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Judges Should Be Discerning Consensus, Not Evaluating Scientific Expertise

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CONTENTS

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I. INTRODUCTION

> Having placed its lay decisionmakers in impossible positions, the *Daubert* regime dooms itself to suboptimal decisions. And while critics are quick to blame the decisionmakers, the fault lies not with them, but with the underlying structure.[1]

At the 2022 Shachoy Symposium,[2] scholars recognized and debated the importance and ingenuity of Vanderbilt Law Professor Edward Cheng's recent article entitled *The Consensus Rule: A New Approach to Scientific Evidence*.[3] While many scholars appreciated Cheng's proposal for a new rule of evidence, the authors of this Article each contributed their own constructive critiques of the proposal.[4] The purpose of this Article is to expand upon our collective concerns with Cheng's proposal and to present our own framework for improving upon the *Daubert* regime, which is similar to but not the same as Cheng's proposed Consensus Rule. Our proposal is necessarily interdisciplinary, relying on the sociology of science for insights into the types of expertise required to evaluate consensus.

Section II briefly summarizes Cheng's proposed new Consensus Rule for inclusion in the *Federal Rules of Evidence* in light of the role of scientific knowledge in litigation and the attempt in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* to ensure reliable expert testimony. Next, Section II discusses the types of expertise that scientists, judges, and jurors possess, and introduces the typology of expertise that inform our proposal for a new admissibility regime. Finally, Section II revisits the perennial debate about the differences between legal and scientific cultures, arguing that conventional descriptions of the differences between law and science often fail to focus on the *types* of expertise relied upon within each field.

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1. Edward K. Cheng, *The Consensus Rule: A New Approach to Scientific Evidence*, 75 VAND. L. REV. 407, 419-20 (2022).

2. The Shachoy Symposium is sponsored each year by the *Villanova Law Review*, which publishes the proceedings. The proceedings of the 2022 symposium, which focused on Cheng's Consensus Rule proposal, are in Volume 67. Respondents at the symposium included Professor Wendy Wagner from the University of Texas School of Law, Dr. Martin Weinel, a research associate from Cardiff University, two federal district judges, Judge Jed Rakoff and Judge Shira Scheindlin (retired), and the two sociologists who are co-authors of this article along with Professor Caudill, who moderated the 2022 symposium.

3. Cheng, *supra* note 1, at 419-20. (proposing a new rule of evidence requiring judges and juries to follow scientific consensus rather than evaluating the reliability of expert testimony as required by Daubert v. Merrell Dow Pharms., Inc., 590 U.S. 579 (1993)).

4. *See* David S. Caudill, *The "Crisis of Expertise" Reaches the Courtroom: An Introduction to the Symposium on, and a Response to, Professor Cheng's Consensus Rule*, 67 VILL. L. REV. 837 (2022); Harry Collins, *The Owls: Some Difficulties in Judging Scientific Consensus*, 67 VILL. L. REV. 877 (2022); Robert Evans, *The Consensus Rule: Judges, Jurors and Admissibility Hearings*, 67 VILL. L. REV. 883 (2022).

Section III agrees with Cheng that judges and juries typically do not possess the expertise needed to make technical decisions based on scientific evidence. However, Section III also expresses skepticism and warns of the difficulty in identifying consensus in any given scientific discipline. Even as we concede that the Consensus Rule alleviates the potential burden placed on jurors of deciding who of two competing scientific experts has presented the best science. Discerning what is true in a scientific field or domain involves making scientific judgments within that domain, and there are many such domains, each with their own specialist techniques, methods and language. In contrast, making a decision about consensus is a matter of social judgement: it involves judging human relationships of a type that appear in every scientific domain and in many areas of life outside of science.

Jurors, like judges, possess what can be called ubiquitous expertise, the sort of expertise that almost all citizens have and use every day in their ordinary lives. While there are some simple examples in which lay jurors' ubiquitous expertise is sufficient to identify the consensus view among experts—for example, most people, including those who smoke, know that doctors will tell them smoking is bad for their health—it is also the case that a significant segment of the U.S. population rejects some well-established scientific theories (i.e., consensus that COVID-19 vaccinations are effective), often in favor of fabricated claims. In the courtroom setting, Cheng's Consensus Rule would not eliminate this problem because opposing advocates will simply switch the focus of testimony from disagreements about scientific questions to disagreements about the degree of consensus within different expert communities. Thus, jurors tasked with identifying consensus will have to make judgments about which expert cultures and informants to trust under conditions in which the uncertainty about each claim is maximized. Cheng does not recognize this reality and therefore underestimates the problems jurors would face in discerning consensus.

In contrast, trial judges (legal experts, but, like jurors, lay persons with respect to science) would be better equipped to evaluate consensus because they are in a position to develop a type of cross-domain ubiquitous expertise that we call "enhanced ubiquitous expertise." Judges would develop cross-domain ubiquitous expertise when their daily job required them to decide which expert's viewpoint represents a consensus and how robust that consensus is—an expertise that would be more thoroughly developed than that of a juror. Judges, in dealing with expert witnesses, would encounter expert domains multiple times, and over the years would be able to refine their ability to choose between competing

claims about the existence and level of consensus.[5] Judges are relatively more capable than jurors at the outset of their judicial careers by virtue of their training and practice experience (and they are in positions to become ever more capable); and in any event, they are more independent than party-affiliated expert witnesses, especially when it comes to evaluating consensus.[6] A recent study of trial judges in Finland who heard cases involving medical controversies provides insight as to how judges might develop an enhanced ubiquitous expertise, superior to the ubiquitous expertise of the typical juror.[7] Section III concludes with examples of how U.S. trial judges already recognize the contours and reliability of consensus.

Because claims of consensus are likely to be contested, we recommend in Section IV that in a case involving scientific or other technical issues (in a consensus regime— such as one based on Cheng's Consensus Rule[8]), judges should hold a pre-trial hearing, during which the judge would hear arguments about any existing consensus (or lack thereof) in the relevant field. Witnesses, with substantial training or experience in the relevant field, would testify concerning the degree and content of consensus in the field at issue. Notably, these expert informants might be natural scientists in the relevant field, or social scientists familiar with how consensus is created and aware of any consensus that exists in the relevant scientific domain. If the judge determines consensus exists after hearing the witnesses' testimony, they will instruct the jury to follow that conclusion. If the judge cannot discern any consensus, the current *Daubert* framework for admissibility of expert witnesses should remain in effect. Even though jurors are likely to be epistemically incapable to judge correctly between disagreeing experts, their choices would at least be limited by some level of judicial gatekeeping (probably eliminating fringe views from the trial) using the *Daubert* and current F.R.E. 702 standards. Next, just as the *Daubert* Court and, in 2002, the Federal Rules of Evidence Advisory Committee, offered a list of factors for judges to consider in evaluating the reliability of proffered expertise, we offer a preliminary list of factors for judges to use in discerning consensus. To

5. For example, while everyone must have a general understanding of the criminal law in order to live in a society and not violate its criminal standards, judges are especially skilled at recognizing the doctrinal nuances in the concepts of preponderance of the evidence or the privilege against self-incrimination; lay jurors, on the other hand, have to encounter those complexities in a trial for the first time.

6. Of course, there will always be judges who are recently appointed and lack extensive experience with various expert domains; nevertheless, on average, judges are in a better position than jurors or party-affiliated expert witnesses to evaluate consensus.

7. *See* Jaakko Taipale, *Judges' Socio-technical Review of Contested Expertise*, 49 SOC. STUD. SCI. 310 (2019).

8. *See* Cheng, *supra* note 1, at 436 ("Rule 702A. If the relevant scientific community believes a fact involving specialized knowledge, then that fact is established accordingly.").

illustrate the application of these factors, Section IV concludes with some brief examples of consensus evident in recent legal controversies.

Section V concludes noting that our proposal combines the best parts of Cheng's proposal with recent insights from sociological studies of expertise. We suggest that lay jurors' understanding of what is called "science" is likely an understanding of the institutional sites of scientific authority and the consensus found in those institutions. So, with the help of the judge, who finds consensus (if it exists) and instructs the jury to follow it, the jury is on familiar ground. Finally, we join Professor Cheng in recommending empirical studies concerning how judges and expert witnesses would perform under a consensus regime. This Article also acknowledges the uncertainties and tentativeness of frontier scientific work, and thereby recognizes that consensus in a particular scientific community is always open to challenge. This Article concludes, nevertheless, that scientific consensus is one of the best sources of knowledge on which legal processes and institutions can rely.

Significantly, this Article provides an answer to the criticism that Cheng's proposed Consensus Rule is both unworkable and unscientific:

> Imagine the endless litigation over what the "relevant" community is. For a health effect claim about a drug and heart attacks, is it the community of cardiologists or epidemiologists? Do we accept the pronouncements of the American Heart Association or those of the American College of Cardiology? If there is a clear consensus based upon a clinical trial, which appears to be based upon suspect data, is discovery of underlying data beyond the reach of litigants because the correctness of the allegedly dispositive study is simply not in issue? Would courts have to take judicial notice of the clear consensus and shut down any attempt to get to the truth of the matter?[9]

While we agree that experts under a consensus regime would argue about the relevant *community*—which is no more "endless" than arguing about the related science—we note that Schactman presumes, incorrectly in our view, that the "correctness" of a finding of consensus is "not in issue," and therefore the "truth of the matter" is not relevant. As made evident later in this Article, an expert's identification of consensus (e.g., based on suspect data) must be open to challenge. Trial judges may well hear conflicting testimony regarding consensus and must decide which expert informant to trust. In the critic's mistaken view, science will, under the Consensus Rule, be reduced

9. *Cheng's Proposed Consensus Rule for Expert Witnesses*, NATHAN A. SCHACTMAN, ESQ., PC (Sept. 15, 2022) [hereinafter Schactman], https://schachtmanlaw.com/2022/09/15/chengs-proposed-consensus-rule-for-expert-witnesses/.

> to polling, conducted informally, often without documentation or recording, by partisan expert witnesses. . . . In Cheng's vision, science in the courtroom is just a communal opinion, without evidence and without inference. To be sure, this alternative universe is tidier and less disputatious, but it is hardly science or knowledge. We are left . . . without data, without internal or external validity, and without good and sufficient facts and data.[10]

From our vantage point, experts on consensus (no more "partisan" than scientific experts) will need to be qualified and attentive to the substantive scientific evidence in their field—their conclusions are both "science" and "knowledge."[11] To label that expertise as "communal opinion" is to assume that science is not a communal enterprise,[12] and ignores well-established findings from the sociological study of expertise reflected in this Article and present in Cheng's proposal. If there was a world of well-ordered scientific facts that no one ever disagreed about then those facts would be a better resource than consensus. Unfortunately, such a utopia is found only in long-established science, not in courtrooms when the science is in dispute from competing experts. In reality, the Consensus Rule is *not*, as Schactman suggests, simple deference to "the herd" (i.e., the majority in a scientific field) whose conclusions have not been tested against "actual data." Under a consensus regime, a lawyer could not simply present an internet search as the determinative evidence of consensus.[13] These are mischaracterizations of Cheng's proposal, and as this Article illustrates, they do not reflect our understanding of a consensus regime as both workable and oriented to scientific truth.

II. THE CONSENSUS RULE AS A MODEL OF HOW TO APPROPRIATE SCIENCE IN LAW

> [M]ischief . . . arises when trial judges overestimate their role as keepers of the gate through which expert evidence must pass . . . .[14]

10. *Id.*

11. Domain experts will need to have specialist expertise about the field, but the difference here (compared to *Daubert*) is they are not asked to testify about their personal view but about the consensus view in the domain as a whole. Their testimony will thus include substantive content and information about the social organization of that field of science. The "social" judgment concerning consensus, referred to earlier, is the one made by the judge who has to decide which account of consensus to trust. This is the same decision that Cheng wants jurors to make, see Cheng, *supra* note 1, at 434. Once the judge has done this, their instructions to the jury take the form of setting out what knowledge can and cannot be relied on.

12. Schactman, *supra* note 9 (criticizing Cheng for channeling "the contemporary understanding that knowledge is a social endeavor, not the unique perspective of an individual in isolation").

13. *Id.*

14. Walsh v. BASF Corp., 234 A.3d 446, 464-65 (Pa. 2020) (Wecht, J., concurring).

A. Professor Cheng's Consensus Rule Proposal

The discipline of law is interdisciplinary. The law necessarily comprises historiography, sociology, literature, economics, and—especially when it comes to courtroom expertise—science. In 1993, the U.S. Supreme Court considered how we might ensure that the science courts appropriate in legal decision-making is reliable—hence *Daubert*'s mandate that judges, somewhat independently of the scientific establishment, decide questions of admissibility.[15] That mandate has, in Professor Cheng's compelling analysis, proven to be misguided.[16] Such criticism of *Daubert* is not new—it proliferated immediately after the Supreme Court's decision and continues to this day—but Cheng's critique is, importantly, a clear proposal for a new federal rule of evidence.

In short, Cheng argues, *Daubert* "asks judges and jurors to make substantively expert determinations, a task they are epistemically incompetent to perform as laypersons."[17] As an alternative structure,

15. *See* Daubert v. Merrell Dow Pharms., Inc., 590 U.S. 579 (1993) (establishing a new regime for discerning admissibility of expert testimony, including assigning the role of gatekeeper to district court judges, and suggesting testability, error rate, peer-reviewed publications, and general acceptance as non-exclusive factors for judges to consider in their evaluation of expertise).

16. *See generally* Cheng, *supra* note 1.

17. *Id.* at 407. Other legal scholars have recognized the problem of epistemic *(in)*competence—the inability of judges and juries to make scientific decisions—with respect to expertise in the courtroom. Over thirty-five years ago, Professor Scott Brewer published a comprehensive critique of the then-current (post-*Daubert*) procedures, concluding that judges and juries lack the understanding necessary to avoid arbitrary decisions, especially since they rely on "credentials, reputation, and demeanor," which results in a decision that is both legally unjustified and a failure to satisfy intellectual due process, a norm that is imminent in the U.S. legal system. *See* Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE L.J. 1535, 1538-39 (1998). Brewer's proposal for reform, briefly suggested at the end of his critique, is termed a two-hat solution: "[O]ne and the same decisionmaker [should possess] both legal legitimacy (by being duly elected or appointed . . .) and epistemic competence with the basic formal tools of scientific analysis." *Id.* at 1677. Examples might include an administrative agency "staffed with trained scientists," specially trained juries or judges, or science courts staffed by sufficiently trained judges. *Id.* Note that Brewer wonders, "[H]ow much training is enough? To the level of a Ph.D.? An M.A.? Are formal degrees good signals at all?" *Id.* at 1679. Creating any such regime, however, would not only require massive changes to our judicial system; it would also fly in the face of adversarial lawyering. *Id.* ("Rule by technocratic-kings has its dangers."). With respect to our proposal (in this article) to allow judges to evaluate *consensus*, Brewer is, like us, "skeptical about [any] assumption" that most judges are better positioned epistemically than juries "to assess . . . the merits of competing scientific testimony." *Id.* at 1677-78. Interestingly, Brewer does not even believe judges are competent to choose a court-appointed expert! *See id.* at 1681. However, Brewer seems to reverse himself with respect to *some* judges:

> It is not unreasonable to suppose that some judges, who are repeatedly and predictably faced with proffers of scientific evidence, may find and take the time and energy required to become decently competent in manipulating the aims, methods, and results of some of the specific sciences that are likely to come into their courts.

Cheng recommends that courts defer to the relevant expert community. In other words, judges and jurors should not be asked to make *scientific* decisions—instead they should be asked the kind of familiar sociological question that we all ask in order to live our daily lives: "Where does the consensus lie in this matter?"[18] For example, to "satisfy the requirement of proving causation in a toxic tort case, the question should not be: does drug A cause disease X? The more appropriate question is: does the scientific community believe that drug A causes disease X?"[19]

To make his case, Cheng recounts in detail the shortcomings of *Daubert*, especially the fact that decisionmakers with respect to scientific claims are unlikely "to acquire [even] a surface-level understanding of the material, let alone develop the expertise necessary to make informed judgments."[20] Hence Cheng's recommended recourse to the "belief" of the relevant scientific community. Of course, the scientific community can be wrong: "The reason why we should listen to the experts is not that they are infallible, but rather that they are more likely to be right than we."[21] Somewhat controversially, in our view, Cheng then claims that

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Id. at 1678. The number of such judges, we suspect, would be very small, and we are not as optimistic as Brewer that the "special workshops on scientific theory and method," available to federal judges in the wake of *Daubert*, help in the effort to find judges with two hats. *See id.* at 1677.

Another critic of the *Daubert* regime—Professor James R. Dillon—likewise emphasizes the problem of epistemic competence. *See* James R. Dillon, *Expertise on Trial*, 19 COLUM. SCI. & TECH. L. REV. 247 (2018). Dillon doubts the practicality of Brewer's two-hat solution:

> [It] suffers from implementation challenges that are obscured by a lack of descriptive detail. . . . How many individuals with expertise in both law and a given scientific domain exist, and how many of those are . . . willing . . . to accept positions as trial judges?

Id. at 289. Moreover, the vast number of scientific domains turns Brewer's solution into "a multitude of hats—a veritable epistemic millinery." *Id.* Dillon proposes a social epistemological solution, drawing (as we do) on the sociology of scientific knowledge, focused on courts, not individual judges, as a site of "distributed cognition." *Id.* at 300. A new administrative office is needed, "staffed by individuals with at least 'interactional' expertise in all of the major scientific domains that routinely come before the court." *Id.* at 296. Scientific "adjuncts" would then be automatically assigned to every case, by a manager possessing "referred expertise." *See id.* The terms "interactional expertise" and "referred expertise" are discussed *infra* in Part II.B. Dillon concedes that there will be objections to his proposal, but he ultimately dismisses them: first, that his proposal is vulnerable to a Constitutional objection (his scientific adjuncts lack Article III status); second, that his proposal would result in unjustifiably substantial financial burdens (intellectual due process may require that we endure these costs); and finally, that neutral experts are hard to find (a claim he finds "overstated"). *See id.* at 300-10. Although Dillon hopes that his proposal does not "require drastic departures from existing institutional structures" (like the Anglo-American adversarial model), *id.* at 295-96, we note that our proposed consensus regime is both less costly and less of a departure from the current admissibility regime.

18. Note that in our view, jurors would have difficulty making that decision in the context of a trial with adversarial experts, whereas we believe judges would be able to develop competence in those sorts of decisions.

19. *See* Cheng, *supra* note 1, at 407.

20. *Id.* at 416.

21. *Id.* at 434 (citing HARRY COLLINS & ROBERT EVANS, RETHINKING EXPERTISE 2 (2007)). As to the fallibility of the scientific community. *See generally* Yehoshua Socol et al., *Interests, Bias, and*

when a "layperson uses his judgment not to determine the substantive answer to the scientific question, but rather to determine what the community consensus thinks it is[,] . . . the latter determination involves *no expert judgment*. The layperson is perfectly competent to perform it . . . ."[22] As we explain below, this formulation does not accurately represent the nature of a juror's lay judgment, which is actually a form of expertise, but not one capable of choosing reliably between opposing experts testifying as to consensus.

Cheng completes his proposal by (1) explaining that where there is no consensus, juries will need to decide (poorly, in all likelihood) expert questions,[23] (2) thereby acknowledging the potential conservatism in his approach,[24] (3) confirming that, in his view, when experts testify as to consensus (i.e., what the community believes, not what each expert's scientific opinions are), their testimony "approaches lay testimony, as it hardly involves expert judgment at all,"[25] and (4) distinguishing his

Consensus in Science and Regulation, DOSE-RESPONSE: INT'L J. 1 (2019) (explaining that scientists are human and prone to bias due to political and economic interests).

22. *See* Cheng, *supra* note 1, at 434-35 (emphasis added). A "lay decisionmaker is qualified to assess contradictory testimony on what a community believes." *Id.* at 458.

> [R]elative to the substantive scientific questions asked by the *Daubert* framework, Consensus Rule questions are far more manageable. At least answering the consensus question requires no special expertise.

Id. at 456-57.

23. *See* Cheng, *supra* note 1, at 437. "In these cases, the Consensus Rule leaves the legal system right back where it started, with the jury deciding the expert question. But this outcome should not trouble us. If the expert community is divided, then the legal system cannot do much better than a coin flip anyway." *Id.* Moreover, Cheng argues, where there is no "expert community view, the question may revert to the jury, but the conventional safeguards remain. For example, if the offered theory has no empirical basis, the judge can exclude it under the conditional relevance rule, because no reasonable juror could find the conditional facts." Cheng, *supra* note 1, at 437 n.130 (citing FED R. EVID. 104(b)).

24. *See* Cheng, *supra* note 1, at 453.

> The Consensus Rule is perhaps a touch conservative, as it automatically rejects cutting-edge or controversial positions. But given the context, it arguably does so with good justification. Since legal actors lack epistemic competence on expert topics, they will find it difficult if not impossible to separate the wheat from the chaff. So the Consensus Rule plays the probabilities.

Id. On the other hand, there may be valid reasons to fear conservatism when industries sponsor their own science—commercial chemical and pharmaceutical companies come to mind—and thereby create a consensus that may be corrupted by conflicts of interest. *See, e.g.*, Sergio Sismondo, *Epistemic Corruption, the Pharmaceutical Industry, and the Body of Medical Science*, 6 FRONTIER RSCH. METRICS & ANAL. 1 (2021).

25. Cheng, *supra* note 1, at 458.

> Under the Consensus Rule, experts no longer offer their personal opinions on causation or teach the jury how to assess the underlying studies. Instead, their testimony focuses on what the expert community as a whole believes about causation. If consensus statements or metaanalyses exist, then the parties will surely rely heavily on them. At the same time, judges do not gatekeep the substantive reliability of the scientific studies as they do under *Daubert*. Judges may of course check whether the testifying experts are adequately familiar with the

evidentiary framework from *Frye v. United States*.[26] Importantly, Cheng's discussion of *Frye*'s General Acceptance Rule anticipates the criticism that his Consensus Rule is simply a return to *Frye*. After all, "general acceptance in the relevant expert community" sounds like consensus, and judges under *Frye* were asked to defer to experts rather than serve as gatekeepers.[27] However, Cheng demonstrates that *Frye*'s General Acceptance Rule (an admissibility rule) simply limits some expert testimony before letting the jury decide—meaning a jury could disregard a generally accepted fact (unlike the Consensus Rule, which *requires* deference).[28] Moreover, in the absence of general acceptance, *Frye*'s General Acceptance Rule ends the litigation, often in favor of defendants, while under Cheng's Consensus Rule, a "divided expert community just leaves us with the current regime in which the jury is guessing at the answer."[29]

In our view, an important point of this Article is that *Frye*'s General Acceptance Rule is simply not a clear or ascertainable one that can be consistently applied in the absence of a great deal of judicial gloss. That is, *Frye* is a short 1923 opinion that was limited to criminal cases until 1988, and while it was rejected for federal courts in *Daubert*, a third of the states still follow *Frye* in some form (often using *Daubert* as a partial guide even as *Daubert* is rejected by those states in favor of *Frye*!).[30]

> relevant expert community, but otherwise all of the evidence on community belief goes to the jury, who is epistemically competent to assess it.

Id. at 467. In the present article, we challenge Cheng's claim that jurors are epistemically competent to assess evidence of consensus.

26. *See* Frye v. United States, 293 F. 1013, 1014 (D.C. Cir. 1923). *See also* Cheng, *supra* note 1, at 437-40.

27. *See* Cheng, *supra* note 1, at 437-38.

28. *See id.* at 438. "*Frye* can obviously influence the jury's decision, since the jury cannot use evidence that it does not hear, but the jury remains free to disregard admitted expert testimony. The jury also receives no guidance should the judge decide that two warring experts have applied generally accepted techniques." *Id.*

29. *Id.* at 439.

30. *See generally* David E. Bernstein, Frye, Frye *Again: The Past, Present, and Future of General Acceptance*, 41 JURIMETRICS 385 (2001). Sixteen states and Washington D.C. "continue to adhere to *Frye*," and while most of the other states follow *Daubert*, some states follow neither. *Id.* at 386-87. "Although the general acceptance test originated in 1923, many issues concerning its application remain unsettled. . . . [C]onfusion over the scope of *Frye* has mushroomed in the last decade, coinciding with more general interest in the issue of the proper standards for the admissibility of expert evidence." *Id.* at 387. Some of that confusion is due to the vagueness of the *Frye* court's language:

> The opinion does not define "general acceptance" or the "particular field's [of expertise]" boundaries, nor does it suggest whether the judge should defer to the scientific community or use another standard to resolve these uncertainties. Confusion among judges on these issues led to contradictory *Frye* rulings in different jurisdictions concerning the same types of evidence.

Id. at 390. Another source of confusion concerns whether scrutiny of proffered expert testimony is limited to techniques and methods, or whether conclusions (properly applied methods) should be considered, leading to various approaches. *See id.* at 396-400. Indeed, "traditionally, *Frye* was applied only to novel

There is, therefore, little to be gained by any positive comparison of *Frye*'s General Acceptance Rule and Cheng's proposed Consensus Rule.

In short, we find Professor Cheng's comprehensive approach to evidence law reform—which involves identifying a weakness in the admissibility framework, specifying a practical solution, and anticipating criticism—both timely and, in large part, persuasive. However, the language that Cheng uses in his analysis of expertise in the courtroom, while familiar ground to professors and law students, is not as clear and precise as Cheng might believe. First, it is not always productive to limit the term *expertise* to esoteric or exceptional knowledge—expertise is more usefully defined as any ability into which one is socialized, such as driving a car, playing tennis, or speaking English. Next, Cheng's proposition that a lay juror's discernment of consensus "involves no expert judgment" is incorrect—there actually is a type of expertise involved in any juror's decision, but it is ubiquitous expertise, which includes the tacit knowledge that everyone has when socialized into society.[31] Cheng, by contrast, limits the term *expert* to someone with what we identify as specialist tacit knowledge. We disagree with Cheng that a lay juror is "perfectly competent" to discern consensus—their ubiquitous expertise is in most cases insufficient to decide between competing views of consensus by experts in the field.[32] On the other hand, as we will argue

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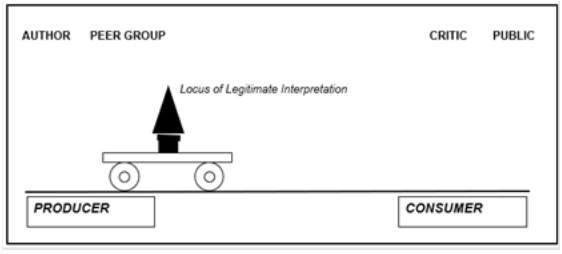
scientific techniques in the criminal context." Cheng, *supra* note 1, at 439.

31. "Tacit knowledge is the deep understanding that one can only gain through social immersion in groups that possess it." COLLINS & EVANS, *supra* note 21, at 6. "[W]hen one has ubiquitous expertise one has, by definition, a huge body of tacit knowledge—things you just know how to do without being able to explain the rules for how you do them." *Id.* at 13. This does not mean, however that those who have been socialized into a sport or language cannot reflect upon and discuss that sport or language when asked to do so. In a similar way, scientific expert witnesses who possess *specialized* tacit knowledge in their everyday practice can be called on to reflect upon and discuss their knowledge.

32. *See* Cheng, supra note 1, at 435. Another way of putting it is that science and the law are defined, in part, by their "locus of legitimate interpretation" ("LLI")—who is legitimately entitled to interpret what is going on in that cultural domain, the answer establishing the meaning of the knowledge-making culture. COLLINS & EVANS, *supra* note 21, at 120-21, and Figure 7. In science, the LLI is restricted to the producers of science, or people close to the producers; that community, for example, is where the peer reviewers are drawn from:



In jury trials the LLI extends to the ordinary citizen, who must make decisions on the basis of their ubiquitous expertise. That expertise is adequate for a juror's judgments about a witness's clarity,

below, because judges have their own enhanced ubiquitous expertise, due to repeated experience with experts, judicial discernment of consensus is likely more reliable than that of lay jurors.

B. The Typology of Expertises

To construct a workable solution to *Daubert*'s shortcomings, one needs to focus on the types of expertise that various players in the courtroom possess. Collins and Evans, co-authors of this Article, have introduced a typology called the Periodic Table of Expertises—based on the interactions between different groups that allow individuals to acquire tacit knowledge—that is particularly helpful in the context of litigation.[33] Not all of their identifiable types of expertise are relevant for this discussion, but it is helpful to distinguish ubiquitous expertises (which every member of a society has) from specialist expertises (which only some members of a society possess), and from meta-expertises (which are expertises about expertise that non-specialists use to make judgments about specialist expertises they do not possess). Using these three types of expertise, we demonstrate why judges are in a better position compared to lay jurors to discern expert consensus. After briefly introducing the categories of expertise relevant for the Consensus Rule in this Part (refer to the abbreviated version of the "periodic table" below), we will apply them to the courtroom in Section III.

demeanor, or honesty and whether the preponderance of evidence is sufficient to warrant a guilty verdict, but judging scientific experts requires technical or specialist expertise and so pits the two different standards against each other. *Id.* at 119-21.

33. *See* COLLINS & EVANS, *supra* note 21, at 13-76, for a descriptive analysis (and a complete diagram, *id.* at 14) of the entire Periodic Table of Expertises.

ABBREVIATED PERIODIC TABLE OF EXPERTISES

UBIQUITOUS EXPERTISES:

Competences needed by every member of a society to participate in it, including natural language speaking, basic moral codes, and an understanding of the society's institutional structures and norms. Ubiquitous expertises are the foundation upon which all other expertises are built.

SPECIALIST EXPERTISES:

Based on ubiquitous tacit knowledge, and includes "beer-mat knowledge," popular understanding, and primary source knowledge.

Based on specialist tacit knowledge, and includes interactional expertise and contributory expertise.

META-EXPERTISES:

External (transmuted), based on ubiquitous tacit knowledge, and includes ubiquitous discrimination and local discrimination.

Internal (non-transmuted), based on specialist tacit knowledge, and includes technical connoisseurship, downward discrimination, and referred expertise.

META-CRITERIA:

Externally measurable criteria such as credentials, experience, and track record.

The most general level, ubiquitous expertises, includes natural language speaking, which everyone must possess in order to live in a society. This category includes all the expertises one needs to make routine moral or political judgments, and to interact with various types of specialists such as doctors, accountants, and plumbers. In the jury system, most jurors' decisions (e.g., whether to believe a witness or the strength of circumstantial evidence) are the same kind of trust decisions they make in their day-to-day lives (e.g., whether to trust a plumber's diagnosis of

the fault in their sink), meaning "ubiquitous expertise" provides a suitable foundation. However, when jurors are asked to make technical decisions about which of two expert witnesses has presented the best science—as required by *Daubert* when opposing expert witnesses are both admitted—these ordinary expertises are neither suitable nor sufficient.

Significantly, judges, as lay persons with respect to science, are likewise limited to ubiquitous expertise in their assessments of experts—even as they possess specialist expertise in legal matters—and are therefore just as unqualified to evaluate scientific expertise *qua* science. As we will argue, judges' only advantage over jurors is that, when discerning consensus, judges can develop a superior, *enhanced ubiquitous* expertise. Through repeated experience with courtroom experts, judges will likely understand more about how science works—and how consensus is formed—and learn to identify the differences between mainstream science and other categories such as outdated and fringe science that appears only on the internet or in fringe journals. Such experience also allows judges to make more subtle judgments, such as that between the mainstream science, on the one hand, and well-intended regular science which is a minority view, on the other.[34]

The next category identifies *specialist* expertises and refers to expertises that are only found in some subsets of the population. Specialist expertises are divided into two main types, based on whether they have been developed through interactions with the expert community. The three lowest levels of specialist expertise—"beer-mat knowledge,"[35] popular understanding, and primary source knowledge—assume *no interactions* with the specialist community, and thus include only the society-wide "ubiquitous tacit knowledge"[36] found within the ubiquitous expertises. They are, therefore, notwithstanding the terminology in the Periodic Table of Expertises, best described as *levels of knowledge* rather than specialist expertises.

The differences between the three lower levels of specialist expertise can be summarized as follows: Beer-mat knowledge is the accumulation

34. *See* Harry Collins et al., *Demarcating Fringe Science for Policy*, 25 PERSP. ON SCI. 411 (2017).

35. *See* COLLINS & EVANS, *supra* note 21, at 18.

> The first rung of the specialist ladder is what we will call "beer-mat knowledge [what we in the U.S. call cardboard coasters in a bar]." Consider [an] explanation of how a hologram works . . . .This explanation, found on a beer mat made for the Babycham company in 1985, appears to give an answer to the question "What Is a Hologram?" It is capable, presumably, of making at least some people feel that they now know more about holograms. The words on the beer mat are not simply nonsense nor could they be taken to be, say, a riddle or a joke.

Id.

36. Tacit knowledge, again, refers to the "things you just know how to do without being able to explain the rules for how you do them." *Id.* at 13.

of isolated facts but without the understanding needed to link them together in a coherent way. Beer-mat knowledge is useful in quizzes, but is not useful for much else. The next level, popular understanding, includes some holistic appreciation of the specialist domain in question, but only of a simplified kind. In the case of science, for example, popular understanding can be gained "from the mass media and popular books. . . . Popular understanding does involve a deeper understanding of the meaning of the information than does beer-mat knowledge. . . . [B]ut [it is] a long way from deep understanding of scientific matters."[37] The difference between popular understanding of science and a deep understanding of science is unlikely to matter when the science is settled. However, when there is a scientific dispute, as between two opposing experts in court, the difference is striking. Deciding who has presented the best science requires a sound, informed evaluation of "those who work in the esoteric core" of a scientific field, and "a level of understanding equivalent to popular understanding is likely to yield poor technical judgments" concerning the dispute.[38]

The highest level of specialist expertise that can be reached using only ubiquitous tacit knowledge is primary source knowledge, which is acquired by reading the relevant primary literature. Unfortunately, such sources provide "only a shallow or misleading appreciation of science in deeply disputed areas . . . . [R]eading the primary literature is so hard, and the material can be so technical, that it gives the impression that real technical mastery is being achieved."[39]

To acquire higher levels of *specialist* expertise, the specialist tacit knowledge of the expert community is needed, but this can only be acquired through sustained immersion in an expert domain—which is why the average juror or judge is not capable of evaluating a courtroom expert according to domain-specific standards.[40] Of the two higher

37. *Id.* at 19-21.

38. *See id.* at 20-21.

39. *Id.* at 22.

> Actually, it can be shown that what is found in the literature, if read by someone with no contact with the core-groups of scientists who actually carry out the research in disputed areas, can give a false impression of the content of the science as well as the level of certainty. Many of the papers in the professional literature are never read, so if one wants to gain something even approximating to a rough version of agreed scientific knowledge from published sources one has first to know what to read and what not to read; this requires social contact with the expert community. Reading the professional literature is a long way from understanding a scientific dispute.

Id.

40. Specialist expertises are not, therefore, available to everyone due to the opportunity cost of participation; time spent training to be a plumber, for example, is time that cannot be spent training to be a lawyer and vice versa.

categories of specialist expertise, which are based on specialist tacit knowledge (the second type of specialist expertise), the superior type is contributory expertise, which one uses to competently engage in an activity. Essentially, it allows one to "contribute" to progress in the domain or field of scientific expertise. Developing this level of expertise typically requires intense training. More importantly, substantial and recent experience in the field are required to maintain this level of expertise and ensure continued practical competence. The highly credentialed courtroom expert is exemplary of this category, and the notion that high levels of genuine technical expertise can also arise from experience, even in the absence of academic or institutional credentials, is familiar to the law of evidence.[41]

Interactional expertise is the second type of specialized tacit knowledge. In the absence of practical competence one can, through immersion in a community of experts, learn to master the language of that specialist domain and "interact" with its contributory experts. The idea of interactional expertise is imminent in many roles, from peer reviewer to high-level journalist, not to mention sociologist of science or anthropologist. But a language also embeds a great deal of information about how to interact in a society, so a specialist language tells one how to interact in a specialist society. This explains why contributory experts also need interactional expertise to coordinate their practical work across the specialist domain, and why managers of scientific projects may do their work and guide the practical actions of others without necessarily engaging in any specialist practices themselves.

The next level, meta-expertise—which has several types—provides a basis upon which one makes judgments about other experts. The first two types, ubiquitous discrimination and local discrimination, involve judgments about experts by those who do not share the expertise being judged and, like the three lower levels of specialist expertise, rely on ubiquitous tacit knowledge. Examples of the heuristics used in making those judgments include judging an expert's demeanor, internal consistency of their remarks, appropriateness of their social locations, and so forth. These first two types of meta-expertise are sometimes referred

41. The plaintiff's tire expert who testified for the plaintiffs in *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 151 (1999), provides an example—he did not have peer-reviewed publications or an error rate as would, for example, an epidemiologist, but he had a field of expertise. We also recognize the expertise of those who train drug detection dogs. *See, e.g.*, Jackson v. City of Bloomington, No. 17-cv-1046-JES-JEH, 2019 U.S. Dist. LEXIS 6895 (C.D. Ill. Jan. 15, 2019) (detailing how a dog training expert was challenged for his lack of formal education and for having no scientific foundation for his opinions, but his testimony was admissible on the basis of extensive experience, having trained over fifty dogs certified for drug-sniffing use by the police and by other organizations). Likewise, we recognize the expertise of police who know street drug terminology, in the absence of academic credentials. *See, e.g.*, United States v. Perry 14 F.4th 1253 (2021) (citing United States v. Garcia, 447 F.3d 1327, 1335 (11th Cir. 2006)) (recognizing that an experienced narcotics agent may testify as an expert witness).

to as "transmuted expertises" because they use a social discrimination to produce a technical discrimination. By deciding *who* to trust, those who possess a transmuted expertise also determine *what* is believed. They are considered external because the outcome "does not depend on the understanding of the expertise being judged but upon an understanding of the experts."[42] Ubiquitous discrimination depends on the ubiquitous expertise everyone gains through enculturation into their host society as they learn to choose between politicians, salespersons, service providers, and so forth:

> For example, those with little scientific knowledge can sometimes make what amounts to a *technical* judgment on the basis of their *social* understanding. The judgment turns on whether the author of a scientific claim appears to have the appropriate scientific demeanor and/or the appropriate location within the social networks of scientists and/or not too much in the way of a political and financial interest in the claim.[43]

While judges and juries alike possess the meta-expertise of ubiquitous discrimination, judges, because of their enhanced ubiquitous expertise, will be better at both discriminating between expert informants and at discerning consensus. For terminological clarity in this Article, however, it is best to emphasize the superior, enhanced ubiquitous expertise as the distinguishing characteristic of judges (vis-à-vis jurors) with respect to

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42. COLLINS & EVANS, supra note 21, at 51 (emphasis in original). Meta-expertise is the "expertise about expertise" that is needed to function in a society with a specialized division of labor. External meta-expertises are the sub-set of these skills that are acquired simply by virtue of being a member of a society and in the absence of any participation in the relevant specialist group. For example, external meta-expertises are what lawyers and plumbers must rely on when employing the services of the other. To see the difference between specialized and external meta-expertise, think of all the additional expertise the lawyer or plumber would bring to evaluating the work of their own profession.

43. *Id.* at 45 (emphasis in original). Professor Cheng discusses ubiquitous discrimination when he argues, against *Daubert*, that lay jurors evaluating experts do not depend on specialist expertise; they must depend, instead, on "external meta-expertise":

> External meta-expertise basically consists of the everyday expertise that people use to distinguish liars. In some sense, resort to these skills and techniques is both understandable and promising. Devoid of other options, jurors naturally fall back on techniques that they both know and are comparatively competent in. The problem, however, is that those everyday techniques do not transfer well to the expert context, which is why jurors are mocked for focusing on an expert's tie or appearance. Everyday cues and stereotypes, perhaps half-useful . . . in assessing the honesty of a salesperson or the danger presented by the person lurking at a street corner, have even less probative value in assessing expert testimony.

Cheng, *supra* note 1, at 421. Professor Cheng is correct that relying on external meta-expertise is a poor method for judging expert claims about expert practices issues, but we disagree that external meta-expertise is perfectly adequate for choosing between competing expert claims about expert beliefs. The reason is that choosing between expert claims about expert beliefs is better done with some knowledge and understanding of the relevant communities, their practices, and their social organization—all of which are opaque to a genuine outsider.

consensus, and not their ubiquitous discrimination, a meta-expertise they share with jurors.

Local discrimination depends on local knowledge about the context where a judgment is made. For example, residents living near an industrial plant with a poor environmental record would have reasons to doubt its reassurances about limited pollution—reasons that would not be available to those living further away. Those reasons to doubt do not depend on a detailed understanding of the specific science—simply knowing that the plant had been unreliable in the past would be enough. Because trial court judges interact with many expert witnesses from different scientific fields, they are not likely to establish the long-term relationships needed to develop the local discrimination that would enable them to reliably identify trustworthy informants in particular fields or domains. However, as we explain in Part II.C, in those rare cases where judges interact repeatedly with the same experts in the same scientific field, there is evidence suggesting they can use local discrimination when making judgments about which informants, and therefore which experts' views, to trust.

The internal meta-expertises— technical connoisseurship, downward discrimination, and referred expertise—are, unlike external judgments, based on possessing one level or another of the expertise being judged. Technical connoisseurship is like the expertise of art critics or wine tasters who are not, themselves, artists or wine makers, but do possess an intimate acquaintance with the substance of the respective expertise. Whether the average trial judge, who is not trained in a scientific field, can develop technical connoisseurship and reliably judge scientific experts is doubtful—such judges would likely not have enough internal experience with the relevant scientific community.

Downward discrimination relates to what one most naturally thinks of as skillful judgment—where one person judges another (for example, "She is a great lawyer")—but that judgment is only reliable if the expert being judged is less an expert than the one passing judgment. As with technical connoisseurship, it seems unlikely that a trial judge with no scientific training will have this capacity to judge a scientist. Referred expertise, on the other hand, is the ability to take insights from one field and apply them in another.[44] Again, it seems unlikely that the average trial judge would have the skills necessary to do this for scientific domains.

Finally, we reach three kinds of meta-criteria—credentials, track

44. For example, this is the type of expertise needed by a manager of a scientific project. *See* COLLINS & EVANS, *supra* note 21, at 64-67 (explaining that managers need not possess the specialist tacit knowledge that scientists who contribute to the project possess, but from previous scientific work and experience, do understand what is involved in contributing to a field of knowledge). *See also id.* at 15 (showing referred expertise's place on the Periodic Table of Expertises).

record, and experience—that outsiders use to make difficult judgments between experts. "Possession of certificates will define a number of kinds of expert, but note that there are not credentials that indicate possession of many of the expertises"[45] that appear in courtroom settings. Track record is a better criterion for expertise, but it excludes, for example, "the ubiquitous and local discrimination of the public, for which no track records of success are available."[46] Experience in a domain, however, seems to "set the boundary [around expertise] in a better place."[47] Importantly, these are the standards that judges, as outsiders to most expert communities, must use.

Focusing on the above categories of expertise demonstrates that Professor Cheng's Consensus Rule does not change the game as radically as he hopes: even under his Consensus Rule, lay jurors must use generic social criteria about *who* to believe in order to make quasi-technical judgements about *what* to believe. The only difference between the Consensus Rule and *Daubert* is that the weaknesses in the chain of inference are now clear: jurors decide—using some general everyday experience—which of several competing claims about the degree of consensus in an expert community to trust and then, based on their conclusion, act "as if" a reliable fact has or has not been established. Making these judgments about what expert communities collectively know in a more reliable and authoritative way—i.e., in a way for which we might legitimately claim that factfinders are epistemically competent—requires a higher level of ubiquitous discrimination, namely an enhanced ubiquitous expertise. As a result, scrapping *Daubert* hearings and replacing them with Cheng's Consensus Rule is unlikely to have the immediate beneficial effects he imagines.

In short, while jurors are competent to make certain judgments and decisions, their expertise is limited due to their lack of experience interacting with expert witnesses. They are not only unable to evaluate the merits of opposing scientific experts arguing about the facts (Cheng's point), but likewise (*contra* Cheng) they are unable to evaluate the merits of opposing scientific experts arguing about consensus. In terms of the typology of expertises, judging consensus in an esoteric community requires more than everyday ubiquitous discrimination. One-time jurors would never get enough practice discerning consensus. As this Article illustrates below, judges, due to their extensive exposure to experts in court, are likely to have more practice discerning whether consensus exists.

45. *Id.* at 67.
46. *Id.* at 68.
47. *See id.*

C. The Key Difference Between Law and Science

Categorizing expertise is not only helpful in understanding the ability (or inability) of judges and juries to make judgments about experts, but it also offers a new perspective for the ongoing discourse—highlighted in *Daubert* as important— concerning the differences between the enterprises of law and science. The typology of expertise reveals a crucial, but typically ignored, difference between the institutions of law and science—namely that science does not draw upon ordinary (or lay) ubiquitous expertise in the way that legal processes and institutions do.

At first glance, the two institutions are as different as C.P. Snow's famous "two cultures"—science and the arts.[48] Law does not seem to have

48. *See* C.P. SNOW, THE TWO CULTURES (1959). Snow, a scientist,

> saw evidence of a strong bipolarity . . . . At one pole were the humanists, exemplified by literary critics; at the other were the scientists, exemplified by the physicists. Between the two camps Snow saw essentially no communication. Indeed, Snow believed that members of each camp displayed a prideful ignorance of one another's topics.

Stephen R. Latham, *Law Between the Cultures: C.P. Snow's* The Two Cultures *and the Problem of Scientific Illiteracy in Law*, 32 TECH. SOC'Y 31-32 (2010). Snow didn't mention social science, a site where "humanists and scientists were, even by 1959, meeting," *id.* at 32, and while law "was still basically a humanities subject" in 1959, *id.* at 33, with "roots . . . primarily in philosophy, history, and political theory," *id.*, law is nowadays "far more social scientific than humanist." *Id.* ("The 1970s trends in sociology of law and criminology yielded to the 1980s law and economics school; today we have law and psychology and, relatedly, law and neuroscience. The legal academy is busily working on scientific literacy . . . .").

Nevertheless, Latham concludes, scientific illiteracy will always remain a problem, requiring the borrowing of expertise—the key is to

> ensure that imported expertise is not biased by political or economic or other competing values, or at least that such biasing is minimized. Legal training therefore needs to accent and inculcate principles of public service, professionalism, accountability, expert neutrality, separation of powers, and so on. Such principles are the subject matter of political theory, of ethics; we gain respect and affection for them through the study of history and through the borrowed experience supplied by literature. In short, to make the best use of science, law must use procedures, and work according to principles, laid down by the humanities.

Id. at 34. There have been attempts, generally unsuccessful, to develop a "science" of law with a stable methodology not unlike the natural sciences. *See* Waldo G. Morse, *The Law as a Science*, 10 L. & JUST. 59 (1923).

> A brochure entitled *The Law as a true Induction*, privately printed in 1917, contained a brief and fragmentary statement of a proposal that the Law be analyzed and its content so distributed in outline, that many workers might collaborate in assembling all of the facts of society and man, in such way that the Law as applicable to human relationships might be ranged along with those facts and a truly scientific treatment and understanding made possible.

Id. at 59. In the end, however, the "law is not scientific, nor does it ask to be made so." *Id.* at 62. Indeed, "[s]hould one wish to appreciate the utter absence of scientific purpose in statute law, he may visit legislative halls in Washington or in Albany, Trenton or Hartford, while well-nigh any inferior court-room may furnish a clinic in the essentials of legal compromises." *Id.* Notably, natural law theory envisions

an agreed upon reference point, like nature for science or world events for historians. Instead, law seems to be a relatively empty, procedurally oriented vessel, using language, history, science, economics, and values to help organize society. Moreover, some would say that science aspires to discover truths about the world, while at times the law ignores, for example, the "truth" of narcotics possession because the evidence was illegally obtained by police. That example is misleading, however, because even though the right to be free of unconstitutional searches trumps the police's evidence, the search for truth underlies all legal processes[49]—society hopes that judges and juries will be competent; it hopes a guilty defendant will be convicted (and we should not blame the defense attorney for putting the prosecutor to the test).[50] Because of the U.S. adversarial system, one might say that in spite of hope for justice, law gives a voice to conflicting arguments that may be resolved by clever rhetorical skills instead of discovering the truth.

But science is not without controversies, and when scientists disagree, reputation, institutional affiliation, and even rhetorical skills may play a role alongside evidentiary considerations. Because the law makes mistakes, one might say the law's search for truth is provisional, but so are scientific truths—scientists reserve the right to refute many previously established truths.[51] And finally, even if one says that law often appears to be ideological—witness the allegations that U.S. Supreme Court decisions reflect the political or religious views of the justices—science

discovering moral "laws" in nature, like the natural sciences, but moral laws and the laws of nature are quite differently discovered and justified. *See generally* JOHN FINNIS, NATURAL LAW AND NATURAL RIGHTS (2d ed. 2011).

49. For example, Justice Blackmun, in *Daubert*, refers to "the quest for truth in the courtroom and the quest for truth in the laboratory" *See* Daubert v. Merrell Dow Pharms, Inc., 509 U.S. 579, 596-97 (1993).

50. Likewise, we hope that an innocent person will go free (and we do not blame an ethical prosecutor with good cause for mistakenly pursuing a defendant); on the civil side, we hope that liability will be imposed on the negligent, and that a lying plaintiff merely out to get money will be caught.

51. Professor Cheng identifies the dynamic changes in scientific truth as a challenge to his proposed Consensus Rule:

> History is littered with famous examples in which the existing theories were ultimately proven wrong, and the Consensus Rule ignores the possibility that minority opinions will be eventually vindicated or that there are geniuses working in obscurity. While this criticism is fair enough, the legal system should be perfectly willing to forgo these "black-swan"-type cases. Maverick ideas on occasion are proven correct, but those instances are famous precisely because they are rare. And if our goal is to maximize the chance of the legal system getting the facts right, then we should skip the long-shot ideas and defer to the expert community's current best guess. Could the consensus be wrong? Absolutely. But the legal system has neither the time nor the expertise to assess maverick ideas, and allowing factfinders to choose from amongst them is a high-risk proposition that harms accuracy in the long-run. Courts should let expert communities fix these problems themselves and in their own time.

Edward K. Cheng et al., *Embracing Deference*, 67 VILL. L. REV. 855, 863 (2022).

is both a methodological search for empirical facts and a social community with linguistic and experimental conventions, economic aspects, ethical limitations on the search for truth, and identifiable power structures. In short, the legal and scientific enterprises are seemingly not so different.

Justice Blackmun, in *Daubert*, addressed the similarities of law and science: "open debate is an essential part of both legal and scientific analyses," and judicial interpretation, like a scientific endeavor, involves an "endless process of testing and retesting, [in which] there is a constant rejection of the dross and a constant retention of whatever is pure and sound and fine."[52] However, he then identified a weakness in law, namely the need for the judge or jury to decide a technical question quickly and impliedly before all the evidence is in.[53]

The difference between law and science was also addressed in David Goodstein's contribution to the *Reference Manual on Scientific Evidence* entitled *How Science Works*.[54] Goodstein, a physics professor, immediately conceded that science, like law, "is, above all, an adversarial process. It is an arena in which ideas do battle . . . ."[55] Although "scientific debate is very different from what happens in a court of law . . . it is crucial [as in law] that every idea receive the most vigorous possible advocacy, just in case it might be right."[56] On the other hand, law differs from

52. *Daubert*, 509 U.S. at 596, 596-97, 597 n.13 (quoting BENJAMIN CARDOZO, THE NATURE OF THE JUDICIAL PROCESS 178-79 (1921)).

53. An essential difference between law and science is their contrasting relationships to time:

> Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly. . . . We recognize that, in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.

Id. at 597. Justice Blackmun adds to this commentary, somewhat confusingly:

> The scientific project is advanced by broad and wide-ranging consideration of a multitude of hypotheses, for those that are incorrect will eventually be shown to be so, and that in itself is an advance. Conjectures that are probably wrong are of little use, however, in the project of reaching a quick, final, and binding legal judgment—often of great consequence—about a particular set of events in the past.

Id. This makes it sounds like judges will somehow immediately recognize and reject "conjectures that are probably wrong" even when the scientific enterprise must take a while to identify incorrect hypotheses!—a strange proposition. What gives judges the unique ability to immediately recognize conjectures that will later be shown to be wrong? While it is true that law, in contrast to science, is always in a hurry, the two sentences quoted above do not make a lot of sense.

54. David Goodstein, *How Science Works*, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 67 (2d ed. 2000).

55. *See id.* at 74.

56. *See id.* ("[S]cientists . . . engage in endless competition according to rules that, although they are nowhere written down, are nevertheless complex and binding."). However, there is a difference in the languages of law and science:

science in in its objectives:

> The objective of the law is justice; that of science is truth . . . . Justice, of course, also seeks truth, but it requires that a clear decision be made in a reasonable and limited amount of time. In the scientific search for truth there are no time limits and no point at which a final decision must be made.[57]

What these analyses—both Justice Blackmun's and Professor Goodstein's—miss, however, is the most important difference between law and science: the fact that judges and juries rely on ubiquitous tacit knowledge and lack the specialist tacit knowledge that would make them competent to evaluate scientific experts. There are no lay juries in science, and no institutionalized reliance on ubiquitous tacit knowledge. Significantly, it is only through the detailed study of the categories of expertise that this distinction arises. This crucial difference challenges the presumption in *Daubert* that judges can acquire the competence to judge the quality of an expert's testimony. On the other hand, judges, due to repeated exposure to expert witnesses, can likely develop—and practice—the skill of recognizing consensus. It is their enhanced ubiquitous expertise, superior to the ubiquitous expertise of jurors, which puts judges in a better position to perform that task in a consensus regime.

> [T]he word evidence is used much more loosely in science than in law. The law has precise rules of evidence that govern what is admissible and what isn't. In science, the word merely seems to mean something less than "proof." A certain number of the papers in any issue of a scientific journal will have titles that begin with "Evidence for (or against)." What that means is, the authors weren't able to prove their point, but here are their results anyway.

See id. at 80.

> Even the word *law* has different meanings in the two disciplines. To a legal practitioner, a law is something that has been promulgated by some human authority, such as a legislature or parliament. In science, a law is a law of nature, something that humans can hope to discover and describe accurately, but that can never be changed by any human authority.

Id.

57. *See id.* at 81. One might quibble that scientific discoveries are certainly announced as "final," even if they turn out to be wrong, but we understand Goodstein's point, echoing Justice Blackmun's point above, that when decision-making moves quickly, the truth may be sacrificed or appear only after a judicial decision. On a deeper level, however, Goodstein is perhaps idealizing science and exaggerating this difference, because (1) in the policy context, "scientific" decisions are made quickly even before all the evidence is in (and scientific advisors make "final decisions" about what the science shows), and (2) in the courtroom, scientific experts offer the latest "final decisions" from the relevant scientific community, so in fact we never wait for the final truth. One could argue that truth is often sacrificed in law due to a skilled attorney or incompetent jurors, but science has its skilled advocates who may form a social elite and persuasively present a position that turns out to be wrong. Even the ethical limitations on lawyers, such as the obligation to keep confidential "truths" from being disclosed, has its analogy in science insofar as society limits human research in ways that interfere with truth. And even Goodstein agrees that science and law have "the same aspirations and many of the same methods. Both disciplines seek, in structured debate and using empirical evidence, to arrive at rational conclusions that transcend the prejudices and self-interest of individuals." *See id.*

With those understandings of expertise in mind, the next Section returns to the limitations of Professor Cheng's proposal, before turning, in Section IV, to the question of how best to integrate scientific knowledge into legal decision-making in the courtroom.

III. THE DIFFICULTIES IN JUDGING SCIENTIFIC CONSENSUS

A. A Battle of the Experts on Consensus

There may be cases where consensus is solidly formed, where jurors can clearly understand the meaning of the term *consensus*. However, when there are disputes concerning consensus, the existence of scientific consensus can be hard to establish. First, scientists come in various types, and some are so focused on scientific progress toward truth that they are skeptical of consensus.[58] Second, there are few scientists who really understand the social subtleties of their profession and, while there is a complementary set of social scientists who have had intense experience interacting with a scientific field, both types of scientists can only offer an answer to the fact of consensus in domains of science to which their training or experience match. Third, some highly qualified scientists whose ideas were once important are no longer taken seriously, even though they continue to cleave to their technical view and may even retain university positions. Finally, there are some scientists corruptly inventing scientific doubt—manufacturing "fake scientific controversies"—or corruptly misrepresenting consensus.[59]

Because consensus is likely to be disputed in an adversarial context, and jurors cannot be expected to understand exactly how consensus is formed and whether it exists, one needs to focus on the way a judge handles the difficult task of evaluating experts who testify on the issue of

58. *See, e.g.*, Ahmed Alkhateeb, *Opinion: Scientists Must Combat Scientific Dogmatism*, THE SCIENTIST,
(Sept. 23, 2021), https://www.the-scientist.com/news-opinion/opinion-scientists-must-combat-scientific-dogmatism-69216.

> [M]ost people . . . rely solely on the formal credentials of scientists to form opinions. But this is unscientific and is an extension of the appeal to authority logical fallacy: something is not automatically true because, and only because, an expert says it is so. The scientific method, which is built on a solid foundation of skepticism, is anti-authoritarian by nature and has no figureheads. Most scientific topics, if not all, are heavily debated.

Id. But then the author concedes that consensus does develop: "A consensus often takes years, not months, to build and mature. It took decades for a scientific consensus to form around the major topics surrounding anthropogenic climate change." *Id.*

59. Regarding manufacturing doubt, refer to *infra* note 62; regarding corruptly creating consensus, see Sismondo, *supra* note 24.

consensus. The key question from a sociological perspective asks what arguments would expert witnesses, who testify on behalf of the opposing parties under a Consensus Rule, need to make to convince the judge that their respective views of the state of agreement or disagreement within relevant expert communities are correct? There are at least four necessary elements involved in consensus judgments:

1. First, one needs to know who the relevant expert community is comprised of. That is, who counts as a relevant expert and who doesn't regarding each scientific fact that a party within a legal dispute deems to be relevant. Judges will need to decide based on the arguments—concerning an identifiable domain and a credible representative—made by the participants in the case.[60] This is a social decision, much like a decision one makes when they decide, often based on advice from more generalized doctors, what kind of medical specialist to consult.

2. Second, one needs to know what the relevant experts agree or disagree on with respect to any scientific fact that a party in the legal case wants to introduce at trial. This introduces a responsibility on the part of expert witnesses to explain, in terms that can be understood by the judge (a layperson, albeit one with enhanced ubiquitous expertise), the technical aspect of the consensus judgment—the substance of the science.[61]

3. Third, one also needs to be able to judge whether a claim to consensus or, indeed, disagreement, is justified. In other words, does the contemporary, substantive science support the consensus

60. In many cases that come before courts, determining which scientific community has the most relevant consensus will itself be a subject of controversy. Scientific disciplines vary in methods and theories, with each foregrounding a slightly different aspect of the problem. It is, therefore, entirely possible that competing-but-contradictory "facts," all of which are held with some degree of consensus by at least one expert community, will be presented to the court. In this all too plausible scenario, judges seeking to determine the consensus to which they should defer now find themselves having to choose between different expert communities.

61. Moreover, what is agreed upon within an expert community depends on how it is phrased. "Bold" claims with high evidential significance (e.g., claims that X causes Y) are likely to be associated with lower levels of consensus than with more "modest" claims (e.g., that some correlation between X and Y has been observed, or that something consistent with X causing Y has been observed). For an early analysis of this idea, see Trevor Pinch, *Towards an Analysis of Scientific Observation: The Externality and Evidential Significance of Observational Reports in Physics*, 15 SOC. STUD. SCI. 3 (1985). For a more recent application of the same idea to scientific advice, see Robert Evans, *SAGE Advice and Political Decision-Making: 'Following the Science' in Times of Epistemic Uncertainty*, 52 SOC. STUD. SCI. 53 (2022).

In other words, judges may need to distinguish between competing expert claims from within the same community about the content and strength of the consensus to which they should defer.

or disagreement that is being claimed: is the court potentially presented with "counterfeit" or "manufactured" consensus, or "counterfeit/manufactured controversies"?[62] The evidence the judge needs is not a presentation of the results of single studies in the field, but rather the collective beliefs of the relevant community.

4. Finally, science may not be the only source of expertise. Where the source of relevant expertise is contested, this controversy is likely to include the question of whether expertise from outside the scientific community is also relevant. In these cases, non-scientists with substantial experiential expertise in a relevant domain of practice—also called "experience-based experts"[63]—can legitimately challenge the extent to which scientific research captures all relevant knowledge.[64] Again, the outcome is that, to determine the consensus to which they will defer, judges must choose; only now they must choose between different types of

62. The term "counterfeit" or "manufactured" scientific controversies refers to scientific debates that, while practically settled within expert communities, are artificially kept alive for non-scientific purposes such as justifying actions that are not compatible with the settlement. In some cases, these efforts of manufacturing controversies involve credentialled scientists with an established track record of having done relevant research. *See generally* L. Ceccarelli, *Manufactured Scientific Controversy: Science, Rhetoric, and Public Debate*, 14 RHETORIC & PUB. AFFS. 195 (2011); DAVID MICHAELS, DOUBT IS THEIR PRODUCT: HOW INDUSTRY'S ASSAULT ON SCIENCE THREATENS YOUR HEALTH (2008); Naomi Oreskes, *The Scientific Consensus on Climate Change*, SCIENCE, Dec. 2004, at 1686; NAOMI ORESKES & ERIK M. CONWAY, MERCHANTS OF DOUBT (1st ed. 2010); Martin Weinel, Technological Decision-Making Under Scientific Uncertainty: Preventing Mother-to-Child Transmission of HIV in South Africa (2011) (Ph.D. dissertation, Cardiff University), https://orca.cardiff.ac.uk/55502; Martin Weinel, *Recognizing Counterfeit Scientific Controversies: A Criteria-Based Approach*, *in* THE THIRD WAVE IN SCIENCE AND TECHNOLOGY STUDIES: FUTURE RESEARCH DIRECTIONS ON EXPERTISE AND EXPERIENCE 53 (David S. Caudill et al. eds., 2019).

63. Here the term "experience-based experts" is *not* a reference to the enhanced ubiquitous expertise that judges develop in their interactions with expert witnesses, but is instead a type of specialist expertise, based on specialist tacit knowledge, developed through intense interaction with a domain of scientific practice. *See* Harry M. Collins & Robert Evans, *The Third Wave of Science Studies: Studies of Expertise and Experience*, 32 SOC. STUD. SCI. 235 (2002).

64. There are many examples of this within the literature associated with the discipline known as Science, Technology, and Society, where both the methodological and value choices that are in intrinsic part of scientific research have been challenged. Much cited and iconic examples include Brian Wynne, *Misunderstood Misunderstanding: Social Identities and Public Uptake of Science*, 1 PUB. UNDERSTANDING SCI. 281 (1992); STEVEN EPSTEIN, IMPURE SCIENCE: AIDS, ACTIVISM, AND THE POLITICS OF KNOWLEDGE (1996); ALAN IRWIN, CITIZEN SCIENCE: A STUDY OF PEOPLE, EXPERTISE, AND SUSTAINABLE DEVELOPMENT (1995). More recent examples include Wendy Wagner, *The Consensus Rule: Lessons from the Regulatory World*, 67 VILL. L. REV. 907 (2022); GWEN OTTINGER, REFINING EXPERTISE: HOW RESPONSIBLE ENGINEERS SUBVERT ENVIRONMENTAL JUSTICE CHALLENGES (2013); Kyle Whyte, *Too Late for Indigenous Climate Justice: Ecological and Relational Tipping Points*, 11 WIREs CLIMATE CHANGE 1 (2019); HEATHER E. DOUGLAS, SCIENCE, POLICY, AND THE VALUE-FREE IDEAL (2009); HELEN E. LONGINO, SCIENCE AS SOCIAL KNOWLEDGE: VALUES AND OBJECTIVITY IN SCIENTIFIC INQUIRY (1990).

experts as well.

These four steps seem to suggest that discerning consensus will necessarily involve substantive scientific and technical expertise when justifying or, indeed, when judging claims that an expert community is either in agreement or disagreement about a scientific fact. This, however, ignores the difference between trying to determine the degree of consensus in a community and determining the validity of individual scientific claims. When testifying as to consensus, the opposing sides will have to deconstruct each other's claims by making specific arguments related to the social organization of the substantive science and the importance of particular claims within that community.[65] The decision required is, therefore, which of the competing testimonies best describes the distribution of views within that community—not which witness has presented the best science. The next Part asserts that judges could make these demarcations based on an enhanced ubiquitous expertise that is not available to lay jurors.

B. An Example of Judicial Meta-expertise from Finland

Jaakko Taipale's recent study of eleven Helsinki district court verdicts involving contradictory and inconclusive medical expertise in traumatic brain injury claims confirmed both (1) the epistemic mismatch between judges and medical professionals, and (2) the employment of a type of meta-expertise on the part of judges, who had repeated exposure to traumatic brain injury cases, to manage that mismatch and make credible decisions.[66] Choosing between competing knowledge claims, when the judge lacks competence in the subject matter field at issue, requires a different basis:

> Trial judges are routinely confronted with expertise and evidence in scientific and technological fields in which they have no professional, specialist or other experience-based competence. Furthermore, in some case-types, judges' decision-making is complicated by contradictory or otherwise inconclusive expert knowledge. Recurrent epistemic asymmetries between experts and judges create a condition of uncertainty, a condition the judges have to overcome in order to make a decision.[67]

65. Opposing parties are likely to argue that the other side has either missed out on crucial scientific research, or wrongly included scientific evidence (to support its respective claims) which others in the field do not take seriously.

66. *See* Taipale, *supra* note 7. Taipale is in the Faculty of Social Sciences at the University of Helsinki.

67. *Id.* at 311. That is, how can trial judges

Consider two types of claims made by expert witnesses: (1) social claims "regarding the social structure and dynamics of their field(s) of expertise and . . . [their, or their opposing expert's,] standing in the field," and (2) technical "claims concerning the validity and reliability" of their testimony.[68] Taipale found that when judges are faced with "technically complex and esoteric" expertise, they generally lack the capacity to make a direct judgment, as *Daubert* requires of U.S. district court judges. In the alternative, they make an indirect judgment based on what the author calls a "socio-technical review"—a type of external meta-expertise.[69]

> While internal meta-expertise relies on some approximate understanding of the substantive side of the judged expertise, external meta-expertise relies on understanding the circumstances in which an expert claim is uttered. In the latter case . . . technical judgments and decisions are made via non-technical means; i.e. conclusions are reached by making *social* judgments about who to believe rather than *scientific* judgments about what to believe.[70]

Lacking "substantial" knowledge of "exactly what the expert know[s]," the judge relies on "contextual knowledge" of the institutional structure in which the expert operates.[71]

> make socially acceptable and legitimate decisions based on knowledge derived from fields of expertise in which they are not expert. Making a credible decision requires some way to effectively choose between competing knowledge claims, but what can that discrimination be based upon in the absence of deep understanding of the disputed issue?

See id. at 310-11.

68. *See id.* at 312, 317.

69. *See id.* at 312-13.

> Thus, judges can either make direct meta-expert judgments on both social and technical expert claims, or judges can make review-based indirect judgments. In the latter case, judges review experts' social claims, i.e. what experts say about fields of expertise and the standing that other experts have in that field, and judges also review experts' technical claims, i.e. how experts discuss and opine about the veracity of other experts' technical claims of substance regarding the evaluated case.

Id. at 315-16.

70. *See id.* at 314 (emphases added) (citing COLLINS & EVANS, *supra* note 21, at 45-52). "[J]udges do not have social or epistemic access to the professional field or an understanding of the technical content of the field." *Id.* at 316.

71. *See id.* at 314-15 (citing Gabor Kutrovátz, *Knowing with Experts: Contextual Knowledge in and Around Science*, 32 THEORY OF SCI. 479, 479-82 (2010)).

> Kutrovátz discusses meta-expertise as social intellect directed at the institutional structure and dynamic of science, but he is somewhat sceptical of the idea that the public at large could develop such a social intellect. It seems plausible, however, that in the limited context of litigation in one case-type, meta-experts (judges) could, by reviewing the social circumstances, render intelligible the social structure and dynamics of the evaluated fields of expertise. This comes fairly close to what Collins and Weinel call sociological discrimination, which refers to a kind of meta-

To summarize, in a socio-technical review, a judge does not directly evaluate either (1) the reliability and validity of the expert's claims—the technical aspect, or (2) the structure of the field of expertise in question and the standing of the experts in that field—the social aspect.[72] Judges typically do not have the requisite understanding to assess such evidence.[73] Instead, the judge indirectly discriminates between experts by reviewing both (1) the "experts' claims about other experts' claims" concerning the validity and reliability of that other expert's testimony, and (2) "the experts' claims about field(s) of expertise" and the standing of their opposing experts in that field.[74] In the latter exercise, in Taipale's view, the judge listens to witnesses who do not serve as experts making scientific (or social scientific) claims about the science (or the institutional aspects of the field). Rather, the witnesses have become informants on the issue of consensus, and the judge is using criteria external to the field of expertise to indirectly assess their testimony (which is why these criteria do not work for direct assessment).[75]

The three meta-criteria, identified in Part II.B above (with respect to the Periodic Table of Expertises), are credentials, experience, and track record. When all of the experts have "comparable levels of formal qualifications" and "comparable levels of experience," the first two of the meta-criteria are of little use in directly discriminating between experts, and the third criterion is often invoked negatively in direct judgments (as a courtroom expert solely for plaintiffs or defendants may suggest bias).[76]

> expertise that scholars investigating the social organization of science might develop.

Id. at 315 (citations omitted) (citing H. Collins & M. Weinel, *Transmuted Expertise: How Technical Non-experts Can Assess Experts and Expertise*, 25 ARGUMENTATION 401, 408 (2011). *See also* Harry Collins et al., *Expertise Revisited, Part II: Contributory Expertise*, 56 STUD. HIST. & PHIL. SCI. 103, 105 (2016). Weinel goes further and argues suggests that the periodic table (developed by Collins and Evans, discussed in Section II, *supra*) might be improved by adding "sociological discrimination" as a transmuted expertise. *See* Weinel, *supra* note 62, at 198-202. Note that this also explains why U.S. Judges cannot engage in sociological discrimination—they don't have sustained interaction with a *single* discipline.

72. Taipale, *supra* note 7, at 317. According to the author, "judges with very little or no training in science or medicine do not venture into making direct judgments about technical expertise." *See id.* at 320.

73. *See id.* at 319. In a traumatic brain injury case, for example, a "judges' practical understanding based on common experience does not suffice . . . [to evaluate] medical experts' diagnostic expertise." *See id.* at 318.

74. *See id* at 317.

75. *See id.* at 321.

> In the case of direct judgment, meta-expert evaluation of expertise is based on external criteria that function as cues for deciding whom to believe. More specifically, the criteria are external to the esoteric circle of expertise. Correspondingly, judges' direct judgment based on external criteria does not grant epistemic access to the social structure and dynamics of the field itself.

Id.

76. *See id.* at 321-22.

Indirectly, however, in a socio-technical review, the judge listens to opposing informants who make claims about the social structure of the field of expertise, including the standing in the field of the experts making technical claims, "which provides judges with a strong indication of credibility and also a proxy for evaluating veracity of expert claims."[77] Instead of directly evaluating experts based on their track records as presented to judges, "judges review claims that experts make about other experts."[78]

In Taipale's view, "The resulting representation orders the field of expertise and individual experts' position in it. The analysis shows that reviewing experts' claims about their professional fields can be more potent than direct judgments in making the structure and dynamics of expertise visible, thus providing bases for discriminating between expert positions."[79] For our purposes, the value of the Helsinki study is that it suggests the contours of the type of enhanced ubiquitous expertise that a judge could develop to identify consensus based on multiple interactions with courtroom experts. However, there is an important difference between the judges in the Helsinki study, who had repeated interactions with the same experts in controversies arising out of the same scientific field (and therefore could develop the meta-expertise called local discrimination[80]), and the typical federal trial court judge who repeatedly deals with multiple experts from various fields of science. This leaves federal trial court judges with only ubiquitous expertise, but with an enhanced ubiquitous expertise that is superior to jurors' ubiquitous expertise.

Taipale is primarily focused on how experts criticize each other, which is not by itself a new concept. Typically, on direct examination in a *Daubert* hearing or at trial, experts are not only asked to give a substantive opinion, but also to opine on the reputation and flaws in the testimony of opposing experts.[81] But there is a subtle difference in what Taipale's study

77. *See id.* at 323.

78. *See id.* at 324 ("The review is an important access point to how experts themselves perceive the field . . . [, giving a] strong indication to the judge as to who to believe."). One judge who was interviewed by the author stated:

> [Judges] do not have doctoral degrees, so how could we then assess [scientific evidence]? However, often the experts criticize one another's statements. So that's how you get some perspective as well. They read each other's statements and then tell us what they perceive to be the weak part in the statement.

Id. at 328.

79. *Id.* at 326.

80. *See supra* note 42 and the discussion of local discrimination in Part II.B.

81. Indeed, Taipale is not concerned with consensus: "It is noteworthy that what judges present as a dominant view within the court has no necessary connection to medical consensus outside of the court; the representation merely expresses judges' contingent or situated understanding based on courtroom testimonial, experience and knowledge of the case-type and courtroom practices." Taipale, *supra* note 7,

is describing, because in the U.S. context, the purpose of the direct examination of experts is to educate the judge (in a *Daubert* hearing) or the jury (once the opposing experts are admitted) to make a technical decision. Taipale, in agreement with Cheng and the authors of this Article, doubts the capacity of judges to make technical evaluations, due to the "epistemic asymmetry between judges and . . . experts."[82] Lacking specialist expertise, judges must find some other basis by which to discriminate between opposing experts and resolve the case. It is through the use of informants, who are familiar with the relevant field of expertise and the views of the majority of scientists in that field, that the judge can reach a decision.

There is another difference between the focus of the Helsinki study and our proposal: the judges in the Helsinki study focused on discriminating between two opposing individual experts and finding the one with the most credibility as the most reliable. We, however, focus on consensus, a social judgment about a community of scientists, and on discriminating between opposing experts based on their respective alignment with the majority of the practitioners in their field. This difference is subtle, but important. In each case, it will be individual experts who will testify, but when the issue at stake is consensus, the expert chosen is the one the judge perceives to be credible, social knowledge of consensus within a community of experts and not necessarily the one with the best substantive, technical knowledge of the relevant science.

C. Judicial Experience with Scientific Consensus

It should be emphasized that federal courts sometimes discuss scientific consensus, in part because *Frye*'s General Acceptance Rule became a factor for consideration in *Daubert*.[83] Professor Cheng bolsters his argument for a Consensus Rule by noting that consensus is already present in some types of cases. Disagreements among expert translators, for example, can be settled (in contrast to disagreements between scientific experts under *Daubert*) by an appeal to the view of a majority

at 328.

82. *See id.*

83. Indeed, prior to *Daubert*, some federal courts sang the praises of the *Frye* "general acceptance" standard because courts should follow relevant majoritarian consensus:

> The requirement of general acceptance in the scientific community assures that those most qualified to assess the general validity of a scientific method will have the determinative voice. Additionally, the *Frye* test protects prosecution and defense alike by assuring that a minimal reserve of experts exists who can critically examine the validity of a scientific determination in a particular case.

United States v. Addison, 498 F.2d 741, 743-44 (D.C. Cir. 1974)

of translators[84]:

> We suspect that courts are implicitly assuming the existence of a "standard" translation—a translation that a consensus of experts (i.e., bilingual speakers) would agree upon.
>
> . . . .
>
> [W]ith regard to foreign language, epistemic incompetency is patently obvious. Something written in a foreign language is facially incomprehensible, and judges easily understand that casual study cannot hope to give them the tools necessary to make complex decisions related to language translation.[85]

Similarly, in medical malpractice cases when experts disagree as to the standard of care, courts look to community customs to establish a majority view in a particular medical field (an expert community's "internal standard-setting is effectively the consensus approach in action").[86] For example:

> Tennessee courts have made clear that a medical expert "must present facts demonstrating how he or she has knowledge of the applicable standard of professional care . . . in the community." . . . [S]uch knowledge can come from not only first-hand experience, but also "reference materials on pertinent statistical information[,] . . . conversing with other medical providers in the pertinent community[,] . . . visiting the community or hospital where the defendant practices, or other means." One can imagine similar techniques being applied to determine scientific consensus in other areas as well.[87]

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84. *See* Cheng et al., *supra* note 51, at 869.

> Unlike with scientific evidence, . . . courts appear to have implicitly adopted a deference framework when it comes to foreign language evidence. First, courts - implicitly assume that a consensus translation exists . . . . Second, the expert's role is not to educate the jury . . . but rather to provide evidence about what the community thinks about a translation. Third, courts acknowledge that they are unqualified to resolve translation disputes. Judges do not gatekeep the experts beyond checking qualifications. Finally, juries are not permitted to second-guess the experts' translations . . . .

Id. at 869-70.

85. *See id.* at 872-73 (citing Buchanan v. Cate Civ. No. 10-0423 BTM (NLS), 2011 WL 10730141 at *20 (S.D. Cal. Sept. 30, 2011); United States v. Sung Myung Moon, 532 F. Supp. 1360, 1364 (S.D.N.Y. 1982); United States v. Dibee, 2020 WL 2039327, at *2 (D. Or. Apr. 24, 2020).

> By contrast, the scientific realm—outside highly technical mathematics—may seem enticingly accessible. Indeed, in the scientific realm, a burgeoning assortment of short courses and reference manuals promise to provide judges with the "tools they need" to manage complex scientific and technical evidence.

Cheng et al., *supra* note 51, at 873.

86. *See* Cheng et al., *supra* note 51, at 863. Medical custom has been recognized in courts' reliance upon medical texts, clinical practice guidelines from medical associations, medical review panels, and surveys. *See id.* at 866-69.

87. *Id.* at 866 (quoting Donathan v. Orthopaedic & Sports Med. Clinic, PLLC, No. 4:07-cv-18, 2009 WL 3584263, at *24 (E.D. Tenn. Oct. 26, 2009); and then quoting Shipley v. Williams, 350 S.W.3d

Significantly, however, the *Daubert* regime specifically downplays the importance of consensus by reducing general acceptance—*Frye*'s seeming consensus standard for admissibility—to a mere factor to consider and therefore not determinative of reliability.[88] Moreover, because *Frye* was an admissibility rule, it left the choice of which expert to believe to the jury, unlike the Consensus Rule.[89] Nevertheless, we agree with Cheng that there are some contexts that exemplify the consensus approach in courts.

The precise term "scientific consensus" appears infrequently in federal court opinions, but the concept seems to be connected to the general acceptance prong of the so-called four-part *Daubert* test.[90] Some circuit courts explicitly confirm that general acceptance is not *the* test for the admissibility of expert testimony,[91] but they note that it can still be an important guidepost in ascertaining the reliability of the testimony.[92] Expert witnesses, therefore, likely will not rely solely on scientific consensus when testifying, but they may mention it. For example, in *United States v. Crisp*, the Fourth Circuit Court of Appeals held that handwriting comparison analysis was admissible because it had achieved "widespread and lasting acceptance in the expert community."[93] Likewise, in *Flick v. Warren*, the Sixth Circuit Court of Appeals held that the prosecution's experts, who testified as to the scientific consensus

527, 553 (Tenn. 2011)).

88. *See* Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 594 ("Finally, 'general acceptance' can yet have a bearing on the inquiry. . . . Widespread acceptance can be an important factor in ruling particular evidence admissible, and 'a known technique which has been able to attract only minimal support within the community,' may properly be viewed with skepticism." (quoting United States v. Downing, 753 F.2d 1224, 1238 (3d Cir. 1985)).

89. As to the question of whether *Frye* was a "consensus rule," Cheng argues:

> *Frye* is emphatically not the proposed consensus rule. For one thing, courts historically applied *Frye* only to techniques or procedures, and not substantive facts. But more importantly, *Frye*, like *Daubert*, is an admissibility rule. Satisfying *Frye* means only that the expert evidence is admissible. The jury is still asked to make the ultimate substantive determination. The Consensus Rule by contrast is more like an inference rule than an admissibility rule. The Consensus Rule changes the very question that we ask factfinders to determine.

Cheng et al., *supra* note 51, at 862 (citing Bernstein, *supra* note 30, at 388).

90. *See, e.g.*, *In re* Abilify (Aripiprazole) Prods. Liab. Litig., 299 F. Supp. 3d 1291, 1312-18, 1372-73 (N.D. Fla. 2018) (finding epidemiological study adhering to "generally accepted" principles served as "reliable evidence of a broad scientific consensus").

91. *See* United States v. McCluskey, 954 F. Supp. 2d 1224, 1268-69 (D.N.M. 2013) ("Defendant submitted an affidavit . . . that a source attribution . . . is not 'the consensus' of the scientific community. . . . [I]n federal court, 'consensus' . . . is not the standard.").

92. *See, e.g.*, Nease v. Ford Motor Co., 848 F.3d 219, 228-29 (4th Cir. 2017) (noting that, although general acceptance is no longer the test, it remains "relevant").

93. *See* United States v. Crisp, 324 F.3d 261, 271 (4th Cir. 2003). Note, however, that the dissent in *United States v. Crisp* remarked that "the Supreme Court has instructed that the trial judge *should* consider [any reasonable measure of the testimony's reliability]" and that the factors are not meant to be exclusive. *Id.* at 272 (Michael, J., dissenting).

about shaken baby syndrome, could not have been successfully challenged under *Daubert* based on an alleged controversy and a minority view regarding shaken baby syndrome.[94] Finally, in *Massachusetts v. EPA*, in which the Supreme Court held that the Environmental Protection Agency had the authority to regulate automobile emissions of greenhouse gases, the Court noted:

> The harms associated with climate change are serious and well recognized.
> . . .
> . . . According to the climate scientist Michael MacCracken, "qualified scientific experts involved in climate change research" have reached a "strong consensus" that global warming threatens (among other things) a precipitate rise in sea levels by the end of the century . . . .[95]

That case did not involve admissibility of expert witnesses, but it suggested an exemplary deference to scientific consensus in the courts.

In general, however, it seems that federal judges pay more attention to consensus when the general acceptance factor is not met. For example, in *United States v. Bonds*, the Sixth Circuit explained that,

> general acceptance does not require that there be "unanimity, or consensus within the scientific community concerning such acceptability. . . ." [H]owever, . . . although "neither consensus nor certainty" is needed, an absence of consensus is not immaterial.[96]

Similarly, in *Young v. Burton*, the D.C. Circuit Court of Appeals held that the lower court did not abuse its discretion when it excluded testimony where there was no accepted consensus in the scientific community.[97] Likewise, in *Black v. Food Lion, Inc.*, the Fifth Circuit reversed a decision admitting an expert whose speculative "theory [concerning the cause of fibromyalgia] ha[d] failed to gain acceptance within the medical profession."[98] Conversely, however, the Fifth Circuit in another case

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94. *See* Flick v. Warren, 465 F. App'x 461, 465 (6th Cir. 2012).

95. *See* Massachusetts v. Env't Prot. Agency, 549 U.S. 497, 521 (2007) (quoting the Declaration of Michael MacCracken, Former Executive Director, U.S. Global Change Research Program in Petitioners' Standing Appendix 207, ¶ 5, 549 U.S. 497 (No. 03-1361)).

> Indeed, the NRC Report itself—which EPA regards as an "objective and independent assessment of the relevant science,"—identifies a number of environmental changes that have already inflicted significant harms, including "the global retreat of mountain glaciers, reduction in snow-cover extent, the earlier spring melting of ice on rivers and lakes, [and] the accelerated rate of rise of sea levels during the 20th century relative to the past few thousand years . . . ."

Massachusetts v. Env't Prot. Agency, 549 U.S. at 521 (citations omitted) (quoting NAT'L RSCH. COUNCIL, CLIMATE CHANGE SCIENCE: AN ANALYSIS OF SOME KEY QUESTIONS 16 (2001)).

96. United States v. Bonds, 12 F.3d 540, 562 (6th Cir. 1993) (quoting the Magistrate Judge in the initial proceedings).

97. *See* Young v. Burton, 354 F. App'x 432, 432 (D.C. Cir. 2009).

98. *See* Black v. Food Lion, Inc., 171 F.3d 308, 313 (5th Cir. 1999) ("Experts in the field conclude that the ultimate cause of fibromyalgia cannot be known . . . .").

confirmed that "the lack of scientific consensus or peer review does not necessarily render expert testimony unreliable," as long as the expert's conclusions are "practiced by (at least) a recognized minority of scientists in their field."[99]

In the states where *Frye* remains the admissibility standard, such as Pennsylvania, judicial references to a determinative consensus are—predictably—more common. For example, in *Pennsylvania v. Topa*, the Pennsylvania Supreme Court confirmed that admissibility of evidence "depends upon the General acceptance of its validity by those scientists active in the field to which the evidence belongs."[100] Justice Wecht, in his concurrence in *Walsh v. BASF Corp.*, was even more explicit in associating the *Frye* test with consensus:

> [T]he *Frye* test, which is premised on a rule—that of "general acceptance"—is more likely to yield uniform, objective, and predictable results among the courts, than is the application of the *Daubert* standard . . . . Moreover, the decisions of individual judges, whose backgrounds in science may vary widely, will be similarly guided by the consensus that exists in the scientific community on such matters.[101]

Justice Wecht also joined in the criticism of *Daubert* for placing a "greater epistemic burden [than *Frye*] on judges tasked with determining the reliability of proposed expert testimony."[102] While "judges generally cannot apply the *Daubert* test with a level of competence necessary to satisfy intellectual due process," *Frye* "delegates the question of reliability to a community of recognized experts."[103]

Returning to the importance of general acceptance as a factor under *Daubert*, some federal judges give more weight to general acceptance than to other factors.[104] In any event, it is common for federal courts to consider the consensus view of a relevant scientific community.

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99. *See* Securities & Exch. Comm'n v. Life Partners Holdings, Inc., 854 F.3d 765, 776 (5th Cir. 2017) (quoting Daubert v. Merrell Dow Pharms., Inc., 43 F.3d 1311, 1319 (9th Cir. 1995)).

100. *See* Pennsylvania v. Topa, 369 A.2d 1277, 1280 (Pa. 1977).

101. Walsh Est. of Walsh v. BASF Corp., 234 A.3d 446, 470 (Pa. 2020) (quoting Grady v. Frito-Lay, Inc., 839 A.2d 1038, 1044-45 (Pa. 2003)).

102. *Walsh Est. of Walsh*, 234 A.3d at 473 (quoting Dillon, *supra* note 17, at 262).

103. *Id.* at 473 (quoting Dillon, *supra* note 17, at 260).

104. *See, e.g.*, Mark Haug & Emily Baird, *Finding the Error in* Daubert, 62 HASTINGS L.J. 737, 746 (2011) ("[T]estability is a favored factor . . . General acceptance, however, has enjoyed the position of sole criterion on admissibility for seventy years, and it is not surprising to see its prevalence in many of the [*Daubert*] decisions[.]"); Sophia I. Gatowski et al., *Asking the Gatekeepers: A National Survey of Judges on Judging Expert Evidence in a Post*-Daubert *World*, 25 L. & HUM. BEHAV. 433, 448 (2001) ("Judges were asked to what extent, if any, and under what circumstances they would weight or combine the four [*Daubert*] guidelines . . . . One hundred and sixty-six of the judges (42% [of 400]) chose to answer the question by indicating the *Daubert* guideline to which they would generally attribute the most weight – of these judges, half (86 of 166, or 22% of 400) indicated that general acceptance would be given the most weight . . . ."). *But see* John B. Meixner & Shari Seidman Diamond, *The Hidden* Daubert *Factor:*

IV. A PRE-TRIAL HEARING ON CONSENSUS

A. Why Judges Are Likely Capable of Discerning Consensus

A new kind of pre-trial hearing is necessary to determine the content and boundaries of the consensus testimony in order to direct the jury accordingly. While Cheng is correct that judges, with respect to scientific knowledge, are lay persons just like jurors (and just as unsuited to evaluate expertise), it is also true that judges are not in the same position as jurors in our legal system:

1. While judges cannot be free of unconscious bias, there is nevertheless the hope (and expectation) that legal training, guidelines, and experience should make them more aware of these effects than the typical lay person, and hence more reflexive about their own practice.

2. As part of their specialist legal expertise, judges can be expected to have a better understanding of the different epistemic criteria used in legal settings (e.g., beyond a reasonable doubt, balance of probabilities, reasonable person, etc.) and to have had more experience than jurors in applying them.

3. As part of their specialist legal expertise, judges can be expected to have a better understanding of how different domains and kinds of expertise have been used and evaluated in similar cases and hence what precedents exist.[105]

4. As part of their specialist legal work, judges will repeatedly oversee these hearings and, while the specific content of each controversy may differ, it is likely that they can develop some transferable skills and knowledge.

5. As part of their specialist legal work, judges will have developed substantial skills in synthesizing and summarizing complex testimony for their instructions to the jury.

How Judges Use Error Rate in Assessing Scientific Evidence, 2014 WIS. L. REV. 1063, 1115 (arguing that a judge's assessment regarding validity of an experts' methodology, rather than any explicit *Daubert* factor, is the most significant component of the *Daubert* analysis).

105. For example, judges can be assumed to follow evaluations of forensic science and be aware of the ways in which the status of forensic techniques can change over time. The study of Helsinki judges in traumatic brain injury cases, *supra* Part III.B, represents an extreme case of how judges benefit from repeated contact with experts from a single field.

A pre-trial hearing on consensus—to establish whether a relevant expert community believes a specific fact—would likely improve the reliability of verdicts. In making this determination, judges would need to hear and synthesize competing testimony from a range of different expert witnesses and make judgments about the domains of science and expertise that are relevant to the case in question. While much of this will need only the most ordinary ubiquitous expertises (e.g., what is or is not a science), judges will also be required, based on their experience with expert witnesses, to make more subtle judgements about the social relations, institutional networks, and intellectual history of the domain. In contrast to a *Daubert* hearing, each expert would testify not as an individual whose claim to technical expertise is being assessed, but as a key informant whose task is to report honestly on their community and its shared practices.[106] *Daubert* requires the judge to act as a scientific peer and assess the quality of the individual expert's work and hence the epistemic value of their claim. In contrast, the Consensus Rule requires a different kind of judgment—is the individual witness capable of accurately describing the nature of their expert community?

The likely outcomes of such hearings can be summarized as follows:

1. The judge determines that there is a clearly defined field of expertise with a strong consensus about the existence of a particular fact or finding. In this case, the jury would be instructed to treat the fact as established for all practical purposes. A current example of such a fact is the claim that DNA fingerprints are unique and, with appropriate protocols, provide an unambiguous means of identification. Because the consensus is strong, neither the plaintiff nor the defendant would be able to call witnesses to challenge this fact, though they could still argue that the relevant science or technique had not been used correctly (e.g., the particular sample was contaminated in some way).

2. The judge determines that there is a consensus, but some dispute about both the content of this consensus and the relevance of particular areas of scientific research or disciplines (e.g., fingerprint identification). In this scenario, the judge would set out

106. In the language of the movement in the sociology of science known as Studies in Expertise and Experience (SEE), the expert is functioning as a "probe." As any competent member of the discipline can do this, this should not be an insurmountable burden on the domain as, even if there are many trials and many judges wanting advice, there will also be many potential experts. For more on the idea of the probe and how a single individual can represent a group, *see* Harry M. Collins & Robert Evans, *Probes, Surveys, and the Ontology of the Social*, 11 J. MIX. METHODS 328-41 (2017).

the contours of the consensus and the extent to which different views are shared across the expert communities. This outcome would be expected in the case of fingerprint evidence, for example, where there is both a community of fingerprint examiners who would argue for the reliability of fingerprint identification (i.e., a consensus) and a more critical community of academic scholars within which there is a consensus that this reliability has not been established.[107] Other examples might occur around toxic tort or similar cases where judges need to determine whether experiential knowledge generated within particular communities should be admitted. Plaintiffs and defendants would then be able to call experts from any of the domains deemed relevant by the judge, with the weight attached to the testimony of these individuals determined by the judge based on its consistency with the consensus in their community and the overall standing of that community within the debate as a whole.

3. The judge determines that there is no meaningful consensus within any credible expert community and would then allow the parties to identify and present expert witnesses if properly qualified. Under *Daubert*, any party could move to have an expert removed, and the judge would hold a *Daubert* hearing to determine admissibility of that expert. Instead of doing away with *Daubert*, as Cheng suggests, we believe that that the *Daubert* regime is useful, in cases where no consensus is established, to keep fringe experts out of the courtroom[108]—the jury would have to decide between competing experts admissible under existing F.R.E. 702. Examples of excluded experts might include the long debunked pseudoscience of "voiceprint" analysis and, perhaps in the not too distant future, expertise in bitemark identification.[109]

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107. *See, e.g.*, Simon A. Cole, *Who Will Regulate American Forensic Science?*, 48 SETON HALL L. REV. 563-65 (2018); David S. Caudill, *Toward a Sociology of Forensic Knowledge? A (Supplementary) Response to Cole*, 48 SETON HALL L. REV. 583 (2018); Michael Lynch & Simon Cole, *Science and Technology Studies on Trial: Dilemmas of Expertise*, 35 SOC. STUD. SCI. 269 (2005).

108. Certainly, people are susceptible to fringe science. *See, e.g.*, Asheley R. Landrum & Alex Olshansky, *The Role of Conspiracy Mentality in Denial of Science and Susceptibility to Viral Deception About Science*, 38 POLS. & LIFE SCIS. 193 (2019).

> [P]eople can reject well-established scientific theories *and* they can believe fabricated, deceptive claims about science to be true. . . . [S]ome individuals are more likely than others to diverge from scientists because of individual factors such as their science literacy, political ideology, and religiosity.

Id. at 193.

109. For a recent critique of forensic odontology see Michael J. Saks et al., *Forensic Bitemark Identification: Weak Foundations, Exaggerated Claims*, 3 J. L. & BIOSCIS. 538 (2016).

In this way, many of the features of the U.S. legal system that Professor Cheng seeks to preserve are maintained, including a substantial role for in-person expert testimony and cross-examination, while the worst excesses of the *Daubert* system are eliminated. Judges retain some gatekeeping functions but, by focusing on consensus, their task is now one for which their training and experience provide a more robust and reliable foundation.

B. A Preliminary List of Factors to Evaluate Consensus

> In a scientifically sophisticated vernacular, consensus is as much a qualitative matter as is a quantitative one.[110]

The gatekeeping role assigned to federal trial judges in *Daubert*—keeping unreliable expert evidence from the jury—together with the *Daubert* guidelines as to how judges should evaluate admissibility (including the famous four factors in *Daubert*: testability, error rate, publications, and general acceptance), invites parties to challenge the proposed expert testimony of an opposing party based on its irrelevance or unreliability. Although procedures and judicial preferences vary (since a motion can be made when testimony occurs, or at the end of the trial), a *Daubert* challenge frequently takes the form of a motion in limine because of the strategic advantages (including settlement or dismissal) of pre-trial exclusion of an opponent's expert.[111] At a pre-trial hearing, the party proffering the challenged expert has the "burden of proof and must prove by a preponderance of the evidence that the expert possesses the requisite level of expertise and the testimony is based on reliable methodologies."[112]

The role of the judge at such a pre-trial hearing was described in *Daubert*:

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110. Matthew H. Slater et al., *Public Conceptions of Scientific Consensus*, ERKENNTNIS (July 18, 2022), https://link.springer.com/article/10.1007/s10670-022-00569-z#:~:text=In%20a%20scientifically%20sophisticated%20vernacular,increasing%20marginalization%20of%20dissenting%20voices.

111. *See generally* Anjelica Cappellino, *The Daubert Standard: A Guide To Motions, Hearings, and Rulings*, EXPERT INST. (Feb. 2, 2023), https://www.expertinstitute.com/resources/insights/the-daubert-standard-a-guide-to-motions-hearings-and-rulings/.

112. *See id.* Although conventionally recommended, *Daubert* hearings are not technically required, as there have been appeals based on the failure of the trial judge to hold a *Daubert* hearing—as long as the judge considered the relevance and reliability of the proffered expertise diligently, the failure to hold a separate hearing was not fatal to the judge's exclusion of the testimony. *See, e.g.*, Hopkin v. Dow Corning Corp., 33 F.3d 1116, 1124 (9th Cir. 1994) (stating that a trial court is not required "to hold a Rule 104(a) hearing, but rather must merely make a determination as to the proposed expert's qualifications").

> Faced with a proffer of expert scientific testimony . . . the trial judge must [make] . . . a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue. . . . Many factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test. But some general observations are appropriate.[113]

The Court goes on to identify testability, peer review and publication, any known error rate, and general acceptance as "pertinent" considerations in the trial court's inquiry.[114] The Advisory Committee Notes to the 2000 amendment to F.R.E. 702 identified "the existence and maintenance of standards and controls" as another factor in *Daubert*, and then noted that courts have "found other factors relevant in determining whether expert testimony is sufficiently reliable to be considered by the trier of fact,"[115] including:

> (1) Whether experts are "proposing to testify about matters growing naturally and directly out of research they have conducted independent of the litigation, or whether they have developed their opinions expressly for purposes of testifying."
> (2) Whether the expert has unjustifiably extrapolated from an accepted premise to an unfounded conclusion.
> (3) Whether the expert has adequately accounted for obvious alternative explanations.
> (4) Whether the expert "is being as careful as he would be in his regular professional work outside his paid litigation consulting."
> (5) Whether the field of expertise claimed by the expert is known to reach reliable results for the type of opinion the expert would give.[116]

Under a consensus regime, judges would also need guidelines or factors to help them understand and evaluate evidence of consensus in the pre-trial hearing. Moreover, just as the Federal Judicial Center offered numerous training programs for federal judges[117] and published *The Reference Manual on Scientific Evidence*[118] in the wake of *Daubert*, the

113. Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 592-93 (1993).

114. *Id.* at 593-94. As to general acceptance, the Court explains: "A 'reliability assessment does not require, although it does permit, explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community.'" *Id.* at 594 (quoting United States v. Downing, 753 F. 2d 1224, 1238 (1985)).

115. FED. R. EVID. 702 Committee Notes on Rules-2000 Amendment.

116. *Id.* (citations omitted) (quoting Daubert v. Merrell Dow Pharms., Inc., 43 F.3d 1311, 1317 (9th Cir. 1995); Sheehan v. Daily Racing Form, Inc., 104 F.3d 940, 942 (7th Cir. 1997)).

117. The Center continues to offer educational resources on scientific expertise for federal judges, including materials on fingerprint identification, neuroscience, and DNA technologies. *See Science Resources: Overview of Science Resources*, FED. JUD. CTR., https://www.fjc.gov/content/326577/overview-science-resources (last visited Mar. 21, 2024).

118. The Manual is now in its third edition (2011), and includes chapters on how science works,

training of trial judges in a consensus regime could follow the same pattern.[119]

Professor Cheng has already offered a brief summary of the tools that courts may use to determine whether consensus exists—a complex inquiry but one made easier by *Frye*'s General Acceptance Rule (a factor under *Daubert*).[120] Expert testimony is the obvious source of consensus evidence; also, courts could consider reports of relevant organizations, whether consensus statements[121] or "other types of systematic reviews."[122] Cheng identified the following as useful: (1) his own work on citation networks to discern scientific consensus; (2) adversarial collaboration (e.g., opposing researchers draft a joint statement); and (3) identifying two non-collaborating experts, appointed by a third party, to opine on consensus.[123] Finally, Cheng acknowledges the challenge that expert testimony concerning case-specific facts presents for any Consensus Rule—the technical issue in a lawsuit may not have been the subject of research, which requires that the jury either (1) decide which expert's view reflects what the relevant expert community would have

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forensic identification expertise, DNS identification evidence, statistics, survey research, economic damages, Exposure science, epidemiology, toxicology, medical testimony, neuroscience, mental health evidence, and engineering. *See generally* NAT'L RSCH. COUNCIL, THE REFERENCE MANUAL ON SCIENTIFIC EVIDENCE (3d ed. 1994).

119. While we do not believe that the Federal Judicial Center's programs and publications were ever able to give judges the competence to evaluate scientific experts, we think that training to develop enhanced ubiquitous expertise, with respect to consensus, could be successful.

120. *See* Cheng, *supra* note 1, at 458-60.

121. *See id.* at 458-59. Cheng cites to National Research Council reports on DNA profiling, polygraphs, electromagnetic fields, and forensics. *Id. See also* Robert Timothy Reagan, *Scientific Consensus on Memory Repression and Recovery*, 51 RUTGERS L. REV. 275, 288-89 (1999) ("statements by large scientific organizations are considerably better evidence of scientific consensus than the testimony of any individual witness.").

122. *See* Cheng, *supra* note 1, at 459. Cheng offers examples:

> Cochrane (formerly known as the Cochrane Collaboration), for example, produces systematic reviews of the medical and health literature. The Mental Measurements Yearbook compiles information on psychological test validity. Even treatises and metaanalyses by individuals or groups of authors are a reflection of what the consensus is, though these may have a greater risk of bias.

Id. (citations omitted). *See also* Rebecca Haw, *Adversarial Economics in Antitrust Litigation: Losing Academic Consensus in the Battle of the Experts*, 106 NW. U. L. REV. 1261, 1301 (2012) ("The medical community actually performs such meta-analyses of scientific consensus on particular issues and publishes the results for practitioners to use in the form of the Cochrane Reviews.").

123. *See* Cheng, *supra* note 1, at 459 (citing Edward K. Cheng, *Proving General Acceptance Using Modularity* (June 30, 2020) (unpublished manuscript) (on file with author)); Uri Shwed & Peter S. Bearman, *The Temporal Structure of Scientific Consensus Formation*, 75 AM. SOCIO. REV. 817, 818-20 (2010) (discussing citation networks); Susan T. Fiske & Eugene Borgida, *Standards for Using Social Psychological Evidence in Employment Discrimination Cases*, 83 TEMP. L. REV. 867, 872 (2011) (discussing adversarial collaboration); Adina Schwartz, *A "Dogma of Empiricism" Revisited:* Daubert v. Merrell Dow Pharmaceuticals, Inc. *and the Need to Resurrect the Philosophical Insight of* Frye v. United States, 10 HARV. J.L. & TECH. 149, 193 (1997) (suggesting a third party identifying non-collaborating experts).

found, or (2) "determine the appropriate method for an expert to use (a general fact), and then defer to that expert's application of the method."[124] In our view, Cheng's explanation highlights the flaw in his own proposal. Because he does not see that ordinary ubiquitous expertise would not be up to the task of determining appropriate methodologies in specialist fields, Cheng overestimates the capacity of the jury to serve as the principal decisionmaker on questions about consensus.

The better decisionmaker is the judge, who can likely recognize a reliable informant (regarding consensus) due to their enhanced ubiquitous expertise gained by extensive interaction with experts. Some preliminary factors to guide judges serving in that capacity, especially when expert witnesses disagree on matters of consensus, would include the following:

1. Whether the informant on the question of consensus has sufficient knowledge of the relevant expert community, either due to being a member of that community (e.g., a scientist in that field) or by fieldwork experience studying, interviewing, and interacting with that community (e.g., a social scientist). Evaluating the reliability of such informants is not so different from the focus in *Daubert* on peer-reviewed publications as a marker of credibility, and the goal of the inquiry is to determine general acceptance—a *Daubert* factor. Moreover, the inquiry is represented in the aforementioned Periodic Table of Expertises as a set of meta-criteria—namely credentials, experience, and track record—that judges must use as "outsiders" when choosing which expert to believe.

2. Whether the informant has an opinion concerning the validity and reliability of the opposing expert's testimony, including, most importantly, an assessment of the standing (i.e., the community's evaluation) of an opposing expert in the relevant field of expertise.

3. Whether the informant has sufficiently identified the relevant expert community in which consensus has formed, a challenge that the notion of general acceptance introduced:

> [T]he knottiest problem posed by *Frye* is the definition of the relevant community: if the reliability inquiry is a matter

124. *See* Cheng, *supra* note 1, at 459-60."If the expert community lacks sufficient individualized data and would decline to make specific determinations, then the situation is one of dissensus. The jury would receive the general fact evidence under the Consensus Rule, but would otherwise be free to make its *own independent findings on the specific facts*." *Id.* at 460 n.231 (emphasis added) (citing David L. Faigman et al., *Group to Individual (G2i) Inference in Scientific Expert Testimony*, 81 U. CHI. L. REV. 417, 425-26 (2014) (discussing instances in which researchers agree that there is insufficient data to individuate from group findings)).

> of nose counting, whose noses are to be counted? This is a problem of great practical import because domains or sub-disciplines often have disciplinary axioms and epistemic norms that lead them to view the reliability of a particular methodology quite differently. Closely related to the problem of identifying the relevant community is the problem of identifying its boundaries. Should the community be defined broadly or narrowly? As Cole and Edmond observe, "[c]ontestation over whether the [reference community] should be construed narrowly or broadly is endemic to a *Frye* analysis. . . . [N]arrow interpretations tend to favor proponents of contested evidence whereas broad interpretations tend to favor opponents and exclusion."[125]

This is more evidence that a judge, with experience evaluating general acceptance (under *Daubert* or *Frye*), and not a jury, would have the capacity to hear arguments and make a decision regarding the boundaries of an expert community. Moreover, a lawsuit involving a technical issue may involve numerous fields of expertise with different views of whether consensus has been achieved.[126] *Daubert* itself involved, *inter alia*, testifying experts from the fields of epidemiology, biostatistics, chemistry, and medicine.[127] Consensus in one of those fields that Bendectin could cause birth defects, however, would be enough under the Consensus Rule to instruct the jury to follow that consensus, unless that consensus could be challenged as reflecting bias or as a fringe view.

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125. Dillon, *supra* note 102, at 262 (footnotes omitted) (quoting Simon A. Cole & Gary Edmond, *Science without Precedent: The Impact of the National Research Council Report on the Admissibility and Use of Forensic Science Evidence in the United States*, 4 BRIT. J. AM. LEGAL STUD. 586, 606 (2015)). *See also* Michelle S. Simon & William Pentland, *Reliable Science: Overcoming Public Doubts in the Climate Change Debate*, 37 WM. & MARY ENV'T L. & POL'Y REV. 219, 244 (2012) ("The existence of a 'consensus' depends on how the relevant scientific community is defined, which can be construed broadly or narrowly.").

126. *See* Sheila Jasanoff, *What Judges Should Know About the Sociology of Science*, 32 JURIMETRICS J. 345 (1992).

> [A] scientific 'field' is intrinsically a moving target, for its boundaries are defined in relation to particular scientific, historical, cultural, and even political circumstances, all of which may change over time. A technique, moreover, can "belong" to more than one field . . . courts may discover through experience that a technique that has gained general acceptance in one field may not yet have done so in another.

Id. at 354.

127. Daubert v. Merrell Dow Pharms., Inc., 509 U.S. at 582-83 nn. 1-2.

4. Whether the informant has used a commonly recognized methodology to measure consensus. As mentioned by Cheng, one can calculate the modularity of a citation network using the related scientific literature.[128] A citation network is a representation of the relationships between papers constructed from the citations each paper makes to other papers—citations tend to indicate agreement, and a citation network can reveal communities of papers that cite mostly to each other.[129] Networks with relatively segregated communities are said to be salient, and a reduction of salience in the literature over time suggests the formation of a consensus.[130] Modularity is essentially a measure of how firmly divided into communities a network is—lower modularity indicates lower salience, which, in turn, indicates consensus.[131] Other methods to measure consensus are available, but, for example, may be less useful as they simply measure overall levels of consensus in a scientific discipline but not agreement on particular scientific facts.[132]

5. Whether the informants have offered reports of relevant organizations, systematic reviews, or consensus statements to support any claim of consensus.[133]

6. Whether the consensus claimed by the informant is the product of bias, or political or economic interests.[134]

7. Whether the disagreement between informants on the issue of consensus is a manufactured or counterfeit controversy.[135]

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128. *See* Cheng, *supra* note 1, at 459 (citing Shwed & Bearman, *supra* note 123, at 820, 833).

129. Shwed & Bearman, *supra* note 123, at 820, 833. These papers are likely to agree with other papers in their communities, but probably disagree with papers outside the community. *See id.* at 820-21.

130. *See id.*

131. *See id.* at 822-23, 833. Tracking the modularity of the citation network over time can thus provide evidence that consensus has formed. *See id.* at 833.

132. *See* Eliza D. Evans et al., *Measuring Paradigmaticness of Disciplines Using Text*, 3 SOCIO. SCI. 757, 764-65 (2016).

133. *See supra* notes 120-21 and accompanying text.

134. *See generally* Socol et al., supra note 21.

> Scientists are human, so they are prone to bias due to political and economic interests. Research funded by public sources is also subject to special interests and therefore prone to bias. Such bias can even lead to consensus not based on evidence.
> . . . .
> Consensus is not an argument in scientific discussion; only experimental evidence matters. There are examples of decades long scientific consensus on erroneous hypotheses.

Id. at 4.

135. *See supra* note 65 and accompanying text.

Because members of the expert community are likely focused on the technical nature of a particular factual claim, and not on the social construction of consensus in their community, a social scientist engaged in qualitative (e.g., interviews and substantial, sophisticated interaction) fieldwork as well as quantitative (e.g., measurements of consensus) research, with respect to a particular expert community, may be a better informant.

C. Selected Examples of Consensus Evidence

While the number of different types of expertise introduced in courts can be overwhelming when one is trying to fashion a rule applicable to all expert testimony, the Court in *Daubert* faced the same challenge. Indeed, the very reason for a *Daubert* "trilogy" is that the Court needed to make some clarifications as to how evaluations of expertise in the new regime might work in different types of cases, as seen in *General Electric Co. v. Joiner*[136] and *Kumho Tire Co., LTD. v. Carmichael*.[137] We should therefore attempt to test the Consensus Rule in several different contexts—one concerning medical evidence in a contemporary policy dispute, the other two involving medical evidence proffered by criminal defendants—although an exhaustive survey is not possible here.

Consider the recent efforts to criminalize medical treatment for transgender children in Texas and Alabama, on the basis that it constitutes child abuse.[138] Those laws have been challenged as using "biased science" because the medical claims justifying these new laws "are not grounded in reputable science and are full of errors of omission and inclusion."[139] The authors of that challenge identify two possibilities: (1) the laws' drafters might genuinely misunderstand "medical protocols and scientific evidence," in which case this is fringe science and do not represent the consensus of an expert community (for example, they repeatedly cite an anti-trans fringe group); or (2) the drafters' misstatements are deliberate and therefore manufactured to create a counterfeit, scientific controversy (the authors of the challenge state that "[t]hese are not close calls or areas

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

137. 526 U.S. 137 (1997).

138. *See* SARAH D. BOULWARE ET AL., BIASED SCIENCE: THE TEXAS AND ALABAMA MEASURES CRIMINALIZING MEDICAL TREATMENT FOR TRANSGENDER CHILDREN AND ADOLESCENTS RELY ON INACCURATE AND MISLEADING SCIENTIFIC CLAIMS 1-2 (2022), https://medicine.yale.edu/lgbtqi/research/gender-affirming-care/report%20on%20the%20science%20of%20gender-affirming%20care%20final%20april%2028%202022_442952_55174_v1.pdf.

139. *See id.* at 2.

of reasonable disagreement").[140] Finally, the authors of the challenge claim the proponents of the laws "ignore the *mainstream scientific evidence* showing the significant benefits of gender-affirming care and exaggerate potential risks."[141] If this debate took place before a judge in a pre-trial hearing on consensus, the proponents of the laws would be discredited as unreliable informants and barred from testifying. Further, the jury would be instructed to accept and follow only the mainstream scientific evidence.

The controversy over shaken baby syndrome provides another example of a debate about consensus.[142] Commentators identified an alleged shift in medical opinion, based solely on outlier sources, that was used by criminal defense attorneys to cast doubt on a "clinically valid and evidence-based [diagnosis, recognized] by an overwhelming majority of pediatric medical specialists."[143]"This diagnosis has been substantiated by the bulk of the medical research in a range of scientific disciplines. It has also been recognized and defined by the Centers for Disease Control and Prevention and widely accepted by courts in the U.S. and numerous foreign countries."[144] This provides another example of a manufactured controversy that a judge, focused on consensus in the relevant expert community, would recognize. A judge could therefore find the proponents of the new research unreliable as informants and thus instruct the jury to follow the consensus definition and diagnosis.

A final example of a consensus controversy is defendants using alcohol-induced blackout (or alcohol-related amnesia) as a defense in a criminal trial.[145] Experts, for example, sometimes suggest that a blackout can create a form of automatism:

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140. *See id.*

141. *See id.* (emphasis added).

142. *See* Joëlle Anne Moreno & Brian Holmgren, *The Supreme Court Screws up the Science: There Is No Abusive Head Trauma/Shaken Baby Syndrome "Scientific" Controversy*, 2013 UTAH L. REV. 1357.

143. *See id.* at 1364, 1366. For example, in *Cavazos v. Smith*, 565 U.S. 1 (2011), the dissenting Justices'

> sweeping scientific-sounding conclusions are not based on any sort of legitimate attempt at a meta-analysis of the relevant data, but rely solely on a handful of single-sentence quotes excerpted from seven cherry-picked articles, all but one of which reflect the extreme outlier child abuse defense argument that [shaken baby syndrome] is diagnostically invalid.

Id. at 1367. "These sources [were] selected without explanation from among the over seven hundred published research papers on" shaken baby syndrome. *Id.*

144. *See id.* at 1364-65.

145. *See* Mark Pressman & David Caudill, *Alcohol-Induced Blackout as a Criminal Defense or Mitigating Factor: An Evidence-Based Review and Admissibility as Scientific Evidence*, 58 J. FORENSIC SCIS. 932 (2013). The authors explain their methodology:

> A computer-based search of PubMed (National Library of Medicine) was conducted for the terms "blackout" and "alcohol," and each in turn with "violence," "criminal behavior," "automatism," "memory," "cognitive function," and

> [A] person in a blackout . . . is in an unconscious state. He has no idea of what he is doing. He is out of control, [but is able] to walk, talk, drive, get into arguments, pick fights and become violent while unconscious. . . . Can a person be held responsible for his actions while in an unconscious state?[146]

While the relevant peer-reviewed literature confirms that blackouts occur and that alcohol affects memory, a recent study confirms that only short-term memory is impaired in such a state and that other cognitive functions—planning, attention, and social skills—are not impaired:

> A controversy persists, however, based on (i) the fact that alcohol diminishes self-control and (ii) the sense that contemporary neuroscience is challenging our legal notions of responsibility and control over our actions . . . .
> . . . .
> . . . [However,] there is no consensus in the field supporting a claim of automatism or unconsciousness.[147]

The study concludes that blackout automatism expertise would not be admissible under *Daubert* (or under *Frye*, unless a court considered a minority view to be "generally accepted"),[148] but the study also provides an example of how a minority view would be rejected under a consensus approach.

V. CONCLUSION

A juror's understanding of what is called "science" is likely an understanding of the institutional sites of scientific authority and the consensus found in those institutions. Under a consensus regime, with the help of the judge who finds consensus (if it exists) and instructs the jury

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> "amnesia." This produced 95 published articles. A review of these articles was performed to identify those in which empirical data were collected to elucidate the nature of alcohol blackouts.

Id. at 934.

146. DONAL F. SWEENEY & ROBERT A. LISTON, *Forward: Ask a Simple Question*, *in* THE ALCOHOL BLACKOUT (2003).

147. Pressman & Caudill, *supra* note 145, at 933, 939.

148. *See id.* at 939-40.

> [I]n many fields of scientific expertise, controversies persist that require identifying a majority and minority opinion, both of which have some support in the field. Thus for a court [following *Frye*] to rely upon "published scientific studies" to discern general acceptance can be misleading when studies offer conflicting conclusions. Alcohol blackout evidence is just such an example, yet on the basis of our evidence-based review, including the lack of recent studies, we conclude that there is no general consensus supporting alcohol blackout as an automatism or state of unconsciousness (to support a claim of no responsibility for a crime).

Id. at 937 (citations omitted).

to follow it, the jury will understand what that means. Prior to that instruction, in cases involving technical expertise, we recommend that judges conduct a pre-trial hearing on the issue of consensus in the relevant expert community. We believe that judges, due to their extensive experience with courtroom experts, have the capacity to discriminate among informants—who are either members of the expert community or social scientists who have studied and interacted with that community—who may disagree as to the relevant community at play as well as the status of consensus. In cases where no consensus exists for a technical issue, this Article recommends that judges return to their role as gatekeepers pursuant to the *Daubert* regime. Despite the problematic duty under *Daubert* to make technical judgments, the regime has at least worked to eliminate most fringe or minority views from the jury's consideration. As to cases where consensus can be discerned, juries should be directed to defer to that consensus.

Professor Cheng wisely concluded his proposed Consensus Rule with the hope of finding "some confirmatory evidence, perhaps through a future vignette study, that a deference approach is empirically superior" to the conventional notion (implied in *Daubert*) that an expert should educate the jury.[149] We share that hope, and this Article concedes that our assumptions concerning the capacity of judges to discern consensus, as well as the capacity of expert witnesses accurately to describe the consensus in their respective fields, need to be tested. We also hope that the theoretical framework introduced in this Article will provide the contours for future empirical studies of the superiority of a consensus regime over *Daubert*. When the *Daubert* trilogy significantly altered the standards for admissibility of expert witnesses,[150] it was not preceded by experimental evidence that it would work to ensure reliable expertise in the courtroom. However, numerous empirical studies immediately following the trilogy evaluated its effects and probable success as it aged.[151] Because the proposal for a consensus regime represents a radical restructuring of evidentiary rules, the Advisory Committee on the Rules of Evidence would likely require, as a condition for approval, significant assurances that evaluations of expertise in the courtroom would

149. *See* Cheng, *supra* note 1, at 473.

150. Daubert v. Merrell Dow Pharms., 509 U.S. 579 (1993); General Elec. Co. v. Joiner, 522 U.S. 136 (1997); Kumho Tire Co., LTD. v. Carmichael, 526 U.S. 137 (1999).

151. *See, e.g.*, Gatowski et al., *supra* note 104; LLOYD DIXON & BRIAN GILL, RAND INST. FOR CIV. JUST., CHANGES IN THE STANDARDS FOR ADMITTING EXPERT EVIDENCE IN FEDERAL CIVIL CASES SINCE THE DAUBERT DECISION (2001); Jennifer L. Groscup et al., *The Effects of* Daubert *on the Admissibility of Expert Testimony in State and Federal Criminal Cases*, 8 PSYCH. PUB. POL'Y, & L. 339 (2002); Carol Krafka et al., *Judge and Attorney Experiences, Practices, and Concerns Regarding Expert Testimony in Federal Civil Trials*, 8 PYSCH. PUB. POL'Y & L. 309 (2002); Edward K. Cheng & Albert H. Yoon, *Does* Frye *or* Daubert *Matter? A Study of Scientific Admissibility Standards*, 91 VA. L. REV. 471 (2005).

improve.[152] We look forward to pursuing further research confirming the advantages of reliance on scientific consensus in legal contexts.

152. For example, in May 2022, the Advisory Committee on Evidence Rules unanimously approved several clarifying amendments to Rule 702, addressing (1) the problem of courts presuming that expert testimony is admissible, and (2) the problem of courts failing to exercise their gatekeeping function. The Committee on Rules of Practice and Procedure unanimously approved these changes on June 7, 2022. The amendments took effect on December 1, 2023, having been approved by the Judicial Conference of the U.S. and U.S. Supreme Court.