute promyelocytic leukemia ("APL"). During the time the plaintiff consumed the product it was sufficiently contaminated with benzene that the U.S. FDA ordered a recall of some flavors produced between January 1989 and February 1990. The court concluded that the plaintiff’s expert’s opinion that there was a “probable causal relationship” between the plaintiff’s leukemia and benzene exposure was not based on reliable scientific evidence, primarily because the plaintiff’s level of exposure was far below the exposure shown to cause leukemia in epidemiological and animal studies.

128. Id. at 196-99.
129. Id. at 198; see Wintz v. Northrop Corp., 110 F.3d 508, 513 (7th Cir. 1997); Cuevas v. E.I. DuPont de Nemours & Co., 956 F. Supp 1306, 1312 (S.D. Miss. 1997); Valentine, 921 F. Supp. at 676. In some cases the plaintiff may not be able to prove that he was even exposed to the chemical in question. Mascarenas v. Miles, Inc., 986 F. Supp. 582 (W.D. Mo. 1997).
131. Id. at 656.
132. Id. at 657.
133. Id. at 662. See General Electric Co. v. Joiner, 118 S. Ct. 512 (1997), in which the Supreme Court affirmed a trial court exclusion of expert opinion that the plaintiff’s PCB exposure caused his cancer insofar as it was based on animal studies showing that infant (but not adult) mice developed cancer after exposure to PCBs. Id. at 519. The mice had massive doses of highly concentrated PCBs injected directly into their peritoneums or stomachs. Joiner’s exposure was much lower. Id. at 518. In addition, the mice contracted a different type of cancer than the plaintiff.

In Schudel v. General Electric Corp., 120 F.3d 991 (9th Cir. 1997), the court concluded that studies involving long-term, low chemical concentrations or short-term exposure at very high concentrations could not form the basis of an expert’s opinion that short-term moderate-level exposure caused plaintiff’s injury. Id. at 997. “Extrapolation was necessary to make the studies relevant, and there was no showing that the necessary extrapolation was scientifically acceptable.” Id.

In Wright v. Willamette Industries, Inc., 91 F.3d 1105 (8th Cir. 1996), the court reversed a judgment on a verdict for the plaintiff after concluding there was no valid data upon which to conclude that the plaintiffs had been exposed to a harmful dose of formaldehyde embedded in wood fiber particles. Id. at 1107-08.

Dosage was also an issue in the Three Mile Island litigation. In In re TMI Litigation Consolidated Proceedings, 927 F. Supp. 834 (M.D. Pa. 1996), the plaintiffs offered the testimony of a number of experts that radiation exposure caused plaintiffs’ injuries that were premised on a dose in excess of 100 rems. Id. at 863. However, the key expert witness who originally was to
Strength of Relationship and Statistical Significance: In Joiner, one of the plaintiff's epidemiological studies was minimized because the relationship failed to reach statistical significance. The strength of the relationship shown by the study is also part of the admissibility calculus.

Totality of Defects: Examining cases in terms of their discussion of each single methodological flaw helps us to understand the types of considerations that go into current admissibility decisions. However, this approach suggests greater arbitrariness across cases than in fact exists. In most cases where the judge has excluded the expert's testimony, the research upon which the expert premised his opinion has more than one flaw. This is true of most of the above cases. For an example we need look no further than the Supreme Court's recent Joiner opinion. The plaintiff's expert testimony in Joiner involved at least three separate problems: substance similarity, injury similarity, and dose rate. More often than not, it is the combination of problems rather than any single shortcoming that leads to a decision to exclude. Multiple defects were observed by the trial judge in Valentine v. Pioneer Chlor Alkali Co. Inc., Schudel v. General Electric Corp., Sutera v. The Perrier Group of America, Inc., and Wright v. Willamette Industries, Inc. It is the combination of problems that often causes the court to conclude both that the expert's methods are unreliable and that there is a lack of fit between the research and the causal question in the case.

testify that plaintiffs' actually were exposed to this level of radiation "recanted the bulk of his opinions in an unsolicited voicemail message left with counsel for Defendants." Id. Absent this testimony, the testimony of the other experts no longer fit the facts of the case and the judge granted the defendant a summary judgment on sufficiency grounds. Id. at 870-71.

134. Joiner, 118 S. Ct. at 518.
135. Id. at 516.
136. Id.
137. It is possible, of course, for a decision to exclude to be based on a single factor. In TMI Litigation, 927 F. Supp. 834, dosage problems alone seem to have sufficed to grant the defendant a summary judgment on sufficiency grounds. Id. at 850.
139. 120 F.3d 991 (9th Cir. 1997) (dosage and substance similarity).
141. 91 F.3d 1105 (8th Cir. 1996) (dosage and substance similarity).
142. In a recent article, Daniel Capra reviewed recent admissibility cases and argued that the courts have focused on several "red flag" factors that are considered relevant when assessing whether an expert's testimony is reliable. Daniel J. Capra, The Daubert Puzzle, 32 GA. L. REV. 699 (1998). They are:

(1) improper extrapolation, i.e., drawing an inappropriate conclusion from an accepted premise, (2) reliance on anecdotal evidence as when an expert bases an opinion solely on personal experience with patients or on only a few case studies, (3) reliance on temporal proximity—concluding a substance caused an injury solely because the injury
In addition, courts seem more willing to exclude testimony based on an expert's lack of qualifications. Representative of such cases is *Mancuso v. Consolidated Edison Co. of New York.*

There, the court concluded that an internist did not have the requisite qualifications to testify that the plaintiff's ailments were caused by exposure to PCBs. The internist lacked formal training and credentials in PCB toxicology or in environmental or occupational medicine. The internist was unable to answer basic questions about PCB toxicology (e.g. what levels of PCB contamination would be dangerous to humans) and relied upon the plaintiffs' attorney to provide him with the scientific literature he relied upon to support his opinion.

The timing of *Daubert* and its progeny is as important as their content. The Federal Rules of Evidence had been in place for nearly twenty years, and for much of that period there had been a disagreement among the circuits as to whether the Rules incorporated *Frye.* Yet only in the mid-1990s did the Supreme Court take the time to resolve the issue. Why then? Arguably, one important reason was the growth of scientific expert testimony in court.

appeared shortly after exposure, (4) lack of relationship between an expert's testimony and the facts of the case, (5) failure to consider other causes, (6) lack of testing, and (7) subjectivity demonstrated by an inability to explain a methodology in objective terms.

*Id.* at 714. Capra's factors, like the factors discussed above, are part of the developing body of criteria courts are using to flesh out the admissibility skeleton provided by *Daubert.* As is the case with the factors I have proposed in the text, Capra notes that with respect to his red flags, none is dispositive, “but each has been considered as cutting against admissibility.” *Id.*


144. *Id.* at 1445.

145. *Id.* at 1443-45; see *Sutera,* 986 F. Supp. at 667. Plaintiff's expert, an oncologist and hematologist with no expertise in epidemiology, toxicology, biostatistics or risk-assessment, lacked the specific knowledge, education, training and experience to render an opinion as to whether the exposures to low levels of benzene in Perrier for a short time period caused the plaintiff's leukemia. *Id.;* see *Wintz v. Northrop Corp.,* 110 F.3d 508, 512-13 (7th Cir. 1997) (noting expert, a toxicologist, was not a licenced physician and lacked sufficient expertise in birth defects bromide exposure, or the specific birth defect from which the plaintiff suffered to testify that bromide exposure to the mother during her pregnancy caused the plaintiff's injury); *Everett v. Georgia-Pacific Corp.,* 949 F. Supp. 856, 857-58 (S.D. Ga. 1996) (noting that the expert, practicing family medicine and surgery, possessed no specialized knowledge or training in the field of toxicology); *Muzzy v. Kerr-McGee Chem. Corp.,* 921 F. Supp. 511, 521 (N.D. Ill. 1996) (holding witnesses without expertise in hematology were not qualified to testify whether plaintiff's exposure to radiation from refining byproduct caused her to contract the disease polycythemia vera).

146. For example, the Third Circuit noted that the status of the *Frye* test was uncertain under the Federal Rules, but rejected it on policy grounds in *United States v. Downing,* 753 F.2d 1224, 1232 (3d Cir. 1985). On the other hand, the Ninth Circuit retained the *Frye* test until reversed in the *Daubert* case. See *Daubert v. Merrell Dow Pharm., Inc.,* 951 F.2d 1128, 1129 (9th Cir. 1991).
The growth was accompanied by the belief among some that there has been an increase in "junk science" in the courtroom,\textsuperscript{147} requiring greater judicial vigilance in admitting expert opinion.\textsuperscript{148} For example, the Judicial Conference Advisory Committee on Civil Rules had proposed a change to Federal Rule 702 that would allow expert testimony only if the testimony is "reasonably reliable and will substantially assist the factfinder."\textsuperscript{149} By this language, the Advisory Committee intended to curtail the use of expert testimony.\textsuperscript{150} These developments were not lost on the Supreme Court.

The post-	extit{Daubert} admissibility opinions, nevertheless, might have established a lower threshold for admissibility had courts believed that jurors were well situated to distinguish between valid and invalid scientific conclusions. However, the adversarial system makes this less likely. As Michael Saks and Roselle Wissler note:

In civil litigation . . . all manner of experts are found to testify opposite their colleagues.

Whether such "balancing" of expert witnesses helps the fact finder evaluate their testimony is another matter. The search for witnesses that is driven by the adversary process may result in a distortion of knowledge when applied to expert witnesses. For example, if 999 of every 1000 experts in a given field hold one view of a question and one holds an alternate view, the two experts who appear in court will have been detached from the extremely skewed

\textsuperscript{147} PETER HUBER, GALILEO'S REVENGE: JUNK SCIENCE IN THE COURTROOM (1991); PETER HUBER, LIABILITY: THE LEGAL REVOLUTION AND ITS CONSEQUENCES (1988).


\textsuperscript{149} Committee on Rules, supra note 110, at 83. The proposed Rule 702 would read: Testimony providing scientific, technical, or other specialized information in the form of an opinion or otherwise, may be permitted only if (1) the information is reasonably reliable and will substantially assist the trier of fact to understand the evidence or to determine a fact in issue, and (2) the witness is qualified as an expert by knowledge, skill, experience, training, or education to provide such testimony.

\textit{Id}.

\textsuperscript{150} The Committee noted with respect to these changes: [The revision requires that expert testimony be "reasonably reliable" and "substantially assist" the fact-finder. The rule does not mandate a return to the strictures of \textit{Frye v. United States}, 293 F.2d 1013 (D.C. Cir. 1923) (requiring general acceptance of the scientific premises on which the testimony is based). However, the court is called upon to reject testimony that is based upon premises lacking any significant support and acceptance within the scientific community or that otherwise would be only marginally helpful to the fact-finder.

Committee on Rules, supra note 110, at 84.
distribution of opinion from which they were drawn. The fact finder has no way of knowing this.\textsuperscript{151}

This problem is exacerbated by the fact that in many cases both sides tend to call a similar number of witnesses, and from the lay person's perspective they all appear well credentialed. Elsewhere, I have described this as the problem of the one-eyed fact-finder.\textsuperscript{152} The jury is not blind. It can "see" the expert testimony. What it lacks is depth perception. The ability to properly weigh the evidence. All experts appear qualified and all evidence of equal value and relevance.\textsuperscript{153}

It is not surprising, therefore, that a fifth factor is emerging in many post-\textit{Daubert} admissibility rulings—a concern that the expert's research and testimony was created for the purpose of litigation. In many cases rejecting expert testimony, including a number of the cases discussed above, the courts refer to this consideration.\textsuperscript{154}

As Judge Posner put the issue in \textit{Braun v. Lorillard, Inc.}:\textsuperscript{155}

The Supreme Court held in \textit{Daubert v. Merrell Dow Pharmaceuticals, Inc.} that the opinion evidence of reputable scientists is admissible in evidence in a federal trial even if the particular methods they used in arriving at their opinion are not yet accepted as canonical in their branch of the scientific community. But that is only part of the holding of \textit{Daubert}. The other part is that the district court is re-


\textsuperscript{152} Psychiatrists today have overwhelmingly rejected the notion that they can predict future violence—let alone do so on the basis of hypothetical questions—but psychiatric testimony to the contrary is regularly heard in court, and is a basis of many death sentences. It is common to point out how the structure of legal proceedings can distort the jury's view of a field of knowledge. The universe of psychiatrists may consist of a hundred experts, of whom one believes in predictions of dangerousness and ninety-nine do not, but the list of witnesses in a particular case will probably include one expert on each side of this fictitious divide. It is less commonly noted that the one expert who will testify to the discredited point of view is probably in greater demand as a witness, more experienced in court, and more effective.

\textsuperscript{153} \textit{JOSEPH SANDERS, BENDECTIN ON TRIAL: A STUDY OF MASS TORT LITIGATION} 130 (1998).

\textsuperscript{154} \textit{Id.}

\textsuperscript{155} 84 F.3d 230, 234-35 (7th Cir. 1996).
sponsible for making sure that when scientists testify in court they adhere to the same standards of intellectual rigor that are demanded in their professional work.\footnote{156}{Id. at 234.}

On the other hand, when research has been conducted independent of the litigation this weighs in favor of admissibility.\footnote{157}{Berry v. CSX Transp., Inc., 709 So. 2d 552, 569 (Fla. Ct. App. 1998) ("Our conclusion [to admit] is strongly influenced by the fact that the epidemiological studies here were conducted independently of this litigation and were peer-reviewed and accepted by journals that are widely acknowledged in the scientific and medical communities.").} An interesting recent case in point is \textit{Zuchowicz v. United States},\footnote{158}{140 F.3d 381 (2d Cir. 1998).} in which the plaintiff's wife died from a fatal lung condition allegedly caused by a negligently prescribed overdose of the drug Danocrine.\footnote{159}{Id. at 386.} According to the plaintiff's experts, because of the rareness of primary pulmonary hypertension and the lack of any formal research on the effects of the drug at this high dose rate, they could not point to specific research supporting their conclusion that the drug caused the decedent's illness.\footnote{160}{Id. at 385.} However, they could point to studies showing other agents, such as birth control pills, some appetite suppressants, and chemotherapy drugs, that cause this illness.\footnote{161}{Id.} Moreover, the experts were able to provide a biologically plausible reason why the drug could cause this effect and were able to show that the decedent had no history of cardiovascular problems prior to taking the drug.\footnote{162}{Judge Calabresi, writing for the Second Circuit, concluded that the trial judge did not abuse his discretion in admitting the expert testimony.} Clearly, the court was impressed by the credentials of the plaintiff's experts, their independent research on the issue in question, and the fact that they were not routinely in the business of providing expert testimony in tort litigation.\footnote{163}{Id. at 387.} These factors weighed in favor of admissibility.

In sum, the renewed judicial activism ushered in by \textit{Daubert} is in part an effort to monitor whether experts are behaving as they would were they not in the courtroom. It is an effort to exclude from the courtroom those experts who are prepared to make statements that

\footnote{164}{The plaintiff's experts were Dr. Richard Matthay, a professor of medicine at Yale and Associate Director and Training Director of Yale's Pulmonary and Critical Care Section and Dr. Randall Tackett, a professor of pharmacology and former department chair from the University of Georgia, who had published widely in the field of the effects of drugs on vascular tissues. \textit{Id.} at 385-86. A Westlaw search failed to find the names of these two experts in any other published opinions.}
support the interests of the party who hired them but that are unsupported by valid scientific evidence. Post-Daubert cases use evidence law in an attempt to weaken the link between the parties and their experts and, therefore, the link between adversarialism and jury decision making.

IV. Other Evidentiary and Procedural Changes

Evidentiary admissibility rulings are perhaps the most visible judicial response to the growth of complex scientific evidence, but they are not alone. This section briefly reviews several additional devices employed by the legal system. As we shall see, they all share the attribute that they alter the jury-evidence-adversarial process mix in response to the problem posed by complex cases.

Court appointed experts: The response most similar to admissibility rulings is the use of court-appointed experts. Federal Rule of Evidence 706 permits the court on its own motion or at the request of one or more of the parties to appoint expert witnesses not aligned with either party.\textsuperscript{165} Although admissibility rules may shield jurors from the most unreliable and most partisan testimony, they do not assist them in understanding the complex evidence they do hear. When all evidence is presented by party experts, there is a tendency for differences to be exaggerated and for scientific consensus to be sup-

\textsuperscript{165} Rule 706 reads:

(a) Appointment. The court may on its own motion or on the motion of any party enter an order to show cause why expert witnesses should not be appointed, and may request the parties to submit nominations. The court may appoint any expert witnesses agreed upon by the parties, and may appoint expert witnesses of its own selection. An expert witness shall not be appointed by the court unless the witness consents to act. A witness so appointed shall be informed of the witness' duties by the court in writing, a copy of which shall be filed with the clerk, or at a conference in which the parties shall have opportunity to participate. A witness so appointed shall advise the parties of his findings, if any; his deposition may be taken by any party; and he may be called to testify by the court or any party. He shall be subject to cross-examination by each party, including a party calling the witness.

(b) Compensation. Expert witnesses so appointed are entitled to reasonable compensation in whatever sum the court may allow. The compensation thus fixed is payable from funds which may be provided by law in criminal cases and civil actions and proceedings involving just compensation under the fifth amendment. In other civil actions and proceedings the compensation shall be paid by the parties in such proportion and at such time as the court directs, and thereafter charged in like manner as other costs.

(c) Disclosure of appointment. In the exercise of its discretion, the court may authorize disclosure to the jury of the fact that the court appointed the expert witness.

(d) Parties' experts of own selection. Nothing in this rule limits the parties in calling expert witnesses of their own selection.

\textsuperscript{FED. R. EVID. 706.
pressed. As Gross notes, this produces an environment in which "disagreements are all but inevitable, areas of agreement are under-emphasized or ignored, disputes in the field are magnified, and the consensus of experts, if any, is obscured." Less tainted by partisanship, court appointed experts may identify areas where little disagreement in the scientific community exists, thereby narrowing the range of controversy. Cross-examination of these experts may focus less on witness competence and integrity, and more on areas where scientific evidence is in genuine dispute.

Despite frequent calls for the increased use of court-appointed experts, historically they have been used sparingly. A survey of published federal opinions through 1985 by the Federal Judicial Center uncovered only forty-five references to Rule 706 and thirty-seven cases in which an appointment was made or extensively discussed. The Federal Judicial Center also surveyed 431 Federal District Court judges and found that 80% had never appointed an expert under Rule 706, while 11% had done so only once. Gross' study of 529 civil cases in California found that while over 1,700 experts were called, none were court appointed, even though California's Evidence Code has a provision similar to Rule 706.

This poor track record apparently has not been due to judicial hostility. Judges are not enamored with party experts. Seventy-nine percent of the judges a study by Shuman and his colleagues did not think party expert witnesses could be depended upon to be impartial and 57% thought of experts as "hired guns" who gave biased testimony. According to recent surveys, many judges support the appointment of

167. Gross, supra note 18, at 1175. Damaska agrees. "The chassé-croisée of partisan queries filters out information that does not clearly advance one of the two clashing positions. Common ground in testimony is neglected and divergences magnified." DAMASKA, EVIDENCE LAW ADRIFT, supra note 1, at 100.
169. THOMAS E. WILLGING, COURT APPOINTED EXPERTS 3 (1986).
171. Gross, supra note 18, at 1191.
172. Shuman et al., supra note 20, at 202-03.
an independent expert in cases involving technical or scientific issues. Judges are deterred by other factors, such as unwillingness to devote time and energy to select and supervise experts, or fear of reversal by appellate courts if the judge appears to have been too active in creating the evidence in the case. As Gross notes, however, the main reason courts rarely appoint experts is a hostile bar fearful that court-appointed experts will dominate the trial.

Although the use of court-appointed experts remains rare, there have been recent cases involving complex scientific evidence where they have been employed. The most noteworthy are two silicone breast implant proceedings.

In *Hall v. Baxter Healthcare Corp.*, Judge Robert E. Jones excluded all testimony to the effect that silicone-gel breast implants ("SGBI") cause autoimmune system disorders. The court reached this result after calling on four independent experts to advise it on the state of scientific knowledge. The *Hall* process began with a medical doctor who "assisted the court by screening dozens of potential appointees and ultimately selecting four . . . uncommitted experts." The district court then appointed those selected—an epidemiologist, a rheumatologist, an immunologist-toxicologist, and a polymer chemist—to assist in evaluating the reliability and relevance of the scientific evidence. These specialists served as "technical advisors" rather than as experts appointed under Rule 706 of the Federal Rules

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174. Gross, supra note 18, at 1197-98. One laboratory study suggests that lawyers overestimate the impact of court-appointed experts and that jurors do not give non-adversarial expert testimony more weight than adversarial expert testimony. Brekke et al., supra note 94, at 468-69.

175. It is estimated that between one and two million women have received implants to enlarge or reconstruct their breasts. See, e.g., Charlotte Allen, Jurisprudence of Breasts, 5 Stan. L. & Pol'y Rev. 83, 84 (1994). But see Ralph R. Cook et al., The Prevalence of Women With Breast Implants in the United States—1989, 48 J. Clinical Epidemiology 519 (1995) (reporting that a random survey of 40,000 households in the United States shows that in 1989 there were approximately 815,000 women with implants). In 1996, there were between 450,000 and 500,000 claimants. In re Dow Corning Corp. (Lindsey), 86 F.3d 482, 485 (6th Cir. 1996); Francis E. McGovern, An Analysis of Mass Torts for Judges, 73 Tex. L. Rev. 1821 (1995). It is well known that implants can leak, rupture, or cause painful contractures. However, the association with other conditions is more questionable. Silicone Gel Breast Implants: The Report of the Independent Review Group (U.K.) (visited Oct. 6, 1998) <http://www.silicone-review.gov.uk>.


177. Id. at 1394.

178. Id.

179. Id. at 1393.

180. Id. at 1392.
Along with counsel and the court, the advisors questioned the parties’ witnesses. After viewing videotaped summations from counsel, they submitted written reports. Counsel then had the opportunity to question them. After considering the advisory experts’ reports and the other submissions, the court granted defendants’ motions “to exclude expert testimony concerning causation of any systemic disease or syndrome.”

The federal silicone implant cases are being handled under the Multidistrict Litigation Act. By October 1994, the Judicial Panel on Multidistrict Litigation had transferred approximately 9,600 cases to Judge Pointer in the Northern District of Alabama for pretrial proceedings. In 1996, Judge Pointer appointed a Rule 706 panel consisting of four experts in the areas of immunology, epidemiology, medicine, and toxicology. Judge Pointer charged the panel to address the extent to which “existing studies, research, and reported observations provide a reliable and reasonable scientific basis for one to conclude that silicone-gel breast implants cause or exacerbate any of the conditions described . . . below?” The order asked the panel to...

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181. Id. at 1393 n.8. Indeed, the court denied motions to appoint experts under Rule 706, believing that this would insulate its advisors from depositions and testifying at trial. Id. at 1401. The court reasoned that it had inherent authority to appoint such advisors. Id. at 1392.

182. Hall, 947 F. Supp. at 1411. The chemist was appointed after the evidentiary hearing. Id. The testimony was organized by field; that is, plaintiffs presented their experts in a particular field, and defendants’ witnesses in that field then testified. Id. at 1393.

183. Id.

184. Id. Hall, 947 F. Supp. at 1393.

185. Id. Recently, a federal court in Louisiana granted the defendant a summary judgment in a case involving a silicone penile implant. Pick v. American Med. Sys., 958 F. Supp. 1151 (E.D. La. 1997). The court ruled that the plaintiff’s evidence was insufficient as a matter of law to establish a causal relationship between silicone and plaintiff’s autoimmune disease. Id. at 1173.


188. Silicone Gel Breast Implants, 793 F. Supp. at 1100. In April, under the leadership of U.S. District Judge Jack Weinstein, three judges in New York designated several experts from various disciplines as special masters, and asked them to locate experts for appointment to a larger expert panel that would consider general principles for establishing cause and effect in the SGBI cases, giving “particular attention . . . to claims respecting immune system dysfunction and connective tissue and rheumatic disease.” Eliot Marshall, New York Courts Seek “Neutral” Experts, 272 SCIENCE 189 (1996); see Mark Hansen, Panel to Examine Implant Evidence, A.B.A. J., June 1996, at 34. This panel was eventually put on hold when Judge Joiner appointed a panel in Alabama. In re Breast Implant Cases, 942 F. Supp. 958 (S.D.N.Y. & E.D.N.Y. 1996).

189. In re Silicone Gel Breast Implant Prods. Liab. Litig., (MDL-926), CV 92-P-10000-S (Oct. 31, 1996). The panel was asked “to consider the relationship, if any, between implants and the following: ‘classic’ connective tissue diseases, such as systemic lupus erythematosus, Sjogren’s...
state the extent to which the opinions it reaches are subject to sufficient dispute that other qualified experts could express contrary opinions that would be viewed as "representing legitimate and responsible disagreement within your profession."\textsuperscript{190}

Unlike the Oregon advisors, the national panel of experts has yet to act. Nonetheless, it has affected SGBI litigation. The district courts in New York cited the prospect of a report from the national panel as a reason not to “rush to judgment,”\textsuperscript{191} and the Oregon district court deferred the effective date of its ruling in \textit{Hall} “until the findings of the Rule 706 panel are available.”\textsuperscript{192}

The panel issued its report in December 1998.\textsuperscript{193} The report contained separate chapters on animal studies, immunology, the epidemiological research, and rheumatology. The panel concluded that the evidence linking silicone implants to connective tissue and autoimmune disease in humans is very weak.\textsuperscript{194} The report probably will have a significant impact on the future of this litigation. Some courts have publicly stated that they were awaiting the panel report before proceeding with pending cases. The district courts in New York cited the prospect of a report from the national panel as a reason not to “rush to judgment,”\textsuperscript{195} and the Oregon district court deferred the effective date of its ruling in \textit{Hall} “until the findings of the Rule 706

\begin{itemize}
\item syndrome, etc.; ‘atypical’ presentations of connective tissue diseases or symptoms; immune system dysfunctions.” \textit{Id.} In an appendix to his order, the judge listed forty diseases, symptoms, conditions, and complaints that some have asserted as possibly associated with silicone implants and asked the panel to comment, where appropriate, on the scientific basis of a claimed linkage between implants and the items on the list. \textit{Id.} The panel was instructed not to consider purely local complications arising from implants, such as breast disfigurement or capsular contracture. \textit{Id.}
\item \textsuperscript{190} \textit{Id.}
\item \textsuperscript{191} \textit{In re Breast Implant Cases, No. 92 CV 7821 (lead) (S.D.N.Y. & E.D.N.Y. Oct. 23, 1996) (Amended Preliminary Memorandum).}
\item \textsuperscript{192} \textit{Hall v. Baxter Healthcare Corp., 947 F. Supp. 1387, 1394 (D. Or. 1996).}
\item \textsuperscript{193} Betty A. Diamond et al., Silicone Breast Implants in Relation to Connective Tissue Disease and Immunologic Dysfunction: A Report by a National Science Panel to the Honorable Sam C. Pointer Jr., Coordinating Judge for the Federal Breast Implant Multi-District Litigation. \textit{<http://www.fjc.gov/BREIMLIT/ SCIENCE/report.htm>.}
\item \textsuperscript{194} The panel drew the following conclusion with respect to the animal study research: “Considering the broad range of testing systems that have been used in the study of silicone effects, the toxicological and immunologic responses are few in number and questionable in significance.” Diamond et al., \textit{supra} note 193, at 5. With respect to the immunological research the panel stated, “The main conclusion that can be drawn from existing studies is that women with silicone breast implants do not display a silicone-induced systematic abnormality in the types or functions of cells of the immune system.” \textit{Id.} at 6. As to the epidemiological evidence, the panel reported that with the possible exception of Sjogren’s syndrome, “no association was evident between breast implants and any of the individual connective tissue diseases, all definite connective diseases combined, or the other autoimmune/rheumatic conditions.” \textit{Id.}
\item \textsuperscript{195} \textit{Breast Implant Cases, No. 92 CV 7821.}
panel are available." Presumably, many other courts will be influenced by the panel when asked to make admissibility and sufficiency rulings when the multi-district cases are referred back to their home districts for trial.

Two cases, of course, do not establish a trend. However, it is worth noting that when confronted with similar scientific uncertainty in the early stages of previous mass torts, such as Bendectin and asbestos, the courts did not turn to this device. Moreover, judicial support for the greater use of Rule 706 experts is on the rise. Most notable in this regard is Justice Bryer's concurring opinion in Joiner. Bryer wrote separately to emphasize the availability of court appointed experts and other procedural devices that would assist courts to parse difficult scientific and technical subjects. Finally, there is some evidence that the use of 706 experts is increasing in frequency. The Federal Judicial Center has replicated their earlier survey of published federal opinions for mentions of 706. The results suggest that there is a small increase in the use of court appointed experts.

**Procedural Devices:** A number of procedural devices have also been used to simplify the jury task in complex cases. Perhaps the most noteworthy is bifurcation. In recent years a number of states have authorized the separation of the punitive damage phase from the rest of a trial. Here, I am more interested in bifurcation that separates the causal question from other elements of the cause of action. Typically, the court first tries the causal question, and only if the plaintiff prevails is the rest of the case tried. Federal Rule of Procedure

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199. The Federal Judicial Center conducted a Lexis search of all Federal District Court decisions since 1985 for the term "court-appointed experts." The average mentions in the five-year period from 1989 through 1993 (the year Daubert was decided) was 35 per year. In the years 1994-1998 (through the middle of October) there were on average 59 mentions per year. Personal correspondence from Joe Cecil to Joseph Sanders, October 23, 1998.
42(b) permits a separate trial of issues for reasons of convenience, economy, expedition, or to avoid prejudice.\textsuperscript{202} Similarly, Rule 23(c)(4)(A) permits separation of issues in class actions.\textsuperscript{203} Most state civil procedure codes have similar provisions.\textsuperscript{204} Economy and expedition justify bifurcation in those mass exposure cases with many plaintiffs or many defendants.\textsuperscript{205} Judge Rubin used this justification for bifurcating a Bendectin trial involving over 800 plaintiffs.\textsuperscript{206} He calculated that the trial of all 1,100 then existing Bendectin cases would require 182 judge years.\textsuperscript{207} Trying even 5\% would consume nine judge years.\textsuperscript{208} Because the defendant prevailed before the jury on the general causation question, a trial on liability and damages was unnecessary.

Recently, the trial judge bifurcated the trial in the protracted Paoli Railroad Yard litigation.\textsuperscript{209} After a thirteen day trial, consisting primarily of expert opinion, the jury found that none of the plaintiffs had been “significantly exposed” to PCBs from the Yard and the PCBs from the Yard had not damaged the plaintiffs’ property.\textsuperscript{210} The Third Circuit rejected the plaintiffs’ argument that this decision violated their Seventh Amendment right to trial by jury.\textsuperscript{211} It went on to say:

In the case at bar, the interests of judicial economy and convenience counseled strongly in favor of severing the issues relating to plain-

\textsuperscript{202} \textit{FED. R. CIV. P. 42(b).} The Rule reads: Separate trials. The court in furtherance of convenience or to avoid prejudice, or when separate trials will be conducive to expedition and economy, may order a separate trial of any claim, cross-claim, counterclaim, or third-party claim or of any separate issue or any number of claims, cross-claims, counterclaims, third-party claims or issues, always preserving inviolate the right of trial by jury as declared by the Seventh Amendment of the Constitution or as given by a statute of the United States.

\textsuperscript{203} \textit{FED. R. CIV. P. 23(c)(4)(a).}


\textsuperscript{205} See Cecil et al., \textit{supra} note 31, at 767, for a list of cases where issues have been separated for trial in the areas of antitrust, patent and personal injury.


\textsuperscript{207} \textit{Id.} at 1221 n.6.

\textsuperscript{208} \textit{Id.}

\textsuperscript{209} \textit{In re Paoli R.R. Yard PCB Litig.}, 113 F.3d 444 (3d Cir. 1997). For another recent case where the causal question was separated, see \textit{Jeter v. Owens-Corning Fiberglas Corp.}, 716 A.2d 633 (Pa. Super. 1998).

\textsuperscript{210} \textit{Paoli}, 113 F.3d at 452.

\textsuperscript{211} \textit{Id.}
tiffs’ exposure to PCBs and causation of their injuries from the issues of defendants’ culpability. Phase I focused on plaintiffs’ exposure to PCBs while Phase II would have concerned whether the conduct of several railroad operators and manufacturers caused that exposure. The trial of the Phase I issues alone lasted three weeks and involved dozens of witnesses. Resolution of the Phase I issues obviated the need for a trial on the issues of the defendants’ liability, which undoubtedly would have taken months and would have involved issues more complicated than the Phase I trial, all at additional cost to the parties. Thus, bifurcation preserved judicial resources and reduced the expenses of the parties, and the district court did not abuse its discretion in ordering such a process.212

It is a closer question whether bifurcation can be justified on the basis of economy and expedition in cases with single plaintiffs and single defendants.213 Within the context of this paper, however, the case for bifurcation rests primarily on the argument that it would improve jury performance by focusing their full attention on complex causal questions and for this reason it might have a place in some single plaintiff, single defendant cases as well.

Bifurcation does appear to alter jury outcomes, generally by producing more defense verdicts.214 Are such outcomes superior? There is some evidence supporting a conclusion that they are. A 1989 Harris Poll survey of federal and state court judges found that not only do the judges believe bifurcation reduces transaction costs, 80% of the federal judges and 77% of the state judges also believe bifurcation had a positive impact on the “fairness of the outcome.”215 More persuasively, perhaps, there is evidence that jurors hearing bifurcated cases are less likely to trade off weak causal evidence against strong evidence on liability or damages. Insofar as we believe that jurors should

212. Id. at 452 n.5.

213. Zeisel and Callahan studied the effects of a program instituted to encourage split trials in the Northern District of Illinois in the early 1960s. Hans Zeisel & Thomas Callahan, Split Trials and Time Saving: A Statistical Analysis, 76 HARV. L. REV. 1606 (1963). They found that bifurcated trials were on average shorter in duration than unitary trials. Id. at 1616. However, these cases bifurcated liability and damages; there were no separate trials of the causal question.

214. Zeisel and Callahan report that in the Northern District of Illinois experiment defendants prevailed in 56% of the bifurcated trials, but only 34% of the unitary trials. Id. at 1616 tbl.3. In a laboratory experiment, using a toxic tort trial stimulus, Horowitz and Bordens found that juries hearing a unitary trial were significantly more likely to find for the plaintiff (85%) than were juries that heard trials in which causation, liability and damages were heard separately (68%). Horowitz & Bordens, supra note 101, at 277-78. If juries in the bifurcated condition did find for the plaintiff, however, their compensatory damages awards were significantly larger than those of unitary juries. Id.

make independent decisions as to each element of a tort, there is evidence that bifurcation will facilitate such decision-making.\textsuperscript{216}

Other procedural devices suggested from time to time include restricting the number of expert witnesses and the length of their testimony,\textsuperscript{217} judicial questioning of witnesses, and summarizing and commenting on the evidence.\textsuperscript{218} There is no evidence, however, that these devices are being used to a greater extent than in the past.

Aids to Jury Comprehension: Another set of procedural devices is designed to improve jury comprehension of complex evidence. It includes jury note taking and jury questions during trial, improved judicial instructions, reordering the presentation of expert testimony, and interim discussions of the case prior to the end of the trial.\textsuperscript{219} It is difficult to be precise but it seems that there are more calls for such reforms\textsuperscript{220} and that an increasing number of courts are at least open to experimenting with these procedures.\textsuperscript{221}


217. District Court Judge Thomas Jackson has limited the number of witnesses the government and Microsoft can call in the pending antitrust case against Microsoft. \textit{Judge Limits Witnesses In Microsoft Antitrust Case}, \textit{Wall St. J.}, June 10, 1998, at B5. Judge Jackson plans to hold both sides to six to 12 witnesses and limited their testimony at trial largely to cross-examination. \textit{Id.}

218. For a discussion of these procedures, see Strier, \textit{supra} note 201, at 175-82.


The buzz in the legal community—in the states, at the federal level, among litigators, and judges and jury consultants—is that participatory juries are the next wave. It's a radical innovation meant, among other things, to address widespread skepticism about the court system by involving the public in the trial process in a more direct way than has ever been attempted in this country.

\textit{Id.}
CONCLUSION

Many of the devices discussed in the previous two sections, including bifurcation and restrictions on who can testify, tend to strengthen the trial judge vis-a-vis the jury and may, therefore, be seen as a way of taking decision making from juries. Others, such as permitting note taking and allowing juries to ask questions, have the effect of increasing the jury’s role and power in litigation. All, however, have one thing in common. They loosen the connection between juries and the adversarial nature of American trials, in part by altering the evidentiary rules that govern the presentation of expert testimony. Some do so by making the judge less passive, some do so by making the jury less passive. Both approaches weaken party control over the trial process. Both approaches facilitate jury decision making in complex cases by altering the other components of the trial process, evidentiary rules and adversarial processes.

Criticisms of adversarial proceedings are nothing new in our legal system, nor are proposals to move toward a more inquisitorial form of trial. What is interesting is the willingness of courts to move in this direction on a number of fronts in cases involving complex scientific questions. Traditionally judges saw their role as passive arbitrators, afraid that any active role would threaten their status as neutral and impartial referees. As Damaska notes, the primacy of neutrality “is easy to understand: in a legal process whose ultimate objective is conflict resolution, the adjudicator is first and foremost a neutral arbitrator.” Likewise, jury passivity has long been the norm. Again, as Damaska notes, “jurors have no proof initiative and are usually not even permitted to ask questions of witnesses. While evidence is being adduced, they sit silent, cast—one might say—into the role of potted courtroom plants.” No more, or at least less and less in complex scientific cases.

222. Perhaps the most famous critic of the adversarial system was Jerome Frank, Courts on Trial: Myth and Reality in American Justice (1949). See John H. Langbein, The German Advantage in Civil Procedure, 52 U. Chi. L. Rev. 823 (1985) and Strier, supra note 201, at 142-52 for a comparison of the two systems and arguing for the advantages of an inquisitorial system for the discovery of truth.


224. Damaska, Evidence Law Adrift, supra note 1, at 124.

225. Id. at 90.
It is not the case, of course, that neutrality and impartiality are less important virtues in such cases. Here, as elsewhere, they are bedrock components of a sense of procedural justice. They are, however, not the only virtue. Accuracy is also fundamental as is a sense that the fact finder understands and bases its decision on the merits of the case. A fair interpretation of developments with respect to scientifically complex tort cases is that the legal system has chosen to trade some neutrality for potential improvements in jury comprehension and hopefully in outcome accuracy.

Two further observations are in order about this development. First, it is important to note the nature of these changes. Perceived adversarial excesses can be countered in two ways. One way is to introduce procedures that attempt to level the playing field and provide equal power to the parties. This fight-fire-with-fire strategy is exemplified by numerous reforms from more liberal discovery rules designed to minimize trial by surprise to the Supreme Court's opinion in *Gideon v. Wainwright*, requiring court-appointed counsel for indigent criminal defendants. Sometimes, as in the case of *Gideon*, these efforts achieve their intended beneficial results, other times they lead to their own adversarial abuses, as is the case when liberal discovery rules are used to harass the opposing party and run up the cost of litigation. These reforms are premised on an acceptance of the adversarial system. Parties remain in control.

The other way to respond to adversarial excess is to take power from the parties. Such responses are premised on a rejection of adversarial processes, even when they are presumed to be working properly. Most of the evidentiary and procedural devices discussed in this paper are in this category. More active judges and more active juries inevitably lead to less power in the hands of the parties and their attorneys. These responses represent a weakening of adversarialism that is more fundamental.

Second, there is the question of whether the legal response to complex scientific cases will spread to other cases tried to a jury. Obviously, some of the response, such as the appointment of 706 experts, will remain rare as will cases where expert opinion is excluded on *Daubert* grounds. On the other hand, it is worth noting that one reason the legal system has responded as it has to these cases is because

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229. *Id.*
they arose in an environment in which both adversarialism\textsuperscript{230} and juries\textsuperscript{231} are under a more general attack and in which lawyers are held in particularly low repute. The scientific complexity of these trials may have been a necessary cause for many of the responses, but it was hardly sufficient. From this perspective, complexity was as much a catalyst as a cause. Whether this catalyst hastens the legal system to a continued erosion of adversarial processes in all jury trials remains to be seen.

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\textsuperscript{231} See Valerie P. Hans, \textit{Attitudes Toward the Civil Jury: A Crisis of Confidence?}, in \textit{Verdict: Assessing the Civil Jury System, supra note 56, at 248; Maura Dolan, Judging the Jury System: Jury System Is Held in Low Regard by Most, L.A. Times, Sept. 27, 1994, at A1 (noting that 55% of Los Angeles County residents have “only some or very little” confidence in the jury system).}
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