Harvard Journal of Law & Technology
Volume 27, Number 1 Fall 2013

SCIENCE, PATENT LAW, AND EPISTEMIC LEGITIMACY: AN EMPIRICAL STUDY OF TECHNICALLY TRAINED FEDERAL CIRCUIT JUDGES

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I. INTRODUCTION

"Patent litigation is like the neurosurgery of litigation: it is hard scientifically and it is hard legally."[1] The practice of patent law has the unique quality of forcing the uninitiated to confront their own technological shortcomings, or even anxieties, head on — to the un-

* Harvard Law School, J.D. 2013; University of Texas, B.S. Electrical Engineering 2004. Many thanks to Professor William W. Fisher, whose pedagogy inspired the genesis of this Note, and to the staff of the *Harvard Journal of Law & Technology*, whose tireless editorial efforts and keen insight helped make it a reality.

1. Kathleen M. O'Malley, Patti Saris & Ronald H. Whyte, *A Panel Discussion: Claim Construction from the Perspective of the District Judge*, 54 CASE W. RES. L. REV. 671, 682 (2004) (statement of Hon. Patti Saris).

ending consternation of lay judges, juries, and lawyers alike. Nowhere is this more apparent than in the "person having ordinary skill in the art" ("PHOSITA") standard of claim construction, which puts the generalist judge in the unenviable position of deciphering decidedly *un*-general language. Judge Kimberly Moore once asked, "[a]re district court judges equipped to resolve patent cases?"[2] This study attempts to answer that question — empirically — by building on a model of "epistemic deference"[3] originally propounded by Professor Scott Brewer in the wake of the Supreme Court's decision in *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579 (1993). The answer, according to the data collected, appears to be "no," or at least "not always." Using a logistic regression model to analyze claim construction reversal decisions among Federal Circuit judges with scientific backgrounds, this study suggests that some district court judges may be — to use Professor Brewer's phraseology — incapable of rendering claim construction rulings "in an epistemically nonarbitrary manner."[4] Without overstating the results from an admittedly limited data set, the study indicates that, to remain meaningful, the continuing dialogue over patent reform must consider more directly the role that sound scientific reasoning necessarily plays in legitimizing the legal doctrine.

II. SCIENCE, PATENTS, AND THE FEDERAL JUDICIARY

> "I CANNOT STOP WITHOUT CALLING ATTENTION TO THE EXTRAORDINARY CONDITION OF THE LAW WHICH MAKES IT POSSIBLE FOR A MAN WITHOUT ANY KNOWLEDGE OF EVEN THE RUDIMENTS OF CHEMISTRY TO PASS UPON SUCH QUESTIONS AS THESE. THE INORDINATE EXPENSE OF TIME IS THE LEAST OF THE RESULTING EVILS, FOR ONLY A TRAINED CHEMIST IS REALLY CAPABLE OF PASSING UPON SUCH FACTS . . . . "[5]

A. The "Two Cultures" Problem

Law and science are like oil and water — they don't mix. Or so the predominant thinking has maintained for much of legal history.[6] More than fifty years ago, C.P. Snow, a noted author and physicist,

2. Kimberly A. Moore, *Are District Court Judges Equipped To Resolve Patent Cases?*, 15 HARV. J.L. & TECH. 1, 1 (2001).

3. Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE L.J. 1535, 1634 (1998).

4. *Id.* at 1680.

5. Parke-Davis & Co. v. H.K. Mulford Co., 189 F. 95, 115 (S.D.N.Y. 1911) (Hand, J.).

6. *Cf.* Thomas Jefferson to Isaac McPherson, August 13, 1813, *in* THE THOMAS JEFFERSON PAPERS SERIES 1. GENERAL CORRESPONDENCE. 1651–1827 1057, 1064, *available at* http://hdl.loc.gov/loc.mss/mtj.mtjbib020976 ("This business . . . is but little analogous to [the courts'] course of reading, since we might in vain turn over all the lubberly volumes of the law to find a single ray which would lighten the path of the mechanic or the mathematician. It is more within the information of a board of academical [sic] professors . . . .").

warned of a "gulf of mutual incomprehension" between the liberal arts and sciences.[7] Snow described a deep epistemological schism between literary and scientific cultures.[8] While commenting on the compartmentalization of postwar British education, Snow's "two cultures" thesis is highly salient to the patent system, where law (traditionally a more literary pursuit) and science necessarily intersect.[9]

As the law struggles to keep pace with technological advance, Snow's schism has only become more pronounced. Fewer than ten percent of law students have undergraduate degrees in science, technology, engineering, or math ("STEM"),[10] and the proportion is likely similar among district court judges.[11] Meanwhile, the number of patent litigation cases is increasing.[12] Unfortunately, as Justice Breyer once observed, "[p]atent law cases can turn almost entirely on an understanding of the underlying technical or scientific subject matter."[13] While federal judges possess a high level of specialized legal expertise, often accumulated over many decades, they are more often than not laypersons with respect to scientific sophistication.[14] It is therefore unsurprising that they may struggle to understand the technology in patent cases.[15] The problem is only compounded by the use of lay juries to resolve these technologically complex disputes at trial.[16]

B. The "Two-Hat" Solution

Professor Scott Brewer's post-*Daubert* philosophical work may suggest a solution to the two cultures problem.[17] Essentially, he would require that the legal decision-maker wear two hats: the hat of practi-

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7. C.P. SNOW, THE TWO CULTURES 4 (Canto ed. 1993).

8. *Id.* at 3–5.

9. *See* Peter Lee, *Patent Law and the Two Cultures*, 120 YALE L.J. 2, 4–5 (2010) (using Snow's thesis to frame a discussion of the Federal Circuit's historically formalistic approach to nonobviousness vis-à-vis the Supreme Court's more holistic approach).

10. DAVID L. FAIGMAN, LEGAL ALCHEMY: THE USE AND MISUSE OF SCIENCE IN THE LAW 53–54 (1999).

11. Lee, *supra* note 9, at 10.

12. CHRIS BARRY ET. AL., PRICE WATERHOUSE COOPER, 2012 PATENT LITIGATION STUDY: LITIGATION CONTINUES TO RISE AMID GROWING AWARENESS OF PATENT VALUE 6 (2012).

13. Stephen Breyer, *Introduction* to FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 3–4 (3d ed. 2011), *available at* http://www.fjc.gov/public/pdf.nsf/lookup/SciMan3D01.pdf/$file/SciMan3D01.pdf.

14. *Id.* at 17.

15. *Id.*

16. *Id.*; *see also Judicial Panel Discussion on Science and the Law*, 25 CONN. L. REV. 1127, 1145 (1993) ("Honest to God, I don't see how you could try a patent matter to a jury. Goodness, I've gotten involved in a few of these things. It's like somebody hit you between your eyes with a four-by-four. It's factually so complicated.") (statement of Hon. Alfred V. Covello).

17. Brewer, *supra* note 3. A full exploration of Professor Brewer's model is beyond the scope of the present paper. Rather, Brewer's work serves as a lens through which the role of scientific expertise in patent legal doctrine may be viewed.

cal legitimacy (by possessing legal authority as a federal judge) and the hat of epistemic legitimacy (by possessing the basic formal tools of sound scientific reasoning).[18] Brewer argued that where law and science meet, the emerging norm of "intellectual due process" (embodying rule-of-law values such as predictability and notice) places epistemic constraints on a nonexpert's reasoning processes.[19] By way of example, Brewer explained that when expert witnesses offer contradictory scientific evidence, the nonexpert judge, incapable of fully understanding such scientists, must rely on a combination of credentials, reputation, demeanor, and other "general canons of rational evidentiary support" in evaluating the competing testimony.[20] This sort of analysis, he argued, lacks epistemic legitimacy, justified from neither a scientific nor a legal point-of-view.[21] Moreover, the judge cannot overcome such deficiencies by soliciting information from a court-appointed expert, special master, or specially trained law clerk, because the judge is not capable of making an epistemically competent decision about which third-party expert to consult in the first place.[22] Indeed, a nonexpert judge deciding which competing scientific expert is "right" paradoxically requires the nonexpert to possess a greater ability to discern the "scientific truth" than the expert.[23]

Brewer's primary focus was on the *Daubert* decision, but his "two-hat" model applies with equal force in any "areas to which scientific results are rationally pertinent."[24] Patent law is certainly one such area. For example, in a *Markman* hearing,[25] when competing technological subject-matter experts (i.e., PHOSITAs) are seemingly matched in credentials, reputation, and demeanor, and when no generally accessible rational criteria break the "tie," the nonexpert district court judge is ultimately not capable of choosing among the competing experts in an epistemically non-arbitrary way.[26] The resulting claim construction order therefore lacks epistemic legitimacy. Moreover, the nonexpert Federal Circuit judge, though possessing more expertise in patent legal doctrine, is in no better position epistemically in reviewing that order. Herein lies the central tension addressed in this note.

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18. *Id.* at 1677.
19. *Id.* at 1675–77.
20. *Id.* at 1538, 1616.
21. *Id.* at 1677.
22. *Id.* at 1679–80.
23. *Id.* at 1595.
24. *Id.* at 1677.
25. During a *Markman* hearing the parties will present expert witnesses and offer conflicting evidence regarding who qualifies as a PHOSITA and the meaning of patent terms to that person. *See, e.g.*, Phillips v. AWH Corp., 415 F.3d 1303, 1332 (Fed. Cir. 2005) (en banc).
26. *Cf.* Brewer, *supra* note 3, at 1680.

If the only way to bridge Snow's two cultures schism is Brewer's two-hat solution, then technically trained judges must be a necessary component of the patent system — at least in theory. One of the goals of the present empirical study is to test whether such judges have a measurable impact.

III. TESTING THE ROLE OF SCIENCE IN PATENT CLAIM CONSTRUCTION

The legal doctrine surrounding the interpretation of patent claims offers a unique opportunity to examine the interaction of law and science. In *Markman v. Westview Instruments, Inc.*, the Supreme Court held that there was no Seventh Amendment right to a jury trial on the issue of patent claim construction.[27] Instead, judges are required to perform this cognitively onerous task.[28] In construing a patent claim, the district court judge must consider the claim language, the patent specification, and its prosecution history.[29] Unlike the construction of a statute or contract, however, patent claim terms are not interpreted under a "reasonable person" standard but rather from the standpoint of a PHOSITA.[30] Because the PHOSITA standard requires scientific knowledge, many judges are at a serious disadvantage from the start.[31] One consequence is that the Federal Circuit has decided to review claim construction rulings *de novo*.[32] Examining the outcomes of appealed claim construction issues illuminates how accurately judges are able to understand the science inherent in patent law because district court judges are required to articulate, in detail, their findings of fact and conclusions of law.[33]

A. Review of Previous Empirical Scholarship

Perhaps recognizing these unique aspects of patent law, many scholars have previously conducted empirical studies on the Federal

27. 517 U.S. 370, 388–91 (1996).

28. *See* Lee, *supra* note 9, at 30.

29. Moore, *supra* note 2, at 5.

30. *Id.* at 6.

31. Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1196 (2002) ("[J]udges are at a rather serious disadvantage in trying to put themselves in the shoes of an ordinarily skilled scientist."); Lee, *supra* note 9, at 12.

32. Arti K. Rai, *Specialized Trial Courts: Concentrating Expertise on Fact*, 17 BERKELEY TECH L.J. 877, 879 (2002); *see also, e.g.*, Cybor Corp. v. FAS Techs., Inc., 138 F.3d 1448, 1454–56 (Fed. Cir. 1998) (en banc). As of the time of this writing, however, the Federal Circuit is reconsidering *en banc* the *de novo* standard of review in claim construction cases. *See* Lighting Ballast Control LLC v. Philips Elecs. N. Am. Corp., 500 F. App'x 951 (Fed. Cir. 2013) (order granting rehearing *en banc*).

33. Moore, *supra* note 2, at 8.

Circuit's handling of claim construction issues.[34] Most, however, have addressed only the role of legal experience in reversal rates; few have investigated scientific expertise, and only one has done so ly[35] — though in a limited fashion. A brief review of the literature is helpful in understanding the current state of the research.

Judge Kimberly A. Moore's[36] study found that the Federal Circuit reversed thirty-three percent of claim construction cases on grounds of improper construction by district court judges.[37] The study tested whether district court judges could construe patent claims in the manner consistent with Federal Circuit direction.[38] Judge Moore initially concluded from her results that district court judges are "not, at present, capable of resolving these issues with sufficient accuracy."[39] She speculated that the Federal Circuit was at fault for the high reversal rate, not providing canons of construction sufficiently clear to guide the district court judges.[40] Judge Moore also considered whether Federal Circuit judges with prior technical or patent-related experience are more likely to substitute their own claim construction for that of the district court and whether judges without such experience are more likely to affirm the district court's construction.[41] Using a simple linear regression, she found no statistically significant difference in how judges with or without a technical background reviewed district court claim constructions.[42] Judge Moore approved of the lack of correlation among these variables, arguing that judges should base their decisions on the facts of each individual case rather than according to some unrelated predisposition.[43]

In a later study, Professor David Schwartz found that thirty-two percent of all claim terms were wrongly construed by the lower

34. David L. Schwartz, *Practice Makes Perfect? An Empirical Study of Claim Construction Reversal Rates in Patent Cases*, 107 MICH. L. REV. 223, 225 n.3 (2008) (collecting studies).

35. *See* W. Michael Schuster, *Claim Construction and Technical Training: An Empirical Study of the Reversal Rates of Technically Trained Judges in Patent Claim Construction Cases*, 29 QLR 887, 888–89 (2011).

36. Judge Moore was a professor at George Mason University at the time of the study; she was appointed to the Federal Circuit in 2006.

37. Moore, *supra* note 2, at 2. Moore analyzed these issues by collecting a database of all claim construction appeals to the Federal Circuit from April 23, 1996 (date of the Supreme Court's *Markman* decision) through 2000, including precedential holdings, non-precedential holdings, and Rule 36 summary affirmances. *Id.* at 8–9. In an updated 2003 study, Judge Moore found that district courts wrongly construed 34.5 percent of claim terms. Kimberly A. Moore, Markman *Eight Years Later: Is Claim Construction More Predictable?*, 9 LEWIS & CLARK L. REV. 231, 233 (2005).

38. Moore, *supra* note 2, at 4 n.13.

39. *Id.* at 38.

40. Moore, *Eight Years Later*, *supra* note 37, at 247.

41. Moore, *supra* note 2, at 21–22.

42. *Id.* at 26.

43. *Id.* at 27.

courts.[44] Further, he found no evidence that increased experience with patent litigation significantly improved outcomes.[45] Indeed, several of the patent-heavy districts in his study had reversal rates above thirty percent.[46] Schwartz provided three possible explanations for the lack of correlation between experience and performance: (1) that the claim construction exercise is itself inherently indeterminate; (2) that some district court judges are incapable of or at least not interested in learning how to properly construe patent claims; and/or (3) that Federal Circuit decisions do not provide adequate guidance in construing claim terms to district court judges.[47]

Professors Jay P. Kesan and Gwendolyn G. Ball conducted a more recent empirical study addressing many of the same issues.[48] However, Kesan and Ball used a series of multivariate logistic regressions to better account for the confounding effects of other variables, such as regional differences.[49] Their data showed that general experience on the federal bench does not have any impact on the probability of being overruled on appeal.[50] However, contrary to Schwartz's findings, Kesan and Ball's data suggested that judges with greater patent experience were less likely to have their claim construction rulings overturned.[51] According to their model, a hypothetical judge with a high cumulative level of patent experience (sixty patent cases, 90th percentile) had an overall reversal rate almost thirty percent lower than that of a judge with low cumulative experience (eleven patent cases, 10th percentile).[52] Kesan and Ball's study found no support for Schwartz's earlier hypothesis that the process of claim construction is so inherently indeterminate that judges gain nothing from the experience that can be applied to future cases.[53]

Finally, W. Michael Schuster[54] attempted to identify district court judges with technical backgrounds (as opposed to just experience with patent cases) and analyze their claim construction error rates relative

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44. Schwartz, *supra* note 34, at 248–49. This figure excludes thirty-two magistrate judges; the error rate is 32.5 percent when they are included.

45. *Id.* at 256.

46. *Id.* at 246.

47. *Id.* at 223.

48. *See generally* Jay P. Kesan & Gwendolyn G. Ball, *Judicial Experience and the Efficiency and Accuracy of Patent Adjudication: An Empirical Analysis of the Case for a Specialized Patent Trial Court*, 24 HARV. J.L. & TECH. 393 (2011). Their study included all patent cases filed between 1995 and 2003. *Id.* at 420.

49. *Id.* at 419, 435.

50. *Id.* at 437.

51. *Id.* at 420, 437, 442.

52. *Id.* at 438. (The authors cautioned against using these results to predict actual reversal probabilities because the pseudo-R^2 value was modest for all their models.).

53. *Id.* at 442.

54. Now a practitioner, Schuster was a law clerk for Judge Kenneth Hoyt at the time of the study.

to those of their non-technical peers.[55] He found a 47.4 percent error rate among technically trained judges — higher than that of nonexpert judges.[56] However, Schuster acknowledged that his results may be misleading.[57] For one, his methodology may have exhibited significant selection bias.[58] In addition, his study sample size, forty-six total reviewed claim constructions issued by eight judges in nineteen cases, was significantly smaller than those of the other studies summarized above.[59] With so few judges and so few cases, the potential for one judge's idiosyncrasies to skew the data was likely quite high.[60] Indeed, the overall percentage of district court judges with technical backgrounds in his study, 4.5 percent (28 of 617), illustrates the difficulty in measuring directly the impact such training has on the claim construction exercise.[61]

What can be made of these studies? For one, cumulative experience with patent cases seems to have only a marginal effect on claim construction error rates. That is, legal expertise is a necessary but not a sufficient condition for accurate claim construction in the district courts. Only Schuster attempted to ascertain whether scientific expertise could alleviate the problem, but his data was not sufficient to justify a conclusion one way or the other. The present study takes a different approach, examining the question from the perspective of the Federal Circuit.

B. Testing the Two-Hat Solution Using Federal Circuit Claim Construction Jurisprudence

The two-hat solution predicts that only judges possessing both legal and subject-matter expertise are capable of reaching epistemically legitimate decisions in patent claim construction issues. Beginning with the premise that the vast majority of judges do not have the requisite technical or scientific training to meet the demands of intellectual due process,[62] one should expect that their legal decisions would be deemed inaccurate and overturned on appeal — but only if the reviewing court itself is epistemically competent to do so. Herein lies the difficulty with testing Brewer's thesis. Where science is concerned, the appellate decisions of nonexperts are no more legitimate,

55. Schuster, *supra* note 35, at 888–89.
56. *Id.* at 906–07.
57. *Id.* at 910–14.
58. Schuster conducted an email survey, supplemented with information on Westlaw, to collect the undergraduate majors of all district court judges. *Id.* at 904. Those efforts yielded a 65.7 percent capture rate, or 617 of 939 judges, of which only twenty-eight (4.5 percent) had a technical background. *Id.* at 904–905.
59. *Id.* at 905.
60. *Id.* at 912.
61. *Id.* at 905.
62. *See id.*

epistemically, than the trial-level decisions of nonexperts. Yet the Federal Circuit, which has nationwide appellate jurisdiction over patent-related disputes, may be a rare exception to this general rule. Some of the Federal Court judges have sufficient scientific or technological training to qualify as PHOSITAs themselves.[63] They also have more experience with substantive patent legal doctrine than most district court judges. If Brewer's thesis is correct,[64] then these "techno-jurists" should disagree with district court claim constructions more frequently than do their nonexpert colleagues on the Federal Circuit, because only they have the epistemic competency to recognize all problematic constructions. Furthermore, if only the decisions of these experts are considered legitimate, then the "true" claim construction error rate is likely higher than the thirty percent measured in previous studies.

If, on the other hand, the high claim construction error rate stems from some indeterminate nature of the claim construction exercise itself and/or the failure of the Federal Circuit to provide sufficient guidance to district courts, there should be little or no difference between how expert and nonexpert Federal Circuit judges decide such cases.[65] Other factors might also be causing the high reversal rate. For example, because litigated patent claims typically lack clear meaning in the abstract and are rarely expressly defined in the specification, there may be multiple plausible definitions.[66] Indeed, as Judge Moore observed, different panels of the Federal Circuit have sometimes construed the same patent terms differently.[67] The high reversal rate may also reflect deficiencies in the law of claim construction, as interpreted by the Federal Circuit, or poor drafting by patent attorneys.[68] Alternatively, the *de novo* standard of review in the Federal Circuit may not afford enough deference to the fact-finding district court.[69]

By developing a multivariate statistical model for claim construction decisions, the present study attempts to answer some of these

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63. Judges Gajarsa, Linn, and Moore each have an undergraduate degree in electrical engineering; Judges Lourie and Newman each have a Ph.D. in chemistry. *Judges*, UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT, https://web.archive.org/web/20120402084412 / http://www.cafc.uscourts.gov/judges (last visited Dec. 20, 2013); *Judge Pauline Newman '58 honored by NYU Law Women as Alumna of the Year*, NYU LAW, http://www.law.nyu.edu/news/pauline_newman_alumna_of_the_year (last visited Dec. 20, 2013).

64. As opposed to some other explanation, such as a biased predisposition on the judge's part. *Cf.* Moore, *supra* note 2, at 27.

65. *Cf.* Schwartz, *supra* note 34, at 267; Lee, *supra* note 9, at 13–14.

66. Schwartz, *supra* note 34, at 259–60.

67. Moore, *supra* note 2, at 18–21 (discussing CVI/Beta Ventures, Inc. v. Custom Optical Frames, Inc., 92 F.3d 1203 (Fed. Cir. 1996) ("*CVI I*") and CVI/Beta Ventures, Inc. v. Tura LP, 112 F.3d 1146 (Fed. Cir. 1997) ("*CVI II*")).

68. *See* Lee, *supra* note 9, at 13.

69. *See* Schwartz, *supra* note 34, at 259. Note also that the *de novo* standard of review may change in the near future. *See supra* note 32.

questions. This is not an attempt to explain the high reversal rate of claim constructions in its entirety, however. There are many other factors that could explain the present situation, several of which defy empirical evaluation. For instance, it is almost impossible to measure directly whether a judge with more experience is more likely to make a correct decision.[70] Indeed, there is often no practical means by which to definitively quantify what the "correct" outcome should be in the first place.[71] However, Brewer's work provides a strong theoretical framework that helps elucidate what ultimately may be indirect evidence of a systemic problem with the interaction of science and law in the patent regime.

IV. STUDY DESIGN AND METHODOLOGY

A. The Data Collected

The data collection methodology for this study builds on the approach developed by Judge Moore in her oft-cited work.[72] A database was constructed of all Federal Circuit decisions over a five-year period between April 30, 2007 and April 30, 2012 — including published opinions, unpublished opinions, and Rule 36 summary affirmances[73] — reviewing district court cases in which one or more claim construction issues were appealed.[74] An initial search conducted on WestlawNext in the Federal Circuit database retrieved 521 cases.[75] Each case was examined to determine whether a district court judge's

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70. *See* Kesan & Ball, *supra* note 48, at 430.

71. *See id*.

72. *See* Moore, *supra* note 2, at 8–10.

73. Federal Circuit Rule 36 permits the court to summarily affirm a decision of a lower court without a written opinion. Such affirmances are limited to situations in which "an opinion would have no precedential value" and any of the following is present:

> (a) the judgment, decision, or order of the trial court appealed from is based on findings that are not clearly erroneous; (b) the evidence supporting the jury's verdict is sufficient; (c) the record supports summary judgment, directed verdict, or judgment on the pleadings; (d) the decision of an administrative agency warrants affirmance under the standard of review in the statute authorizing the petition for review; or (e) a judgment or decision has been entered without an error of law.

FED. CIR. R. 36.

74. This seemingly arbitrary date range corresponds to the five years following the Supreme Court's decision in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 407, 415 (2007) (holding that the sole application of the teaching-suggestion-motivation test for obviousness was overly rigid and not in-keeping with the language of 35 U.S.C. § 103 or Court precedent). These dates were selected in anticipation of a possible future expansion of this study that includes the reversal rates of nonobviousness determinations by district courts after the last major change in the governing substantive law.

75. The specific search string was: <patent & claim /s interp! constru! & DA(aft 4/30/2007 & bef 4/30/2012) % SY(board /2 patent /2 appeal!) % SY(international /2 trade /2 commission itc)>.

claim construction was appealed to the Federal Circuit.[76] Similarly, summary affirmances were collected by searching WestlawNext for Federal Circuit opinions citing Rule 36 of the Federal Circuit Rules of Procedure and then limiting the results to only those cases appealed from federal district courts.[77] For each of the resulting 242 cases,[78] appellate briefs were retrieved and examined to eliminate those cases that did not appeal a claim construction issue; 121 cases remained after the eliminations. From the combined 642 cases, 100 were selected at random for purposes of the present study.[79] In these 100 cases, 159 separate claim constructions were appealed.[80] For each of the 159 appealed claim constructions, the primary data point was each Federal Circuit judge's vote to affirm or reject the district court's construction. A total of 473 such votes were analyzed — this is the sample size for the present study (N = 473).[81]

For each case, several variables potentially correlated to judicial decision-making were coded. The response variable, *Modify Construction*, records whether a judge on the Federal Circuit voted to modify a district court judge's construction of the term or phrase at issue (coded one if yes, zero otherwise). Table 1 lists the response and explanatory variables included in the study and their associated descriptive statistics.[82]

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76. Only those opinions in which the Federal Circuit explicitly reviewed the district court's claim construction were collected for the study. *Cf.* Christian A. Chu, *Empirical Analysis of the Federal Circuit's Claim Construction Trends*, BERKELEY TECH. L.J. 1075, 1094 (2001) (using similar methodology). Claim construction orders by magistrate judges were also excluded.

77. The Federal Circuit also hears appeals from many other specialized tribunals, including the Patent Trial and Appeals Board and the International Trade Commission, none of which were considered for the present study.

78. WestlawNext sometimes retrieved 244 cases, but the additional two were not relevant and/or miscategorized. This highlights a limitation inherent in any sort of empirical legal study based on published opinions available through a commercially available database. *Cf.* Schwartz, *supra* note 34, at 269 n.221.

79. The random number-generating function in R (open source statistical modeling software) was used for this purpose. *See R: Random Number Generation*, ETH, http://stat.ethz.ch/R-manual/R-patched/library/base/html/Random.html (last visited Dec. 20, 2013).

80. In most cases, more than one claim term or phrase construed by the district court judge was appealed to the Federal Circuit.

81. All votes by judges sitting by designation on the Federal Circuit panel were excluded.

82. It is immediately apparent that the mean "reversal" rate of claim construction issues in this study is slightly lower than that of previous studies (twenty-nine versus thirty-two percent). *See, e.g.*, *supra* note 44 and accompanying text. One possibility is that all the data in the present study is collected from cases decided well after *Phillips v. AWH Corp.*, 415 F.3d 1303 (2005) (en banc), in which the Federal Circuit attempted to clarify the doctrine on claim construction. *Cf.* Schwartz, *supra* note 34, at 259 n.162. There may also be appreciable variation in the reversal rate from year to year. *See id.* at 250 (demonstrating an error rate as high as 41.6 percent in 2004 and as low as 19.4 percent in 2006).

Table 1: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min.	Max.
Modify Construction	0.2939	N/A	0.4560	0.000	1.000
FCJ Experience	14.72	15.72	6.864	0.3083	28.40
FCJ Expertise	0.1818	N/A	0.3861	0.000	1.000
DCJ Experience	13.16	12.77	7.319	0.5917	28.51
DCJ Patent Cases	97.47	62.00	96.85	5.000	512.0
Ideology Gap	0.6733	0.2790	0.6068	0.000	1.642

The main explanatory variable of interest is *FCJ Expertise*; it is designed to capture whether a Federal Circuit judge possessed technical or scientific expertise in the same field as the patent he or she was construing.[83] This additional dimension of analysis was not attempted in previous studies, which considered only whether a judge had a technical degree. While arguably relevant, expertise in one technical field does not connote expertise in all technical fields.[84] Indeed, expertise in one area of science may distort a judge's view of other areas of science.[85] Of the nineteen Federal Circuit judges in this study, five have technical backgrounds.[86] In an attempt to determine, objectively, whether a judge's scientific background matched the technical subject matter of the patent in dispute, the study utilized the USPTO's patent classification system.[87] If a judge's technical back-

83. Following the method developed by Miller and Curry, a panel effect variable was also initially calculated. *See generally* Banks Miller & Brett Curry, *Experts Judging Experts: The Role of Expertise in Reviewing Agency Decision Making*, 38 LAW & SOC. INQUIRY 55 (2013). Panel effects measure the impact that the composition of a three-judge panel has on the voting behavior of an individual judge. *See id.* at 64. There is some scholarly debate as to whether Federal Circuit decisions are susceptible to panel effects. *See* Schwartz, *supra* note 34, at 244 n.129. Ultimately, the panel expertise variable was excluded from the model in the present study, because it was collinear with *FCJ Expertise* ($p = 0.53$).

84. *See* Rai, *supra* note 32, at 879.

85. *See id.* at 894 n.71. This lends further support to a technology-specific expertise variable as opposed to a general scientific expertise variable.

86. *See supra* note 63.

87. The NBER classification system attempts a similar categorization but focuses on industrial classification and does not necessarily align well with academic backgrounds or technical expertise. For example, the NBER category "Drugs and Medical" includes technologies ranging from organic chemistry to mechanical prosthetics. *See* Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools* 41 (Nat'l Bureau of Econ. Research, Working Paper 8498, 2001), *available at* http://www.nber.org/papers/w8498. At the beginning of each patent, field 52 lists the relevant classification codes for the technology being patented; the bold classification code is the most relevant. *See* MPEP § 903, *available at* http://www.uspto.gov/web/offices/pac/mpep/s903.html (last modified Sept. 13, 2012). These classification codes, in turn, correspond to Patent Technology Centers within the USPTO, each specializing in a different area of technology. The Patent Technology Centers are: Biotechnology and Organic Chemistry (1600); Chemical and Materials Engineering (1700); Computer Architecture, Software, and Information Security (2100); Computer Net-

ground matched the specialty of the Patent Technology Center corresponding to the classification code for a given patent, *FCJ Expertise* was coded as one; otherwise, it was coded as zero.[88] Per Brewer's thesis, the coefficient for *FCJ Experience* in the model is expected to be positive.

The variables *FCJ Experience* and *DCJ Experience* record the number of years a judge had spent on the bench at the time of the appellate and district court decisions, respectively.[89] For Federal Circuit judges, the *FCJ Experience* variable primarily captures legal expertise in patent doctrine, recognizing that patent cases comprise the largest portion of the Federal Circuit's docket.[90] For district court judges, the *DCJ Experience* variable captures general legal expertise, relevant to all types of adjudication.[91]

The *DCJ Patent Cases* variable records the cumulative number of patent cases the district court judge had on his or her docket at the time he or she issued the claim construction decision on appeal. Bloomberg Law's docket search tool was used to collect this data by limiting results for each district court judge to dockets classified with a "nature of suit" code corresponding to patent litigation (830).[92] In contrast to the more general *DCJ Experience* variable, the *DCJ Patent Cases* variable specifically captures experience with patent law. The

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works, Multiplex Communication, Video Distribution, and Security (2400); Communications (2600); Semiconductors, Electrical and Optical Systems and Components (2800); Designs (2900); Transportation, Construction, Electronic Commerce, Agriculture, National Security and License & Review (3600); and Mechanical Engineering, Manufacturing, Products (3700). *See Patent Technology Centers*, UNITED STATES PATENT AND TRADEMARK OFFICE, http://www.uspto.gov/about/contacts/phone_directory/pat_tech (last modified Feb. 17, 2010). Patent Technology Center 3600 encompasses several different fields of technical expertise; for the purposes of this study, only the Electronic Commerce subdivisions 3620, 3680, and 3690, were considered. *See Patent Technology Center 3600 Contact Information*, UNITED STATES PATENT AND TRADEMARK OFFICE, http://www.uspto.gov/about/contacts/phone_directory/pat_tech/3600.jsp (last modified Apr. 2, 2013).

88. Judges Gajarsa, Linn, and Moore were associated with Patent Technology Centers 2100, 2400, 2600, 2800, 3620, and Art Units 3680, 3690, and 3742. Judges Newman and Lourie were associated with Patent Technology Centers 1600 and 1700.

89. For each judge, biographical data from the Federal Judicial Center was used to determine commission dates. *See Biographical Directory of Federal Judges, 1789–Present,* FEDERAL JUDICIAL CENTER, *available at* http://www.fjc.gov/history/home.nsf/page/judges.html (last visited Dec. 20, 2013).

90. In 2012, intellectual property cases comprised 47 percent of the Federal Circuit's caseload. *Appeals Filed, by Category: FY 2012*, UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT, http://www.cafc.uscourts.gov/images/stories/the-court/statistics/Caseload_by_Category_Appeals_Filed_2012.pdf (last visited Dec. 20, 2013).

91. Experience accrued before the formation of the Federal Circuit was not counted. Thus, the theoretical maximum value for both *DCJ Experience* and *FCJ Experience* is 29.58 years, the amount of time between October 1, 1982, the formation of the Federal Circuit, and April 30, 2012, the end of the study period.

92. *Nature of Suit Codes*, PUB. ACCESS TO COURT ELEC. RECORDS, http://www.pacer.gov/documents/natsuit.pdf (last visited Dec. 20, 2013). Records built from PACER data may contain "some inaccuracies as to what is counted as a patent case." *See* Schwartz, *supra* note 34, at 244. However, the aggregate number of patent cases obtained from this source is sufficiently accurate for the purposes of this study.

data demonstrated only a slight positive correlation between years of experience and number of patent cases handled (r = 0.24).[93] This is likely due to the fact that some districts, such as the Northern District of California and the District of Delaware, have larger patent dockets than others do.[94]

The *Ideology Gap* variable attempts to control for differences between the ideological positions of the district court judge and the reviewing Federal Circuit judge. The ideological position of each judge's appointing President, as measured by the first dimension of their DW-Nominate score, was used as a proxy for the likely policy preferences of each judge in the dataset.[95] Higher values indicate more conservative policy preferences, and lower values indicate more liberal policy preferences. The *Ideology Gap* variable measures the absolute value of the difference in DW-Nominate scores between the district court judge and the reviewing Federal Circuit judge; if their respective ideological scores are the same, the value is zero.

B. Data Limitations

There are several limitations inherent in the data available for empirical legal studies of the sort attempted here. The claim constructions that get appealed to the Federal Circuit may not accurately reflect the status of claim construction as a whole at the district court level. For example, parties may only appeal those close cases in which they are more likely to disagree on the results.[96] Cases with clearly right or wrong claim construction would likely settle to avoid appellate transaction costs.[97] On the other hand, those costs are typically lower than the cost of a trial, which may encourage more "Hail Mary" appeals.[98] And some judges may pressure parties to settle after issuing

93. Two variables are correlated when the value of either can be used to predict the value of the other for a given subject. The Pearson Correlation Coefficient (a value between -1.0 and +1.0) describes the strength and direction of this linear relationship. *See* DAVID COPE, FUNDAMENTALS OF STATISTICAL ANALYSIS 98 (1st ed. 2005).

94. *See* Kesan & Ball, *supra* note 48, at 421.

95. DW-Nominate scores are available for all Presidents through President Barack Obama. The scores for Presidents are estimated based on presidential positions taken on bills presented by Congress. The first scaled dimension represents "government intervention in the economy or liberal-conservative in the modern era." *See* Royce Carroll et al., *DW-NOMINATE Scores With Bootstrapped Standard Errors,* VOTEVIEW, http://www.voteview.com/dwnomin.htm (last updated Feb. 17, 2013); *see also* Banks Miller & Brett Curry, *Expertise, Experience, and Ideology on Specialized Courts: The Case of the Court of Appeals for the Federal Circuit*, 43 LAW & SOC'Y REV. 839, 852–53 (2009) (using DW-Nominate scores as a proxy for Federal Circuit judge ideology).

96. *See* Moore, *supra* note 2, at 10.

97. *See id.* at 10.

98. *See id.* at 10. According to one report, the average costs of patent litigation through the close of discovery, excluding the cost of trial, is $5,000,000 for high damage cases and $600,000 for lower damage cases. *See* Schwartz, *supra* note 34, at 243.

a claim construction order.[99] If the parties decide whether to appeal a decision based in part on the identity of the district court judge — by considering, for example, the expertise and reputation of the judge — there may be a selection bias in the body of appellate decisions.[100] On the other hand, the potential for a high damage award may overcome that bias.[101] Other limitations include difficulty in controlling for lawyering skills, issues that parties choose to raise on appeal, and financial resources available to each litigant.[102] Finally, there is a small degree of personal judgment (and potential for human error) involved in collecting data from court opinions, though every effort has been made to avoid systematic bias in case evaluation.[103]

V. RESULTS AND ANALYSIS

A. Overview

Table Table 2 presents the results of a logistic regression model comprising the variables described above. A logistic regression model describes the relationship between a categorical (in this case, binary) response variable and a group of explanatory variables (continuous or categorical). It models the logit-transformed (i.e., the natural logarithm) probability as a linear relationship with the explanatory variables. The likelihood ratio test for the present model indicates that it, as a whole, fits significantly better than an empty model (i.e., no variables). The chi-square statistic (χ^2) has a value of 12.72 with 5 degrees of freedom and an associated p-value of 0.0262 (ninety-five percent confidence level).

99. *See id.* at 242.
100. *See id.* at 243.
101. *See id.* at 243–44.
102. *See* Chu, *supra* note 76, at 1095–96; *see also* John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 204 (1998).
103. *See* Chu, *supra* note 76, at 1095.

Table 2: Logit Model

Variable	Coefficient	Std. Err.	p-value	95% Conf. Int.		Odds Ratio
FCJ Experience	0.0274	0.0160	0.0874	-0.0038	0.0591	1.028
FCJ Expertise	0.6409*	0.2723	0.0186	0.1033	1.1738	1.898
DCJ Experience	0.0268	0.0146	0.0667	-0.0019	0.0555	1.027
DCJ Patent Cases	-0.0026*	0.0012	0.0334	-0.0050	-0.0003	0.9974
Ideology Gap	-0.2465	0.1723	0.1525	-0.5869	0.0895	0.7815
Intercept	-1.361	0.3498	0.0001	-2.059	-0.6848	0.2564

* Coefficients are significant at a 95% confidence level.

The *FCJ Experience* and *Ideology Gap* variable coefficients are not statistically significant in the model. That is, the number of years a Federal Circuit judge has been on the bench has no impact on the probability of a district court's claim construction being overruled. Similarly, the difference in political ideology of a reviewing Federal Circuit judge and a district court judge has no impact on the outcome. Nor should one expect either of these variables to be significant. Seniority and political ideology clearly should not, from a policy standpoint, determine how the Federal Circuit rules on a claim construction issue. The more probative *DCJ Patent Cases*, *DCJ Experience*, and *FCJ Expertise* explanatory variables are discussed below.

B. The Impact of District Court Judge Experience

The *DCJ Patent Cases* and *DCJ Experience* explanatory variables take into account a topic of interest explored in several previous studies: district court judge experience with patent cases. The present results are roughly in-line with those studies.[104] The *DCJ Patent Cases* variable has a negative coefficient, indicating that the more experience a district court judge has with patent litigation, the less likely he or she is to have a claim construction modified or overturned by the Federal Circuit. More specifically, for every additional patent case a district court judge has had on his or her docket at the time of issuing a claim construction order, the odds of being overruled on a claim

104. *See* Kesan & Ball, *supra* note 48 at 440–42 (finding that more patent experience in general, and more claim construction experience in particular, reduces the probability of being overruled on appeal).

construction issue (versus being affirmed) decrease by 0.26 percent. In terms of probability, a hypothetical district court judge that has had 126 (seventy-fifth percentile) patent infringement suits on his or her docket has a 15.92 percent lower chance of being overruled than a judge with only thirty-one (twenty-fifth percentile) patent cases.[105] Like the Kesan and Ball study, the data refutes the Schwartz hypothesis that the claim construction exercise is so idiosyncratic that district court judges gain no knowledge that can be applied in the future.

By contrast, the *DCJ Experience* variable is not statistically significant. This indicates that the amount of time a district court judge has spent on the bench does not affect the probability, to a statistically significant degree, that he or she will err in construing a patent claim. Again, this result is consistent with the Kesan and Ball study, which found that general courtroom experience did not impact the probability of a judge's claim construction ruling being reversed on appeal.[106] Together, these *DCJ Patent Cases* and *DCJ Experience* results suggest that there is some tangible skill or quality peculiar to the claim construction exercise that lies beyond the average experience of a generalist judge.

C. The Impact of Two-Hat-Wearing Federal Circuit Judges

The main variable of interest in the present study, *FCJ Expertise*, has a coefficient of 0.6409 and is significant at the 95 percent confidence level. As expected, this coefficient is positive. When a reviewing Federal Circuit judge has expertise in the technological field encompassing the patent at issue, he or she is more likely to find error in the district court's claim construction. More specifically, the odds of an epistemically competent techno-jurist overruling a district court's claim construction are higher by a factor of 1.898 than the odds of a nonexpert Federal Circuit judge doing so. Put differently, the predicted probability of a Federal Circuit judge overturning a claim construction increases by 53.42 percent when his or her technical background is relevant to the patent at issue.[107]

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105. The reader is cautioned against using these results to predict the probability of reversal in a particular case, as several other factors may affect the merits of a unique dispute.

106. *See id.* at 442.

107. Full appreciation of this number requires some explanation. The binomial logit model in this study predicts the probability of the response variable (claim construction error) being true (equal to one), based on a number of categorical and continuous explanatory variables on a natural logarithmic scale. Holding all of these explanatory variables at their means except for the explanatory variable of interest yields probabilities directly related to the value of that variable. For instance, setting *FCJ Expertise* at zero yields a predicted probability of 26.42 percent. Setting the same variable at one yields a predicted probability of 40.53 percent. Thus, a Federal Circuit techno-jurist is 53.42 percent more likely than a nonexpert Federal Circuit judge to modify a claim construction, when the relevant technology matches his or her particular scientific specialty.

Pulling this data together raises some interesting normative questions. The results appear to be in line with Brewer's two-hat theory and offer at least indirect evidence that district court judges lacking in technical expertise may not be epistemically competent to construe patent claim terms. Following Brewer's framework, if appellate judges with specialized technical and legal expertise are the most epistemically competent to adjudicate combined scientific/legal issues, then their decisions are the most legitimate from an intellectual due process point of view. If these techno-jurists find mistakes at a higher rate than their nonexpert appellate peers do, then intellectual due process is being violated at both levels of the judiciary. Nonexpert district court judges are making mistakes at the trial level, and nonexpert appellate judges are failing to catch them all on appeal. Claim construction rulings in the Federal Circuit appear to fit this pattern.

The data does not, however, prove the converse — district court judges that *do* possess technological knowledge may or may not be overruled with the same frequency as their lay counterparts. Unfortunately, the present study does not contain enough data to refute the suggestion that Federal Circuit techno-jurists may instead be more akin to "technocrat-kings,"[108] unduly predisposed to substitute their own claim constructions for those of the district courts.[109] Indeed, the best means of approaching the question may be that attempted by Schuster's study; but, as discussed above, such a method is fraught with sufficient logistical difficulty as to be impracticable at present. The burden of proof, rather, should be on the Federal Circuit's detractors.

If the results of the present study demonstrate a problem in the patent system, as they appear to do, the next question is what, if anything, should be done about it.

VI. IMPLICATIONS AND PROPOSED REFORM

> "HOW LONG WE SHALL CONTINUE TO BLUNDER ALONG WITHOUT THE AID OF UNPARTISAN AND AUTHORITATIVE SCIENTIFIC ASSISTANCE IN THE ADMINISTRATION OF JUSTICE, NO ONE KNOWS; BUT ALL FAIR PERSONS NOT CONVENTIONALIZED BY PROVINCIAL LEGAL HABITS OF MIND OUGHT, I SHOULD THINK, UNITE TO EFFECT SOME SUCH ADVANCE." [110]

As with any statistical study, the reader should approach the results of the present effort with some caution. The intent is *not* to suggest that federal judges are always incapable of accurately construing patent claims or understanding technologically difficult issues. In-

108. Brewer, *supra* note 3, at 1679.
109. *See* Moore, *supra* note 2, at 21.
110. Parke-Davis & Co. v. H.K. Mulford Co., 189 F. 95, 115 (S.D.N.Y. 1911) (Hand, J.).

deed, the *Daubert* court expressed its "confiden[ce] that federal judges possess the capacity to undertake"[111] the demands of handling scientific evidence. However, the potential for problems cannot be altogether ignored either. Many academics and practitioners have called for reform of the patent system, but few have addressed the epistemic competence of the judiciary directly. As Professor Peter Lee put it, "no matter how elegantly policymakers craft patent law, if generalist judges lack the capacity to administer it, the patent system cannot fulfill its objectives."[112] The focus of the studies summarized in Part II, *supra*, was on trial judge experience — that may yet be a necessary condition for reducing the claim construction error rate, but the present study demonstrates that it is ultimately insufficient on its own. Taking Brewer's two-hat argument to its logical extreme would mean creating a highly specialized patent trial court that begins to resemble the structure of a complex administrative agency such as the USPTO.[113] Such a move would be highly impractical from a cost-benefit standpoint.[114] Moreover, the odds of identifying and assembling a group of judges with sufficient experience not only in patent law but also in all the various scientific and technical fields relevant to the patent system are low.[115] Instead, a number of less drastic options have been proposed — though, a full exploration of each is beyond the scope of this paper.

Patent Specialty Courts — A specialized trial court with nonexpert judges that relies heavily on court-appointed experts may be sufficient to overcome the deficiencies of the current regime.[116] The World Trade Organization dispute settlement system employs such a process for dealing with "complex factual questions of a technical or scientific nature."[117] Several Continental European jurisdictions are likewise reluctant to entrust nonexperts with such technology- or science-imbued decisions.[118] Of course, this does not fully overcome the difficulty of epistemic competence with respect to initial expert selection.[119] There is also the question of when a certain subject matter crosses into the expert domain. Yet another potential problem with a specialized patent court is that cases frequently cross subject matter

111. Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 593 (1993).

112. *See* Lee, *supra* note 9, at 6.

113. *See* Rai, *supra* note 32, at 879–80.

114. *See id.* at 880.

115. *Id.* at 894.

116. *See id.* at 880.

117. *WTO Bodies Involved in the Dispute Settlement Process*, WORLD TRADE ORGANIZATION, http://www.wto.org/english/tratop_e/dispu_e/disp_settlement_cbt_e/c3s6p1_e.htm (last visited Dec. 20, 2013).

118. *See* Brewer, *supra* note 3, at 1566.

119. However, credentials may serve as a reasonable basis for the second-order decisions regarding which individuals should be appointed to make the first-order decisions (regarding competing scientific expert claims). *See* Rai, *supra* note 32, at 894.

boundaries, making it difficult to determine which court should preside over the case or forcing the specialist judge to deal with areas beyond his or her expertise.[120]

Patent Cases Pilot Program — Partly in response to the results of the studies discussed in Part II,[121] Congress recently established the ten-year Patent Cases Pilot Program "to encourage enhancement of expertise in patent cases among district judges."[122] The program allows for judges in certain districts to specialize in hearing patent cases within their district.[123] The pilot program seeks to evaluate the effect of such increased patent exposure through two measures: (1) "the rate of reversal by the [Federal Circuit] . . . on the issues of claim construction," and (2) "the period of time elapsed from the date on which a case is filed to the date on which trial begins or summary judgment is entered."[124] While this development is encouraging, the pilot program fails to address the lack of technical expertise in the judiciary. A provision in an earlier version of the bill would have provided funds for specialized training or for hiring law clerks with technical backgrounds.[125] As the present study suggests, Congress may have missed a key opportunity by failing to more directly address the expertise issue.

Expanded Training and Education — Some autodidactic adjudicators take it upon themselves to fill gaps in their technical knowledge through outside study — Judge William Alsup is one notable example.[126] For others, the Federal Judicial Center provides training to district court judges in scientific matters.[127] While even Brewer notes that a judge lacking formal scientific background may become sufficiently epistemically competent to satisfy the demands of intellectual

120. *Cf.* Kesan & Ball, *supra* note 48, at 401–02 (arguing that courts specialized to deal with certain legal subject matters will inevitably need to handle issues beyond their expertise).

121. *See generally Improving Fed. Court Adjudication of Patent Cases Before the Subcomm. on Courts, the Internet, and Intellectual Property of the H. Comm. on the Judiciary*, 109th Cong. (2005) (containing the testimony and articles of then Professor Moore).

122. Patent Cases Pilot Program, Pub. L. No. 111–349, 124 Stat. 3674, 3674.

123. *See id.*, § 1(b), at 3674–75. Patent cases are still randomly assigned, but a judge not participating in the program may transfer the case to another participating judge within the same district. *See id.,* § 1(a), at 3674.

124. *See id.*, § 1(e), at 3675.

125. H.R. 628, 111th Cong. § 1(f) (2009).

126. *Cf.* Transcript of Jury Trial Proceedings at 4225–26, Oracle v. Google, 872 F. Supp. 2d 974 (2012) (No. C 10–03561 WHA) (statement of Alsup, J.) ("I couldn't have told you the first thing about Java before this trial. But, I have done and still do a lot of programming myself in other languages. I have written blocks of code like rangeCheck a hundred times or more. I could do it. You could do it. It is so simple."), *available at* http://www.groklaw.net/pdf4/OraclevGoogle-1172.pdf.

127. *See* Lee, *supra* note 9, at 17–18.

due process,[128] providing adequate education for time-strapped judges may prove impracticable in many cases.[129]

Other Solutions — Other potential solutions include: making more expert resources available to district court judges,[130] obtaining administrative opinions on claim construction from the USPTO,[131] requiring patent claims to be drafted in "standard English,"[132] providing more deference to district court constructions,[133] and allowing interlocutory claim construction appeals.[134] Each of these suggestions may have an impact on the issue of epistemic competency (to varying degrees of efficacy) and merit further study.

VII. CONCLUSION AND RECOMMENDATIONS FOR FUTURE STUDY

This study demonstrates that the lack of technically trained judges is having a measurable impact on the patent system. More specifically, the multivariate statistical model developed herein shows that when a reviewing Federal Circuit judge has expertise in the relevant technological field, he or she is more likely to find error in a district court's claim construction than are his or her nonexpert colleagues. Brewer's two-hat theory predicts such a result: only such techno-jurists have both the technical and legal expertise necessary to recognize the problematic constructions that might otherwise go unnoticed.

Several implications follow from this realization. Because these expert judges find more erroneous trial court claim constructions than their nonexpert peers, Brewer's "intellectual due process" is being violated at both levels of the judiciary: nonexpert district court judges make mistakes at the trial level, and nonexpert appellate judges fail to recognize them all on appeal. In addition, if only the decisions of these experts are considered epistemically legitimate, then the "true" claim construction error rate is likely quite higher than the 30 percent measured in previous studies — further exacerbating the commonly

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128. *See* Brewer, *supra* note 3, at 1678, 1680.

129. *See* Lee, *supra* note 9, at 18.

130. *See id.* (e.g., employing special masters or clerks with scientific expertise or training).

131. *See* John F. Duffy, *On Improving the Legal Process of Claim Interpretation: Administrative Alternatives*, 2 WASH. U. J.L. & POL'Y 109, 136 (2000) (e.g., allowing a trial court to obtain an advisory opinion from a centralized, expert administrative agency).

132. *See* Schwartz, *supra* note 34, at 266–67 (e.g., lowering indeterminacy issues by simplifying or eliminating the patent *lingua franca*).

133. *See id.* at 264 (e.g., lowering the claim construction reversal rate by requiring a higher threshold for finding district court error).

134. *See* Moore, *supra* note 2, at 4 (arguing that the most efficient way to approach the claim construction problem is to provide for expedited appeals to the Federal Circuit under limited circumstances).

criticized unpredictability and uncertainty of patent litigation.[135] Judges, it would seem, are genuinely struggling to assume the technological mantle imposed upon them by patent law.

To be sure, this is not a new problem, but it could be a better-understood problem. Current reforms focus on fostering greater legal expertise to the exclusion of greater scientific expertise. This study shows such an approach to be insufficient. To provide further insight, future studies could include other areas of patent doctrine implicating the PHOSITA standard. Nonobviousness is one example. They could also investigate the impact of neutral technical advisors, court-appointed experts, and the use of clerks with technical backgrounds. Such data will help shape future dialog over meaningful patent reform by bringing to light those "long felt but unsolved needs"[136] of the federal judiciary.

135. *See, e.g.*, 153 CONG. REC. H1431 (daily ed. Feb. 12, 2007) (statement of Rep. Smith) (testifying in support of the patent cases pilot program that "it is widely recognized that patent litigation is too expensive, too time consuming, and too unpredictable"); 156 CONG. REC. H8537 (daily ed. Dec. 16, 2010) (statement of Rep. Chu) (arguing that the patent cases pilot program would "increase efficiency and consistency in patent and plant variety protection litigation and reduce the reversal rate").

136. Graham v. John Deere Co. of Kan. City, 383 U.S. 1, 17 (1966) (a long felt but unsolved need is a secondary consideration of nonobviousness).