

A Nonobvious Comparison: Nonobviousness Decisions at the PTAB and in the Federal Courts

Gregory N. Mandel*

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* Interim Dean and Peter J. Liacouras Professor of Law, Temple University—Beasley School of Law. I am grateful to participants at the 2016 Texas Intellectual Property Law Symposium and to Aaron Rabinowitz for their comments on an earlier draft of this work, and to Rachel Reznick, Shannon Daniels, and Diana Joskowicz for their outstanding research assistance on this project.

I. Introduction¹

The most fundamental requirement for obtaining a patent is that the invention would not have been obvious to a person of ordinary skill in the art at the time the patent application was filed.² Patent protection is not available for merely new and useful inventions; inventions must also provide a non-trivial advance over existing technology in order to merit a patent. Proper application of the nonobviousness requirement is often viewed as necessary to comport with the constitutional requirement that patents “promote the Progress.”³

Though the nonobviousness standard can be recited straight-forwardly, in practice it is notoriously difficult to apply. The standard itself is highly indeterminate: the term “nonobvious” has never been defined by Congress or the courts. Further, the nonobviousness requirement mandates that the decision-maker put themselves in the mind of another individual (the person of ordinary skill in the art) in order to make a judgment. Research in psychology teaches that humans are not cognitively capable of carrying out this objective. Finally, nonobviousness decisions require a hindsight judgment, another task at which people demonstrate marked biases.

Despite these challenges, decision-makers must judge nonobviousness for hundreds of thousands of patent applications a year, both at the United States Patent and Trademark Office (“PTO”) and in the federal courts. Some of these decision-makers possess expertise in the particular technology at issue (PTO examiners and sometimes Patent Trial and Appeal Board (“PTAB”) administrative judges), some possess general scientific or technological expertise (PTAB judges deciding cases outside their area of expertise and some federal judges), and some lack any technological training (many federal judges). These differing levels of expertise can have different effects on the challenges of making nonobviousness determinations. Conversely, some of these decision-makers have been extensively trained in the law (federal judges, some PTAB judges, and some PTO examiners) and others have not (other PTAB judges and PTO examiners).

¹ Portions of the Introduction and Part I of this article are drawn from earlier articles I have written on nonobviousness. See Gregory N. Mandel, *The Non-Obvious Problem: How the Indeterminate Non-Obvious Standard Produces Excessive Patent Grants*, 42 U.C. DAVIS L. REV. 57 (2008); Gregory N. Mandel, *Another Missed Opportunity: The Supreme Court’s Failure to Define Non-Obvious or Combat Hindsight Bias in KSR v. Teleflex*, 12 LEWIS & CLARK L. REV. 323 (2008); Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration that the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391 (2006).

² 35 U.S.C. § 103 (2012); Mandel, *Patently Non-Obvious*, *supra* note 1, at 1393; NONOBVIOUSNESS—THE ULTIMATE CONDITION OF PATENTABILITY (J. Witherspoon ed. 1980); Hon. Giles S. Rich, *Laying the Ghost of the “Invention” Requirement*, 1 AIPLA Q. J. 26 (1972).

³ U.S. CONST. art. I, § 8; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 427 (2007) (“as progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts.”); *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 6 (1966); Rich, *supra* note 2, at 26.

In an effort to elucidate how the challenges of nonobviousness decisions affect different decision-makers, this article presents an original dataset of nonobviousness decisions throughout the patent decision process. This dataset includes nonobviousness decisions at the PTO and in the federal courts for the time period subsequent to the effective date of the Leahy-Smith America Invents Act's (AIA)⁴ first-to-file provisions.

The results provide strong evidence that nonobviousness decisions are highly indeterminate: similarly situated decision-makers reach differing conclusions on nonobviousness at a strikingly high rate. The data does not support the hypothesis that technologically sophisticated decision-makers are better able to make judgments from the perspective of a person of ordinary skill in the art. Finally, the analysis provides some potential support for the possibility that technologically trained individuals may experience slightly less of a hindsight bias than untrained decision-makers.

The data reported here can also be compared to earlier studies of nonobviousness decisionmaking, including for time periods prior to the Supreme Court's decision in *KSR v. Teleflex*⁵ and between *KSR* and the effective date of the AIA. Comparing results across these periods indicates that both the district courts and the Federal Circuit reacted significantly to the Supreme Court's decision in *KSR*, but that subsequent to the AIA both judicial bodies have reverted to nonobviousness decisionmaking that is more consistent with pre-*KSR* outcomes.

This article proceeds in three parts. Part I provides a deeper explanation of the challenges of nonobviousness decisionmaking. Part II discusses how these challenges are expected to affect nonobviousness decisionmaking in patent prosecution, administrative patent review, and infringement proceedings in federal court. Part III presents the data concerning nonobviousness decisions at the PTO and in the federal courts and discusses the implications of the data for nonobviousness decisions throughout the patent system.

II. The Challenge of Nonobviousness

The purpose of the nonobviousness standard is to assure that only significant technological advances merit a patent award.⁶ The reasons for this requirement are evident: obvious advances will be achieved without a patent incentive, and obvious advances do not benefit society enough to warrant imposing the costs of a patent monopoly on the public.⁷ Thus, the nonobviousness requirement protects society

⁴ Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (Sept. 16, 2011) (codified largely in various sections of 35 U.S.C.).

⁵ 550 U.S. 398 (2007).

⁶ *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 156 (1989); DONALD S. CHISUM, 4-11 CHISUM ON PATENTS § 5.01 (2015); ROBERT MERGES & JOHN DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 644 (3d ed. 2002).

⁷ *KSR*, 550 U.S. at 416, 427; *Bonito Boats*, 489 U.S. at 156 ("Both the novelty and the nonobvious-

against the social costs both of denying a deserving patent and of granting an undeserving monopoly.⁸ Improper application of the standard would result either in inefficiently low incentives to innovate (reducing technological innovation) or allow the patenting of minor advances, leading to patent thickets and other inefficiencies and similarly reducing future technological advance.⁹

The Patent Act's nonobviousness requirement provides that a patent may not be obtained

if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains.¹⁰

Nonobviousness typically presents the greatest validity hurdle to an inventor trying to obtain a patent.¹¹ The importance of the nonobviousness requirement is evident in patent litigation. The nonobviousness requirement is the patent validity issue that is

ness requirements of federal patent law are grounded in the notion that concepts within the public grasp, or those so obvious that they readily could be, are the tools of creation available to all.”); *Graham*, 383 U.S. at 6 (explaining that without innovation and social benefit, patent protection removes useful knowledge from prior art instead of promoting progress).

⁸ *Bonito Boats*, 489 U.S. at 151, 156 (the nonobviousness standard provides “a careful balance between the need to promote innovation and the recognition that imitation and refinement through imitation are both necessary to invention itself and the very lifeblood of a competitive economy”); *Graham*, 383 U.S. at 6 (“Innovation, advancement, and things which add to the sum of useful knowledge are inherent requisites in a patent system which by constitutional command must promote the Progress of . . . useful Arts. This is the *standard* expressed in the Constitution and it may not be ignored.” (internal quotations omitted)).

⁹ FED. TRADE COMM’N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, ch. 4, at 6-7 (2003); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1577, 1586 (2003); MERGES & DUFFY, *supra* note 6, at 646-47. See generally Gregory N. Mandel, *Leveraging the International Economy of Intellectual Property*, 75 OHIO ST. L.J. 733 (2014) (discussing the need to balance the incentives versus the exclusionary costs of patent rights); Gregory N. Mandel, *Proxy Signals: Capturing Private Information for Public Benefit*, 90 WASH. U. L. REV. 1 (2012) (same).

¹⁰ 35 U.S.C. § 103 (2012). The nonobviousness requirement was formally introduced in the 1952 Patent Act. Prior to 1952, courts recognized that something more than novelty was required for patentability and had read a requirement similar to non-obviousness into the term “invention” in the Patent Act. *Hotchkiss v. Greenwood*, 52 U.S. 248, 267 (1850). The Supreme Court held that the 1952 obvious requirement was generally not intended to change the level of patentable invention, but to codify the judicial precedent deriving from *Hotchkiss*. *KSR*, 550 U.S. at 427; *Graham*, 383 U.S. at 15-17.

¹¹ Christopher C. Kennedy, *Rethinking Obviousness*, 2015 WIS. L. REV. 655, 655 (2015) (stating that “the nonobviousness requirement is generally considered to be the core requirement of patentability” and that nonobviousness is “among the most commonly litigated issues in patent infringement cases, resulting in more invalidity determinations than any other defense”); Mandel, *Patently Non-Obvious*, *supra* note 1, at 1398; John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 208-09 (1998).

most commonly litigated and that is most likely to result in a patent being held invalid.¹²

Though the nonobviousness requirement is statutorily recited in relatively succinct language, in practice it presents numerous hurdles to apply. Chief among these are the indeterminacy of the standard, the difficulty of making a judgment from the perspective of a person of ordinary skill in the art (a “PHOSITA”), and the hindsight bias. The following sections elaborate upon each of these challenges.

A. Nonobvious Indeterminacy

The Patent Act does not define the term “obvious,” and neither the Supreme Court nor the Federal Circuit—the federal appeals court with jurisdiction over most patent appeals¹³—has ever defined it either. This failure to identify the quantum of advance necessary to achieve nonobviousness renders such evaluations necessarily indeterminate.¹⁴

Nonobviousness is a mixed question of fact and law.¹⁵ The factual part of this inquiry concerns the prior art, the differences between the invention and the prior art, the level of skill in the art, and other objective evidence of nonobviousness.¹⁶ The legal part of this inquiry requires determining whether the differences between the invention and the prior art would have been obvious to one of ordinary skill in the art.¹⁷ Although the Supreme Court has developed certain aspects of the factual portion of the nonobviousness inquiry, it has never delineated the legal portion of the standard. This leaves nonobviousness in the same position as Judge Learned Hand described its predecessor: “as fugitive, impalpable, wayward, and vague a phantom as exists in the whole paraphernalia of legal concepts.”¹⁸

In a series of three cases known as the Trilogy, the Supreme Court established the framework for nonobviousness analysis:

Under § 103, the scope and content of the prior art are to be determined; differences between prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.¹⁹

¹² Allison & Lemley, *supra* note 11, at 208–09; *see also* GLORIA K. KOENIG, PATENT INVALIDITY: A STATISTICAL AND SUBSTANTIVE ANALYSIS 5–50 (rev. ed. 1980) (finding that obviousness was the most common basis for judicial invalidation of patents for the period 1953–1978); P.J. Federico, *Adjudicated Patents, 1948-54*, 38 J. PAT. OFF. SOC’Y 233, 249 (1956) (finding that obviousness was the most common basis for judicial invalidation of patents for the period studied).

¹³ 28 U.S.C. § 1295 (2012).

¹⁴ Gregory N. Mandel, *The Non-Obvious Problem*, *supra* note 1.

¹⁵ *Graham*, 383 U.S. at 17.

¹⁶ *Id.*

¹⁷ *Id.*

¹⁸ *Harries v. Air King Prods. Co.*, 183 F.2d 158, 162 (2d Cir. 1950).

¹⁹ *Graham*, 383 U.S. at 17. The other two cases in the Trilogy are *Calmar v. Cook Chem.*, 383 U.S. 1

The Court's analysis of the nonobviousness of the subject inventions in these three cases involved careful evaluation of the factual background factors identified in the first sentence of the framework and then a simple statement of the Court's legal conclusion. Similarly, in all four of the substantive nonobviousness cases that the Supreme Court has decided in the fifty years since the Trilogy, the Court has elaborated its factual requirements, but never provided content for the legal standard of nonobviousness.²⁰ The Supreme Court's most extensive discussion of nonobviousness determinations since the Trilogy took place in *KSR v. Teleflex*.²¹ Though the Court in *KSR* provides some guidance concerning how to conduct the nonobviousness inquiry (prior art references may be combined in the nonobviousness inquiry only when there is a "reason to combine"), it did not indicate how to measure or evaluate the quantum of ingenuity necessary to actually satisfy the standard.²²

The Federal Circuit has historically provided some limited direction concerning the level of ingenuity necessary to satisfy the nonobviousness standard in certain cases. For example, the Federal Circuit had established that an invention was not obvious simply because it may have been "obvious to try," but rather an obvious-to-try invention was only obvious if a person of ordinary skill would also have had a reasonable expectation of success.²³ Even this limited guidance, however, was curtailed by the Supreme Court in *KSR* where the Court held that "obvious to try" could indicate that an invention was obvious.²⁴ Some vestige of the "obvious-to-try doctrine" may remain, but it does not meaningfully identify what is obvious or not in most cases.

In short, the Supreme Court and Federal Circuit precedent does not define the legal nonobviousness standard. Simply using the term "non-obvious" as a requirement does not create an applicable metric; it is nothing more than a naked legal

(1966), and *United States v. Adams*, 383 U.S. 39 (1966).

²⁰ *KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 415–22 (2007); *Dann v. Johnston*, 425 U.S. 219, 220–22 (1976); *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 273 (1976); *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 59 (1969). *Dennison Manuf. Co. v. Panduit Corp.*, 475 U.S. 809 (1986), hinted at this problem, but did not resolve it. In *Dennison* the Supreme Court issued a brief opinion remanding a Federal Circuit reversal of a district court nonobviousness holding, questioning whether the Circuit had afforded appropriate deference to the district court's factual nonobviousness findings. 475 U.S. at 811. In doing so, the Court indicated a need to differentiate the legal nonobviousness decision from the underlying factual inquiries. *Id.* On remand, however, the Circuit simply held that its obviousness conclusion had been one of law, not fact, and cited the Supreme Court's own opinion in *Graham*, which the Circuit noted, "disagreed with conclusions reached below, did not remand, [and] described no finding as 'clearly erroneous.'" *Panduit Corp. v. Dennison Manuf. Co.*, 810 F.2d 1561, 1567 (1987). The Supreme Court denied certiorari to review the Federal Circuit decision, leaving the issues unresolved. *Dennison Manuf. Co. v. Panduit Corp.*, 481 U.S. 1051, 1052 (1987).

²¹ *KSR*, 550 U.S. 398.

²² *Id.*

²³ *See, e.g., Brown & Williamson Tobacco Corp. v. Phillip Morris, Inc.*, 229 F.3d 1120, 1124–25 (Fed. Cir. 2000) (citing *In re O'Farrell*, 853 F.2d 894, 903–04 (Fed. Cir. 1988)).

²⁴ *KSR*, 550 U.S. at 420–21.

conclusion.²⁵ In this regard, the nonobviousness requirement stands apart from the negligence standard to which it is sometimes compared.²⁶ Negligence has an elaborated definition that is not circularly self-referential. Negligence is commonly defined as failing to provide the standard of care that a reasonable or average person would use under similar circumstances.²⁷ Judge Learned Hand's famous empirical formula for evaluating reasonableness provides a stricter definition: whether the cost of avoiding the accident is less than the probability of the accident times the cost of the potential injury.²⁸ In addition, precedent provides greater determinacy in negligence law than in nonobviousness law. Precedent concerning the standard of due care, such as the relevance of common industry practice or regulatory requirements, provides guidance for judging negligence.²⁹ Such considerations generally do not exist for assessing nonobviousness.

Both the Supreme Court in its nonobviousness cases and the legislative history of the nonobviousness standard in Section 103 have pointed to the need to establish a "more practical test of patentability" to produce more "uniformity and definiteness" in nonobviousness decisions.³⁰ This objective, however, has not been achieved. There remains no clear guidance on the requisite measure of nonobviousness or on how a decision-maker is expected to evaluate whether an invention meets the standard. What remains is a bare legal standard that is necessarily indeterminate.³¹

B. The Person of Ordinary Skill

Adding to the nonobviousness challenge, a decision-maker must evaluate nonobviousness from the perspective of a person of ordinary skill in the art.³² This presents an inherent epistemic challenge.³³ Lay individuals, such as judges and jurors untrained in the pertinent technological field, cannot accurately apply the nonobviousness requirement because it requires them to have the mental state of another person.

²⁵ H.L.A. HART, *THE CONCEPT OF LAW* 130–31 (1961).

²⁶ *See Graham v. John Deere of Kan. City*, 383 U.S. 1, 18 (1966) ("What is obvious is not a question upon which there is likely to be uniformity of thought in every given factual context. The difficulties, however, are comparable to those encountered daily by the courts in such frames of reference as negligence and scienter.").

²⁷ *RESTATEMENT (SECOND) OF TORTS* § 282 (1965); *BLACK'S LAW DICTIONARY* 716 (abr. 6th ed. 1991).

²⁸ *United States v. Carroll Towing Co.*, 159 F.2d 169, 173 (2d Cir. 1947).

²⁹ *See, e.g., Surles ex rel. Johnson v. Greyhound Lines, Inc.*, 474 F.3d 288, 300 (6th Cir. 2007) (noting "the generally accepted rule that industry standards [and safety regulations] may be proven as some evidence of care"); *Muncie Aviation Corp. v. Party Doll Fleet, Inc.*, 519 F.2d 1178, 1180 (5th Cir. 1975) ("Evidence of custom within a particular industry, group, or organization is admissible as bearing on the standard of care in determining negligence.").

³⁰ *Graham*, 383 U.S. at 17–18.

³¹ HART, *supra* note 25, at 130–31.

³² 35 U.S.C. § 103.

³³ *See Scott Brewer, Scientific Expert Testimony and Intellectual Due Process*, 107 *YALE L.J.* 1535, 1539 (1998) (discussing the similar epistemic challenge created by competing expert testimony).

Only an actual person having ordinary skill in the art could know what is obvious to such a person.³⁴ This problem is most apparent for complex technologies. A lay decision-maker would be lucky to even understand the gist of the problem at issue in sophisticated technological fields, such as those involving the human genome or synthetic biology. A layperson cannot determine with any significant accuracy whether solving such a problem would have been obvious to a person of ordinary skill in that art. This limit in cognitive capability will largely persist regardless of the introduction of prior art evidence and expert testimony, and will exist for simpler technological fields as well.

Psychological research has revealed that individuals are cognitively incapable of making judgments from other people's perspectives. A seminal study involved participants tapping out the rhythms of well-known tunes while a second participant listened.³⁵ The tappers predicted that the listeners would identify the tunes 50% of the time. The listeners were actually only able to identify the tunes 3% of the time.³⁶ The tappers were not able to put themselves in the perspective of the listeners; instead, the tappers assumed that what was obvious to them would be at least somewhat obvious to the listeners as well.³⁷ Other studies have found that individuals cannot accurately judge the opinions of persons they know have different information, even when the individual judging has greater information and it is in their economic interest to make an accurate evaluation.³⁸ This phenomenon is dubbed the "curse of knowledge."³⁹ Individuals are cognitively unable to detach themselves from their own perspective when asked to evaluate the perspective of another.⁴⁰ Not only are individuals unable to place themselves in the perspective of another, but they are also significantly overconfident in their ability to do so.⁴¹

These findings raise serious doubts as to the ability of lay decision-makers to judge whether an invention would have been obvious to a person of ordinary skill in

³⁴ See Doug Lichtman & Mark Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 123 (2007) ("District Court judges are poorly equipped to read patent documents and construe technical patent claims. Lay juries have no skill when it comes to evaluating competing testimony about the originality of a technical accomplishment."). This problem existed under the earlier judicially-created requirement of invention as well. See *Parke-Davis & Co. v. H. K. Mulford Co.*, 189 F. 95, 115 (C.C.S.D.N.Y. 1911) ("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. . . . [O]nly a trained chemist is really capable of passing upon such facts, e.g., in this case the chemical character of [the inventor's] so-called 'zinc compound', or the presence of inactive organic substances.").

³⁵ See Justin Kruger et al., *Egocentrism Over E-Mail: Can We Communicate as Well as We Think?*, 89 J. PERSONALITY & SOC. PSYCHOL. 925, 933 (2005).

³⁶ See *id.*

³⁷ See *id.*

³⁸ Colin Camerer et al., *The Curse of Knowledge in Economic Settings: An Experimental Analysis*, 97 J. POL. ECON. 1232, 1232 (1989).

³⁹ *Id.*

⁴⁰ *Id.* at 1244–45; Kruger, *supra* note 35, at 933.

⁴¹ Kruger, *supra* note 35, at 933.

the art.⁴² The experiments above involved participants judging the perception of others who had equal skill and experience. Not only do lay nonobviousness decision-makers face the challenges revealed by the curse of knowledge, but they also have to judge the perspectives of individuals who generally have far greater relevant education and training. If individuals usually cannot judge the perspective of an equally trained person with less information, they will be profoundly challenged to judge the perception of a more highly trained person with greater information.

Nonobviousness decision-makers do not rely solely on their own judgment concerning whether an invention was obvious to a person of ordinary skill. Decision-makers are able to draw on expert testimony and related evidence concerning the art and what would have been obvious. In most circumstances, however, this assistance will not resolve the curse of knowledge problem. Where a decision-maker does not independently understand the technology or problem at issue, the decision-maker is not epistemically competent to judge the expert testimony pertaining to nonobviousness.⁴³

Consider the problem this way: imagine that one expert opines that a certain combination was within the knowledge of a person of ordinary skill in the art and a second expert states that such a combination was unknown and not obvious. Assume each expert provides a potentially plausible explanation for his or her opinion. In this situation, lay decision-makers would not have an objective basis by which to determine which opinion is correct, given that the decision-maker is untrained in the technology. In effect, we are asking the decision-maker to be a better judge of the technological ingenuity of an invention than experts who are highly skilled in the field.⁴⁴ In most cases, lay decision-makers lack the capability to make such a determination.⁴⁵

This concern about making a judgment from another person's perspective exists not only for technologically lay judges and jurors, but also for technologically trained PTO examiners and PTAB administrative judges. Though examiners and administrative judges may be more technologically sophisticated than lay individu-

⁴² The findings concerning both individual inability to judge others' perspectives and overconfidence in such judgment likely are part of the explanation for the hindsight bias in nonobviousness decisions. *See infra* Part I.C.

⁴³ Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE L.J. 1535, 1539 (1998).

⁴⁴ *See id.* at 1595 (discussing similar issues for scientific expert testimony).

⁴⁵ The Supreme Court opinion, authored by Justice Souter, in *Markman v. Westview Instruments, Inc.*, provided some insight into this dilemma: "[I]n these cases [involving complex technical patents] a jury's capabilities to evaluate demeanor, to sense the mainsprings of human conduct, or to reflect community standards . . . are much less significant than a trained ability to evaluate the testimony in relation to the overall structure of the patent." 517 U.S. 370, 389–90 (1996) (internal quotations and citations omitted). The problem with this analysis is that, while recognizing the deficiency in juror ability to evaluate expert technical testimony, *Markman* holds that such a decision is for the court. For the same reasons discussed above, however, lay judges also generally cannot be expected to be able to evaluate technical expert testimony.

als, they are still trained for different tasks and have different jobs than persons of ordinary skill in an art.⁴⁶ Examiners and administrative judges may know the general technological field of a patent application, but they are not “persons of ordinary skill” in the specific technology at issue in many inventions.⁴⁷ This is simply a matter of modern technological advance. Technological fields have become highly particularized and differentiated. For these reasons, examiners and administrative judges will face similar cognitive challenges in evaluating nonobviousness, particularly the challenge that technological problems often can be more complex than they appear to be to persons of lesser understanding.⁴⁸ Examiners and administrative judges will also tend to spend significantly less time and have significantly fewer resources and information available to them than persons of ordinary skill who are pursuing inventive activity.⁴⁹

Patent examiners, PTAB administrative judges, and lay judges and jurors will all have a very difficult time evaluating nonobviousness from the perspective of a PHOSITA. This cognitive challenge is inherent in the nonobviousness inquiry and, though it may be lessened, cannot be cured with greater information or expert testimony.

C. Hindsight Bias

The nonobviousness standard of Section 103 requires a decision-maker to make a historical judgment: whether the invention would have been obvious at a time in the past.⁵⁰ To reach a proper nonobviousness conclusion, the decision-maker must step backward in time to a moment when the invention was unknown. Unfortunately, this mandate is more easily stated than achieved. Humans are cognitively incapable of ignoring what they have learned (here, that the invention was achieved), as is required for the proper ex ante analysis. Psychologists have studied this phenomenon and have termed it the “hindsight bias.”⁵¹

⁴⁶ See, e.g., Burk & Lemley, *supra* note 9, at 1187–88 (stating that person of ordinary skill should be “an ultimate conclusion of law based upon evidence, not dictated by the capabilities or knowledge of the Patent Office examiner”); Rebecca S. Eisenberg, *Obvious To Whom? Evaluating Inventions from the Perspective of PHOSITA*, 19 BERKELEY TECH. L.J. 885, 888, 898 (2004) (asserting patent examiners will “have less technological skill . . . than the hypothetical [person of ordinary skill]” as they spend more time in a patent office away from technological fields).

⁴⁷ Lichtman & Lemley, *supra* note 34, at 53.

⁴⁸ Richard S. Gruner, *Everything Old is New Again: Obviousness Limitations on Patenting Computer Updates of Old Designs*, 9 B.U. J. SCI. & TECH. L. 209, 264 (2003); Kimberly A. Moore, *Jury Demands: Who’s Asking?*, 17 BERKELEY TECH. L.J. 847, 848 (2002).

⁴⁹ Lichtman & Lemley, *supra* note 47, at 46–47, 53.

⁵⁰ 35 U.S.C. § 103 (2012); *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 35–36 (1966).

⁵¹ Baruch Fischhoff, *Hindsight ≠ Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty*, 1 J. OF EXPERIMENTAL PSYCHOL.: HUM. PERCEPTION & PERFORMANCE 288, 289 (1975); see also Susan J. LaBine & Gary LaBine, *Determinations of Negligence and the Hindsight Bias*, 20 LAW & HUM. BEHAV. 501, 502–04 (1996) (surveying a wide variety of hindsight bias studies); Jay J. J. Christensen-Szalanski & Cynthia Fobian Willham, *The Hindsight Bias: A Meta-Analysis*, 48 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 147, 162–64 (1991) (conduct-

The hindsight bias routinely affects both lay and expert judgment in many fields.⁵² Individuals are not cognitively able to prevent knowledge gained through hindsight from impacting their analysis of past events. Rather, individuals routinely overestimate the ex ante predictability of events after they have occurred. Once individuals have hindsight information, they consistently exaggerate what could have been anticipated in foresight and not only tend to view what has occurred as having been inevitable, but also as having appeared relatively inevitable beforehand.⁵³ In law, the hindsight effect has been found to affect mock juror judgments about the legality of searches and seizures, and tort law judgments about negligence, recklessness, and whether reasonable precautions were taken.⁵⁴ It has also been demonstrated in patent law.

I have conducted prior research on the hindsight bias in patent law nonobviousness decisions.⁵⁵ In a series of experiments, participant mock jurors were given a hypothetical fact scenario concerning an invention. The scenarios were based on facts surrounding actual issued patents that were challenged on nonobviousness validity grounds in litigation and were the subject of a reported decision. The scenarios included background information about the field of art of the invention, a variety of prior art reference information, and a description of the problem that a person cast in the role of the inventor was working on. The scenarios were selected for inventions that would be easy for mock jurors to comprehend to reduce the need for significant material on the skill level of a person having ordinary skill in the art,⁵⁶ and for inventions that presented apparently disputable questions of nonobviousness.⁵⁷

The experiments utilized a between-subjects design. Participants in the control condition received all of the lead-up information described above. These partici-

ing a meta-analysis of over 120 hindsight bias studies).

⁵² Kim A. Kamin & Jeffrey J. Rachlinski, *Ex Post ≠ Ex Ante: Determining Liability in Hindsight*, 19 LAW & HUM. BEHAV. 89, 90–91 (1995) (citing studies revealing hindsight bias in surgeons' appraisal of surgical cases, physicians' medical diagnoses, women's reactions to pregnancy tests, voters' election predictions, and nurses' employee evaluations).

⁵³ Baruch Fischhoff, *For Those Condemned to Study the Past: Heuristics and Biases in Hindsight*, in JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 335, 341 (Daniel Kahneman et al. eds., 1982).

⁵⁴ Kamin & Rachlinski, *supra* note 52 at 98–99; LaBine & LaBine *supra* note 51; CASS R. SUNSTEIN ET AL., PUNITIVE DAMAGES: HOW JURIES DECIDE 103–04 (2002).

⁵⁵ See generally Gregory N. Mandel, *Patently Non-Obvious II: Experimental Study on the Hindsight Bias Issue before the Supreme Court in KSR v. Teleflex*, 9 YALE J. L. & TECH. 1 (2007); Gregory N. Mandel, *Patently Non-Obvious*, *supra* note 1.

⁵⁶ In this manner, this study imitated the Supreme Court's decision in *Graham v. John Deere Co. of Kansas City*, where the Court first instituted the PHOSITA analysis, and implicitly applied its own (lay) understanding of what a person having ordinary skill in the art would know. 383 U.S. 1, 24–26, 32–35 (1966) (conducting an analysis of whether the inventions at issue were obvious to a PHOSITA without any factual record concerning what a PHOSITA would know or know how to do).

⁵⁷ The inventions, prior art, and facts were modified in part from the actual cases in order to meet these requirements and other practical concerns.

pants were placed in the position from which nonobviousness is *supposed* to be judged: prior to knowledge about the invention being revealed. Participants in the hindsight condition received the exact same information as participants in the control condition, but with one additional sentence at the end of the scenario revealing the inventor's invention. Thus, participants in the hindsight condition were placed in the position from which nonobviousness judgments are *actually* made.

The results revealed a significant hindsight bias in nonobviousness determinations. In one scenario involving an instructional baseball product, only 34% of participants in the foresight condition considered the invention obvious, while 71% of participants in the hindsight condition thought that the invention was obvious.⁵⁸ In a separate scenario involving a new fishing lure, 23% of foresight participants versus 54% of hindsight participants thought that the invention was obvious.⁵⁹ These differences are all statistically significant at the $p < .001$ level.⁶⁰

The nonobviousness hindsight bias studies also examined the effect of various jurisprudential methods that the Supreme Court and the Federal Circuit have developed in an effort to combat the hindsight problem. These methods include jury instructions warning jurors about the hindsight bias and instructing them to avoid it, the Supreme Court's nonobviousness framework outlined in *Graham v. John Deere*, and the Federal Circuit's (subsequently overturned) teaching, suggestion, or motivation requirement.⁶¹ The results revealed that none of these doctrines significantly reduced the hindsight bias in nonobviousness judgments.

The outcomes of these experiments indicate that the hindsight bias significantly influences nonobviousness decisions. Participants who were not informed of the invention were substantially more likely to judge a solution nonobvious than participants who were informed of what the invention was. The magnitude of the hindsight bias in these patent scenarios was striking, greater than that reported for other legal judgments.⁶² Ex post knowledge of invention deeply affected participants' conclusions regarding whether an invention was nonobvious ex ante.

⁵⁸ Mandel, *Patently Non-Obvious II*, *supra* note 55, at 15–16; Mandel, *Patently Non-Obvious*, *supra* note 1, at 1409. The percentages stated in the text are arrived at by combining the results of the two identical studies.

⁵⁹ Mandel, *Patently Non-Obvious*, *supra* note 1, at 1409.

⁶⁰ Mandel, *Patently Non-Obvious II*, *supra* note 55, at 16; Mandel, *Patently Non-Obvious*, *supra* note 1, at 1409.

⁶¹ Mandel, *Patently Non-Obvious II*, *supra* note 55, at 13–17; Mandel, *Patently Non-Obvious*, *supra* note 1, at 1408–10. The presumption of validity that adheres to issued patents, *see* 35 U.S.C. § 282 (2000), is sometimes identified as a potential remedy to the hindsight problem, but such a contention is inappropriate. Mandel, *Patently Non-Obvious*, *supra* note 1, at 1437–38.

⁶² The hindsight bias shifted the decisions of about one-half and about one-third of the mock jurors in the baseball and fishing lure scenarios, respectively. Studies of the hindsight bias in other legal judgments have found that 24% to 34% of mock jurors or judges shifted their judgments. Chris Guthrie, Jeffrey J. Rachlinski & Andrew J. Wistrich, *Inside the Judicial Mind*, 86 CORNELL L. REV. 777, 818 (2001) (24% of judges shifted decision in Section 1983 scenario in hindsight); Reid Hastie, David A. Schkade & John W. Payne, *Juror Judgments in Civil Cases: Hindsight Effects on*

III. Variation Among Institutional Actors

Before turning to the data on nonobviousness decisions by various decision-makers in the patent system, it is worth exploring how the nonobviousness challenges outlined above might be expected to affect different decision-making entities. This variation could depend on the technological expertise of a given body, the procedural posture in which the nonobviousness decision presents itself, and other factors.

Nonobviousness issues arise in two different contexts in the patent system. First, nonobviousness decisions are made during patent prosecution when an applicant is applying for a patent.⁶³ Such procedures are *ex parte* and involve an initial determination of whether an invention is nonobvious.⁶⁴ The standard for review during patent prosecution is a preponderance of the evidence.⁶⁵

Second, once a patent is issued, it is entitled to a presumption of validity.⁶⁶ Subsequent challenges to a patent's validity may be brought at both the PTO and in federal court. Such challenges will situate in different procedural postures and evaluate patent validity under different standards.⁶⁷ Many will involve an adversarial party opposing the patent's validity.⁶⁸

At the PTO, subsequent to the AIA, there are a host of post-grant procedures that may be instituted to challenge an issued patent's validity. Each procedure is subject to different procedural requirements and different standards for initiation. Of primary concern here are post-grant review and *inter partes* review. Post-grant review is an adversarial proceeding brought before the PTAB by a third party to challenge a recently issued patent.⁶⁹ Post-grant review challenges must be brought within nine months after the grant of the patent or issuance of a reissue patent.⁷⁰ A third

Judgments of Liability for Punitive Damages, 23 LAW & HUM. BEHAV. 597, 606 (1999) (24% of mock jurors shifted decision concerning punitive damages in hindsight); Kamin & Rachlinski, *supra* note 52, at 98 (34% of mock jurors shifted decision concerning negligence in hindsight); Merrie Jo Stallard & Debra L. Worthington, *Reducing the Hindsight Bias Utilizing Attorney Closing Arguments*, 22 LAW & HUM. BEHAV. 671, 679 (1998) (28% of mock jurors shifted decision concerning negligence in hindsight).

⁶³ CHISUM, *supra* note 6, at § 11.03 (1)(c).

⁶⁴ Christopher A. Cotropia, *Predictability and Nonobviousness in Patent Law After KSR*, 20 MICH. TELECOMM. & TECH. L. REV. 391, 409 (2014); John M. Golden, *Patentable Subject Matter and Institutional Choice*, 89 TEX. L. REV. 1041, 1098 (2011); Melissa F. Wasserman, *The Changing Guard of Patent Law: Chevron Deference for the PTO*, 54 WM. & MARY L. REV. 1959, 2014 (2013).

⁶⁵ MANUAL OF PATENT EXAMINING PROCEDURE § 706.I.

⁶⁶ 35 U.S.C. § 282(a) (2012); *Microsoft Corp. v. i4i Ltd. P'ship*, 564 U.S. 91, 100 (2011).

⁶⁷ *Bristol-Myers Squibb Co. v. Teva Pharm. USA, Inc.*, 752 F.3d 967, 972–73 (Fed. Cir. 2014); *Abbott Labs. v. Cordis Corp.*, 710 F.3d 1318, 1320–21 (Fed. Cir. 2013); DONALD S. CHISUM, 6A-19 CHISUM ON PATENTS § 19.02 (2015).

⁶⁸ Christopher C. Kennedy, *Rethinking Obviousness*, 2015 WIS. L. REV. 665, 704–07.

⁶⁹ 35 U.S.C. § 321(a) (2012).

⁷⁰ 35 U.S.C. § 321(c) (2012).

party may challenge the patent on nearly any validity grounds.⁷¹ Inter partes review is likewise an adversarial proceeding brought before the PTAB by a third party to challenge a patent.⁷² Inter partes review challenges may only be brought after the nine-month post grant review window has passed.⁷³ Inter partes review is limited to novelty and nonobviousness validity issues, and only to such issues arising out of prior art consisting of patents or printed publications.⁷⁴ Patent invalidity challenges brought through post-grant review and inter partes review procedures are both subject to preponderance of the evidence standards.⁷⁵

Patent validity may also be challenged in federal court by an accused infringer. In these cases, the burden is on the challenger to prove invalidity by clear and convincing evidence.⁷⁶ How these different standards and situations may play out in the adjudicative process is discussed below.

A. The Narrowing Effect in Prosecution

For patent prosecution, one would anticipate a winnowing effect in nonobviousness decisions as a challenge progresses through the process. This narrowing should occur because patent applicants will only appeal adverse decisions. At each stage of prosecution there should be a winnowing as the “easy” cases involving valid patents are granted, and some percentage of denials are appealed. Some of the close cases that are denied at an earlier stage will succeed at a later stage, while most of the clear cases of denial will be denied subsequently as well. Through successive stages, most close cases would be expected to be eventually granted (if one flips a coin several times, odds are in the favor of getting at least one heads). This will leave a pool of cases at later stages that involve increasingly large percentages of applications that have been properly denied. As a result, the rates of invalidity in the patent prosecution process should continually increase as one moves through the various stages of the process.

This effect may be mitigated slightly by the added cost of appeals. To the extent patent applicants can correctly judge their likelihood of success on appeal, they will tend to appeal improperly denied applications to a greater extent than correctly denied applications. The cost of appeal, however, is generally relatively low relative to

⁷¹ § 321(b); Wasserman, *supra* note 64, at 1993.

⁷² 35 U.S.C. § 311(a) (2012) (stating that “[s]ubject to the provisions of this chapter, a person who is not the owner of a patent may file with the Office a petition to institute an inter partes review of the patent. The Director shall establish, by regulation, fees to be paid by the person requesting the review, in such amounts as the Director determines to be reasonable, considering the aggregate costs of the review”).

⁷³ § 311(c)(1).

⁷⁴ § 311(b).

⁷⁵ 35 U.S.C. §§ 316(e), 326(e).

⁷⁶ *Microsoft Corp. v. i4i Ltd. P’ship.*, 564 U.S. 91, 102 (2011).

the overall cost of patent prosecution,⁷⁷ so this difference would not be expected to create too significant of an effect.

This hypothesis concerning a winnowing effect through patent prosecution is based on the assumption that there is some correlation across adjudicative bodies in their decision-making analysis. That is, it is based on the presumption that nonobviousness decisions are not entirely indeterminate.

The model for patent prosecution is relatively straight-forward because it only involves a single decision-maker at each stage with respect to whether to continue to prosecute. For litigation, on the other hand, it takes two to tango.

B. Incentives to Litigate

In their seminal work on the incentives for parties to litigate, George Priest and Benjamin Klein hypothesized that litigants will tend to go to trial only in relatively uncertain cases.⁷⁸ If the case is not close, rational parties will settle.⁷⁹ Based on this rationale, we would expect litigants to have about a fifty-fifty chance of prevailing in most cases.⁸⁰ Priest's and Klein's hypothesis is subject to a number of qualifications, including that the parties have symmetric stakes.⁸¹

Patent disputes present a context in which parties often will have asymmetric stakes in the outcome. In many cases involving practicing entities, an accused infringer's risk is that they will have to pay the patent owner licensing fees if they lose or figure out how to design around the patented invention, whichever appears less expensive. If the patent owner loses on validity grounds, however, the patent owner will not only miss out on the accused infringer's potential licensing value, but will also suffer similar losses with respect to other licensees and may face greater competition from multiple parties as a result. These effects will vary based on the situation, but in many contexts patent owners may face far greater risks from invalidity than the risks accused infringers face from a finding of no invalidity.

For litigation by non-practicing patent owners, however, the incentives are different. Such owners only monetize their patent value through litigation or the threat of litigation.⁸² Consequently, they need to take the risk of litigation. For these rea-

⁷⁷ AIPLA, 2015 REPORT OF THE ECONOMIC SURVEY (2015); David Fagundes & Jonathan S. Masur, *Costly Intellectual Property*, 65 VAND. L. REV. 677, 689–90 (2012) (reporting that patentees spend an average of approximately \$22,000 to successfully prosecute a patent application).

⁷⁸ George L. Priest & Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J. LEGAL STUD. 1, 16–17 (1984).

⁷⁹ *Id.* at 17.

⁸⁰ *Id.*

⁸¹ *Id.* at 7, 24–29.

⁸² James Bessen & Michael J. Meurer, *The Direct Costs From NPE Disputes*, 99 CORNELL L. REV. 387, 390 (2014); David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System*, 99 CORNELL L. REV. 425, 429 (2014).

sons, patent validity litigation outcomes are not necessarily expected to result in evenly divided success rates for each side.

The effects described above will generally exist in adversarial post-grant challenges at the PTO as well. Parties choosing to challenge patents in post-grant procedures take the risk that a reaffirmation of patent validity will weaken their position going forward, while patentees face the prospect of patent invalidity. Depending on the context, these risks will often be asymmetrical, so it is not possible to predict an expected outcome rate *ex ante*.

C. Expertise and Experience

Several of the nonobviousness challenges identified above might be ameliorated by expertise in the pertinent technological field or by experience making nonobviousness decisions. Most explicitly, PTAB administrative judges have greater technical expertise than the average federal court judge.⁸³ This factor may assist them in evaluating nonobviousness from the perspective of the person of ordinary skill in the art.⁸⁴ Whether such expertise will tend to cause PTAB administrative judges to hold patent claims nonobvious at a greater or lesser rate is unclear: greater expertise may lead one to believe that an apparently inventive step is less substantial than it appears to lay individuals or greater expertise may highlight a cognitive leap that was required to achieve an advance.

PTAB administrative judges will also tend to have greater experience practicing patent law and will make many more nonobviousness decisions than federal judges. Studies of hindsight bias in other contexts have found that individuals familiar with a task, either because they have experienced it or because they are an expert in an area relevant to the task, demonstrate slightly less of a hindsight bias than individuals who are unfamiliar with the task.⁸⁵ The magnitude of the improvement, however, is small: the effect size of the hindsight bias for those familiar with the task is only 0.2 standard deviations less than for those unfamiliar with the task.⁸⁶ This expertise benefit is unlikely to accrue to most judges. Federal district court judges tend to hear few patent cases⁸⁷ and appear to hold inventions nonobvious at similar rates

⁸³ Christi J. Guerrini, *Defining Patent Quality*, 82 *FORDHAM L. REV.* 3091, 3120 n.150 (2014) (stating “[u]nlike PTAB judges, federal court judges are not required to have any technical expertise to hear patent cases”).

⁸⁴ Ryan R. Klimczak, *i4i and the Presumption of Validity: Limited Concerns Over the Insulation of Weak Patents*, 27 *BERKELEY TECH. L.J.* 299, 316, 319 (2012) (stating “the technical expertise of the PTO provides a more favorable forum for more conceptually challenging pieces of prior art and combinations of prior art that may be less accessible to judges and jurors in litigation”).

⁸⁵ Christensen-Szalanski & Willham, *supra* note 51, at 155.

⁸⁶ *Id.* This calculation is based on data for conditions in which an event did occur, the condition most appropriate for the non-obvious determination.

⁸⁷ Neil E. Graham, *Specialized Patent Trial Court, Judges, Debated at House Hearing on Patent Reform*, 70 *PAT., TRADEMARK & COPYRIGHT J. (BNA)* 657, 657 (2005) (citing the testimony of Kimberly A. Moore and John B. Pegram before the House Subcommittee on Courts, the Internet, and Intellectual Property). That being said, certain districts hear significantly more patent cases and a

as juries (who lack such experience).⁸⁸ Though Federal Circuit judges are in a different position, a study of cognitive biases among judges found that judges exhibited the “hindsight bias to the same extent as mock jurors and other laypersons.”⁸⁹

Neither technological expertise nor experience in making nonobviousness determinations, however, can ameliorate the indeterminacy of nonobviousness analysis. With the foregoing discussion as background, the following part presents the results of the instant nonobviousness study.

IV. Nonobviousness Decisions

As discussed above, nonobviousness decisions are made by a variety of decision-makers under differing procedural postures. Though the situational context is not identical between the various bodies, it is useful to compare nonobviousness rates to better understand what factors may be influencing nonobviousness decisionmaking and the effects of the challenges described earlier.

A. Methodology and Results

I collected data on the rates at which various tribunals held patent applications or patents obvious versus nonobvious. Only utility patents were considered and double-patenting decisions were removed from the dataset. The nonobviousness decisions are differentiated by tribunal (PTAB, district court, or Federal Circuit) and by the procedural posture of the validity issue (patent prosecution, inter partes review, or infringement litigation).⁹⁰ In each case, the data collection began with decisions issued on December 31, 2015 and worked backwards from that date until 100 reported decisions concerning nonobviousness had been identified for the particular tribunal in each procedural posture. Opinions that did not reach a final decision on the merits on the issue of nonobviousness are not included in the dataset. If there were not 100 pertinent decisions issued subsequent to March 16, 2013 (the effective date of the AIA’s first inventor to file regime), the data collection terminated at March 16, 2013.

One hundred decisions were identified for the PTAB prosecution and inter partes review proceedings, as well as for the district court infringement proceedings. There were no reported district court prosecution decisions for this time period.⁹¹

pilot program directs more cases to certain judges. 28 U.S.C. § 137 (2015).

⁸⁸ Allison & Lemley, *supra* note 11, at 214–15. Although the difference was not significant, judges did conclude that an invention was obvious more frequently than juries did. *Id.*

⁸⁹ Guthrie et al., *supra* note 62, at 803, 818.

⁹⁰ There are too few post-grant review nonobviousness decisions to date to provide statistically significant information.

⁹¹ A patent applicant who wants to appeal a denial by the PTAB may appeal either to the District Court for the Eastern District of Virginia or directly to the Federal Circuit. 35 U.S.C. §§ 141, 145 (2012). The vast majority of applicants appeal directly to the Federal Circuit, as confirmed in the data here, but applicants may appeal to the District Court in order to introduce new evidence or for other reasons. § 145.

Federal Circuit prosecution and infringement decisions did not reach the 100-case threshold; there were forty-one and fifty-six reported decisions, respectively, in these contexts here. The patent prosecution data is reported in Table 1 and the validity challenge data in Table 2. The PTAB inter partes review data is included with the district court and Federal Circuit infringement litigation data because all involve adversarial challenges to granted patents.

Tribunal	N	Date range	Nonobviousness rate
PTAB	100	Dec. 22, 2015 – Dec. 31, 2015	37%
District Court	0	Mar. 16, 2013 – Dec. 31, 2015	N/A
Federal Circuit	41	Mar. 16, 2013 – Dec. 31, 2015	10%

Table 1. Patent Prosecution Nonobviousness Rates.

Tribunal	Proceeding	N	Date range	Nonobviousness rate
PTAB	Inter Partes Review	100	Sep. 23, 2015 – Dec. 31, 2015	21%
District Court	Infringement Litigation	100	Oct. 17, 2013 – Dec. 31, 2015	58%

Federal Circuit	Infringement Litigation	56	Mar. 16, 2013 – Dec. 31, 2015	54%
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Table 2. Patent Invalidation Challenge Nonobviousness Rates.

B. Discussion

The results of the nonobviousness analysis provide a variety of evidence concerning the effects of each of the three nonobviousness challenges identified above.

1. Indeterminacy

One way to evaluate the extent of indeterminacy in a legal standard is the likelihood that two similarly situated decision-makers will reach differing conclusions on the same legal issue. A rule that tends to result in similar outcomes among varied decision-makers is more determinate than a rule that tends to result in widely varied decisions. This variation is particularly easy to evaluate on binary issues such as nonobviousness.

Viewed through this lens, the results here appear to affirm the hypothesis that nonobviousness is a significantly indeterminate standard. The most direct evidence is the PTAB's rate of holding at least some claims to be nonobvious in 37% of patent prosecution appeals. In these circumstances, the PTAB is evaluating the same evidence as the patent examiner. Where the patent examiner concluded that the claim at issue was obvious, 37% of the time the PTAB concluded the opposite. If nonobviousness decisions were being decided randomly (e.g., a flip of a coin), we would expect a nonobviousness rate of 50% in PTAB prosecution appeals; 37% is not far off. Accordingly, the data indicates a highly indeterminate nonobviousness standard.

Various selection effects may be affecting these results. For example, patent applicants may be more likely to appeal perceived close nonobviousness cases or may hire more experienced attorneys to handle PTAB appeals. Either situation could help explain why the PTAB's reversal rate is so high. Arguably, the former explanation would require that patent applicants could identify which are the close or incorrectly decided nonobviousness cases more successfully than patent examiners. Though plausible, this explanation does not seem highly likely, and would raise significant concerns about the ability of patent examiners to judge nonobviousness in general.

In addition, the selection effects likely do not provide a full explanation of the high PTAB nonobviousness rate because of the relatively inexpensive cost of appeal and the asymmetric benefits of appeal. As noted above, appeal to the PTAB adds only a modest expense above the total cost of patent prosecution. This suggests that

for economically-rational actors it is worth it to appeal in many cases in which a patent application is rejected. Further, there are asymmetric benefits to appeal for the patent applicant. If the applicant loses, the applicant's only loss is the cost of the appeal. If the applicant prevails, the applicant receives the full benefit of a patent grant. For these reasons, we would actually expect to see a high volume of appeals and a low success rate. The high rate of nonobviousness reversals by the PTAB is strong evidence of significant nonobviousness indeterminacy.

That being said, the nonobviousness standard is not fully indeterminate. Not only does the PTAB affirm the examiner's decision on obviousness 63% of the time, but the Federal Circuit concurs with the PTAB's nonobviousness decision 90% of the time. Though it is possible that some of this agreement is due to deference, the Federal Circuit's willingness to reverse other appealed issues at higher rates⁹² indicates that this is not the full explanation.

The relationship between the Federal Circuit's nonobviousness rate in patent prosecution and the PTAB's rate also appears to confirm the winnowing hypothesis. The Federal Circuit's nonobviousness rate is significantly lower than the PTAB's.

With respect to indeterminacy, it is also worth considering the substantial difference in Federal Circuit nonobviousness reversal rates across the different validity contexts. The Federal Circuit reverses only 10% of appeals from the PTAB in patent prosecution, but holds nearly 50% of patent claims invalid for obviousness in infringement litigation.⁹³ There are several explanations that could explain the Circuit's apparent strong deference to or agreement with the PTO in patent prosecution decisions where the PTO concludes that an invention is obvious versus the Circuit's strong disagreement with PTO decisions that an invention is nonobviousness and entitled to a patent. Perhaps most significantly, patent prosecution is an *ex parte* proceeding, with only the patent applicant and the PTO providing arguments for the Circuit. In the infringement context, an adversarial party is not only present before the court to argue obviousness, but may also have introduced additional evidence of obviousness at trial.

There are alternative explanations for the variation in Federal Circuit nonobviousness decisions in the different contexts. The Federal Circuit may perceive that the PTO is more likely to erroneously grant a patent than it is to erroneously deny a patent. This possibility would be consistent with criticisms of the PTO as being too liberal in granting patents.⁹⁴ Selection effects may be contributing to the disparity.

⁹² J. Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 NW. U. L. REV. 1, 1 (2013); David L. Schwartz, *Practice Makes Perfect? An Empirical Study of Claim Construction Reversal Rates in Patent Cases*, 107 MICH. L. REV. 223, 223 (2008).

⁹³ The degree to which the rate is understated may not be very significant; most district court patent decisions appear to be appealed to the Federal Circuit. Ryan Holte & Christopher Seaman, *Injunctions on Appeal: An Empirical Study of the Federal Circuit's Application of eBay* (forthcoming).

⁹⁴ See, e.g., Michael D. Frakes & Melissa F. Wasserman, *Does the U.S. Patent and Trademark Office*

Parties challenging patents may be able to successfully identify questionable patents that are particularly susceptible to validity challenges. This possibility cannot explain the full effect, however, because most defendants in infringement lawsuits were unknowing infringers and did not choose to challenge the patent's validity prior to litigation.⁹⁵ In addition, third parties are expected to challenge valuable patents as well as weak patents.⁹⁶ The selection of patents for challenge based on their value is not likely to correlate with obviousness. The varying contexts do not allow us to parse which of these explanations is more accurate, or whether the outcomes result from some combination of these effects.

With regard to the potential differences between the prosecution and infringement contexts, it is worth noting the nearly identical rates of reversal between the PTAB's nonobviousness decisions in patent prosecution (37%) and district court decisions in infringement proceedings (42%). The former is based on appeals by the patentee because the PTO examiner concluded an invention was obvious; the latter is based on appeals by a third party where the PTO concluded that an invention was nonobvious. A simple explanation for the similarity of these results is a symmetrical indeterminacy in the nonobviousness requirement, with the PTO being perceived by the PTAB or district courts to have erred about 40% of the time. This suggests that the adversarial nature of infringement proceedings, as well as the potential introduction of new evidence of obviousness, may not play that significant a role in nonobviousness decisions.

The PTAB, on the other hand, has an extraordinarily high reversal rate in inter partes review proceeding nonobviousness decisions (79%). This reversal rate is essentially identical to the 77% rate found in other studies that have examined inter partes reversal rates in general, not just nonobviousness decisions.⁹⁷ Some of the discrepancy between inter partes review and district court infringement rates may be due to the different burden of proof that is applied in the two contexts. Inter partes review requires proof of obviousness by a preponderance of the evidence, while establishing invalidity in an infringement proceeding requires clear and convincing evidence.⁹⁸ This difference, however, hardly seems capable of explaining the extent of the difference, particularly as the effect of differing burdens of proof is not

Grant Too Many Bad Patents?: Evidence From A Quasi-Experiment, 67 STAN. L. REV. 613, 615 (2015) (noting, “[m]any believe the root cause of the patent system’s dysfunction is that the U.S. Patent and Trademark Office (PTO or Agency) is issuing too many invalid patents”); Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY L.J. 181, 185 (2008) (explaining that there is a “widespread perception that the PTO is acting as a rubber stamp, regularly issuing bad patents that wind up imposing costs on others”).

⁹⁵ Christopher Seaman, *Willful Patent Infringement and Enhanced Damages After In re Seagate: An Empirical Study*, 97 IOWA L. REV. 417, 441 (2012).

⁹⁶ Anup Malani & Jonathan S. Masur, *Raising the Stakes in Patent Cases*, 101 GEO. L.J. 637, 640 (2013) (stating “challengers tend to target holders of the most profitable and (and often most socially valuable) patents.”).

⁹⁷ Brian J. Love & Shawn Ambwani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CHI. L. REV. DIALOGUE 93, 94 (2014).

⁹⁸ 35 U.S.C. § 316(e); *Microsoft Corp. v. i4i Ltd. P’ship*, 564 U.S. 91, 91 (2011).

clear.⁹⁹ The high rates of inter partes review reversals have led to significant critique of the PTAB, perhaps most famously including then-Federal Circuit Chief Judge Randall Rader referring to the PTAB as a “death squad” for patents.¹⁰⁰

2. Are PTAB Administrative Judges Better Able to Judge Ordinary Skill in the Art?

The second nonobviousness challenge concerned the difficulty of making a judgment from another person’s perspective. Though everyone faces this challenge, it is possible that technologically sophisticated parties would be better able than scientifically lay individuals to make a judgment about whether a given invention would have been obvious to a person of ordinary skill in the art. Determining whether such an effect exists is difficult to evaluate because a greater ability to make a judgment from the perspective of a PHOSITA could lead to either a (more accurate) conclusion of obviousness or a (more accurate) conclusion of nonobviousness. That is, there is no way to know *ex ante* what relationship to expect between judgments by technologically sophisticated parties and scientifically lay individuals because we do not know in any given case whether an invention is actually obvious or nonobvious.

Some data that may shed light on this issue is a comparison of the correlation between PTAB and patent examiner decisions on the one hand, and the correlation between PTAB and federal judge decisions on the other. PTAB administrative judges and patent examiners are all technologically sophisticated parties.¹⁰¹ Most federal judges are not.¹⁰² If technological sophistication has a significant effect on nonobviousness decisions, then we would expect there to be a high rate of correlation between technologically sophisticated parties and a lower rate of correlation when comparing a technologically sophisticated decision-maker to a lay decision-maker. What we find is just the opposite. There is a relatively weak correlation between patent examiner and PTAB decisions: the PTAB reverses 37% of patent examiner nonobviousness decisions and an extraordinary 79% of inter partes review challenged patents.¹⁰³ There is a strong correlation, however, between the Federal Circuit and PTAB nonobviousness decisions during patent prosecution: the Federal Circuit reverses only 10% of the PTAB’s decisions here.

The data is inconsistent with the hypothesis that technological expertise has a significant effect on nonobviousness decisions, and therefore it is inconsistent with the hypothesis that technological expertise helps decision-makers reach significantly more accurate nonobviousness decisions. It is still possible that technological so-

⁹⁹ Dorothy K. Kagehiro & W. Clark Stanton, *Legal vs. Quantified Definitions of Standards of Proof*, 9 LAW & HUM. BEHAV. 159, 163–73 (1985) (discussing an empirical study finding that different standards of proof produced similar jury verdicts).

¹⁰⁰ Peter J. Pitts, *‘Patent Death Squads’ vs. Innovation*, WALL ST. J., June 10, 2015, at A13.

¹⁰¹ Klimczak, *supra* note 84, at 316, 319; Guerrini, *supra* note 83, 3120 n.150.

¹⁰² Klimczak, *supra* note 84, at 316, 319; Guerrini, *supra* note 83, 3120 n.150.

¹⁰³ *Supra* Table 1.

phistication helps with the nonobviousness inquiry, but that this benefit is swamped by other effects in the data (such as indeterminacy, hindsight bias, and selection effects). Overall, it does not appear that technological sophistication significantly improves nonobviousness decisionmaking.

3. Hindsight Bias

Hindsight bias has been found to affect all decision-makers who attempt to judge an issue *ex ante* once they have *ex post* knowledge.¹⁰⁴ In the present circumstances, hindsight bias will tend to make inventions appear more obvious than they actually were at the time of filing. There is evidence, however, that decision-makers who are expert in a given field or familiar with the type of decision may suffer less of a hindsight bias.¹⁰⁵ If this effect manifests in nonobviousness decisions, then we would expect experts to tend to find inventions nonobvious more often than non-experts.

There is some evidence for this effect in the data. Most significantly, while the PTAB reached a conclusion of nonobviousness in patent prosecution appeals 37% of the time, the Federal Circuit only held claims nonobvious 10% of the time in such appeals.¹⁰⁶ However, as discussed above, there are winnowing and selection effects that may be affecting these results as well. Because patent applicants will only appeal contrary decisions, the pool of patent prosecution appeals that the Federal Circuit hears should include fewer close cases than the pool appealed to the PTAB. That being said, the PTAB's cases have already been appealed from a patent examiner. If we make the rough assumption of a similar winnowing effect at each stage in the process, there still appears to be some additional effect at the Federal Circuit stage that could be due to a greater hindsight effect. This effect, however, could also be due to other factors, such as the types of selection effects described above or possibly Federal Circuit deference to PTAB decisions. Teasing apart the influences of these different effects is not possible with this dataset.¹⁰⁷

The patent invalidity challenge data is inconsistent with the hypothesis that decisionmaking expertise reduces the hindsight bias in nonobviousness decisions because the PTAB finds patents challenged in *inter partes* review to be obvious 79% of the time, while district court judges find them to be obvious just 42% of the time. As explained above, however, *inter partes* review has been particularly problematic for patentees, and there are likely other influences that are driving these results, making any comparison problematic.

C. Comparison with Prior Periods

¹⁰⁴ *Supra* Part I.C.

¹⁰⁵ Christensen-Szalanski & Willham, *supra* note 51, at 155.

¹⁰⁶ *Supra* Table 1.

¹⁰⁷ That the effect may be due to some deference does not mean that benefits of expertise and experience with respect to the hindsight bias are irrelevant. It is possible that the Federal Circuit defers to the PTAB because of the PTAB's perceived expertise.

Nonobviousness decisionmaking has been studied across other periods of time in various tribunals and these prior studies provide additional context for understanding the instant results. Table 3 displays the results of previous studies of non-obviousness decisions for time periods prior to the Supreme Court's decision in *KSR v. Teleflex*, and Table 4 displays the results for studies of nonobviousness decisions between *KSR v. Teleflex* and the AIA.

Tribunal	Proceeding	Authors	Time period	Nonobviousness rate
District Court & Federal Circuit	Infringement	Allison & Lemley ¹⁰⁸	1989-1996	64%
District Court	Infringement	McEldowney ¹⁰⁹	1995-2000	69%
District Court	Infringement	Mojibi ¹¹⁰	2004-2007	94%
Federal Circuit	Prosecution	Petherbridge & Wagner ¹¹¹	1990-2005	31%
Federal Circuit	Prosecution	Rantanen ¹¹²	1997-2007	17%
Federal Circuit	Prosecution	Cotropia ¹¹³	2002-2005	8%
Federal Cir-	Infringement	Petherbridge &	1990-2005	~50% ¹¹⁵

¹⁰⁸ Allison, *supra* note 11, at 209 tbl.2.

¹⁰⁹ Sean M. McEldowney, *New Insights on the "Death" of Obviousness: An Empirical Study of District Court Obviousness Opinions*, 2006 STAN. TECH. L. REV. 4, *32 tbl.2 (2006).

¹¹⁰ Ali Mojibi, *An Empirical Study of the Effect of KSR v. Teleflex on the Federal Circuit's Patent Validity Jurisprudence*, 20 ALB. L.J. SCI. & TECH. 559, 583 fig.2 (2010).

¹¹¹ Lee Petherbridge & R. Polk Wagner, *The Federal Circuit and Patentability: An Empirical Assessment of the Law of Obviousness*, 85 TEX. L. REV. 2051, 2081-82 (2007).

¹¹² Jason Rantanen, *The Federal Circuit's New Obviousness Jurisprudence: An Empirical Study*, 16 STAN. TECH. L. REV. 709, 737 tbl.1 (2013).

¹¹³ Christopher A. Cotropia, *Nonobviousness and the Federal Circuit: An Empirical Analysis of Recent Case Law*, 82 NOTRE DAME L. REV. 911, 937 (2007).

cuit		Wagner ¹¹⁴		
Federal Circuit	Infringement	Cotropia ¹¹⁶	2002-2005	56%
Federal Circuit	Infringement	Rantanen ¹¹⁷	1997-2007	57%

Table 3. Pre-KSR v. Teleflex Nonobviousness Studies

Tribunal	Proceeding	Authors	Time period	Nonobviousness rate
Federal Circuit	Prosecution	Nock & Gaddie ¹¹⁸	2007-2009	0%
Federal Circuit	Prosecution	Rantanen ¹¹⁹	2007-2012	4%
District Court	Infringement	Mojibi ¹²⁰	2007-2009	59%
Federal Circuit	Infringement	Nock & Gaddie ¹²¹	2007-2009	45%
Federal Circuit	Infringement	Rantanen ¹²²	2007-2012	43%

Table 4. Post-KSR v. Teleflex Nonobviousness Studies

¹¹⁵ Petherbridge's and Wagner's article does not directly report this rate, but it can be approximately deduced from the data that is reported. *Id.*

¹¹⁴ Petherbridge & Wagner, *supra* note 111, at 2081-82.

¹¹⁶ Cotropia, *supra* note 113, at 934.

¹¹⁷ Rantanen, *supra* note 112, at 738.

¹¹⁸ Jennifer Nock & Sreeker Gaddie, *Raising the Bar for Nonobviousness: An Empirical Study of Federal Circuit Case Law Following KSR*, 20 FED. CIR. B.J. 369, 404 (2011).

¹¹⁹ Rantanen, *supra* note 112, at 737 tbl.1.

¹²⁰ Mojibi, *supra* note 110, at 583 fig.2.

¹²¹ Nock & Gaddie, *supra* note 118, at 395.

¹²² Rantanen, *supra* note 112, at 737 tbl.1.

For patent prosecution validity appeals from the PTO in the decade prior to *KSR v. Teleflex*, the Federal Circuit reversed the PTO's conclusion of obviousness in about 8% to 17% of cases.¹²³ The Federal Circuit became more deferential in the five years subsequent to *KSR*, reversing the PTO in just 4% of cases. The present study indicates that, subsequent to the AIA, the Federal Circuit appears to have loosened the reins slightly again, returning to the pre-*KSR* rate of reversing about 10% of PTO decisions to hold an invention nonobvious.

Patent infringement decisions display a similar *KSR* effect. The Federal Circuit upheld patents as nonobvious in about 57% of infringement cases in the decade prior to *KSR v. Teleflex*, and became significantly more stringent following *KSR*, upholding patents in 43% of cases.¹²⁴ The data in the current study indicates that the Federal Circuit appears to be drifting back to its pre-*KSR* nonobviousness rate in validity challenges in infringement proceedings as well. Over the past three years, the Federal Circuit has held patents to be nonobvious in 54% of such cases. In each context, the Federal Circuit's reaction to *KSR* appears to have dissipated subsequent to the AIA.

District court nonobviousness decisions follow a different pattern than the Federal Circuit. District courts upheld patents as nonobvious in some 69–94% of cases prior to *KSR*, and then dropped down to a rate of 59% following the Supreme Court's decision.¹²⁵ This rate appears to have held subsequent to the AIA, standing at 58% in the instant study. Unlike the Federal Circuit, *KSR* appears to have had a longer term impact on district court nonobviousness decisions.

The data from the prior studies is also consistent with the results of the present analysis in indicating that the Federal Circuit is much more deferential to the PTO in patent prosecution appeals than it is in infringement cases. Patent applicants rarely succeed in challenging the PTO's nonobviousness decision before the Federal Circuit. Accused infringers, on the other hand, have significant success in convincing the Federal Circuit that the PTO erred in granting the patent at issue.

V. Conclusion

The data presented here paint a challenging picture for nonobviousness decisions. The results indicate a highly indeterminate standard based on the significant rates of disagreement across the various tribunals. In addition, the data does not support the hypothesis that technologically sophisticated decision-makers are better able to make judgements from the perspective of a person of ordinary skill in the art. Finally, the analysis provides potential support for the possibility that technologically trained individuals may experience slightly less of a hindsight bias than untrained decision-makers. Because it is not possible to know whether any given

¹²³ *Supra* Table 3.

¹²⁴ *Supra* Table 3, Table 4.

¹²⁵ *Supra* Table 3, Table 4.

invention is actually nonobvious, however, we cannot reach definitive conclusions on these matters.