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# The Non-Obvious Problem: How the Indeterminate Nonobviousness Standard Produces Excessive Patent Grants

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*The dominant current perception in patent law is that the core requirement of nonobviousness is applied too leniently, resulting in a proliferation of patents on trivial inventions that actually retard technological innovation in the long run. This Article reveals that the common wisdom is only half correct. The nonobviousness standard is not too low, but both too high and too low. It is indeterminate. Three principal factors produce nonobviousness indeterminacy: a failure to identify the quantum of innovation necessary to satisfy the standard, a failure to define the baseline level of ordinary skill against which to measure an innovation, and the epistemic infeasibility of requiring a technologically lay decision maker to judge from the perspective of a more highly trained and educated person of ordinary skill in the art.*

*This Article introduces a mathematical model of innovation and patenting to analyze the effects of nonobviousness indeterminacy. Based on the model, indeterminacy in nonobviousness decisions has several unexpected consequences. First, indeterminacy results in an excessive total number of patent grants, and in many patent grants on obvious inventions. Second, indeterminacy leads to too many patent applications on obvious inventions and too few applications on non-obvious inventions.*

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Third, uncertainty causes more patent litigation than is optimal and leads to incorrect litigation outcomes. Fourth, indeterminacy leads to inefficiently low incentives to research and develop great advances, and excessively high incentives to invest in mundane innovation. All of these effects occur even assuming that decision makers apply the nonobviousness standard correctly on average.

That many of the current patent system ills may result from indeterminacy rather than from too low a nonobviousness standard has significant consequences for the patent system and for current recommendations for reform. Perhaps most critically, arguments for raising (or lowering) the nonobviousness threshold, a mainstay of recent legal and economic analysis, may be somewhat inapposite, unless and until we can establish greater specificity in the standard. This Article concludes with several recommendations for improving determinacy in nonobviousness decisions, including differentiating nonobviousness analysis and developing a substantive nonobviousness standard.

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#### INTRODUCTION

A dark storm is brewing around the core requirement that an invention be non-obvious to receive a patent. A loud, nearly universal, chorus contends that decision makers apply the nonobviousness standard too leniently, allowing patent monopolies on trivial innovations with devastating effects. Inventors cannot conduct research because patent thickets block their way. Patent trolls lurk in the shadows, waiting to jump out and hold-up true innovators. Any attempt to market genuinely pioneering subject matter requires navigating a patent minefield.

These are colorful stories. The commonly attributed cause of the stories — too low a nonobviousness standard — however, is only half correct. The nonobviousness standard is not simply too low, but both too high and too low. It is indeterminate. Though the United States Supreme Court has issued eight decisions on nonobviousness, it has never defined this most critical patent validity requirement.<sup>1</sup> Rather, the Court has focused almost exclusively on the factual underpinnings that help inform the nonobviousness analysis. This misdirection has blinded many from the lapse that the standard itself remains unformulated.

The nonobviousness standard is not the only indeterminacy problem. Nonobviousness is judged not from the perspective of a lay individual, but from the perspective of a person having ordinary skill in the art. This hypothetical person of ordinary skill represents a baseline against which the degree of innovation of an invention is measured. For an invention to receive a patent, it must represent a non-obvious advance over the baseline. Though there is some doctrine describing the person of ordinary skill, this standard remains substantially open-ended. In particular, the level of ordinary skill is usually determined based on tautological reasoning and improper hindsight.

In addition to these indeterminacy challenges, the nonobviousness problem is compounded by requiring lay decision makers to judge whether a given advance would have been obvious from the perspective of another — the person of ordinary skill. Such a judgment is epistemically impractical. Due to the “curse of

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<sup>1</sup> See *infra* Part I.A.

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knowledge,” individuals are cognitively incapable of accurately making judgments from other individuals’ perspectives.<sup>2</sup> Nonobviousness exacerbates this problem by requiring lay individuals to make a judgment from the perspective of a more highly educated and trained person of ordinary skill. These indeterminacy and epistemic problems cause nonobviousness decisions to be inconsistent and unpredictable.

This Article introduces a mathematical model of innovation and patenting to analyze the effects of nonobviousness indeterminacy. Based on this model, indeterminacy in nonobviousness decisions has several dramatic and unexpected consequences. First, inconsistent application of the nonobviousness standard results both in too many patent grants on average and in too many patent grants on obvious inventions. Second, inconsistency leads to too many patent applications on obvious inventions and to too few applications on non-obvious inventions. Third, inconsistent application of the nonobviousness requirement causes more patent litigation than is optimal, and leads to affirmation of patents on obvious inventions and invalidation of patents on non-obvious inventions. Fourth, indeterminacy leads to inefficiently low incentives to research and develop great advances, and excessively high incentives to invest in mundane innovation. These effects all occur even assuming that decision makers apply the nonobviousness standard correctly on average.

Unlike prior analyses of nonobviousness,<sup>3</sup> often based on anecdotal extrapolation, this model reveals that the recent perceived surge in patent grants on obvious inventions may result not from too low a nonobviousness standard, but from an indeterminate nonobviousness requirement. Under the model, the problems of patent thickets, anticommons, patent trolls, patent minefields, and patent hold-ups all occur even if the nonobviousness standard is not applied too leniently, but is applied correctly on average. An advantage of this analysis is that the conclusions do not rely on any normative claim concerning where the nonobviousness threshold should be set or any descriptive identification of where the nonobviousness threshold currently is set — both oft-attempted but seemingly irresolvable inquiries. Rather, the conclusions result simply from demonstrating that the nonobviousness standard is indeterminate and cannot be applied consistently as currently construed.

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<sup>2</sup> See *infra* Part II.B.

<sup>3</sup> See *infra* note 144.

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The teachings of this model have significant consequences for the patent system and recommendations for patent reform. In particular, the model suggests that arguments for raising (or lowering) the nonobviousness threshold, a mainstay of recent legal and economic analysis, may be somewhat inapposite, unless and until we can establish greater specificity in the standard. This new understanding suggests means to simultaneously reduce both erroneous patent grants and denials — an outcome, unlike many other proposals, that does not require biasing the nonobviousness standard to err on one side or another. Consequently, this analysis reveals a way out of the constant historical oscillation between too strict and too lenient application of the nonobviousness requirement.<sup>4</sup> This oscillation results, in part, from a malleable standard that produces significant overcorrections each time nonobviousness decisions are perceived as being skewed too far in one direction or the other. Rather than succumbing to one more excessive swing of this pendulum, this Article offers insight into how to simultaneously dampen the doctrinal swings and improve the accuracy of nonobviousness decisions.

Increasing the determinacy of the nonobviousness standard is not an easy task. Legal experts have struggled with this challenge for over 150 years.<sup>5</sup> Nevertheless, this Article provides several suggestions in light of its new perspective.

First, nonobviousness analyses should be differentiated. Patent doctrine should recognize that different inventions may be non-obvious for different types of reasons. Some inventions are non-obvious in their conception, though once conceived are easy to achieve. Post-It notes provide an example. Other inventions are obvious to conceive of, but identifying operative means for carrying them out is non-obvious — an HIV vaccine, for instance. A third category comprises inventions where potential operative means are obvious, but the field is uncertain enough that actually reducing the invention to practice is non-obvious. For example, several inventors developed incandescent light bulbs before Thomas Edison, but their filaments burned out quickly; Edison was the first to reduce a long-lasting filament to practice.<sup>6</sup> Differentiating nonobviousness would improve the content and specificity of nonobviousness decisions by sharpening their focus and producing more tractable analyses.

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<sup>4</sup> See *infra* Part III.A.

<sup>5</sup> See *infra* Part I.C.1.

<sup>6</sup> *Consol. Elec. Light Co. v. McKeesport Light Co.*, 159 U.S. 465, 472-73 (1895).

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A separate recommendation is for a substantive nonobviousness standard. This Article forgoes the typical approaches of attempting to use “but-for” or “promoting progress” tests as proxies for nonobviousness, tests that even proponents acknowledge are not practical in individual cases.<sup>7</sup> Rather, the standard for nonobviousness should be based on how probable the invention would have been for a person having ordinary skill in the art working on the problem that the invention solves. This test is more closely equivalent to the nonobviousness standard, solves a number of outstanding ambiguities concerning the person of ordinary skill, and is more practical to implement than other proposals.

Following these recommendations will not eliminate uncertainty in applying the nonobviousness requirement. The proposals could, however, substantially reduce the indeterminacy in this central patent standard, and consequently improve the accuracy of patent decisions and promote the innovation and incentive goals of the patent system.

#### I. INDETERMINACY IN THE NONOBVIOUSNESS STANDARD

The core requirement for obtaining a patent is that the invention was not obvious at the time it was made.<sup>8</sup> An inventor does not receive a patent for a merely new and useful invention, but only for an invention that measures a significant advance over existing technology (referred to as “prior art” in patent law). The nonobviousness requirement protects society against the social costs both of denying a deserving patent and of granting an undeserving monopoly.<sup>9</sup> Improper application of the nonobviousness standard results either in inefficiently low incentives to innovate (reducing technological innovation) or permits the patenting of trivial advances, leading to patent thickets and other inefficiencies, and similarly reducing future technological advance.<sup>10</sup> Patent litigation demonstrates the

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<sup>7</sup> See *infra* Part I.C.2.

<sup>8</sup> DONALD CHISUM, CHISUM ON PATENTS § 5.02[6] (2007); NONOBVIOUSNESS — THE ULTIMATE CONDITION OF PATENTABILITY 2:101 (J. Witherspoon ed., 1980); Hon. Giles S. Rich, *Laying the Ghost of the “Invention” Requirement*, 1 APLA Q. J. 26, 29-30 (1972). To receive a patent, an invention must also satisfy subject matter, utility, novelty, and adequate disclosure validity requirements. 35 U.S.C. §§ 101-02, 112 (2000).

<sup>9</sup> *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 151, 156 (1989) (stating that 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”).

<sup>10</sup> FED. TRADE COMM’N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF

importance of the nonobviousness requirement; it is the most commonly litigated patent validity issue and the requirement most likely to result in patent invalidation.<sup>11</sup> The nonobviousness requirement stands at the center of innovation policy and the technology economy in the United States.

Section 103 of the Patent Act establishes the nonobviousness requirement, providing that a patent may not be obtained on an invention:

if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.<sup>12</sup>

The statutory nonobviousness standard thus requires an inquiry that involves several elements. The first is determining what a person of ordinary skill in the art would have already known. This (then-)current state-of-the-art presents a baseline against which to measure nonobviousness. The second is establishing the quantum of innovation beyond the baseline necessary to satisfy nonobviousness. The final element requires measuring the advance provided by the invention over prior art.<sup>13</sup> Combining these three elements answers the ultimate nonobviousness question: whether the inventor's advance over the baseline exceeds the required quantum necessary to satisfy the § 103 standard (see Figure 1).

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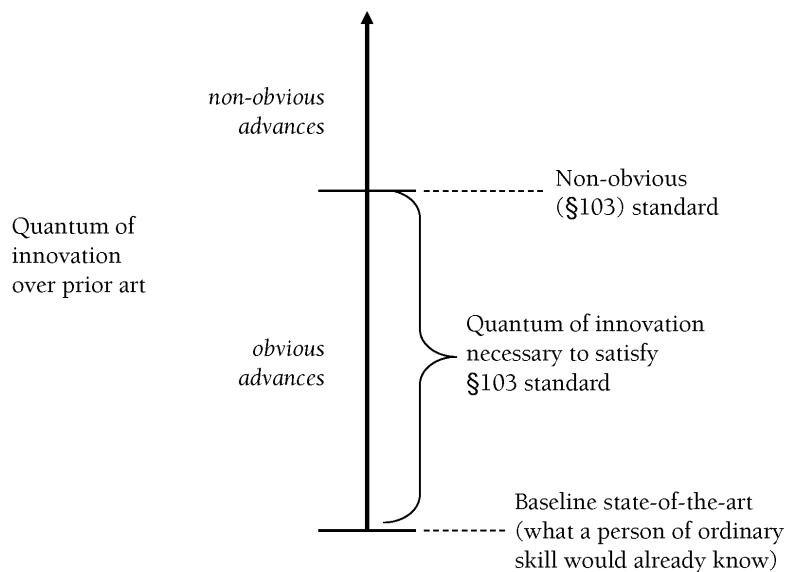
COMPETITION AND PATENT LAW AND POLICY, ch. 4, at 6-7 (2003); ROBERT MERGES & JOHN DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 646-47 (3d ed. 2002); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1577, 1586 (2003).

<sup>11</sup> John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q. J. 185, 208-09 (1998).

<sup>12</sup> 35 U.S.C. § 103(a) (2000). The patent reform bills currently pending in Congress do not materially affect the issues discussed here. See Patent Reform Act of 2007, H.R. 1908, 110th Cong. 7-10, 1st Sess. (2007); Patent Reform Act of 2007, S. 1145, 110th Cong. 55-61, 1st Sess. (2007).

<sup>13</sup> See Christopher Cotropia, *Nonobviousness as an Exercise in Gap Measuring*, in INTELLECTUAL PROPERTY AND INFORMATION WEALTH: ISSUES AND PRACTICES IN THE DIGITAL AGE, VOLUME 2: PATENTS AND TRADE SECRETS 25-26 (Peter K. Yu ed., 2007) (discussing difference between invention and prior art as gap representing degree of technological progress produced by invention).

Figure 1. The Section 103 non-obvious standard.



Current nonobviousness doctrine is indeterminate because neither the measure of ingenuity necessary to satisfy the standard nor the manner of determining the level of ordinary skill in the art is adequately defined. The failure to define the quantum of advance required may be the most spectacular flaw. Despite issuing eight opinions on nonobviousness, most recently last term, the Supreme Court has provided almost no guidance concerning either what degree of ingenuity is necessary to meet the standard or how a decision maker is supposed to evaluate whether the differences between the invention and the prior art meet this degree. Federal Circuit doctrine also fails to fill this gap.

The Supreme Court and Federal Circuit have provided some instruction on determining the level of ordinary skill in the art. However, as explained below, this instruction is both incomplete and not sufficiently germane to the appropriate nonobviousness inquiry.

#### A. *The Undefined Nonobviousness Standard*

Nonobviousness is a mixed question of fact and law.<sup>14</sup> The factual part of the inquiry concerns the prior art, the differences between the

<sup>14</sup> *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17 (1966).



invention and the prior art, the level of skill in the art, and other considerations.<sup>15</sup> The legal part of the 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.<sup>16</sup> The Supreme Court has delineated only limited aspects of the nonobviousness inquiry. The opinions have either developed the jurisprudence of the factual portion of the inquiry or have stated a conclusion concerning the legal part of the inquiry (some opinions do both). The opinions have not, however, developed the legal standard of nonobviousness.

### 1. The Trilogy

*Graham v. John Deere*,<sup>17</sup> and its companion cases, *Calmar v. Cook Chemical*<sup>18</sup> and *United States v. Adams*<sup>19</sup> (collectively referred to as the “Trilogy”), represent the Supreme Court’s first interpretation of the statutory nonobviousness requirement.<sup>20</sup> The principal issue in the Trilogy cases is establishing the level of ingenuity necessary to satisfy § 103’s nonobviousness requirement, which Congress added to the Patent Act in 1952. The Supreme Court explained that the question in each case was “what effect the 1952 Act had upon traditional statutory and judicial tests of patentability and what definitive tests are now required.”<sup>21</sup> The Court concluded that the § 103 standard “was intended to codify judicial precedents . . . [and that] the general level of innovation necessary to sustain patentability remains the same.”<sup>22</sup>

The predicament created by the Court’s holding that § 103 simply codified the earlier judicially created requirement of “invention” is that the level of ingenuity necessary to satisfy the prior standard was not well defined and it was heavy criticism of the amorphousness of

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<sup>15</sup> *Id.* The other considerations include objective evidence of obviousness. See *supra* Part I.A.1.

<sup>16</sup> *Graham*, 383 U.S. at 17.

<sup>17</sup> 383 U.S. 1 (1966).

<sup>18</sup> 380 U.S. 949 (1965).

<sup>19</sup> 383 U.S. 39, 51-52 (1966).

<sup>20</sup> *Graham*, 383 U.S. at 3.

<sup>21</sup> *Id.*

<sup>22</sup> *Id.* at 3-4. One of the primary drafters of § 103 disputes the Supreme Court’s conclusion, contending that Congress did not intend § 103 to codify the patentability precedent, but to replace it. Rich, *supra* note 8, at 36. The congressional reports on the bill that added § 103 state, “Section 103 . . . provides a condition which exists in the law and has existed for more than 100 years.” S. REP. NO. 82-1979, at 6 (1952); H.R. REP. NO. 82-1923, at 7 (1952).

the invention standard that led Congress to enact § 103 in the first instance.<sup>23</sup> As the *Graham* Court itself noted:

this Court has observed, [that] ‘(t)he truth is, the word (‘invention’) cannot be defined in such a manner as to afford any substantial aid in determining whether a particular device involves an exercise of the inventive faculty or not.’ Its use as a label brought about a large variety of opinions as to its meaning both in the Patent Office, in the courts, and at the bar.<sup>24</sup>

The House and Senate Reports on § 103 identified the same problem, stating that the judicial invention requirement “has been expressed in a large variety of ways.”<sup>25</sup> Judge Learned Hand famously critiqued the invention standard for being “as fugitive, impalpable, wayward, and vague a phantom as exists in the whole paraphernalia of legal concepts.”<sup>26</sup>

Congress expressly enacted § 103 in an attempt to provide “uniformity and definiteness” to the patentability inquiry, so as to “have a stabilizing effect and minimize great departures which have appeared in some cases.”<sup>27</sup> The *Graham* decision, which purportedly defines the § 103 nonobviousness standard to require the same degree of ingenuity as the former judicial test of patentability, fails to provide Congress’s desired uniformity and definiteness.

The *Graham* opinion identifies the method for determining nonobviousness in two succinct sentences:

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

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<sup>23</sup> Joseph Miller, *Nonobviousness: Looking Back and Looking Ahead*, in INTELLECTUAL PROPERTY AND INFORMATION WEALTH, *supra* note 13, at 7; Rich, *supra* note 8, at 32-33; George M. Sirilla & Hon. Giles S. Rich, 35 U.S.C. 103: *From Hotchkiss to Hand to Rich, the Obvious Patent Law Hall-of-Famers*, 32 J. MARSHALL L. REV. 437, 501-26 (1999).

<sup>24</sup> *Graham*, 383 U.S. at 11-12 (citing *McClain v. Ortmayer*, 141 U.S. 419, 427 (1891)).

<sup>25</sup> S. REP. NO. 82-1979, at 6; H.R. REP. NO. 82-1923, at 7.

<sup>26</sup> *Harries v. Air King*, 183 F.2d 158, 162 (1950).

<sup>27</sup> *Graham*, 383 U.S. at 15, 17; S. REP. NO. 82-1979, at 6; H.R. REP. NO. 82-1923, at 7.

obviousness or nonobviousness of the subject matter is determined.<sup>28</sup>

The scope and content of the prior art, differences between the prior art and the invention, and the level of ordinary skill in the art are the factual inquiries that underlie the nonobviousness inquiry.<sup>29</sup> The Court noted an additional factual query as well: “secondary considerations [such] as commercial success, long felt but unresolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.”<sup>30</sup> Whether an invention is non-obvious in light of these factual considerations is the ultimate legal question.<sup>31</sup>

The opinion in *Graham*, however, does not explain how to evaluate the ultimate legal question of nonobviousness, beyond stating that it depends on the identified underlying factual considerations.<sup>32</sup> Identifying the differences between the patent claims at issue and the prior art is one question. Determining the amount of inventiveness a person of ordinary skill in the art would need to bridge these differences, and whether such an amount meets the nonobviousness threshold, are separate issues.

The Supreme Court’s application of its new nonobviousness framework to the facts in *Graham* likely exacerbated the problem created by the lack of a definitional basis for the nonobviousness standard. The patent at issue in *Graham* concerns a spring for a plow shank, which allows the plow shank to move upwards when it hits rocks or other obstructions in the soil, thereby reducing damage to the plow.<sup>33</sup> The Court engaged in a detailed factual analysis of the relevant prior art in plow shanks and the differences between the prior art and the claims at issue.<sup>34</sup> The Court did not, however, analyze the

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<sup>28</sup> *Graham*, 383 U.S. at 17.

<sup>29</sup> *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 280 (1976); *Graham*, 383 U.S. at 17.

<sup>30</sup> *Graham*, 383 U.S. at 17-18. The Federal Circuit has subsequently held that it is “error to exclude [secondary consideration] evidence from consideration.” *Stratoflex, Inc. v. Aeroquip*, 713 F.2d 1530, 1539 (Fed. Cir. 1983).

<sup>31</sup> *Sakraida*, 425 U.S. at 280; *Graham*, 383 U.S. at 17.

<sup>32</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 9 (“Although the Court lists the key elements, it does not tell how to apply them.”) (citing testimony of Professor John Duffy, “these primary factors . . . sort of leave you off at the very point you think the analysis should start”); *Cotropia*, *supra* note 13, at 26 (noting that *Graham* failed to identify when differences between invention and prior art were great enough to meet nonobviousness standard); *Miller*, *supra* note 23, at 9 (“[T]he Court did *not* indicate . . . how one was to go about determining obviousness (or not).”).

<sup>33</sup> *Graham*, 383 U.S. at 19-21.

<sup>34</sup> *Id.* at 19-24.

level of ordinary skill in the art. Rather, the Court omitted its own newly established requirement and skipped to the conclusory legal conclusion that, “[c]ertainly a person having ordinary skill in the prior art . . . would immediately see that the thing to do was what Graham did.”<sup>35</sup> On this basis, the Court held the invention obvious.<sup>36</sup> The Court similarly substituted its own judgment on nonobviousness for that of a person of ordinary skill in *Calmar* and *Adams*.<sup>37</sup>

The failure of the Supreme Court to apply its own requirements in these cases muddied the important distinction between the factual and legal elements of nonobviousness decisions. These inquiries, although related, are distinct. The blending of the level of ordinary skill factual question with the ultimate nonobviousness legal question has obscured the problem of the nonobviousness standard remaining undefined.

## 2. Post-Trilogy Nonobviousness Decisions

The Supreme Court’s subsequent nonobviousness cases have not resolved the problem of the lack of a standard for judging nonobviousness. *Anderson’s-Black Rock v. Pavement Salvage*,<sup>38</sup> *Dann v. Johnston*,<sup>39</sup> and *Sakraida v. Ag Pro*<sup>40</sup> all consider the nonobviousness of inventions that combine multiple prior art elements in new ways. In each case the Court substituted its own expertise for that of a person of ordinary skill and did not provide any further guidance for judging or measuring the nonobviousness standard. For example, the extent of the Court’s analysis of the legal question of nonobviousness in *Dann* is one conclusory sentence: “The gap between the prior art and [the invention] is simply not so great as to render the [invention] nonobvious to one reasonably skilled in the art.”<sup>41</sup> How great would be great enough? None of the opinions answers this question.

*Dennison Manufacturing Co. v. Panduit Corp.* tantalizingly hints at some of the problems identified here, but does not resolve them.<sup>42</sup> In

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<sup>35</sup> *Id.* at 25.

<sup>36</sup> *Id.*

<sup>37</sup> *Id.* at 30-37; *United States v. Adams*, 383 U.S. 39, 52 (1966); see also Rebecca S. Eisenberg, *Obvious to Whom? Evaluating Inventions from the Perspective of PHOSITA*, 19 BERKELEY TECH. L.J. 885, 888 (2004) (discussing Court’s substitution of its own judgment for that of person of ordinary skill in Trilogy cases).

<sup>38</sup> 396 U.S. 57, 59 (1969).

<sup>39</sup> 425 U.S. 219, 220-22 (1976).

<sup>40</sup> 425 U.S. 273, 273 (1976).

<sup>41</sup> *Dann*, 425 U.S. at 230.

<sup>42</sup> 475 U.S. 809, 810-11 (1986).

*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. In doing so, the Court indicated a need to differentiate the legal nonobviousness decision from the underlying factual inquiries.<sup>43</sup> 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.'"<sup>44</sup> The Supreme Court denied certiorari to review the Federal Circuit decision,<sup>45</sup> leaving the issues unresolved.

The Supreme Court's most recent nonobviousness case is *KSR v. Teleflex*.<sup>46</sup> The patent at issue combines an adjustable pedal assembly with an electronic throttle control for automobiles.<sup>47</sup> Adjustable pedals allow people of different heights to drive a car comfortably. Electronic throttles provide for electronic, rather than mechanical, operation of the accelerator. Once again, all elements exist in the prior art, and the issue is whether it was obvious to combine them. The case centers on Federal Circuit doctrine under which a fact-finder is required to identify some "teaching, suggestion, or motivation" ("TSM") to combine prior art references in order to conclude that it was obvious to combine them.<sup>48</sup> Such a TSM can be found in the nature of the problem to be solved, the teachings in the prior art, or the ordinary skill of one in the art.<sup>49</sup>

The Supreme Court rejected rigid application of the TSM test, particularly where applied to focus only on prior publications or explicit content of issued patents.<sup>50</sup> The opinion, however, acknowledged the value of the TSM inquiry, to the extent implicit suggestions could satisfy the test. The Court concluded that the fact-finder must "determine whether there was an apparent reason to combine the known elements in the fashion claimed."<sup>51</sup>

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<sup>43</sup> *Id.* at 811.

<sup>44</sup> *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1567 (Fed. Cir. 1987).

<sup>45</sup> *Dennison Mfg. Co. v. Panduit Corp.*, 481 U.S. 1052, 1052 (1987).

<sup>46</sup> 127 S. Ct. 1727 (2007).

<sup>47</sup> *Id.* at 1734.

<sup>48</sup> *In re Dembiczak*, 175 F.3d 994, 999-1000 (Fed. Cir. 1999); *In re Rouffet*, 149 F.3d 1350, 1355-56 (Fed. Cir. 1998).

<sup>49</sup> *In re Kahn*, 441 F.3d 977, 987-88 (Fed. Cir. 2006); *Rouffet*, 149 F.3d at 1357.

<sup>50</sup> *KSR*, 127 S. Ct. at 1739.

<sup>51</sup> *Id.* at 1741.

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In *KSR* the Supreme Court engaged in substantially more discussion concerning the role of the person of ordinary skill in the art than in prior nonobviousness decisions. Most significantly, the Court explained, “A person of ordinary skill is also a person of ordinary creativity, not an automaton.”<sup>52</sup> This statement highlights that an invention that represents some quantum of advance over prior art can still be obvious if it does not meet the nonobviousness threshold. The Court’s analysis of the level of ordinary skill in the art and how the person of ordinary skill would have approached the invention is significantly more concrete than in the earlier nonobviousness cases.<sup>53</sup>

In *KSR* the Court also engaged in its most significant discussion of the legal nonobviousness inquiry. It did so, however, only with respect to evaluating whether it was obvious to combine certain elements, not with respect to the ultimate question of evaluating the level of advance over prior art. In the context of combining prior art, the Court explained the need to consider market demand, design incentives, and other market forces that might lead to combinations or variations of prior art.<sup>54</sup> The Court also clarified that obviousness must be judged based on the claims and the prior art generally, not just on the particular solution to the particular problem that the patentee was working on.<sup>55</sup> These statements impart insight relevant to measuring nonobviousness, for the first time providing some guidance concerning how to conduct the legal nonobviousness inquiry. These statements do not, however, provide a means to measure the quantum of ingenuity necessary to actually satisfy the nonobviousness standard.

### 3. The Federal Circuit

The Federal Circuit, the federal appeals court with jurisdiction over most patent appeals, had provided some direction concerning the level of ingenuity necessary to satisfy the nonobviousness standard in certain cases. Even this limited guidance, however, was curtailed by the Supreme Court in *KSR v. Teleflex*. Under a line of cases, 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

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<sup>52</sup> *Id.* at 1742

<sup>53</sup> *Id.* at 1743-45. The District Court’s significant findings on the level of ordinary skill in the art no doubt aided this analysis. *Id.* at 1744.

<sup>54</sup> *Id.* at 1741.

<sup>55</sup> *Id.* at 1742.

would also have had a reasonable expectation of success.<sup>56</sup> The Supreme Court limited this rule in *KSR*, holding that “obvious to try” could indicate that an invention was obvious.<sup>57</sup> Though some vestige of the “obvious to try doctrine” may remain, it does not meaningfully identify what is obvious or not in most cases.

Similarly, the Federal Circuit’s TSM test at issue in *KSR*, whether appropriate or not, had provided some instruction concerning the legal standard of nonobviousness in certain cases. References that lacked a TSM to combine in the prior art could not be considered obvious to combine.<sup>58</sup> *KSR*, however, overruled any hard-line rule in favor of an expansive and flexible approach.<sup>59</sup>

In sum, Supreme Court and Federal Circuit precedent do not define the legal nonobviousness standard. The courts have not met the goal identified in *Graham* of creating a “more practical test of patentability” nor achieved Congress’s desire for a “more uniform and definite” test.<sup>60</sup> There remains no significant guidance on the measure of the nonobviousness threshold or on how a decision maker is supposed to evaluate whether an invention meets this threshold.

### *B. The Undefined Level of Ordinary Skill in the Art*

Pursuant to § 103, the level of ordinary skill in the art is one of the critical factual inquiries necessary to determine nonobviousness. As discussed above, the Supreme Court has often failed to engage in the appropriate inquiry, substituting its lay technological judgment for that of a person of ordinary skill.<sup>61</sup> Beyond this failure, however, lays a

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<sup>56</sup> *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)).

<sup>57</sup> *KSR*, 127 S. Ct. at 1742.

<sup>58</sup> See, e.g., *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1385-86 (Fed. Cir. 2002) (reversing finding of obviousness due to lack of evidence of TSM to combine necessary references); *C.R. Bard, Inc. v. M3 Sys., Inc.*, 157 F.3d 1340, 1351-52 (Fed. Cir. 1998) (same); *N. Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 934-35 (Fed. Cir. 1990) (affirming district court’s finding of nonobviousness where prior art did not contain TSM to combine references including all elements of patentee’s invention).

<sup>59</sup> *KSR*, 127 S. Ct. at 1739. This is not to say that the decision in *KSR* was incorrect. Certainty and guidance are not the only goals of legal standards; accuracy is critical as well. To the extent the Federal Circuit’s TSM test led to inaccurate nonobviousness decisions, as the Supreme Court held, it was an inappropriate doctrine.

<sup>60</sup> See *supra* Part I.A.1.

<sup>61</sup> *Supra* Part I.A.1-2.

more fundamental problem — the courts have not established how to identify the pertinent level of ordinary skill in the art in the first instance.

### 1. The Undefined Level of Ordinary Skill

The level of ordinary skill in the art provides the baseline against which the nonobviousness of a particular advance is measured. Patent law provides that the person of ordinary skill is presumed to know everything in the prior art, but neither the Patent Act nor case law identify what level of skill is brought to bear on this prior art.<sup>62</sup> Knowledge of information is different from skill. Without a baseline it is impossible to measure the level of innovation an invention provides, and therefore impossible to determine whether the invention is non-obvious.

As an example of the undefined level of ordinary skill, consider the plow shank in *Graham*. Is the level of ordinary skill a farmer who uses a plow in his field or is it a highly educated and experienced engineer working in John Deere's research and development laboratory? The difference is critical, and in many cases will be dispositive. Despite admonishing lower courts to make factual determinations concerning the level of ordinary skill, neither the Supreme Court nor Federal Circuit has adequately explained on what to base such a decision.<sup>63</sup>

In practice, courts usually conduct the level-of-ordinary-skill inquiry by reciting the educational achievements of a person of ordinary skill, such as having a Ph.D. in a given field, or by defining the person of ordinary skill to be someone with extended experience in the field.<sup>64</sup> Level of education, however, is not necessarily a good

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<sup>62</sup> *Supra* Part I.A.1-2.

<sup>63</sup> See James B. Gambrell & John H. Dodge, II, *Ordinary Skill in the Art — An Enemy of the Inventor or a Friend of the People?*, in NONOBVIOUSNESS, *supra* note 8, at 5:302 (“[T]he Supreme Court in particular, but other courts as well, has done precious little to define the person of ordinary skill in the art.”); Michael Meurer & Katherine Strandburg, *Nonobviousness and Nerd Culture* 16 (Sept. 26, 2007) (unpublished manuscript, on file with author) (“[T]he cases following *Graham* do not shed much light on the role the level of skill in the art should play in the ultimate assessment of obviousness.”).

<sup>64</sup> See *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 666-67 (Fed. Cir. 2000); *Robotic Vision Sys., Inc. v. View Eng'g, Inc.*, 189 F.3d 1370, 1373 (Fed. Cir. 1999); *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696-97 (Fed. Cir. 1983); *Orthopedic Equip. Co., Inc. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381-82 (Fed. Cir. 1983); CHISUM, *supra* note 8, § 5.03[4][e]; Eisenberg, *supra* note 37, at 889-97 (critiquing manner in which courts identify person of ordinary skill).



proxy for identifying actual skill, which is the relevant criterion.<sup>65</sup> More importantly, there is no solid doctrinal basis for how a fact-finder identifies the relevant educational or experiential level.

Fact-finders often designate the level of ordinary skill based on the education and experience of the inventor; in fact, caselaw suggests such an approach.<sup>66</sup> This basis displays a remarkable hindsight bias.<sup>67</sup> There is no reason to assume that a person of ordinary skill in the art is the equivalent of the inventor. Such analysis also transforms a supposedly objective standard into a more subjective analysis based on the inventor's particular education and training.

The Federal Circuit's recent decision on the level of ordinary skill in the art in *Daiichi Sankyo Co. v. Apotex, Inc.* provides an example.<sup>68</sup> The patent at issue concerns a method for treating bacterial ear infections by topically administering the antibiotic ofloxacin to the ear.<sup>69</sup> The Federal Circuit reversed a district court holding of nonobviousness. The Circuit concluded that the district court had clearly erred in finding that the level of ordinary skill in the art was that of a pediatrician or general practitioner with a medical degree, experience treating patients with ear infections, and knowledge of pharmacology and antibiotics.<sup>70</sup>

The Circuit began its explanation by reciting oft-quoted doctrine on the level of ordinary skill:

Factors that may be considered in determining level of ordinary skill in the art include: (1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field.<sup>71</sup>

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<sup>65</sup> Brief for Twenty-Four Intellectual Property Law Professors as Amici Curiae Supporting Petitioner at 14, *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727 (2007) (No. 04-1350); Eisenberg, *supra* note 37, at 897.

<sup>66</sup> *Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256-57 (Fed. Cir. 2007); *Envtl. Designs*, 713 F.2d at 696-97; *Orthopedic Equip.*, 707 F.2d at 1381-82.

<sup>67</sup> 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) (discussing hindsight bias in patent law); Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration that the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391 (2006) (same).

<sup>68</sup> *Daiichi Sankyo*, 501 F. 3d at 1256-57.

<sup>69</sup> *Id.* at 1255-56.

<sup>70</sup> *Id.* at 1259.

<sup>71</sup> *Id.* (citing *Envtl. Designs*, 713 F.2d at 696); see also Examination Guidelines for

A number of these factors highlight the hindsight and education level deficiencies identified above. Some of the factors are also somewhat circular (for example, one cannot identify the educational level of workers in the field without defining the field). Most critically, the caselaw does not explain how to apply these factors. Consider again the plow shank in *Graham*. These factors are insufficient to resolve whether the person of ordinary skill is a farmer or laboratory researcher. Similarly, they do not resolve whether the person of ordinary skill in *Daiichi Sankyo* is a pediatrician (as the district court found) or a pharmaceutical research specialist (as the Federal Circuit concluded). That being said, criteria focused on the problem at issue, such as the second and third factors above, are at least directed to the appropriate inquiry.<sup>72</sup>

The Circuit began its analysis in *Daiichi Sankyo* by relying on the inventors' skill level — not the skill level of a person of ordinary skill in the art.<sup>73</sup> The Circuit did note that others in the same field as the inventors had the same skill level, a more relevant fact.<sup>74</sup> The Circuit concluded its discussion of the level of ordinary skill by reasoning:

while a general practitioner or pediatrician could (and would) prescribe the invention . . . to treat ear infections, he would not have the training or knowledge to develop the claimed compound absent some specialty training such as that possessed by the . . . patent's inventors. Accordingly, the level of ordinary skill in the art . . . is that of a person engaged in developing pharmaceutical formulations and treatment methods for the ear or a specialist in ear treatments . . . who has training in pharmaceutical formulations.<sup>75</sup>

This reasoning is tautological — it argues that because a general practitioner could not develop the claimed invention, the person of ordinary skill must be of a higher skill level. Such logic will routinely result in holding an invention obvious, effectively reasoning that the person of ordinary skill must have the training and knowledge necessary to accomplish the invention.

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Determining Obviousness Under 35 U.S.C. 103 in View of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.*, 72 Fed. Reg. 57,526, 57,528 (Oct. 10, 2007) (citing number of these factors for PTO examiners to consider in determining level of ordinary skill in art).

<sup>72</sup> See *infra* Part III.C.

<sup>73</sup> *Daiichi Sankyo*, 501 F. 3d at 1257.

<sup>74</sup> *Id.*

<sup>75</sup> *Id.*

Also remaining unresolved are the quantity of resources and time a person of ordinary skill should be considered to utilize for purposes of evaluating nonobviousness. Courts and the Patent and Trademark Office (“PTO”), for example, have not indicated whether nonobviousness should be judged based on whether a person of ordinary skill would identify the invention immediately (no time and no resources), or whether nonobviousness should be judged with respect to whether the person of ordinary skill would be expected to resolve the problem if given a year and millions of dollars. These different standards would yield contrary results in many cases and are fundamental to the analysis of obviousness, but have been largely ignored.<sup>76</sup>

The definitional problem concerning the person of ordinary skill has become even more significant following *KSR v. Teleflex*. As noted, the Supreme Court made clear that the person of ordinary skill in the art is “also a person of ordinary creativity.”<sup>77</sup> The level of creativity will vary notably depending on who the person of ordinary skill is determined to be. The ordinary creativity of a person working in a research laboratory, for instance, may often be greater than the ordinary creativity of a consumer who simply uses a product.

The effect of (correctly) recognizing the creativity of the person of ordinary skill is that the level of ordinary skill in the art will vary by technological field. Persons of ordinary skill in highly sophisticated arts generally will display greater inventiveness than persons of ordinary skill in simple technological arts. Consequently, the level of ingenuity necessary to satisfy the nonobviousness requirement may be greater in more sophisticated arts than in less sophisticated ones.

From a normative perspective, it is unclear whether this differentiation is appropriate or optimal. First, there generally will be fewer individuals working on problems in highly sophisticated fields because few individuals will have the necessary knowledge and training. As a result, even “obvious” advances over prior art might not be realized because no one will work on certain problems. We therefore may want a lower, or at least equivalent, nonobviousness threshold in highly sophisticated fields to encourage achievement of significant (though doctrinally obvious) advances.<sup>78</sup> Second, in highly

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<sup>76</sup> See, e.g., Brief for Economists and Legal Historians as Amici Curiae Supporting Petitioner at 16-19, *KSR v. Teleflex*, 127 S. Ct. 1727 (2007) (No. 04-1350) (discussing lack of attention paid to context for evaluating nonobviousness).

<sup>77</sup> *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1742 (2007).

<sup>78</sup> See Meurer & Strandburg, *supra* note 63, at 18 (“A simplistic equation of high level of skill with significant education and expertise leads to an unsatisfying

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sophisticated fields, it may be impossible to satisfy the nonobviousness standard as a technical matter. Consider someone in a sophisticated medical nanotechnology drug-device field, with advanced training in biology, chemistry, physics, and applied materials sciences. There are few such individuals in the world. All are likely highly innovative and would be expected to achieve significant advances over prior art in any area to which they turned their attention. Many advances in these fields may be obvious to a person of “ordinary skill” in the art because such a person would be expected to achieve substantial advances on any problem attended to. Nevertheless, we presumably want to incentivize innovation in these areas with the carrot of a patent.

The baseline level of ordinary skill in the art is essential to judging the nonobviousness of a given invention, but remains only vaguely identified. Without significantly greater guidance concerning how to delimit the baseline, nonobviousness analysis will remain indeterminate.

## 2. Improperly Substituting Lay Judgment for the Person of Ordinary Skill

Exacerbating the baseline problem, in many cases the Supreme Court has substituted its lay judgment concerning whether an invention was obvious for the requisite judgment of the person of ordinary skill.<sup>79</sup> With the exception of *KSR*, the Supreme Court has not made or adopted any findings on the level of ordinary skill in the art in any of its nonobviousness decisions.<sup>80</sup> The failure to handle rigorously the factual inquiry into the level of ordinary skill has lent greater uncertainty to the nonobviousness inquiry.<sup>81</sup>

It is only procedurally appropriate for a judge or jury to substitute its own determination of obviousness where there is an explicit finding that the level of ordinary skill for a particular invention involves no technical expertise. That is, that the average layperson has

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conclusion that highly technical advances made by highly educated researchers are necessarily more obvious than simple advances made by unskilled workers.”).

<sup>79</sup> *Supra* Part I.A.1-2.

<sup>80</sup> The Federal Circuit has a mixed record on requiring specific findings on the level of ordinary skill in the art. *Compare* *Okajima v. Bourdeau*, 261 F.3d 1350, 1354-56 (Fed. Cir. 2001) (holding “no legal error in the absence of specific findings as to the level of ordinary skill”), *with* *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 660 (2000) (remanding for findings on level of ordinary skill on which to base nonobviousness decision).

<sup>81</sup> *See* Eisenberg, *supra* note 37, at 889-97 (critiquing judicial decisions for failing to truly take into account person of ordinary skill in art).

ordinary skill in the particular art; no particular experience or learning is required. Such a finding, though possible, should be very rare, and the Supreme Court has not made it in any of its nonobviousness cases. Further, the technology involved in many of the cases would render such a finding highly suspect — involving, for instance, battery electrodes, car accelerators, and computerized check systems. Understanding how an invention works is different from having ordinary skill in the art, and particularly different from judging whether the invention was obvious at the time it was made.

Though it is tempting to reason that an invention that is obvious to a lay judge or juror must necessarily also be obvious to a person of ordinary skill, such a conclusion is not logically definite. A problem may be substantially more complex than it appears to a lay individual.<sup>82</sup> There may, for instance, be knowledge in the art indicating that an apparently obvious solution to a known problem does not work, or that such a solution creates other, more significant problems.<sup>83</sup> Courts have recognized that there may be teachings away from apparently obvious solutions to certain problems.<sup>84</sup> As Judge Learned Hand explained, “Courts, made up of laymen as they must be, are likely either to underrate, or to overrate, the difficulties in making new and profitable discoveries in fields with which they cannot be familiar.”<sup>85</sup> It is now well recognized that it is inappropriate to substitute lay skill in the art for the required person of ordinary skill in the art.<sup>86</sup>

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<sup>82</sup> 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).

<sup>83</sup> *In re Fine*, 837 F.2d 1071, 1074 (Fed. Cir. 1988) (reversing finding of obviousness because prior art taught that patentee’s invention would have produced undesirable problems); *Dow Chem. Co. v. Am. Cyanamid Co.*, 816 F.2d 617, 622 (Fed. Cir. 1987) (stating prior art which indicated that patentee’s advance would have been ineffective indicated that advance was not obvious); Lance Leonard Barry, *Teaching a Way is Not Teaching Away*, 79 J. PAT. & TRADEMARK OFF. SOC’Y 867, 870-75 (1999) (explaining that prior art may suggest that apparent solution does not work or that it would cause other problems).

<sup>84</sup> *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006); *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349-50 (Fed. Cir. 2000). In *Adams*, the Supreme Court relied on the fact that prior art taught away from combining certain elements to demonstrate that the combination was non-obvious. *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739-40 (2007) (stating this interpretation of *Adams*); *United States v. Adams*, 383 U.S. 39, 51-52 (1966).

<sup>85</sup> *Safety Car Heating & Lighting Co. v. Gen. Elec. Co.*, 155 F.2d 937, 939 (1946).

<sup>86</sup> *Dann v. Johnston*, 425 U.S. 219, 229 (1976) (“In making the determination of

Hindsight bias will exacerbate errors of substituting lay judgment for that of the person of ordinary skill. The task of judging nonobviousness is difficult enough for a lay decision maker, let alone requiring such judgment in reference to a past state of the art, prior to the invention's existence.<sup>87</sup>

This analysis also reveals that the common presumption that PTO examiners represent persons of ordinary skill in the art may not be fully accurate.<sup>88</sup> Even though examiners may be expected to be better judges of nonobviousness than lay individuals, examiners are trained for different tasks and have different jobs than persons of ordinary skill in an art. Examiners may know the general technological field of a patent application, but they are not experts in the specific details of the invention.<sup>89</sup> For these reasons, they would also face the challenge of problems sometimes being more complex than they appear. In addition, examiners spend only an average of about seventeen hours over a period of several months reviewing each patent, presumably far less time than a person of ordinary skill would devote to solving a particular problem.<sup>90</sup> Examiners also often have significantly fewer resources and less access to information than persons of ordinary skill who are pursuing inventive activity.<sup>91</sup>

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'obviousness,' it is important to remember that the criterion is measured not in terms of what would be obvious to a layman, but rather what would be obvious to one 'reasonably skilled in (the applicable) art.'" (citing *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 37 (1966)); *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987); Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific*, 17 BERKELEY TECH. L.J. 1155, 1185 (2002).

<sup>87</sup> See Mandel, *Patently Non-Obvious II*, *supra* note 67, at 18.

<sup>88</sup> See, e.g., Stuart Minor Benjamin & Arti Rai, *Who's Afraid of the APA? What the Patent System Can Learn from Administrative Law*, 95 GEO. L.J. 269, 277-78 (2007) ("[T]o the extent that the PTO examiner is herself one of ordinary skill . . ."); Burk & Lemley, *supra* note 86, 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 . . ."); Eisenberg, *supra* note 37, at 888, 898 (asserting patent examiners will "have less technological skill . . . than the hypothetical [person of ordinary skill]" as they spend more time in patent office away from technological fields).

<sup>89</sup> Doug Lichtman & Mark Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 53 (2007).

<sup>90</sup> *Id.*

<sup>91</sup> *Id.* at 46-47. For similar reasons, recent proposals to divert patent cases to specified district court judges to increase their expertise, or arguments that the Federal Circuit judges possess greater technical expertise than generalist district court judges, will not resolve the issues identified here. See, e.g., H.R. 34, 110th Cong. § 1(a) (2007) (diverting patent cases to specified patent-focused district court judges).

In sum, substituting the judgment of a lay decision maker, whether judge, juror, or PTO examiner, for that of the statutory person of ordinary skill in the art, further distorts nonobviousness decisions.

### 3. Secondary Considerations

In certain instances, objective evidence of obviousness, termed “secondary consideration evidence,” can provide a remedy for the definitional uncertainty of the nonobviousness standard. Though much secondary consideration evidence has been discounted as highly unreliable evidence of nonobviousness (particularly evidence of commercial success, copying by others, and licensing by others), other objective evidence can help resolve the nonobviousness dilemma.<sup>92</sup>

If a patentee can demonstrate that other researchers had been engaged in research directed at solving the same problem solved by the invention, had sufficient time and resources to devote to their research, and had failed to solve the problem, then this may be strong evidence of nonobviousness.<sup>93</sup> Though the level of ordinary skill in the art remains undefined, this does not mean that it is entirely open-ended. Where the other researchers’ skill level was near the high end of the range of possible levels of ordinary skill, such prior failure evidence indicates that the invention was not obvious to persons of ordinary skill in the art. Only in rare cases, however, will a patentee be able to present clear evidence of prior failure by others pursuing similar research with sufficient time and resources.<sup>94</sup>

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<sup>92</sup> *Ecolochem, Inc. v. S. Cal. Edison Co.*, 227 F.3d 1361, 1377-78 (Fed. Cir. 2000) (noting that patent owner must show commercial success resulted from invention and that copying by others and accolades from others are to be given less deference than other forms of secondary consideration evidence because of potential unreliability); FED. TRADE COMM’N, *supra* note 10, ch. 4, at 18-19 (arguing commercial success often is not valid indicator that invention was non-obvious); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 805, 859-73 (1988). Unfortunately, these unreliable forms of secondary consideration evidence are also some of the most common types of secondary consideration evidence. Mandel, *Patently Non-Obvious*, *supra* note 67, at 1424-25, 1463 (finding that for reported nonobviousness cases over an 18-month period, 33% included evidence of commercial success (the greatest frequency of any secondary consideration evidence), 12% included evidence of copying by others, and 5% included evidence of licensing by others).

<sup>93</sup> Merges, *supra* note 92, at 862-63.

<sup>94</sup> Mandel, *Patently Non-Obvious*, *supra* note 67, at 1424-25, 1463 (reporting that 12% of reported nonobviousness cases over period studied included evidence of prior failure by others). Only a subset of the cases with evidence of prior failure by others will meet the criteria identified above.

Evidence that the prior art taught away from the patentee's achievement can also help resolve the definitional indeterminacy problems. If the prior art strongly teaches away, and there were no countervailing reasons to try the inventor's approach, this indicates that the advance would not have been obvious to a person of ordinary skill.<sup>95</sup> *Adams* may represent such a case — as the Supreme Court noted, “each of the elements of the Adams battery was well known in the prior art, [but] to combine them as did Adams required that a person reasonably skilled in the prior art must ignore [current scientific understanding].”<sup>96</sup> In most cases, however, there usually will be some countervailing reasons to have tried the invention — after all, the inventor did — and once the decision maker has to judge between competing evidence he or she is back in the indeterminacy quandary.

Evidence of long-felt need in a field can provide a surrogate for the nonobviousness standard as well. This only applies, however, where a patentee can demonstrate that the long-felt need had been identified, persons of ordinary skill in the art had sufficient time and resources to work on the problem, and such persons were near the high-end of the possible range of ordinary skill.<sup>97</sup> Even then, a patentee would have to establish that the persons of skill thought about the problem to a sufficient extent (which is undefined) to demonstrate that the invention was not simply non-obvious “at first glance,” but actually non-obvious overall. Where a patentee can prove all these factors, long-felt need evidence can evade the definitional problems and indicate nonobviousness.<sup>98</sup>

Though potentially valuable in certain circumstances, secondary consideration evidence is generally of limited use in resolving the nonobviousness doctrine problems. In most cases, the failure to define the necessary quantum of innovation and level of ordinary skill will render nonobviousness decisions indeterminate.

### C. *The Undertheorized Nonobviousness Requirement*

The intent or legislative history of § 103 could ameliorate the lack of a definition for nonobviousness under certain circumstances. The purpose of the nonobviousness requirement is to assure that only

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<sup>95</sup> Barry, *supra* note 83, at 869-70.

<sup>96</sup> *United States v. Adams*, 383 U.S. 39, 51-52 (1966).

<sup>97</sup> *Merges*, *supra* note 92, at 872 (discussing inferences necessary for long-felt need evidence to be reliable).

<sup>98</sup> In such circumstances, long-felt need evidence is very similar to evidence of prior failure by others.



significant technological advances merit a patent award.<sup>99</sup> 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.<sup>100</sup> This theoretical basis for the nonobviousness requirement, however, provides limited substantive guidance for setting the level of ingenuity necessary to satisfy the nonobviousness standard. Further, attempts to establish a more precise theoretical basis for the nonobviousness requirement, such as awarding patents only for inventions that would not have been achieved “but for” the patent incentive, lack support in § 103’s language or history.

### 1. History of the Nonobviousness Requirement

The nonobviousness requirement is directed at an age-old problem — how to distinguish inventions innovative enough to be worthy of a patent from trivial advances that do not deserve legal protection. Thomas Jefferson, author of an early Patent Act and member of the Patent Board that reviewed patent applications, recognized “well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent and those which are not.”<sup>101</sup>

The first Patent Act, enacted in 1790, required that an invention be “sufficiently useful and important” to receive a patent.<sup>102</sup> Congress dropped the “important” provision in 1793,<sup>103</sup> and from then until 1952, the Patent Act’s only express requirements for patentability were novelty and utility.<sup>104</sup> Early in this period, in response to attempts to patent perceived trifles, Jefferson proposed an amendment to the

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<sup>99</sup> *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 156 (1989); CHISUM, *supra* note 8, § 5.01; MERGES & DUFFY, *supra* note 10, at 644.

<sup>100</sup> *Bonito Boats*, 489 U.S. at 156 (“Both the novelty and the nonobviousness 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 v. John Deere Co. of Kan. City*, 383 U.S. 1, 6 (1966) (explaining that without innovation and social benefit, patent protection removes useful knowledge from prior art instead of promoting progress).

<sup>101</sup> Letter from Thomas Jefferson to Mr. Isaac M’Pherson (Aug. 13, 1813), in 6 THE WRITINGS OF THOMAS JEFFERSON 181 (H.A. Washington ed., 1905).

<sup>102</sup> Act of Apr. 10, 1790, ch. 7, § 1, 1 Stat. 109, 110 (1790).

<sup>103</sup> No judicial decision ever interpreted this language. This construction was reintroduced in the Patent Act of 1836, but was little referenced and never interpreted to establish an independent patent validity requirement. John Duffy, *Inventing Innovation: A Case Study in Legal Innovation*, 86 TEX. L. REV. 1, 27 (2008).

<sup>104</sup> CHISUM, *supra* note 8, § 5.02.

Patent Act to deny patentability where “[t]he invention is so unimportant and obvious that it ought not to be the subject of an exclusive right.”<sup>105</sup> Although Congress never enacted this amendment, it represents the American origins of the nonobviousness requirement that Congress adopted a century-and-a-half later.<sup>106</sup>

In 1851 the Supreme Court established a judicial requirement for patentability beyond those of novelty and utility.<sup>107</sup> In *Hotchkiss v. Greenwood* the Court held that subject matter was not patentable unless it possessed “that degree of skill and ingenuity which constitute essential elements of every invention.”<sup>108</sup> This holding created a new patent validity requirement of “invention,” a requirement that courts would interpret in a variety of ways under a number of names over the next century.<sup>109</sup>

As discussed, concern over inconsistency in the application of the judicially created invention requirement led Congress to enact the § 103 nonobviousness standard in 1952.<sup>110</sup> The specific term “obvious”

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<sup>105</sup> Rich, *supra* note 8, at 28 (citing 5 THE WRITINGS OF THOMAS JEFFERSON, 1788-1792, at 279 (P.L. Ford ed., 1895)).

<sup>106</sup> A. Samuel Oddi, *Beyond Obviousness: Invention Protection in the Twenty-First Century*, 38 AM. U. L. REV. 1097, 1122-23 (1989); Rich, *supra* note 8, at 28 (citing 5 THE WRITINGS OF THOMAS JEFFERSON, *supra* note 105, at 279). *But see*, Duffy, *supra* note 103, at 28 (stating that Jefferson’s use of term “obvious” “has only slight significance in development of invention standard”).

<sup>107</sup> Prior to 1851, something more than pure novelty (as understood today) was required to receive a patent, as trivial changes in form were considered non-novel. Edmund W. Kitch, *Graham v. John Deere Co.: New Standards for Patents*, 1966 SUP. CT. REV. 293, 303-09 (1966). An early patent treatise equated this requirement with the concept of not obvious. WILLARD PHILLIPS, *THE LAW OF PATENTS FOR INVENTIONS* 125-26 (Boston 1837).

<sup>108</sup> *Hotchkiss v. Greenwood*, 52 U.S. 248, 267 (1851).

<sup>109</sup> *Thompson v. Boisselier*, 114 U.S. 1, 11 (1885); *see* *George P. Converse & Co. v. Thomas J. Lipton, Inc.*, 149 F. Supp. 105, 110 (1957) (“The term ‘invention’ is undoubtedly one of the most baffling in the judicial lexicon.”); Rich, *supra* note 8, at 26 (referring to vagueness of invention requirement as “great mystery” and “absurdity”). The term “obvious” was used sparingly in court opinions during most of this period, but became more common in the time leading up to the enactment of § 103, a trend that corresponds temporally with the British codification of a non-obvious requirement in 1932. Duffy, *supra* note 103, at 39.

<sup>110</sup> S. REP. NO. 82-1979, at 6 (1952); H.R. REP. NO. 82-1923, at 7 (1952); Hon. Giles S. Rich, *Why and How Section 103 Came to Be*, reprinted in *NONOBVIOUSNESS*, *supra* note 8, at 1:201; *see also* *Report of the National Patent Planning Commission*, H.R. DOC. NO. 239, at 6, 10 (1943) (“One of the greatest technical weaknesses of the patent system is the lack of a definitive yardstick as to what is invention. To provide such a yardstick and to assure that the various courts of law and the Patent Office shall use the same standards, several changes are suggested. It is proposed that Congress shall declare a national standard whereby patentability of an invention shall be determined

in § 103 did not come from a particular judicial opinion or other work, “but was a synthesis of numerous equivalent expressions[,] . . . words[,] and phrases [that] had been frequently used and were in the common stock of patent law terminology.”<sup>111</sup>

When Congress enacted § 103, it recognized that the bare terminology was insufficient on its own to establish a specific standard, but expected that the new language would serve as the basis for the development of guidelines to provide the desired definiteness. The Senate Report on § 103 noted, “This paragraph is added with the view that an explicit statement in the statute may have some stabilizing effect, and also to serve as a basis for the addition at a later time of some criteria which may be worked out.”<sup>112</sup> These later criteria, however, generally have not materialized.

Remarkably, Congress did not elaborate on the purpose of the nonobviousness requirement beyond the goal of lending greater certainty to the patentability requirement. The legislative history of § 103 does not provide the guidance necessary to establish the quantum of ingenuity or level of ordinary skill required to meet the nonobviousness standard.

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by the objective test as to its advancement of the arts and sciences.”).

<sup>111</sup> P.J. Federico, *Origins of Section 103* (1977), reprinted in NONOBVIOUSNESS, *supra* note 8, at 1:106. P.J. Federico was one of the principal authors of the 1952 Patent Act, assisted by a two-person committee including Giles Rich. John H. Barton, *Non-Obviousness*, 43 IDEA 475, 485-86 (2003). How the precise term “obvious” ended up in the statute is not precisely reported. In hearings before Congress on amending the Patent Act to add an invention requirement in 1949, two witnesses made proposals that included the phrase “obvious to one skilled in such art.” *Id.* The term “obvious” later appeared in a draft developed by Federico of what would become § 103. Rich, *supra* note 110, at 1:210. The Committee drafting § 103 subsequently changed the title of the proposed section, replacing the phrase “lack of invention” with “non-obvious subject matter.” *Id.* at 1:211. The change to use the term “obvious” has been attributed to a response to the Supreme Court’s decision in *The Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147 (1950), which the Committee felt demonstrated that the “invention” standard was too inherently vague and could not be applied uniformly. Rich, *supra* note 8, at 32-34. Similarly, the reference to a person having ordinary skill in the art had appeared in earlier patent cases as well. See, e.g., *Earle v. Sawyer*, 8 F. Cas. 254, 255 (C.C.D. Mass. 1825) (Story, J.) (explaining invention “must be what would not occur to all persons skilled in the art”); Federico, *supra* note 111, at 1:106 (discussing origins of person of ordinary skill terminology).

<sup>112</sup> S. REP. NO. 82-1979, at 2411; see also P.J. Federico, *Further Comments and Observations on the Origins of Section 103*, in NONOBVIOUSNESS, *supra* note 8, at 1:304 (stating that § 103 does not provide any standard for measuring nonobviousness, but simply creates requirement).

Intriguingly, Supreme Court decisions prior to the enactment of § 103 had contained some guidance concerning how to evaluate the then-required invention standard. For instance, just before the enactment of § 103, the Court held in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp.* that a “patent for a combination which only unites old elements with no change in their respective functions . . . obviously withdraws what is already known into the field of its monopoly and diminishes the resources available to skillful men.”<sup>113</sup> Pre-section 103 instruction, however, cannot be applied to the current nonobviousness requirement. First, despite the Supreme Court’s statements in *Graham* and other cases that § 103 did not change the level of ingenuity required, the “non-obvious” requirement is different from earlier judicial pronouncements on “invention.”<sup>114</sup> Second, as discussed, Congress enacted § 103 to lend greater uniformity and definiteness to the nonobviousness requirement, indicating the intent to revise the precedent. Third, § 103 is commonly understood to have been directed at overruling certain prior Supreme Court decisions (including the aforementioned *Great A&P* decision, as well as *Cuno Engineering Corp. v. Automatic Devices Corp.*<sup>115</sup>) that created too great a hurdle to patentability.<sup>116</sup> Because the non-obvious standard is incommensurate with the prior invention requirement, pre-1952 precedent cannot establish the quantum of innovation necessary to satisfy nonobviousness.<sup>117</sup>

## 2. Alternate Conceptions of Nonobviousness

Numerous scholars argue for alternate conceptions of the nonobviousness requirement, some of which could provide more guidance on the requisite level of ingenuity. One of the most popular

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<sup>113</sup> *Great Atl. & Pac. Tea Co.*, 340 U.S. at 152.

<sup>114</sup> Kitch, *supra* note 107, at 296 (explaining that § 103 eliminated past tests of invention that were not related to nonobviousness standard); *see also* Rich, *supra* note 8, at 26 (explaining that § 103 requirement is different from prior requirement of invention). Although the Supreme Court has quoted approvingly from earlier “invention” cases in nonobviousness decisions, it has never held that these earlier instructions are identical to the nonobviousness inquiry. *See* *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1739 (2007); *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 281 (1976); *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 11-12 (1966).

<sup>115</sup> *Cuno Eng’g Corp. v. Automatic Devices Corp.*, 314 U.S. 84 (1941).

<sup>116</sup> P.J. Federico, *supra* note 111, at 1:101; Miller, *supra* note 23, at 7; Hon. Giles S. Rich, *Congressional Intent — or, Who Wrote the Patent Act of 1952?*, reprinted in *NONOBVIOUSNESS*, *supra* note 8, at 1:7-8; Rich, *supra* note 8, at 28-32.

<sup>117</sup> Pre-section 103 precedent, however, can still be useful in analyzing nonobviousness policy.

alternatives states that the nonobviousness requirement is meant to provide a proxy for a “but-for” standard for patenting.<sup>118</sup> Under this conception, decision makers should only grant patents on inventions that would not have been created but for the patent system incentives.<sup>119</sup> The logic behind this economic argument is that such a system will better align the incentive function of patents with the actual patent monopolies granted, reducing the social loss that occurs when a patent is granted on an invention that the public would have obtained anyway.<sup>120</sup>

The language of the Patent Act and its legislative history, however, effectively preclude a but-for construction by imposing a technological standard.<sup>121</sup> If § 103 sought a but-for standard, the nonobviousness requirement represents a remarkably inept attempt to meet this goal. The nonobviousness standard bears only a tangential correlation to a but-for requirement. There are many inventions that are non-obvious, but that inventors still would have achieved without the incentive of the Patent Act — for instance, non-obvious inventions developed as a result of academic and publicly-funded research or for reputational purposes. Other examples include the wide variety of non-obvious inventions from which owners could profit due to first-mover advantages, branding, advertising, marketing, or other means.<sup>122</sup>

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<sup>118</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 6-8; Cotropia, *supra* note 13, at 22-24; Kitch, *supra* note 107, at 301; Robert Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 35 (1992); cf. ROBERT MERGES & JANE GINSBURG, FOUNDATIONS OF INTELLECTUAL PROPERTY 111 (2006) (discussing that legal doctrines tend to view nonobviousness as question of technological advance, while economic scholars tend to view question as balancing costs and benefits of patent system).

<sup>119</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 6; Kitch, *supra* note 107, at 301.

<sup>120</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 6-8; MERGES & GINSBURG, *supra* note 118, at 19.

<sup>121</sup> The Supreme Court in *Graham* notes in dicta that “[t]he inherent problem was to develop some means of weeding out those inventions which would not be disclosed or devised but-for the inducement of a patent,” but does not state that this is what the statutory nonobviousness standard actually measures. *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 11 (1966).

<sup>122</sup> See Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 BROOKINGS PAPERS ON ECON. ACTIVITY 783, 795 (reporting survey data revealing that potential first-mover advantages provide significant incentives); Wesley Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U. S. Manufacturing Firms Patent (Or Not)* 24 (Nat’l Bureau of Econ. Research, Working Paper No. 7552, 2000) (reporting survey data revealing that lead time and complementary sales and services are important factors for firms protecting intellectual assets); Peter Menell, *A Method for Reforming the Patent System 1* (May 3, 2007) (unpublished manuscript), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=958089](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=958089) (discussing some of these reasons).

Certain non-obvious inventions could be protected under other intellectual property regimes, such as trade secret, copyright, or trademark (for certain subject matter), and therefore would still be achieved without the patent incentive.<sup>123</sup> In addition, the nonobviousness standard allows a lucky individual who accidentally produces a non-obvious invention to obtain a patent, even though such an invention would have been achieved absent the patent incentive.

Conversely, there are obvious inventions that would not be produced absent the patent incentive. Many trivial and obvious advances are produced as by-products of industrial research and development conducted in an effort to produce potential non-obvious inventions. These advances would not be achieved but for the prospect of a patent grant, but nevertheless are obvious and not patentable. Research by the most sophisticated scientists in the most complex technological areas may represent another example. Scientists sometimes conduct such research solely because of the patent incentive, but certain advances are still “obvious” to the highly sophisticated persons having ordinary skill in such advanced arts. The nonobviousness standard would represent a remarkably underinclusive and overinclusive proxy for a but-for requirement.<sup>124</sup>

Proponents of a but-for standard concede that it would not be feasible to apply in individual cases.<sup>125</sup> Even if the factual and evidentiary problems with implementing a but-for requirement could be solved, application of a but-for standard would still create a number of inefficiencies.<sup>126</sup> Granting patents on inventions that would not have been created absent the patent incentive would still result in patent thickets, minefields, hold-ups, and related concerns.<sup>127</sup> The potential for hold-ups, in fact, could provide the incentive for an

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<sup>123</sup> Cohen, *supra* note 122, at 8 (reporting survey data indicating that secrecy and other legal alternatives are important means used to protect innovation); Menell, *supra* note 122, at 7.

<sup>124</sup> *But see* Benjamin & Rai, *supra* note 88, at 278 (concluding “[s]cientifically- and technically-based requirements such as nonobviousness can thus serve as reasonably good proxies for the ultimate economic inquiry,” though going on to discuss problems with this proxy).

<sup>125</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 7 (citing testimony of numerous patent experts stating that but-for test would not be practical to apply in actual cases); MERGES & GINSBURG, *supra* note 118, at 19 (“It would be impossible in most cases to apply [but-for] standard.”).

<sup>126</sup> That being said, the inefficiencies identified in the following sentence could be less significant than those created under a nonobviousness standard.

<sup>127</sup> FED. TRADE COMM’N, *supra* note 10, ch. 4, at 5.

inventor to innovate, satisfying the but-for requirement, and exacerbating certain patenting problems. On a related note, creation of a but-for standard also could allow the patenting of trivial advances that no one would have bothered to achieve but for the opportunity of a patent monopoly.

Another alternate conception of the nonobviousness requirement focuses on the common understanding that it requires something more than a “trivial” advance.<sup>128</sup> The rationale behind the non-trivial interpretation is that trivial advances will be achieved without the patent incentive.<sup>129</sup> In addition, allowing patents on trivial inventions could lead to unnecessary races to patent such inventions, diverting resources from more productive lines of research. Heavy patenting of trivial advances would also exacerbate patent thickets and other patent problems, retarding further economic and technological development.<sup>130</sup> This analysis, however, only provides a rationale for a floor to the nonobviousness standard; it explains why patents should not be granted on minimal advances, but does not identify how high above the minimum the standard should be set.

Others argue that the nonobviousness standard is constitutionally mandated, and that the Constitution can provide the necessary substantive content for nonobviousness.<sup>131</sup> The intellectual property clause of the Constitution provides, “The Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”<sup>132</sup> According to this argument, congressional power is limited by the “To promote the Progress” language and the nonobviousness standard serves to satisfy the requirement that patents are only granted on inventions that promote progress.

The Supreme Court has made statements that support this line of reasoning. In *KSR v. Teleflex* the Court stated, “Granting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior

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<sup>128</sup> Cotropia, *supra* note 13, at 23; Merges, *supra* note 92, at 812.

<sup>129</sup> Benjamin & Rai, *supra* note 88, at 277; Miller, *supra* note 23, at 2.

<sup>130</sup> Benjamin & Rai, *supra* note 88, at 277; Cotropia, *supra* note 13, at 23; *supra* note 10.

<sup>131</sup> See Malla Pollack, *E-Commerce in the Digital Millenium: The Legal Ramifications of the DMCA and Business Method Patents*, 28 RUTGERS COMPUTER & TECH. L.J. 61, 120 (2002).

<sup>132</sup> U.S. CONST. art. I, § 8, cl. 8.

inventions of their value and utility.”<sup>133</sup> In a similar vein, the Court in *Graham* explained:

The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose. . . . 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.<sup>134</sup>

The Supreme Court, however, has never held that the Constitution mandates a precise level of nonobviousness, or a precise level beyond trivial, to obtain a patent.<sup>135</sup> The constitutional “promote the Progress” language is simply too broad to set the substantive level of ingenuity necessary to satisfy § 103.<sup>136</sup> Further, the Constitution places only a general limit on Congress’s power to enact patent law, consistent with the particular grant of power in the Intellectual Property Clause.<sup>137</sup> To the extent the Patent Act satisfies the goal of promoting progress generally,<sup>138</sup> the constitutional limitation does not provide guidance for how to apply the nonobviousness standard in individual cases.

It may be that no legal term as significant as “nonobviousness” is as poorly defined. Neither the Constitution, § 103’s statutory language, legislative intent, nor judicial precedent provides sufficient guidance concerning the quantum of ingenuity necessary to satisfy the nonobviousness standard or the level of ordinary skill relevant to such

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<sup>133</sup> *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007).

<sup>134</sup> *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 5-6 (1966); see Rich, *supra* note 8, at 29 (discussing possibility of constitutional basis for nonobviousness requirement based on “promote the Progress” language).

<sup>135</sup> John Duffy & Robert Merges, *The Story of Graham v. John Deere: Patent Law’s Evolving Standard of Creativity*, in *INTELLECTUAL PROPERTY STORIES* 109 (Jane C. Ginsburg & Rochelle Cooper Dreyfuss eds., 2006).

<sup>136</sup> Benjamin & Rai, *supra* note 88, at 276-77.

<sup>137</sup> *Eldred v. Ashcroft*, 537 U.S. 186, 199-208 (2003); *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 429 (1984); Edward C. Walterscheid, *To Promote the Progress of Science and the Useful Arts: The Anatomy of a Congressional Power*, 43 *IDEA* 1, 80-81 (2002) (concluding that Congress would satisfy Intellectual Property Clause in enacting any law which generally promoted progress of science and useful arts).

<sup>138</sup> *Special Equip. Co. v. Coe*, 324 U.S. 370, 381-82 (1945) (“The purpose ‘to promote the Progress of Science and useful Arts’ accordingly provides the standards for [Congress’s] exercise of the power and sets the limits beyond which [Congress] may not go.”).



analysis. As a result, the nonobviousness standard is substantially indeterminate and nonobviousness decisions are largely unbounded and unconstrained.

## II. THE INDETERMINATE NONOBVIOUSNESS STANDARD PRODUCES EXCESSIVE PATENT GRANTS

Appropriate application of the nonobviousness standard is critical to the function of patent law.<sup>139</sup> Too high a nonobviousness standard reduces the incentives for innovators to invent and disclose.<sup>140</sup> Too low a nonobviousness standard allows excessive patenting, resulting in inefficient patent thickets, anti-commons, minefields, hold-ups, and other problems.<sup>141</sup> This too can reduce innovators' incentives to invent. Either too lax or too restrictive a nonobviousness standard can retard technological progress and be socially and economically detrimental.

Because the nonobviousness standard is undefined, it is impossible for decision makers to apply the standard consistently. Simply using the term "non-obvious" as a standard does not create an applicable metric; it is nothing more than a bare legal conclusion. As discussed, the drafters of § 103 were aware of this; they only intended the standard to serve as a basis for the development of criteria to judge obviousness.<sup>142</sup> Because this development has not occurred, what remains is an empty legal conclusion without standards to provide a framework for decision-making, a consequence that is woefully indeterminate. Not surprisingly, nonobviousness determinations are highly inconsistent and unpredictable.<sup>143</sup>

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<sup>139</sup> Duffy & Merges, *supra* note 135, at 110 (explaining level of creativity necessary to satisfy nonobviousness standard "is one of the most important policy issues in all of patent law").

<sup>140</sup> MERGES & DUFFY, *supra* note 10, at 646-47; Burk & Lemley, *supra* note 10, at 1681-82.

<sup>141</sup> KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 1741 (2007); *supra* note 10.

<sup>142</sup> See *supra* Part I.C.I.

<sup>143</sup> See FED. TRADE COMM'N, *supra* note 10, ch. 4, at 9-15 (critiquing nonobviousness decision-making); Donald W. Banner, *Foreword*, in NONOBVIOUSNESS, *supra* note 8, at v (writing by Commissioner of Patents and Trademarks stating that § 103 has not produced reliability and predictability in judicial decisions); Comm'n on Revision of the Fed. Court Appellate Sys., *Structure and Internal Procedures: Recommendations for Change*, 67 F.R.D. 195, 370 (1975) (discussing inconsistency in how different circuits applied nonobviousness standard prior to development of Federal Circuit); Robert Desmond, *Nothing Seems "Obvious" to the Court of Appeals for the Federal Circuit: The Federal Circuit, Unchecked by the Supreme Court, Transforms the Standard of Obviousness under the Patent Law*, 26 LOY. L.A. L. REV. 455, 473-83

Viewed in this light, the strong and widespread recent criticism of the judicial system and Patent Office for improperly applying too low a nonobviousness standard appears to be at least partially misplaced.<sup>144</sup> Decision makers cannot consistently or accurately apply an indeterminate standard. Though criticism of the failure to define the nonobviousness standard is warranted, criticism for failure to apply it correctly may not be well-grounded. Importantly, proposed solutions directed at ratcheting-up the nonobviousness standard may not be successful because they are directed at the wrong problem.<sup>145</sup>

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(1993) (contending that Federal Circuit has failed to create clear and uniform nonobviousness law); Rochelle Cooper Dreyfuss, *The Federal Circuit: A Case Study in Specialized Courts*, 64 N.Y.U. L. REV. 1, 9-10 (1989) (discussing problems with and inconsistency in applying nonobviousness standard); Carl Shapiro, *Symposium on Ideas into Action: Implementing Reform of the Patent System: Economic Analysis and Critique*, 19 BERKELEY TECH. L.J. 1017, 1028-30 (2004) (discussing problems of unreliability with current nonobviousness standard).

<sup>144</sup> See, e.g., Brief for Twenty-Four Intellectual Property Law Professors, *supra* note 65, at 10 (arguing Federal Circuit case law sets nonobviousness standard too low); FED. TRADE COMM'N, *supra* note 10, ch. 4, at 8-19 (criticizing low standard for application of nonobviousness requirement and citing testimony of many patent and economic scholars for same); ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 32-35, 75, 119-23, 145-49 (2004) (criticizing PTO for granting patents on obvious inventions); NAT'L RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY 87-95 (2004) (criticizing lenient nonobviousness standards, particularly for business method and biotechnology patents); Barton, *supra* note 111, at 477-78 (arguing that nonobviousness standard applied by PTO and courts today is not as strict as that articulated by Supreme Court in *Graham*); Matthew Sag & Kurt Rohde, *Patent Reform and Differential Impact*, 8 MINN. J. L. SCI. & TECH. 1, 2 (2007) (noting that “[a]cademics, business leaders, and government officials have all expressed concern that too many patents are issued for [obvious] inventions” (internal quotations omitted)); Shapiro, *supra* note 143, at 1018 (noting that complaints regarding PTO “typically allege that the [PTO] issues too many questionable patents” including those that were “obvious at the time the patent application was filed”); John R. Thomas, *A Review of Recent Decisions of the United States Court of Appeals for the Federal Circuit: Formalism at the Federal Circuit*, 52 AM. U. L. REV. 771, 773 (2003) (criticizing Federal Circuit for lowering nonobviousness standard); Mark Myers, Comment, *Edited & Excerpted Transcript of the Symposium on Ideas into Action: Implementing Reform of the Patent System*, 19 BERKELEY TECH. L.J. 1053, 1056 (2004) (calling for “reinvigorat[ion] of the nonobvious standard” and noting that panelists “believe that there has been some lowering of the bar of that standard”).

<sup>145</sup> See Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 598 (1999) (noting that “[t]he easiest way to raise standards [at the PTO], conceptually, is to tighten the nonobviousness requirement of Section 103,” but acknowledging that this would be difficult).

A. *An Undefined Nonobviousness Standard Cannot Be Applied Consistently*

This Article's analysis of indeterminacy in the nonobviousness requirement applies the relatively well-accepted position that most legal terms are neither fully objectively fixed (an extreme formalist position) nor entirely unconstrained (an extreme rule-skeptic position).<sup>146</sup> The meaning of most legal terms thus contains a mix of both determinacy and indeterminacy.<sup>147</sup> It follows that different legal terms can be relatively more or less determinate, depending on the degree to which decision makers recognize a common meaning.<sup>148</sup> More determinate legal terms have a larger core of shared understanding and can be applied relatively consistently.<sup>149</sup> Indeterminate terms are less universally understood and have a smaller core of common meaning.<sup>150</sup>

A common or shared understanding of a legal standard, such as nonobviousness, can come from a variety of sources, including definition by statute or judicial precedent, or through an understanding of the purpose of the standard.<sup>151</sup> Definition and purpose provide context and meaning for a legal standard, constraining its interpretation and allowing application of the standard with greater determinacy.<sup>152</sup>

In certain cases, a legal term can be self-defining if it is commonly understood on its own to a substantial degree.<sup>153</sup> For example, a law

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<sup>146</sup> J.M. Balkin, *Ideology as Constraint*, 43 STAN. L. REV. 1133, 1136, 1150 (1991).

<sup>147</sup> H.L.A. HART, THE CONCEPT OF LAW 124-35 (1961). Ronald Dworkin's famous dispute with Hart does not affect the analysis here because, even under Dworkin's conception, principles are sometimes unknown until a judge is required to rule. RONALD DWORIN, LAW'S EMPIRE 225-75 (1986). As discussed below, nonobviousness decisions often present contextual issues that will not be resolvable by precedent. See *infra* Part II.A.

<sup>148</sup> HART, *supra* note 147, at 124-35; David Millon, *Objectivity and Democracy*, 67 N.Y.U. L. REV. 1, 14-15 (1992); see Balkin, *supra* note 146, at 1136. For the purposes of the analyses presented here, it is immaterial whether the term "meaning" is derived from social structure, individual analysis, some combination of the two, or other factors. For this reason, it is unnecessary to adopt a position in the long-running debate between "traditional" and "critical" legal scholars concerning the objectivity or source of the meaning of legal terms. See ROBERT SUMMERS, LON L. FULLER 118-19 (1984); Balkin, *supra* note 146, at 1154, 1157; Joseph Singer, *The Player and the Cards: Nihilism and Legal Theory*, 94 YALE L.J. 1, 6-7 (1984).

<sup>149</sup> Singer, *supra* note 148, at 6-7.

<sup>150</sup> *Id.*

<sup>151</sup> HART, *supra* note 147, at 124-35; Balkin, *supra* note 146, at 1154.

<sup>152</sup> HART, *supra* note 147, at 124-35.

<sup>153</sup> *Id.* at 126; SUMMERS, *supra* note 148, at 118.

mandating a sixty-five mile per hour speed limit for motor vehicles would be relatively self-defining, as there is a common understanding of “sixty-five miles per hour.”<sup>154</sup> “Non-obvious,” on the other hand, is not self-defining because it lacks a commonly recognized meaning as a measure of a degree of innovation.<sup>155</sup> The ongoing debate concerning exactly what the nonobviousness standard is supposed to measure belies any contrary contention.<sup>156</sup>

The lack of definition for the quantum of ingenuity and level of ordinary skill measures, combined with the undertheorized purpose of the standard, leaves the nonobviousness requirement with a relatively small core of common understanding. As a result, the nonobviousness standard is highly indeterminate.<sup>157</sup>

Without clear standards, each nonobviousness decision is largely *sui generis*. As there is little to bound a decision, nonobviousness decisions are decidedly unconstrained. This problem is particularly pervasive in the nonobviousness context because precedent, a common mechanism for lending greater definitional precision to legal standards, is less useful than in many other circumstances. Because nonobviousness decisions are so intensely fact-specific, prior nonobviousness holdings are rarely comparable to a specific case at hand. This phenomenon helps explain why patent attorneys and judges view patent litigation as a particularly uncertain legal area.<sup>158</sup>

An analogy is often drawn between the nonobviousness standard and the negligence standard in tort as a basis for supporting the legitimacy of applying the nonobviousness standard. The Supreme Court drew such a comparison in *Graham*, noting: “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

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<sup>154</sup> Disputes may arise, however, concerning what a “motor vehicle” is. See *McBoyle v. United States*, 283 U.S. 25, 25-27 (1931) (concerning whether airplane was “motor vehicle” for purposes of federal law prohibiting interstate transport of motor vehicles).

<sup>155</sup> See *In re Seagate Tech. LLC*, 497 F.3d 1360, 1371 (Fed. Cir. 2007) (en banc) (stating that “reckless” is not self-defining term); HART, *supra* note 147, at 126; SUMMERS, *supra* note 148, at 118.

<sup>156</sup> See MERGES & GINSBURG, *supra* note 118, at 111 (discussing conflict between views of nonobviousness as question of technological advance versus question of balancing costs and benefits of patent system); Michael Astorino, *Obviously Troublesome: How High Should the Standard Be for Obtaining a Patent*, 89 J. PAT. & TRADEMARK OFF. SOC'Y 239, 241-42 (2007) (discussing current debate over nonobviousness standard); *supra* Part I.C.2.

<sup>157</sup> HART, *supra* note 147, at 130-31.

<sup>158</sup> Sag & Rohde, *supra* note 144, at 32.

comparable to those encountered daily by the courts in such frames of reference as negligence and scienter.”<sup>159</sup> This analogy, however, is not appropriate. While it is true that both the nonobviousness and negligence standards are determined from the perspective of a hypothetical person, significant substantive differences between the legal standards reveal that the (potential) ability of decision makers to judge negligence is not representative of their ability to judge nonobviousness.

First, the negligence standard is significantly defined, reducing its indeterminacy. Negligence is commonly defined as failing to provide the standard of care that a reasonable or average person would use under similar circumstances.<sup>160</sup> Though this definition is not necessarily precise, it provides substantial context. 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.<sup>161</sup> These definitions of negligence provide context for a decision maker, which is lacking in the nonobviousness inquiry.<sup>162</sup>

Second, 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.<sup>163</sup> Such considerations generally do not exist for assessing nonobviousness.

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<sup>159</sup> *Graham v. John Deere of Kan. City*, 383 U.S. 1, 18 (1966).

<sup>160</sup> RESTATEMENT (SECOND) OF TORTS § 282 (1965); BLACK’S LAW DICTIONARY 716 (abr. 6th ed. 1991).

<sup>161</sup> *United States v. Carroll Towing Co.*, 159 F.2d 169, 173 (2d Cir. 1947).

<sup>162</sup> That being said, who the “reasonable person” is in negligence cases is generally undefined, and this can lead to a well-recognized problem in certain instances. Where a claim for negligence is based on whether particular comments were offensive, it is unclear who to consider the “reasonable person.” DAN B. DOBBS, *THE LAW OF TORTS* § 403 (2000); W. PAGE KEETON, *PROSSER AND KEETON ON THE LAW OF TORTS* § 111 (5th ed. 1984). A “reasonable minority individual,” for instance, may be more easily offended by minority-disparaging comments than a “reasonable non-minority.” The attributes of the reasonable person in this context are undefined, and therefore the legal analysis is recognized as indeterminate. DOBBS, *supra*, § 403; KEETON, *supra*, § 111.

<sup>163</sup> *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.”).

Third, evaluating reasonableness for negligence purposes requires a decision maker to place himself or herself in the mindset of an ordinary person.<sup>164</sup> A lay decision maker can place himself or herself in the mindset of an ordinary person. Nonobviousness, however, requires a lay decision maker to place himself or herself in the mindset of a person of ordinary skill in the art, a task that lay individuals are generally not cognitively capable of performing.<sup>165</sup> The negligence standard, though often difficult to judge, provides a defined and epistemically tractable inquiry for a decision maker, which the nonobviousness inquiry does not.<sup>166</sup>

The indeterminacy of a bare legal standard, like nonobviousness, exists in other areas of law as well. For example, in 1957 the Supreme Court held in *Roth v. United States* that “obscene” speech was not “speech” under the First Amendment,<sup>167</sup> creating the need to define obscenity so as not to curtail protected First Amendment speech. The difficulty in defining obscenity, however, led to disparate and unpredictable results, with different Justices applying different standards and tests.<sup>168</sup> Justice Stewart’s famously indeterminate definition of obscene material — “I know it when I see it” — exemplified this period.<sup>169</sup> Justice Stewart later recognized that this (non)standard was unworkable.<sup>170</sup> A decade after *Roth*, Justice Harlan wrote for the Court: “The subject of obscenity has produced a variety of views among the members of the Court unmatched in any other course of constitutional adjudication. In the 13 obscenity cases [since *Roth*] . . . [there have] been a total of 55 separate opinions among the justices.”<sup>171</sup> Several years later, Justice Brennan, the author of *Roth*, concluded: “[Our] efforts to implement [the *Roth*] approach demonstrate that agreement on the existence of something called “obscenity” is still a long and painful step from agreement on a

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<sup>164</sup> RESTATEMENT (SECOND) OF TORTS § 290 cmt. e; BLACK’S LAW DICTIONARY 716.

<sup>165</sup> See *infra* Part II.B.

<sup>166</sup> See HART, *supra* note 147, at 133 (referring to precedent surrounding negligence as leaving “only a fringe of open texture, instead of a variable standard”).

<sup>167</sup> 354 U.S. 476, 485 (1957).

<sup>168</sup> GERALD GUNTHER, CONSTITUTIONAL LAW 1102-04 (12th ed. 1991). This period was highlighted by the “*Redrup* Reversals,” a series of 31 cases starting with *Redrup v. New York*, 386 U.S. 767 (1967), in which the Court issued *per curiam* reversals of obscenity law convictions with various members of the Court applying different tests. GUNTHER, *supra*, at 1104.

<sup>169</sup> *Jacobellis v. Ohio*, 378 U.S. 184, 197 (1964) (Stewart, J., concurring).

<sup>170</sup> *Miller v. California*, 413 U.S. 15, 47-48 (1973) (Brennan, J., dissenting).

<sup>171</sup> *Ginsberg v. New York*, 390 U.S. 629, 704-05 (1968) (Harlan, J., concurring).

workable definition of the term.”<sup>172</sup> The inability to achieve a workable definition during this period is attributed, in part, to the failure to identify a clearly defined purpose.<sup>173</sup> In *Miller v. California* in 1973, a majority of the Supreme Court developed a more precise definition of obscenity, finally providing somewhat greater certainty and predictability to this First Amendment doctrine.<sup>174</sup>

An “I know it when I see it” standard did not provide manageable guidance for obscenity law, but this is precisely where nonobviousness doctrine currently stands. As Justice Brennan wrote, agreement on a concept is not agreement on its definition. Providing greater definition for the nonobviousness standard will not eliminate indeterminacy in nonobviousness decisions, but can reduce it. The goal is not to remove all indeterminacy, but to provide greater guidance and content so that nonobviousness decisions can be more accurate and predictable.

A number of other factors exacerbate the inconsistency caused by indeterminacy in the nonobviousness standard. These factors include the hindsight bias, constraints at the patent office, and litigation effects. Studies reveal that decision makers suffer a significant hindsight bias when judging nonobviousness.<sup>175</sup> This bias unconsciously and inevitably distorts judgment of the obviousness of an invention, making inventions appear more obvious *ex post* than they actually were *ex ante*. Although *KSR* concerned the hindsight bias — the basis for the TSM test in the first instance — the decision failed to ameliorate problems caused by the bias.<sup>176</sup> Similarly, a variety

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<sup>172</sup> *Paris Adult Theatre I v. Slaton*, 413 U.S. 49, 79 (1973) (Brennan, J., dissenting).

<sup>173</sup> GUNTHER, *supra* note 168, at 1102-07.

<sup>174</sup> *Miller*, 413 U.S. at 24. The Court held that obscenity was based on:

- (a) whether the average person, applying contemporary community standards would find that the work, taken as a whole, appeals to the prurient interest; (b) whether the work depicts or describes, in a patently offensive way, sexual conduct specifically defined by the applicable state law; and (c) whether the work, taken as a whole, lacks serious literary, artistic, political, or scientific value. *Id.* (internal quotations and citations omitted).

Although this definition of obscenity improved the situation, it by no means resolved all cases. GUNTHER, *supra* note 168, at 1117. Justice Brennan, in dissent in a companion case, lamented that none of the standards, including the new *Miller* one, “can reduce the vagueness [of] our obscenity standards to a tolerable level.” *Paris Adult Theatre I*, 413 U.S. at 73.

<sup>175</sup> Mandel, *Patently Non-Obvious II*, *supra* note 67, at 18-20; Mandel, *Patently Non-Obvious*, *supra* note 67, at 1411-14.

<sup>176</sup> Gregory 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.

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of factors at the PTO and in litigation can distort nonobviousness decisions. A non-exhaustive list includes problematic incentives for examiners to grant patents, the *ex parte* nature of proceedings at the patent office, the limited time examiners have to devote to each patent application, the limited information to which examiners have access, and potential jury and judge deference to experts.<sup>177</sup> These factors add to the unpredictability and inconsistency of nonobviousness decisions.

Given all of these problems, why is there a common perception that decision makers are at least somewhat capable of, and do in fact, apply the nonobviousness requirement in some roughly consistent manner? Though some commentators question individual ability to apply the nonobviousness standard at all, most critics argue that the standard is applied too leniently, rather than arguing that it is applied relatively randomly.<sup>178</sup>

There are likely several reasons for the perception of consistency. The first, discussed above, is that even though the standard is indeterminate, there is still some area within which most agree that certain inventions are obvious or non-obvious. A number of nonobviousness decisions are commonly perceived as accurate.

Second, precisely because of the lack of definition, it is difficult to demonstrate that any particular nonobviousness decision is incorrect. To the extent nonobviousness decisions involve complicated issues and complex technologies that are difficult for a lay individual to understand, it is hard for any observer to be confident that a given decision was wrong. There may also be a tendency for observers to (consciously) “give the benefit of the doubt” or (unconsciously) defer to authorized decision makers in ambiguous cases.

Individuals also likely engage in a significant amount of heuristic processing that allows them to make nonobviousness decisions and that creates the perception of the ability to make nonobviousness decisions accurately. These heuristics allow decision makers to believe they can identify the level of ordinary skill in the art, put themselves in the position of a person having ordinary skill, and

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REV. 323, 340-42 (2008).

<sup>177</sup> See, e.g., Benjamin & Rai, *supra* note 88, at 278 (discussing challenges posed by *ex parte* proceedings at the PTO, limited time available to examiners, and limits on the information available to examiners); Shubha Ghosh & Jay Kesan, *What Do Patents Purchase? In Search of Optimal Ignorance in the Patent Office*, 40 Hous. L. Rev. 1219, 1225-26, 1246 (2004) (discussing various factors that can impede nonobviousness decisions); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 Nw. U. L. Rev. 1495, 1499-1500 (2001) (same).

<sup>178</sup> See *supra* note 144.



understand the level of ingenuity necessary to measure nonobviousness.<sup>179</sup> For example, a wealth of empirical data reveals a strong overconfidence bias: individuals have irrationally high confidence in their own judgments.<sup>180</sup> Overconfidence has been demonstrated for both lay and expert judgment, and in real-world as well as experimental situations.<sup>181</sup> Individuals' tendency to interpret information as supporting a single conclusion, rather than viewing decisions as more complex and ambiguous, likely also exacerbates overconfidence in nonobviousness judgments.<sup>182</sup> Individual conviction that a nonobviousness decision is correct is also likely intensified by a naïve realism bias — the belief that one's own perspective is especially accurate<sup>183</sup> — and by a false consensus bias, pursuant to which individuals view their own judgments as more common than they actually are, and view alternative judgments as uncommon and inappropriate.<sup>184</sup> This suite of heuristics, and likely others, operate to create the perception that decision makers can make, and in fact do make, nonobviousness decisions more consistently than they do in reality.

*B. Lay Individuals Cognitively Cannot Apply the Nonobviousness Requirement*

In addition to the indeterminacy problems, there is also an inherent epistemic unfeasibility in the nonobviousness requirement. Lay individuals cannot apply the nonobviousness requirement as construed

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<sup>179</sup> As evidence of these heuristics, consider the Supreme Court cases discussed above in which the Court took such steps, apparently without realizing it. See *supra* Part I.A.1-2.

<sup>180</sup> Dale Griffin & Amos Tversky, *The Weighing of Evidence and the Determinants of Confidence*, in *HEURISTICS AND BIASES: THE PSYCHOLOGY OF INTUITIVE JUDGMENT* 230 (Thomas Gilovich et al. eds., 2002); Paul Slovic et al., *Fact versus fears: Understanding perceived risk*, in *JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES* 463, 472 (Daniel Kahneman, Paul Slovic & Amos Tversky eds., 1982).

<sup>181</sup> Griffin & Tversky, *supra* note 180, at 230; Slovic et al., *supra* note 180, at 475-78.

<sup>182</sup> Charles Lord et al., *Biased Assimilation and Attitude Polarization: The Effects of Prior Theories on Subsequently Considered Evidence*, 37 *J. PERSONALITY & SOC. PSYCHOL.* 2098, 2099 (1979); Dan Simon, *A Third View of the Black Box: Cognitive Coherence in Legal Decision Making*, 71 *U. CHI. L. REV.* 511, 544-45 (2004).

<sup>183</sup> Emily Pronin et al., *Understanding Misunderstanding: Social Psychological Perspectives*, in *HEURISTICS AND BIASES: THE PSYCHOLOGY OF INTUITIVE JUDGMENT* 646-47 (Thomas Gilovich et al. eds., 2002); Simon, *supra* note 182, at 545.

<sup>184</sup> Pronin, *supra* note 183, at 642; Lee Ross & Craig A. Anderson, *Shortcomings in the Attribution Process: On the Origins and Maintenance of Erroneous Social Assessments*, in *JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES* 140 (Kahneman et al. eds., 1982).

because it requires them to have the mental state of another. Only an actual person having ordinary skill in the art can really know what is obvious to such a person.<sup>185</sup> The 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 nanotechnology. 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 experiments reveal that individuals are not capable of making judgments from other individuals' perspectives. A seminal study involved participants tapping out the rhythms of well-known tunes while a second participant listened.<sup>186</sup> The tappers predicted that the listeners would identify the tunes fifty percent of the time. The listeners were actually only able to identify the tunes three percent of the time.<sup>187</sup> 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.<sup>188</sup>

Similarly, a recent set of experiments found that people tend to believe they can communicate emotion and tone (such as sarcasm, seriousness, and anger) over e-mail far better than they actually can.<sup>189</sup> Other studies have found that individuals cannot accurately judge the

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<sup>185</sup> See Lichtman & Lemley, *supra* note 89, at 123 ("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.").

<sup>186</sup> 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) (discussing Elizabeth Newton, *The Rocky Road from Actions to Intentions* (June 1990) (unpublished Ph.D. dissertation, Stanford University) (on file with Stanford University Department of Psychology)).

<sup>187</sup> See *id.*

<sup>188</sup> See *id.*

<sup>189</sup> *Id.*

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 judgment.<sup>190</sup> The authors of both sets of studies concluded that the reason for these misperceptions is that individuals are unable to detach themselves from their own perspective when asked to evaluate the perspective of another.<sup>191</sup> This phenomenon is dubbed the “curse of knowledge.”<sup>192</sup> 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.<sup>193</sup>

These findings raise serious doubts about the ability of lay decision makers to judge whether an invention would have been obvious to a person of ordinary skill in the art.<sup>194</sup> The experiments involved participants judging the perception of others who had equal skill and experience. Not only do 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. This task is cognitively impractical, if not impossible in many cases.

It is true that 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. This assistance, however, will not resolve the problem in most circumstances. 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.<sup>195</sup>

Consider the problem this way: imagine that one expert opines that a certain combination was within the knowledge of a person of

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<sup>190</sup> Colin Camerer et al., *The Curse of Knowledge in Economic Settings: An Experimental Analysis*, 97 J. POL. ECON. 1232, 1232 (1989).

<sup>191</sup> Camerer, *supra* note 190, at 1244-45; Kruger, *supra* note 186, at 933.

<sup>192</sup> Camerer, *supra* note 190, at 1232.

<sup>193</sup> Kruger, *supra* note 186, at 933.

<sup>194</sup> 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.

<sup>195</sup> Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE L.J. 1535, 1539 (1998).

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ordinary skill in the art, and that 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. On what basis can a lay decision maker 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.<sup>196</sup> In most cases, lay decision makers lack the epistemic capability to make such a decision analysis.<sup>197</sup>

### C. *The Indeterminate Nonobviousness Model*

At first blush, an inconsistent nonobviousness standard may not seem that detrimental to the patent system. Patent law exists to promote innovation and the disclosure of innovation information. As long as potential inventors do not know in advance how their patent application will fare, inconsistent nonobviousness decisions may not be that bad, so long as the correct standard is applied on average. Correct application of the nonobviousness standard on average could produce the appropriate number of patent grants (though not correct patent decisions in individual cases), and thus provide proper incentives to potential inventors.

This rationale, however, fails to recognize the reality of technological innovation. Innovation is neither linear nor uniform across the entire range of technological advance. Rather, small, trivial technological advances are very common, while great, dramatic advances are rare. The exact relationship between the quantum of innovation of an advance and the quantity of advances of such quantum is not precisely known. Rough features of the nature of this relationship, however, can be described. Straightforward reasoning indicates that the greater the technological advance, the less likely it

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<sup>196</sup> See *id.* at 1595 (discussing similar issue for scientific expert testimony).

<sup>197</sup> 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.” *Markman v. Westview Instruments, Inc.*, 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, however, lay judges also generally cannot be expected to be able to evaluate expert technical testimony.

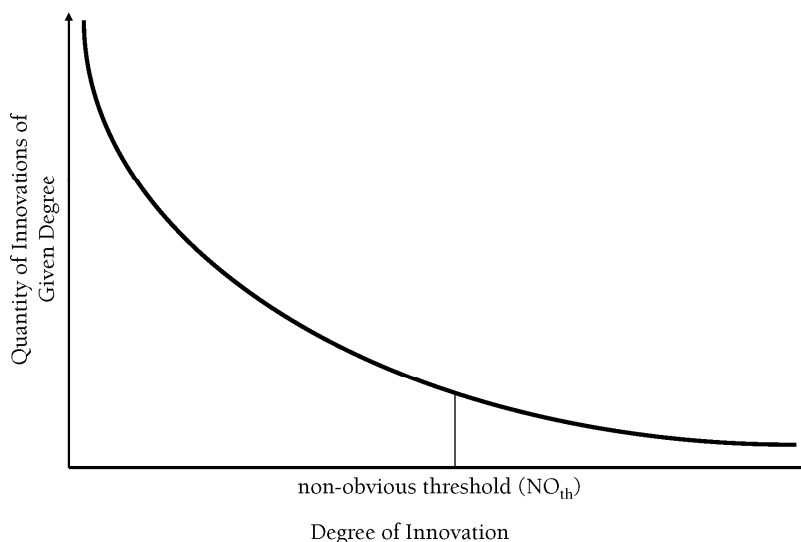
will be. Conversely, the smaller the advance, the more common it will be. There are many trivial advances, but few revolutionary ones. This means that the innovation-quantity function will be downward sloping. The innovation-quantity relationship also is not expected to be linear. First, technological advances lie on a continuum, and both immeasurably small advances and unboundedly great advances are possible. Second, more advanced innovations are expected to become successively less and less likely.<sup>198</sup> These factors mean that the innovation-quantity function is roughly hyperbolic and asymptotic.<sup>199</sup> The innovation-quantity function can thus be roughly represented as the curve graphed in Figure 2. The point on the curve identified as “nonobviousness threshold” represents the standard actually defined in § 103 (whether or not it is correctly applied). This graph is not meant to define precisely the innovation-quantity function or the nonobviousness threshold, but rather to provide a rough, schematic representation.

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<sup>198</sup> See, e.g., *Dewey & Almy Chem. Co. v. Mimex Co.*, 124 F.2d 986, 990-91 (2d Cir. 1942) (Hand, J.) (noting that great pioneer inventions are rare and patentable inventions more common).

<sup>199</sup> These assumptions about the relationship between the quantum and quantity of technological advance appear logical and probable, but cannot be stated definitively. Other relationships are theoretically possible. For example, it is possible that the innovation-quantity function is constantly downward sloping, but has some point (or even points) of inflection. This would appear unlikely: it would either require that for some range, greater advances are roughly just as common as lesser advances, or (perhaps slightly more plausible) there is some innovation threshold, and advances greater than this threshold suddenly become much less likely. Though the existence of such a threshold could provide an intriguing theoretical basis for the nonobviousness standard, such a threshold has not been hypothesized and appears unlikely, particularly considering the cross-industry scope of this analysis and that psychologists studying creativity have identified no such threshold. R. Keith Sawyer, *Creativity, Innovation, and Obviousness*, 12 LEWIS & CLARK L. REV. 461, 476-77 (2008). For a discussion of how these alternative innovation-quantity function possibilities would affect the conclusions drawn from the model, see footnote 185.

Figure 2. Innovation versus quantity function.



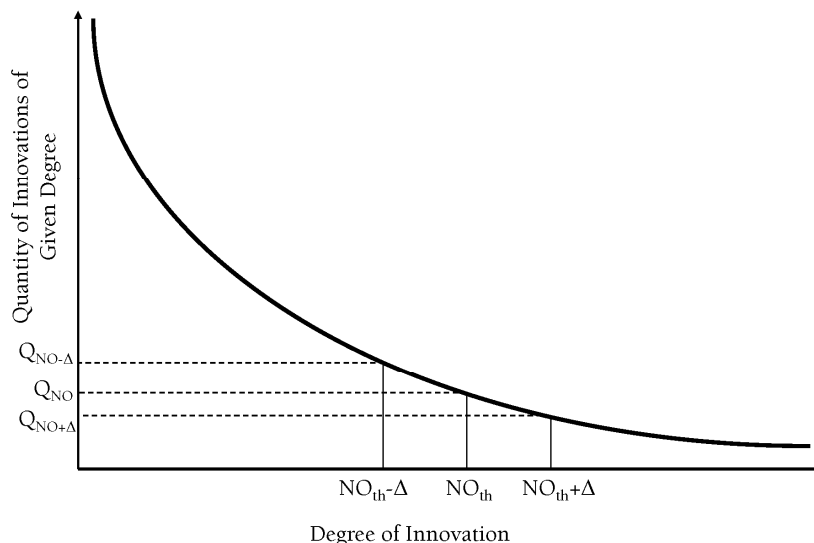
The interaction between indeterminacy in the nonobviousness standard and this model reveals some striking consequences. Perhaps most significantly, an inconsistent nonobviousness standard, even if applied correctly on average, will not yield the correct number of patents, but too many patents. Consequently, an inconsistent nonobviousness standard (again, even if applied correctly on average) will not provide the appropriate patent incentive, but may provide too great a patent incentive.<sup>200</sup>

Indeterminacy in the nonobviousness standard will mean that within some range of advances (both above and below the § 103 threshold), the probability of any individual advance receiving a patent will be roughly equal. In other words, indeterminacy flattens or smoothes the probability of patent grant curve for inventions in the vicinity of the nonobviousness standard. Consider two inventions that lie within this range: one that represents an advance that is a certain amount ( $\delta$ ) above a non-obvious advance and another that

<sup>200</sup> Excess patent grants might not produce too great an incentive if the cost of wrongful denials of patents on actually non-obvious inventions exceeds the extra incentive offered by patent grants on obvious inventions. I am grateful to Mark Lemley for making this point. Considering the applicant's uncertainty surrounding whether any given application is non-obvious, such an outcome appears unlikely. Such an outcome would also require that the § 103 standard is not set at optimal efficiency.

represents an advance that is the same delta below a non-obvious advance (see Figure 3). We can refer to the former invention as having a level of advance “ $NO_{th+}$ ” and the latter as “ $NO_{th-}$ .”  $NO_{th+}$  will represent an actually non-obvious advance under § 103 and  $NO_{th-}$  a statutorily obvious advance.

Figure 3. The effect of an indeterminate non-obvious standard.



We can now identify the quantity of innovations of each level of advance.  $Q_{NO+}$  is the quantity of advances of the level  $NO_{th+}$ , and  $Q_{NO-}$  is the quantity of advances of the level  $NO_{th-}$ . The difference between  $Q_{NO-}$  and  $Q_{NO}$  will be greater than the difference between  $Q_{NO+}$  and  $Q_{NO}$  because of the increasingly downward sloping nature of the innovation-quantity function. That is,

$$Q_{NO-\Delta} - Q_{NO} > Q_{NO} - Q_{NO+\Delta}$$

Because the probability of the two different levels of invention receiving a patent grant is roughly equal, the result (to the degree of analysis presented so far) is that there will be more patents granted on actually obvious advances of the level  $NO_{th-}$  than patents granted on actually non-obvious advances of the level  $NO_{th+}$ . Sum this across all pertinent levels of advance, and a potentially extreme problem is projected: too many patents in total will be granted, too many patents

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on obvious inventions will be granted, and too few patents on non-obvious inventions will be granted.<sup>201</sup>

The greater the indeterminacy in the nonobviousness standard, the more each of these errors is exacerbated. Mathematically, the errors are exacerbated because the band over which the above equation holds true widens with greater indeterminacy in applying the nonobviousness standard.

There are also problematic dynamic effects. Excess patent grants increase the probability of a patent grant on any given application, which increases incentives for patent applicants to apply, leading to more patent applications, and then to even more patent grants (including more erroneous patent grants).<sup>202</sup> This cycle will reach equilibrium, as at some point there will be a consistent percentage of patent grants. The stage of equilibrium will be determined by the level of indeterminacy in the nonobviousness standard. The larger the indeterminacy, the greater the excess of patent applications and grants at equilibrium.

This analysis can be refined to take into account additional factors to make it more realistic. First, the probability of an advance of a given level being held non-obvious is not constant, but varies with the level of advance. If decision makers could apply the § 103 standard perfectly, they would deny all applications on obvious advances and grant all applications on non-obvious advances. The function defining the probability of a patent grant would have a single step at the

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<sup>201</sup> As noted in footnote 199, it is possible that the innovation-quantity function has a point of inflection. There are two basic alternatives. First, that the function is convex towards the quantity axis, and then inflects and becomes concave further away. If the nonobviousness threshold is to the right of the inflection, there is no effect on the conclusions drawn here. If the threshold is to the left of the inflection then the conclusions would change: there would not be too many patents, but there would be even greater error in the number of patents on obvious inventions granted, and there would also be exacerbated dynamic effects on the number of patent applications (as discussed in the main text following). The second alternative is that the function is concave towards the quantity axis and then inflects and becomes convex further away. In this case, if the nonobviousness threshold is to the left of the inflection, there is no effect on the conclusions drawn here. If the threshold is to the right of the inflection then the conclusions would change in the same manner described above: there would not be too many patents, but there would be even greater error in the number of patents on obvious inventions granted, and there would also be exacerbated dynamic effects on the number of patent applications.

<sup>202</sup> See JAFFE & LERNER, *supra* note 144, at 175 (“To put it crudely, if the patent office allows bad patents to issue, this encourages people with bad applications to show up.”).



nonobviousness threshold going from zero percent below the threshold to 100% at or above the threshold

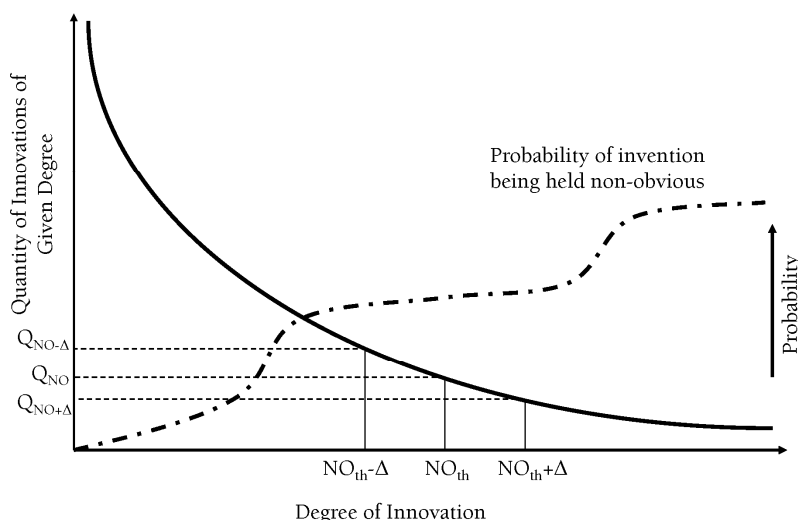
Indeterminacy in the nonobviousness standard, however, flattens the probability-of-grant function in the area around the nonobviousness threshold. The greater the indeterminacy, the flatter the curve, and the greater the range around the threshold over which the probability function is flat. The result is the hypothesized probability curve presented by the dashed line in Figure 4. Assuming that the probability curve is symmetrical in the area around the § 103 standard (a result indeterminacy will produce), the exact shape of the curve is not critical.<sup>203</sup> The increased probability of grant below the nonobviousness standard will produce erroneous grants, the decreased (from 100%) probability of grant above the nonobviousness standard will produce erroneous denials, and the downward sloping nature of the innovation function will mean that the former outnumber the latter.<sup>204</sup>

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<sup>203</sup> Similarly, the shape of the probability curve from the inflection points to the extremes at either end does not materially affect the analysis presented here. It is possible, for example, that the actual probability of grant curve is more linear at the extremes than represented here. This outcome would occur if decision makers are unable to judge nonobviousness accurately at the extremes as well as around the nonobviousness threshold. It seems intuitively likely, however, that decision makers are relatively more accurate in judging the obviousness of trivial advances and “highly non-obvious” advances, producing the twice-inflected function presented.

<sup>204</sup> To the extent the probability curve is not symmetrical around the nonobviousness standard, the substantial criticism of application of the nonobviousness standard would indicate that the error is greater for actually obvious inventions, rendering the problems predicted by this model still valid. I am grateful to Katherine Strandburg and Davis Adelman for discussing some of the details concerning the probability curve.

Figure 4. Probability of invention being held non-obvious.



The model can be further enhanced by recognizing that the probability of an inventor applying for a patent on an advance of a given level also is not expected to be constant across the range of advances. The greater the advance, the more likely it will be for an inventor to file a patent application, both because there is a greater probability of a patent grant and because (on average) the advance is likely more valuable.

Indeterminacy in the nonobviousness standard will affect the incentives of potential patent applicants. Because of the known unpredictability of nonobviousness decisions, it often will be rational for utility-maximizing inventors to apply for patents on inventions that the inventor perceives to be obvious. At a basic economic level, an inventor will apply for a patent whenever the value of the potential patent, if granted, multiplied by its probability of grant is greater than the cost of patent application.<sup>205</sup> Because indeterminacy produces excess applications on obvious advances, as explained above, this can create a detrimental cycle: more patent applications on obvious advances will lead to more patents being granted on obvious inventions, which is expected to lead to the appearance of an even more inconsistent nonobviousness standard.

<sup>205</sup> That is, an inventor will file a patent application whenever  $V \times P > C$ , where "V" is the value of the patent if granted, "P" the expected probability of the application being approved, and "C" the expected cost of the application and patent process.

This cycle will produce applications on successively more and more obvious advances. As other inventors see more patents on  $NO_{th}$ -advances granted, and are generally unaware of the volume of  $NO_{th}$ -applications that are denied,<sup>206</sup> there will be greater incentives for inventors to file patent applications on even more obvious advances (for example, on  $NO_{th-2}$  advances). These effects, of course, will cycle. Indeterminacy will lead both to a greater percentage of applications on the set of advances a given quantum below the nonobviousness threshold, and to more applications on the sets of advances that are even more obvious.

Recall that indeterminacy also reduces the probability of patent grants on non-obvious inventions. This will produce lower incentives for inventors to apply for patents on actually non-obvious inventions.<sup>207</sup> This effect, however, should not be very concerning because the detrimental impact will only be significant for the perceived least valuable non-obvious inventions (it will still be worth filing a patent application on a valuable invention even if there is a reduced probability of grant).<sup>208</sup> Nevertheless, as a consequence of nonobviousness indeterminacy, inventors will not file applications on a number of non-obvious advances, and these inventions will not be patented or disclosed. The result is precisely contrary to that desired: excessive patent applications are filed (and granted) on obvious inventions and too few applications are filed (and granted) on non-obvious inventions.

Perhaps more problematic, a reduction in the probability of patent grants on non-obvious advances will reduce incentives for industry to

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<sup>206</sup> Many patents that are denied are never published. Inventors presumably have a rough awareness of patent application success rates overall (though these rates vary widely depending on whose statistics one chooses), but not an awareness of the reasons for patent denials or of how many  $NO_{th}$ - applications are denied. See also Lawrence B. Ebert, *Patent Grant Rates at the United States Patent and Trademark Office*, 4 CHI.-KENT J. INTELL. PROP. 108, 110-15 (2004) (critiquing varying reports purporting to calculate patent grant rates). Compare Robert A. Clarke, *U.S. Continuity Law and its Impact on the Comparative Patenting Rates of the US, Japan and the European Patent Office*, 85 J. PAT. & TRADEMARK OFF. SOC'Y 335 (2003) (calculating 75% patent grant rate), with Cecil D. Quillen & Ogden D. Webster, *Continuing Patent Applications and Performance of the U.S. Patent and Trademark Office*, 11 FED. CIR. B.J. 1 (2001) (postulating patent grant rate as high as 97% when including continuing applications), and Press Release, U.S. Patent and Trademark Office, Fiscal Year 2006: A Record-Breaking Year for the USPTO (Dec. 22, 2006), available at <http://www.uspto.gov/web/offices/com/speeches/06-73.htm> (reporting patent allowance rate of 54% for 2006).

<sup>207</sup> See *supra* note 205.

<sup>208</sup> See *supra* note 205.

engage in research and development of anticipated non-obvious advances. Conversely, an increase in the probability of patent grants on actually obvious advances will increase the incentives to invest in more trivial research. Indeterminacy in the nonobviousness standard likely produces a socially detrimental shift in research and development away from targeting great technological advances and towards more mundane innovation.

Indeterminacy will also play a role in decisions about whether to challenge patents in litigation. Because indeterminacy will increase the probability of an incorrect decision overturning an actually non-obvious patent, parties will challenge more non-obvious patents than they otherwise would.<sup>209</sup> More challenges to actually non-obvious patents will lead to more incorrect legal outcomes. Conversely, parties will challenge fewer actually obvious patents than appropriate, because of the cost of litigation and the uncertainty of outcome.<sup>210</sup> The result, again, is precisely contrary to that desired: parties will litigate patents on non-obvious advances excessively and patents on obvious advances too infrequently.

The outcomes predicted by this model will cause many of the problems currently identified in the patent system.<sup>211</sup> Excessive patent grants increase the prevalence and density of patent thickets and anticommons problems. Too many patents on obvious advances aggravate the problems of patent minefields and potential patent hold-ups. Further, patents on less innovative advances are likely the greatest concerns from patent minefield and hold-up perspectives. These effects play directly into the hands of patent trolls,<sup>212</sup> and may help explain why patent trolls have become such a significant problem.<sup>213</sup> On the other side of the threshold, the denial of patents

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<sup>209</sup> George Priest & Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J. LEGAL STUD. 1, 6 (1984).

<sup>210</sup> James Bessen & Michael Meurer, *Lessons on Patent Policy from Empirical Research on Patent Litigation*, 9 LEWIS & CLARK L. REV. 1, 2 (2005).

<sup>211</sup> Indeterminacy in other patent doctrines, such as claim construction, can result in certain of these effects as well. See, e.g., Jeffrey A. Lefstin, *The Measure of the Doubt: Dissent, Indeterminacy, and Interpretation at the Federal Circuit*, 58 HASTINGS L.J. 1025, 1089-92 (2007) (discussing indeterminacy in patent claim construction).

<sup>212</sup> Though “patent troll” may be difficult (or impossible) to define, the term still provides a useful concept for understanding certain activity that may be detrimental to the patent system.

<sup>213</sup> All of these problems are even more severe if those who argue that the nonobviousness standard is being applied too leniently (on average) are correct. *Supra* note 144. Because of the shape of the innovation-quantity curve (greater slope to the left of the nonobviousness threshold than to the right), a low nonobviousness

on deserving non-obvious inventions raises a different concern — reducing incentives for what may be the most socially valuable inventions. Indeterminacy in the nonobviousness standard may be responsible for much of the variety and extent of problems perceived to be plaguing the patent system.

### III. TOWARDS A DEFINITION OF NONOBVIOUSNESS

Adding greater determinacy to the nonobviousness standard is a difficult challenge. Many jurists and other experts have tried, and many have given up hope.<sup>214</sup> Developing an appropriate standard for judging obviousness, however, will decrease the indeterminacy of nonobviousness analysis, and consequently help mitigate the problems identified above. Reducing uncertainty, however, is not the only goal. Any definition of nonobviousness must also set the standard at an appropriate level to balance properly the costs and benefits of the monopoly incentive.

#### A. *The Value of Greater Determinacy*

The benefits of a more clearly defined and more reproducible nonobviousness standard could be significant. A more determinate standard would create a greater likelihood that the Patent Office and judicial system would apply the standard correctly and consistently, and in turn would render the Federal Circuit less likely to disturb PTO and district court decisions. In addition, parties outside the litigation and patent application context would be better able to apply the nonobviousness standard to evaluate potential licensing arrangements, values of companies based on patent holdings or exposure, and litigation decisions.

A more determinate nonobviousness standard would also reduce the excess in overall patent grants identified above, reduce the number of patent grants on obvious inventions, and increase the number of patent grants on non-obvious inventions. These effects would result in more socially beneficial incentives for innovators deciding whether to research a particular area, file a patent application, or challenge a

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standard will result in an even greater excess of patent grants overall and of patent grants on obvious advances.

<sup>214</sup> See, e.g., *Kirsch Mfg. Co. v. Gould Mersereau Co.*, 6 F.2d 793, 794 (1925) (Hand, J.) (“An invention is a new display of ingenuity beyond the compass of the routinier, and in the end that is all that can be said about it.”); FED. TRADE COMM’N, *supra* note 10, ch. 4, at 13 (citing Judge Newman, “[Nonobviousness is] fuzzy ground. It’s hard to decide, difficult to administer, even harder to set”).

patent in litigation. Certainty and predictability concerning what is and is not patentable protects the balance the Patent Act seeks to strike between the incentives of monopoly rights for inventors and society's interest in an optimal public domain.<sup>215</sup> Being able to determine correctly what is and is not protected "is essential to promote progress, because, it enables efficient investment in innovation."<sup>216</sup>

Greater determinacy should also serve to dampen the seemingly endless oscillation between a patent standard that is applied too leniently and a patent standard that is applied too strictly. In the 1960s, there were heavy complaints that the nonobviousness standard was too relaxed, resulting in excess patent grants, and many deficiencies.<sup>217</sup> Some consider the Supreme Court holding in *Graham* to have been an effort to reign in lenient validity holdings.<sup>218</sup> In the 1970s, the concern was that patents were being improperly denied and held invalid, causing a different set of problems, and leading to the creation of the Federal Circuit.<sup>219</sup> In the past decade, the pendulum has swung strongly the other way — there is great concern that the nonobviousness standard is too low, and this concern may have led in part to the Supreme Court decision in *KSR*.<sup>220</sup> Part of the reason for

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<sup>215</sup> See, e.g., *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 731 (2002) (noting clarity of patent rights promotes "the delicate balance the law attempts to maintain between inventors, who rely on the promise of the law to bring the invention forth, and the public, which should be encouraged to pursue innovations, creations, and new ideas beyond the inventor's exclusive rights" (citing *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150 (1989))).

<sup>216</sup> *Id.* at 730-31.

<sup>217</sup> JAMES BESSEN & MICHAEL MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* 259 (2007); Kitch, *supra* note 107, at 342-43.

<sup>218</sup> Myron Cohen, *Nonobviousness and the Circuit Courts of Appeal — Twenty-Five Years in Review*, in *NONOBVIOUSNESS*, *supra* note 8, at 3:12. *Graham* did have the effect of producing a more stringent nonobviousness requirement, at least for a time. *Id.*

<sup>219</sup> Scott Cole, *The Rise and Fall of Patent Law Uniformity and the Need for a Congressional Response*, 81 *CHI.-KENT L. REV.* 713, 716-17 (2006) (explaining that Congress intended Federal Circuit to be pro-patent); Dreyfuss, *supra* note 135, at 6 (citing 1975 Hruska Commission's finding that presumption of patent validity was being eroded by various regional appellate circuits); George Frost, *Future Considerations — Views of a Corporate Counsel*, in *NONOBVIOUSNESS*, *supra* note 8, at 8:111 (lamenting ill-treatment of patents by courts in 1970s); Pauline Newman, *The Federal Circuit — A Reminiscence*, 14 *GEO. MASON U. L. REV.* 513, 514-16 (1992) (noting that prior to creation of federal circuit in 1982 patents were commonly invalidated and "[p]atent property had lost the reliable protection of a stable law, and was cynically described as no more than a license to sue").

<sup>220</sup> *KSR Int'l Co. v. Teleflex Inc.* 127 S. Ct. 1727, 1746 (2007) (explaining that low nonobviousness requirement can "stifle, rather than promote, the progress of the

the great size and continuity of these perturbations is that an indeterminate nonobviousness standard is highly malleable, and cannot provide a bulwark against whichever mood swing is in vogue.<sup>221</sup> Lending greater consistency to nonobviousness decisions could ameliorate the inefficiency and cost of these perturbations and of incorrect nonobviousness decisions.

### B. Differentiating Nonobviousness

Different inventions can be non-obvious for different reasons. Differentiating these distinct bases of nonobviousness, as elaborated below, will lend greater context and content to nonobviousness analysis.

Some inventions may be non-obvious in their conception, though once conceived may be easy to achieve. Post-It notes provide an example. The concept of combining paper with an adhesive that bonds weakly likely was not obvious, but once the combination was conceived, identifying means to reduce the invention to practice was

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useful arts”); Christopher A. Cotropia, *Nonobviousness and the Federal Circuit: An Empirical Analysis of Recent Case Law*, 82 NOTRE DAME L. REV. 911, 912 (2007) (positing that concerns that Federal Circuit had made it too easy to hold claimed invention non-obvious was basis for Supreme Court decision in *KSR*); *supra* note 144. The great swings in the perception of patenting standards did not begin with the creation of the nonobviousness requirement. As discussed, Congress enacted § 103 in part to reverse what was perceived to be too great a hurdle to satisfy the invention requirement. See Barton, *supra* note 111, at 486; *supra* Part I.A.1. And, there had been prior shifts as well. The patent system was changed from a registration to examination system in 1836 due to concerns about the low quality of patents being issued. See BESSEN & MEURER, *supra* note 217, at 259 (noting 1930s concern about low quality patents). *Hotchkiss* has been explained as a reaction to the patent standard being perceived as being too low, and there was also concern about too much patenting and abuse of the patent system in the period following the Civil War. Kitch, *supra* note 107, at 304-05, 321. By the end of the nineteenth century, the patent system was being praised again as a driver of technological innovation. BESSEN & MEURER, *supra* note 217, at 259. In the 1930s, however, the public had turned more hostile to patents, which they viewed as creating monopolies that were exacerbating the Great Depression. F.M. Scherer, *The Political Economy of Patent Policy Reform in the United States* 3 (Harvard Univ., John F. Kennedy School of Gov't Faculty Research Working Paper Series, Paper No. RWP07-042, 2007).

<sup>221</sup> See John F. Duffy, *A Timing Approach to Patentability*, 12 LEWIS & CLARK L. REV. 343, 344 (2008) (“[A] theme evident in both judicial opinions and scholarly articles is that the legal institutions of the patent system should try to find and articulate as clear a standard as possible for deciding patentability . . . [in order to make] decisions as accurate as possible rather than mere wild guesstimates that vary dramatically from decision-maker to decision-maker.”).

uncomplicated.<sup>222</sup> This category will include situations where the inventor was the first person to identify a particular (non-obvious) problem, which once identified has an obvious solution.<sup>223</sup>

Other inventions are obvious to conceive, but identifying operative means for carrying them out is non-obvious. An HIV vaccine is an example. The concept of developing an HIV vaccine likely became obvious to people of ordinary skill in the art as soon as HIV was identified as a virus that could cause AIDS. Developing a vaccine, however, was (and still is) not obvious.

A third nonobviousness category concerns inventions where potential operative means are obvious, but the field is uncertain enough that actually reducing the invention to practice is non-obvious. This could occur where certain operative means appear obvious, but do not actually work; or where there are many obvious means available, but none are guaranteed to be successful, and actual reduction to practice requires extensive trial and error work with various means. For example, other inventors developed incandescent light bulbs before Edison, but their filaments burned out quickly, rendering the light bulbs impractical.<sup>224</sup> Through lengthy trial and error work, involving over 6,000 plant species collected from around the world, Edison was able to identify certain species of bamboo that produced far superior filaments.<sup>225</sup> Edison was the first to reduce a long-lasting filament to practice.

This differentiation of types of nonobviousness corresponds with different concepts under the doctrine of priority used to determine who invented a particular invention first. In order for an invention to be conceived for the purposes of inventor priority, the inventor must have both a “directing conception” and an “operative conception.”<sup>226</sup> The directing conception is the inventive idea; the operative

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<sup>222</sup> Post-It notes were never patented, so there is no PTO or judicial decision concerning whether the combination was actually non-obvious. The adhesive used in Post-It notes was developed by a research scientist at 3M trying to improve the adhesive used in tape. For five years, the scientist told many other researchers about his new adhesive, searching for a use for it, until one day a co-worker realized that it could produce a bookmark that would not fall out, and this concept launched the Post-It. Sawyer, *supra* note 199, at 474.

<sup>223</sup> See, e.g., Kitch, *supra* note 107, at 340-41 (explaining that inventions which represent obvious solutions to non-obvious problems should satisfy § 103).

<sup>224</sup> Gregory Mandel, *Thomas Edison's Patent Application for the Incandescent Light Bulb*, in 2 MILESTONE DOCUMENTS IN AMERICAN HISTORY 979 (Paul Finkelman & Bruce Lesh eds. 2008).

<sup>225</sup> *Id.* at 983.

<sup>226</sup> *Oka v. Youssefyeh*, 849 F.2d 581, 583 (Fed. Cir. 1988).



conception is a reasonable means or general plan for carrying out the idea.<sup>227</sup> Further, in highly uncertain arts an invention is not considered conceived until actually reduced to practice.<sup>228</sup> The field of chemical compounds provides a useful study. Where a method of making a new chemical compound is routine for those of ordinary skill in the art, the compound is considered conceived of for priority purposes when described.<sup>229</sup> Where operative means are not routine, conception does not exist until an inventor identifies a method of making the compound.<sup>230</sup> Where, however, the field is sufficiently uncertain that no operative means are reliable, or where operative means that were thought to be reliable are found not to work, the invention is not considered conceived for priority purposes until actually reduced to practice.<sup>231</sup> These three concepts of conception for priority purposes — directing conception, operative conception, and reduction to practice — correspond with the three differentiated categories of nonobviousness proposed above. They are distinctions that are already drawn in patent law concerning different stages of the inventive process.

In addition to these categories, there may be other, perhaps less common, means of achieving non-obvious advances as well. For instance, selecting particular experts or researchers to work on a given problem may be non-obvious, though once the right people are brought together, solving a problem may be obvious. This may particularly be the case for interdisciplinary teams of experts.<sup>232</sup> Similarly, a particular laboratory design may be non-obvious, but once developed solving certain problems may become obvious.

Nonobviousness differentiation could provide significantly greater clarity and content to nonobviousness analysis in many cases. Consider the Supreme Court nonobviousness cases. Neither *Anderson's-Black Rock* nor *Sakraida* provide any content in their legal nonobviousness analysis. Differentiation might have solved this problem. *Anderson's-Black Rock* concerns the combination of an asphalt paver with a radiant burner, both of which existed in the prior art, to form a better joint between adjacent strips of pavement when

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<sup>227</sup> *Id.*

<sup>228</sup> *See Singh v. Brake*, 222 F.3d 1362, 1367 (Fed. Cir. 2000).

<sup>229</sup> *Oka*, 849 F.2d at 583.

<sup>230</sup> *See id.*

<sup>231</sup> *Burroughs Wellcome Co. v. Barr Labs., Inc.*, 40 F.3d 1223, 1228 (Fed. Cir. 1994).

<sup>232</sup> *See BESSEN & MEURER*, *supra* note 217, at 168 (noting that in certain cases “the probability of a breakthrough will increase with the diversity of potential innovators”).

laying asphalt.<sup>233</sup> Once conceived, it likely would have been obvious to one of ordinary skill to identify operative means and reduce this combination to practice. The issue then becomes, was it non-obvious to conceive? This question appropriately focuses the nonobviousness inquiry on the relevant target, and would lead the decision maker to question whether a person of ordinary skill would conceive of this solution. The Court's analysis, on the other hand, was a relatively undirected hodgepodge of different considerations, combining conception, means, and whether the two parts of the invention could operate in tandem on different machines, an issue seemingly irrelevant to the nonobviousness analysis.<sup>234</sup>

*Sakraida* involves a water flushing system to remove cow manure from barn floors by abruptly releasing water onto the floor, washing the animal waste into drains without the need for supplemental manual labor.<sup>235</sup> In conclusory analysis, the Court held the invention obvious.<sup>236</sup> Again, differentiation could have focused and clarified the inquiry. It may have been non-obvious to conceive of using an abrupt release of water to wash away the waste without further work. Alternatively, it may have been non-obvious to identify operative means once conceived. The record is insufficient to analyze these questions now, but targeting the analysis would likely have produced a more reasoned answer to the legal nonobviousness inquiry than the unsatisfactory minimalist approach of the opinion.<sup>237</sup>

This differentiation proposal also helps clarify the difference between the Supreme Court and Federal Circuit opinions in *KSR*. The Federal Circuit focused primarily on whether the operative means for combining the adjustable pedal assembly with an electronic throttle control was non-obvious.<sup>238</sup> Due to the lack of a TSM on how to combine these elements, the Circuit concluded that the combination must have been non-obvious.<sup>239</sup> The Supreme Court, on the other

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<sup>233</sup> *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 57-58 (1969).

<sup>234</sup> *Id.* at 60-63.

<sup>235</sup> *Sakraida v. Ag Pro, Inc.*, 425 U.S. 273, 276-77 (1976).

<sup>236</sup> *Id.*

<sup>237</sup> In *Sakraida* the Court referred to the potential for synergistic results to establish nonobviousness. *Id.* at 281-82. This reference may have been an unknowing recognition of the potential value of differentiating nonobviousness analysis. It would appear that operative means for combining known elements would rarely be considered synergistic, but that if an inventor conceived of a combination that would produce a synergistic result, this may be non-obvious.

<sup>238</sup> *Teleflex, Inc. v. KSR Int'l Co.*, No. 04-1152, slip op. at 5-6 (Fed. Cir. Jan. 6, 2005).

<sup>239</sup> *Id.* at 8.

hand, focused primarily on whether the conception was obvious.<sup>240</sup> Based on market forces, design needs, and other factors, the Court concluded that it was obvious to conceive of combining these elements, and (effectively) that once conceived, means for combining were obvious as well.<sup>241</sup> Though differentiation analysis may not have led the Court and Circuit to agree, it would have at least focused their inquiries and rendered their examinations significantly more consistent and easier to analyze.

Differentiation also helps explain the problem with the obvious to try doctrine that the Supreme Court criticized and revised in *KSR*. Where operative means are obvious to try, an invention is obvious unless uncertainty renders reduction to practice not obvious.<sup>242</sup> Obvious to try doctrine should not be relevant where the obviousness issue concerns whether conception was non-obvious.

Nonobviousness differentiation also may explain the quandary with the non-obvious analysis in one of the most heavily critiqued Federal Circuit decisions, *In re Deuel*.<sup>243</sup> Deuel applied for a patent on DNA nucleotide sequences coding for human and bovine heparin-binding growth factors (“HBGF”).<sup>244</sup> The process that Deuel used to derive the nucleotide sequences was known in the art, but no one had yet applied it to produce the nucleotide sequences for HBGF. When Deuel derived the HBGF nucleotide sequences, the Circuit reasoned, they were non-obvious because no one could have identified the particular ordering of the sequences beforehand.<sup>245</sup> This decision has been criticized because the Circuit recognized that the process Deuel used to derive the unknown nucleotide sequences was itself obvious.<sup>246</sup> In other words, persons of ordinary skill could have done what Deuel did at the time, he just happened to be first. The Circuit in *Deuel* relied on the fact that no one had reduced the invention to practice to conclude that the invention was non-obvious. However, reduction to practice was obvious here; means for deriving nucleotide

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<sup>240</sup> *KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1743-45 (2007).

<sup>241</sup> *Id.* at 1745.

<sup>242</sup> *Id.* at 1742. This understanding also comports with the caselaw on “reasonable expectation of success.” See *infra* notes 257-58.

<sup>243</sup> *In re Deuel*, 51 F.3d 1552, 1552 (Fed. Cir. 1995).

<sup>244</sup> *Id.* at 1554-55.

<sup>245</sup> *Id.* at 1559.

<sup>246</sup> Philippe Ducor, *The Federal Circuit and In re Deuel: Does § 103 Apply to Naturally Occurring DNA?*, 77 J. PAT. & TRADEMARK OFF. SOC'Y 871, 884-87 (1995); Anita Varma & David Abraham, *DNA is Different: Legal Obviousness and the Balance Between Biotech Inventors and the Market*, 9 HARV. J. L. & TECH. 53, 75-78 (1996).

sequences were, as the case states, known in the art.<sup>247</sup> Requiring the court to identify which element was non-obvious in *Deuel* may have avoided the problematic result.

Different factors will be relevant to nonobviousness depending on the type of nonobviousness a decision maker is analyzing. Whether it was obvious to combine references (the subject of *KSR* and the Federal Circuit's TSM test) will be particularly pertinent to the question of whether operative means for carrying out a particular invention were non-obvious. Trial and error work may be relevant to whether operative means were non-obvious, and will be particularly pertinent in cases where reduction to practice may have been non-obvious. Whether a conception was non-obvious may be the hardest category to judge. It was this issue the Supreme Court was focused on in *Cuno Engineering* when it referred to the need for a "flash of creative genius."<sup>248</sup> Though this reference was inappropriate when applied to the then invention standard as a whole, it may have some relevance in the context of determining whether an invention was non-obvious to conceive. Inventions that are non-obvious to conceive can result from a (clichéd) "eureka" moment, though they can be conceived due to extended analysis or trial and error work as well.

Differentiation will not be feasible in every nonobviousness case. Innovation can be a chaotic process, without clearly distinguished moments of conception, identification of operative means, and reduction to practice. As noted, however, patent law already has long recognized these points as steps of the inventive process in priority law.<sup>249</sup> Differentiating nonobviousness where practical can sharpen the focus of the nonobviousness inquiry to produce a more tractable analysis and consequently improve the precision of nonobviousness decisions.

### C. Towards a Definition of Nonobviousness

In addition to differentiating nonobviousness analysis, developing a substantive definition of nonobviousness could also reduce indeterminacy in the nonobviousness inquiry while maintaining an appropriate nonobviousness standard.

Nonobviousness should depend on how probable the invention would have been for a person having ordinary skill in the art working on the problem that the invention solves. This standard would not

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<sup>247</sup> *Deuel*, 51 F.3d at 1554-55.

<sup>248</sup> See *Cuno Eng'g Corp. v. Automatic Devices Corp.*, 314 U.S. 84, 91 (1941).

<sup>249</sup> 35 U.S.C. § 102(g) (2000); see *supra* notes 226-31.

have to be definitive, but could establish a prima facie case of nonobviousness.<sup>250</sup>

Though there has been only limited focus on probability as a potential proxy for nonobviousness,<sup>251</sup> probability likely represents the best means for establishing a nonobviousness standard from both equivalency and practical perspectives. Nonobviousness entails, at least in significant part, an analysis of the probability of invention.<sup>252</sup> As the Supreme Court noted in *KSR*: “The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”<sup>253</sup> Advances that are highly likely to occur are generally obvious, whereas advances that are very unlikely to occur are generally non-obvious. All other things being equal, an invention that is seventy-five percent likely to be achieved is more obvious than an invention that is only twenty-five percent likely.

Probability also presents a good surrogate for nonobviousness from the perspective of advancing the policy objectives of the patent system. As Professor Robert Merges points out, linking nonobviousness and probability fits well with both the incentive and disclosure theories of the patent system.<sup>254</sup> Granting patents on inventions that are unlikely to have been achieved by others will incentivize research into inventions that otherwise would not be achieved, generally promoting progress. And, denying patents on inventions that are likely to be achieved by others costs little, as such inventions will be achieved anyway.<sup>255</sup> In particular, basing nonobviousness on probability should

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<sup>250</sup> Using a probability standard as prima facie evidence also means that nonobviousness would remain ultimately a question of law.

<sup>251</sup> Professor Robert Merges presented an initial case for linking nonobviousness and probability, arguing that the non-obvious requirement “seeks to reward inventions that, viewed prospectively, have a low probability of success.” Merges, *supra* note 118, at 2. Other authors have indicated a relationship between nonobviousness and probability without necessarily focusing on or recognizing it. See, e.g., Eisenberg, *supra* note 37, at 886 (“An invention that seems obvious at the time it was made . . . is likely to occur promptly to others with or without the inventor’s efforts.”); Meurer & Strandburg, *supra* note 63, at 552 (stating that obviousness should be judged based on whether research project “would be easy or difficult (likely or unlikely to succeed)”).

<sup>252</sup> See Merges, *supra* note 118, at 2-4 (arguing for conception of nonobviousness based on uncertainty of research resulting in invention).

<sup>253</sup> *KSR Int’l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727, 1739 (2007). The PTO has relied heavily on this predictability concept in their new examination guidelines on nonobviousness issued in light of *KSR*. 72 Fed. Reg. 57,526, 57,526-29 (Oct. 10, 2007).

<sup>254</sup> Merges, *supra* note 118, at 2-3.

<sup>255</sup> *Id.* at 32. A probability-based conception of nonobviousness, however, differs

encourage inventors to undertake some research with a lower probability of success but higher potential reward, which likely provides a higher social rate of return than low-risk research.<sup>256</sup> An exception to achieving optimal incentives could occur if an advance were likely to be achieved, but required substantial research and development resources to produce, such that no one would make the investment without the patent incentive. The definition of the level of ordinary skill, discussed below, may resolve this potential problem. In addition, under such a scenario the advance is presumably obvious (it is considered a likely result of the identified research *ex ante*), and therefore at worst the probability definition provides no less incentive than the current standard. Thus, the probability definition can simultaneously provide a more determinate standard and advance the goals of the patent system better than the current (non)definition.

Probability of invention is already taken into account in current patent doctrine in certain circumstances. Most significantly, subject matter is obvious if research producing the invention was both obvious to try and had a reasonable expectation of success.<sup>257</sup> “Reasonable expectation of success” speaks to probability. However, this doctrine usually only applies where there is a specific set of experiments to conduct on the pertinent subject matter, not as a general standard of nonobviousness.<sup>258</sup> In addition, no threshold for “reasonable” has been identified.

Though the equivalency between probability and nonobviousness is strong, it is not perfect. Non-obvious advances hypothetically could be likely, for instance where a particular advance would probably have

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from a but-for conception. A probability definition would grant patents on improbable inventions that would have been achieved even absent the patent incentive, for instance due to first-mover or other incentives; conversely, a probability definition would deny patents that are likely to be achieved, even if they are only achieved due to the patent system. See *supra* Part I.C.2.

<sup>256</sup> *Merges*, *supra* note 118, at 9.

<sup>257</sup> *Brown & Williamson Tobacco v. Philip Morris Inc.*, 229 F.3d 1120, 1125 (Fed. Cir. 2000); *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991); see *Boehringer Ingelheim Vetmedica, Inc. v. Schering-Plough Corp.*, 320 F.3d 1339, 1354 (Fed. Cir. 2003) (holding invention non-obvious because there was no reasonable expectation of success). The Supreme Court’s criticism of obvious to try doctrine in *KSR* places some question on this doctrine, but the statement in the text is non-controversial. See *KSR*, 127 S. Ct. at 1742; see also 72 Fed. Reg. at 57,529, 57,532 (stating PTO obviousness examination guidelines recognizing obvious to try with reasonable expectation of success as basis for concluding that invention was obvious).

<sup>258</sup> See *Boehringer Ingelheim Vetmedica*, 320 F.3d at 1354; *Brown & Williamson Tobacco*, 229 F.3d at 1123; *Vaeck*, 947 F.2d at 493.

occurred one way or another through chance<sup>259</sup> or where so many people were working on a problem that the non-obvious solution would be found. Neither of these scenarios, however, presents significant problems. The former situation could result in the “improper” denial of a patent on a non-obvious invention, but this would be an invention achieved serendipitously, and the denial therefore would not significantly affect incentives (if at all). The latter possibility identifies an advantage of probability-based nonobviousness decisions. Granting patents on technically non-obvious advances that are highly likely to be achieved can be socially costly — it can result in a patent monopoly where society could have received the information without a patent grant, and where the invention is likely to be valuable (which is why many people would be working on it). Amazon’s 1-Click patent<sup>260</sup> and Priceline’s patent on Internet reverse auctions,<sup>261</sup> to the extent they were non-obvious, may present examples of this scenario — they are inventions that became likely to be achieved once certain Internet development occurred. Not granting patents in these circumstances could affect the number of people working on the problem, but in most situations where inventions are likely, due to the number of people working on a problem, there are substantial nonpatent incentives inducing the work.

Conversely, some obvious advances may be unlikely, for instance, if no one would be expected to work on the problem, perhaps because the problem is uninteresting or not valuable to solve. The proposed definition resolves these potential disparities because it concentrates on a person of ordinary skill working on the problem.<sup>262</sup> An alternate discrepancy could arise if an invention was a probable outcome of anticipated work on a given problem, but the invention solves a

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<sup>259</sup> This scenario is presumably rather rare. More common will be inventions that are improbable (and non-obvious), but are discovered through chance. Granting patents on such inventions is not significantly problematic for the patent system because the patent may still be necessary to promote disclosure of the invention. In addition, the serendipitous invention will often have resulted from a line of research pursued because of the patent incentive in the first instance. *Merges, supra* note 118, at 39.

<sup>260</sup> U.S. Patent No. 5,960,411 (filed Oct. 21, 1999).

<sup>261</sup> U.S. Patent No. 5,794,207 (filed Oct. 13, 1998).

<sup>262</sup> The reference to a person of ordinary skill working on the problem may result in a social inefficiency that is also present under the current system. There hypothetically could be certain potential inventions that would be probable to achieve and obvious, but that are not developed because the required research costs to achieve the invention are too high, and such costs cannot be recovered because no patent is available. To the extent such inventions exist, it would be efficient to provide a patent or other incentive for their development, though neither the current nonobviousness standard nor the proposed probability definition accomplish this.

different problem. A literal interpretation of the proposed probability standard could render such an invention unworthy of a patent, even though the invention would not have been likely if working on the problem actually solved. This inequivalency, however, can be resolved by refining the proposed definition to include consideration of whether the invention would have been probable if a person of ordinary skill would be expected to work on the problem the inventor was working on.<sup>263</sup>

A probability standard may produce more appropriate outcomes in certain contexts. As discussed, a person of ordinary skill in the art is presumed to know everything in the prior art. In reality, of course, this is not the case. Probability analysis recognizes this, and therefore will provide a more accurate result where, for instance, the invention involves a combination of two references that are technically both in the prior art but that no person of ordinary skill would be aware of simultaneously. In sum, probability represents a robust proxy for obviousness in most contexts, may prove superior in some, and the situations in which it may not be a good surrogate are not particularly worrisome.

Probability is a concept that judges and jurors are already considered capable of evaluating, as they routinely judge it in other contexts, for instance in determining foreseeability in cases ranging from tort to criminal law,<sup>264</sup> as well as certain patent contexts.<sup>265</sup> Probability also presents a more tractable cognitive determination for decision makers. Current nonobviousness doctrine, pursuant to *KSR*, requires a distinction between “ordinary innovation” or “ordinary creativity” on one hand and “real innovation” on the other.<sup>266</sup> Experts in cognitive psychology, however, do not recognize any such

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<sup>263</sup> Such a solution also comports with the Supreme Court’s admonition in *KSR* not to focus only on the specific technological problem at issue. *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1742 (2007).

<sup>264</sup> *Witte v. United States*, 515 U.S. 389, 393 (1995) (recognizing criminal liability for reasonably foreseeable activities within scope of jointly undertaken criminal activity); *Zettle v. Handy Mfg. Co.*, 998 F.2d 358, 362 (6th Cir. 1993) (determining foreseeability in products liability action that manufacturer’s designed washer was dangerous, and examining probability alternative designs would have diminished any foreseeable risk); *Suchomajcz v. Hummel Chem. Co.*, 524 F.2d 19, 28-29 (3d Cir. 1975) (noting determination in products liability action that child’s harm from bottle of chemicals was foreseeable hinged on “the probability that the chemicals would be misused”).

<sup>265</sup> *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722, 738 (requiring determination of whether equivalent was reasonably foreseeable).

<sup>266</sup> *KSR*, 127 S. Ct. at 1742.



disjunction in human creativity — rather creativity is believed to vary along a continuum.<sup>267</sup> Probability varies along a continuum as well.

The proposed probability definition also fits very well with the existing conception and requirements of nonobviousness. The proposal satisfies the Supreme Court's mandate in *KSR* for an "expansive and flexible approach" to nonobviousness, as opposed to a "formalist conception."<sup>268</sup> The definition comports with § 103's requirement that "[p]atentability shall not be negated by the manner in which the invention was made."<sup>269</sup> Inventions can be both non-obvious and improbable because they require genius, great effort, or extensive trial and error work. The proposal is also consistent with patent doctrine recognizing that even simple advances can be non-obvious, under appropriate circumstances.<sup>270</sup>

Secondary consideration evidence would continue to play a useful role under a probability definition. If there had been prior failure by others of ordinary skill in the art working on the problem, or if there had been a well-defined long-felt need in an industry,<sup>271</sup> such evidence would indicate that it was less probable that a person of ordinary skill working on the problem would achieve the invention. An invention also would be less probable if experts had expressed skepticism that the problem could be solved or if the prior art taught away from the invention. Less reliable secondary evidence, such as commercial success, copying by others, or licensing by others, generally would provide only limited, if any, evidence that a particular advance was not likely.

The proposed probability definition indicates that evidence of simultaneous invention by others should play a significant role in nonobviousness analysis. Simultaneous invention provides evidence that it was probable that a person of ordinary skill working on the problem would have achieved the invention. The Federal Circuit has tended to downplay the importance of simultaneous invention

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<sup>267</sup> Sawyer, *supra* note 199, at 484.

<sup>268</sup> *KSR*, 127 S. Ct. at 1739.

<sup>269</sup> 35 U.S.C. § 103(a) (2000).

<sup>270</sup> *Intel Corp. v. U.S. Int'l Trade Comm'n*, 946 F.2d 821, 835 (Fed. Cir. 1991); *Demaco Corp. v. F. von Langsdorff Licensing Ltd.*, 851 F.2d 1387, 1390-91 (Fed. Cir. 1988).

<sup>271</sup> See Duffy, *supra* note 221, at 345 (arguing that evidence of others racing to achieve invention is critical to evaluating nonobviousness). See generally Joseph Miller, *Level of Skill and Long Felt Need: Notes on a Forgotten Future*, 12 LEWIS & CLARK L. REV. 579 (2008) (arguing that long felt need should be primary test for nonobviousness).

evidence,<sup>272</sup> a position that a number of commentators have critiqued.<sup>273</sup> Simultaneous invention by others reveals that it was probable that another person of ordinary skill in the art would have achieved the invention. Simultaneous invention also presents a good proxy for obviousness here — if multiple parties came up with the invention at approximately the same time, it tends to suggest that the invention was obvious to a person of ordinary skill, perhaps because recent technological advances or market changes made a previously non-obvious advance obvious.<sup>274</sup> That being said, simultaneous invention by others should not be dispositive of obviousness, as it may occur due to a race among multiple parties to achieve a recognized non-obvious outcome and obtain a patent (an activity the patent system seeks to foster), and not due to the fact that the invention was obvious.

The probability definition has the added benefit of making secondary consideration analysis more commensurate with the rest of the nonobviousness inquiry. Current doctrine requires relatively disparate consideration of the factual questions concerning the prior art and person of ordinary skill on the one hand, and secondary consideration evidence on the other. Often it is hard to compare the results of these two approaches when they point in opposite directions. A focus on probability unifies the analysis to an extent because both the inquiry into the context of the invention and the

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<sup>272</sup> See, e.g., *Hybritech Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1380 n.4 (Fed. Cir. 1986) (stating that “simultaneous development may or may not be indicative of obviousness,” and concluding that it was irrelevant in that case); *Stewart-Warner Corp. v. City of Pontiac*, 767 F.2d 1563, 1570 (Fed. Cir. 1985) (suggesting that simultaneous invention evidence is not relevant unless other invention occurred before patentee’s invention); *Lindemann Maschinenfabrik GMBH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452 (Fed. Cir. 1984) (concluding that simultaneous invention evidence was irrelevant in case).

<sup>273</sup> E.g., Tun-Jen Chiang, *A Cost-Benefit Approach to Patent Obviousness*, 82 ST. JOHN’S L. REV. 39, 94-100 (2007); Mark Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1534 (2007). Justice Frankfurter effectively recognized the importance of simultaneous invention evidence in a pre-*Marconi* case. *Marconi Wireless Tel. Co. of Am. v. United States*, 320 U.S. 1, 62 (1943) (Frankfurter, J., dissenting) (“[T]he history of thought records striking coincidental discoveries – showing that the new insight first declared to the world by a particular individual was ‘in the air’ and ripe for discovery and disclosure.”).

<sup>274</sup> *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740 (2007) (discussing importance of circumstances surrounding invention, such as market forces, in judging nonobviousness); see also *Concrete Appliances Co. v. Gomery*, 269 U.S. 177, 185 (1925) (“The adaptation independently made by engineers and builders . . . within a comparatively short space of time, for devices for that purpose are in themselves persuasive evidence that this use . . . was the product of only mechanical or engineering skill”).

secondary considerations are centered on evaluating the same thing — probability. Focusing on a single question should also bring about clearer precedent that guides the nonobviousness inquiry, as has occurred with negligence doctrine.<sup>275</sup> Such precedent could include doctrine on how to assess probability and how to evaluate various types of secondary consideration evidence.

Basing nonobviousness on probability of invention raises a new matter. How improbable must the invention be to be non-obvious? At a minimum, an invention that is more likely to be achieved than not would presumably be considered obvious.<sup>276</sup> Conversely, most would likely agree that an invention that stands only a slim chance of being achieved is generally non-obvious. I do not recommend a precise probability threshold here, but propose that it should fall somewhere in this rough range of likelihood. Even this coarse a range would provide greater determinacy to nonobviousness analysis than current doctrine. More importantly, a variety of interested stakeholders and patent experts could begin a dialogue in an effort to refine the probability threshold further.

In addition to defining (and reducing indeterminacy in) the quantum of ingenuity necessary to satisfy the nonobviousness standard, the probability definition also resolves a number of the open-ended questions concerning the person of ordinary skill in the art. First, the proposal provides objective guidance for determining who the person of ordinary skill is: it is the type of person who would be expected to work on the problem that the invention solves. This definition not only lends greater determinacy to this currently undefined standard, but also avoids the hindsight problem. The person of ordinary skill is not based on the inventor, but on the problem. Where there are multiple types of persons who would be expected to work on the problem, the invention is obvious if it would have been obvious to any of these persons. This is appropriate from a patent policy perspective because society's interest is in the objective likelihood of someone else solving the problem, not whether the invention was obvious to the inventor subjectively.<sup>277</sup>

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<sup>275</sup> See *supra* notes 160-66 and accompanying text.

<sup>276</sup> In arguing for linking the nonobviousness standard to the uncertainty of research, Merges states: "My preferred standard rewards one who successfully invents when the uncertainty facing her prior to the invention makes it more likely than not that the invention won't succeed." Merges, *supra* note 118, at 19.

<sup>277</sup> The increased focus on the technological problem proposed here bears some relation to the analysis in inventive step decisions (the European equivalent to nonobviousness) under European patent law. Under the European Patent

Second, a number of scholars have critiqued current nonobviousness doctrine and analysis for failing to focus adequately on the skill and creativity of the person having ordinary skill, and for failing to adequately take into account situational factors that may have led to the invention.<sup>278</sup> By explicitly centering the analysis on a person of ordinary skill working on the problem that the invention solves, the proposed definition should ameliorate these problems. Defining the ordinary person working on the problem will focus the nonobviousness inquiry both on the hypothetical person's own skill and creativity and on the situational factors surrounding the effort. Consider again the heavily critiqued Amazon.com patent on 1-Click purchasing.<sup>279</sup> Current doctrine requires an abstract inquiry into whether this advance was obvious, an inquiry that is unclear from such a contextless perspective. Under the probability standard, the question instead would be whether it was likely that a person of ordinary skill in the art, working on the problem of providing a means to purchase items on the Internet as quickly and efficiently as possible, would come up with the 1-Click solution. This problem-based nonobviousness inquiry is significantly more grounded.<sup>280</sup>

Third, the proposed standard helps to resolve the conundrum of undefined criteria for resources and time in the nonobviousness

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Convention, "An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art." Convention on the Grant of European Patents (European Patent Convention) art. 56, Oct. 5, 1973, 1065 U.N.T.S. 255, available at <http://www.epo.org/patents/law/legal-texts/html/epc/1973/e/ma1.html>. The inventive step analysis generally involves three steps: (1) identifying the closest prior art; (2) determining the technical problem achieved by the invention by comparing the results to the closest prior art; and (3) assessing the obviousness of the solution in light of prior art and the knowledge of a person with ordinary skill in the art. KATSUYA SAITO & ROSEMARY SWEENEY, CTR. FOR ADVANCED STUDY & RESEARCH – UNIV. OF OF WASH. SCH. OF LAW, ASSESSMENT OF INVENTIVE STEP OR OBVIOUSNESS IN THE UNITED STATES, EUROPE, AND JAPAN 3-4 (2006) (student research paper), available at <http://www.law.washington.edu/casrip/harmonization/PDF/obviousness.pdf>.

<sup>278</sup> Brief for Twenty-Four Intellectual Property Law Professors, *supra* note 65, at 10-16; Eisenberg, *supra* note 37, at 889-97; Miller, *supra* note 23, at 12.

<sup>279</sup> James E. Landis, *Amazon.com: A Look at Patenting Computer Implemented Business Methods Following State St.*, Note, 2 N.C.J.L. & TECH. 1, 30 (2001) (concluding that Amazon patent was obvious and should not have issued); James Gleick, *Patently Absurd*, N.Y. TIMES MAG., Mar. 12, 2000, at 44.

<sup>280</sup> See, e.g., John Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 504-05 (2004) (explaining context surrounding internet advances as making those advances obvious); Duffy & Merges, *supra* note 135, at 152 (explaining influence of development of market on internet inventions); Glynn Lunney, *E-Obviousness*, 7 MICH. TELECOM. & TECH. L. REV. 363 (2001) (same).

inquiry. The definition indicates a solution to this problem based on its reliance on a person working on the problem solved. Nonobviousness (and probability) should be judged based on the amount of time and resources a person of ordinary skill working on the problem would reasonably be expected to have.<sup>281</sup> If the person of ordinary skill is a casual inventor, he or she may reasonably be expected to devote a moderate amount of time and few resources to solving the problem. If the person of ordinary skill is an advanced research scientist in a sophisticated research lab, he or she may reasonably be expected to devote greater time and substantial resources to the project.

Fourth, the probability definition helps resolve the anomaly identified above whereby the nonobviousness standard may render only extraordinary advances patentable in highly skilled areas.<sup>282</sup> There are few persons of ordinary skill in the most advanced areas, and therefore many (valuable) advances will be improbable, simply because no one would be expected to work on the particular problem. Incentivizing such research aligns well with the policy goals of the patent system, a result that current doctrine does not achieve. By providing objective instruction on defining the person of ordinary skill, focusing on situational factors, identifying resources and time available, and resolving the highly-skilled expert dilemma, the proposed probability definition helps to ameliorate several long-standing problems with nonobviousness doctrine.<sup>283</sup>

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<sup>281</sup> Others have proposed to resolve these problems by recommending that the evaluation be based on “reasonable budgetary constraints” and a policy judgment about whether the industry would have developed the invention quickly enough. *E.g.*, Brief of Economists and Legal Historians, *supra* note 76, at 2. The instant proposal has the advantages of providing greater instruction on resources and not requiring a seemingly open-ended policy judgment in every case.

<sup>282</sup> *Supra* note 78 and accompanying text.

<sup>283</sup> The proposed definition might even help correct the hypothesized existing market failure in socially valuable obvious inventions that require large research and development investment, and which therefore go undeveloped because no one can capture their social value through a patent grant. *See supra* note 262. The proposed definition’s focus on the expected resources of a person working on the problem could be interpreted in such cases to be no resources, as no one would be expected to research and develop the unprofitable research opportunity. In this case, the invention would be recognized as unlikely, and therefore possibly deserving of a patent award. There are problems with this analysis, however. First, by hypothesis, the invention is actually obvious, even if unlikely, and as recommended, the probability definition is not proposed to fully replace the nonobviousness standard. Second, the consequences of this reasoning may be paradoxical. If the probability standard produces a potential patent award under the scenario identified above, then it becomes likely for an inventor to pursue the opportunity, rendering the advance

The proposed probability definition is not perfect. Decision makers will still be required to make difficult judgments. Judging the past probability of an invention is not easy. The inherent difficulty of a lay individual evaluating complex technology is somewhat intractable, and, absent its revision, § 103's statutory language requires such analysis. Similarly, the hindsight bias likely remains a problem with probability analysis, although greater precision concerning secondary consideration evidence may ameliorate it to some extent. Under these proposals, however, lay decision makers would at least have guidance and context for standards that they are cognitively capable of evaluating, rather than standards requiring indeterminate investigations into the mental perspective of a materially differently experienced person. The probability definition remains true to the statutory mandate, provides a more tractable definition, and presents a standard that can promote patent policy goals. These accomplishments are significant and may be the best achievable given the current nonobviousness standard and the complex and chaotic nature of innovation.

Because nonobviousness decisions would remain difficult, the probability definition would not remove all indeterminacy. No "expansive and flexible approach" ever could, however, and no standard within the realm of reason could comprehensively cover every potential scenario involving the obviousness of unknown technological advance. There always will be difficult borderline cases. The socially optimal probability threshold likely cannot be firmly fixed, and even if firmly fixed could not be perfectly evaluated in every case. Indeterminacy will also remain in some cases in identifying the problem being worked on, and consequently in defining the person of ordinary skill. Some degree of indeterminacy, however, exists in essentially all legal standards, and some uncertainty in applying the nonobviousness requirement can even be useful.<sup>284</sup> Certain flexibility can provide decision makers discretion to appropriately fit nonobviousness decisions to the infinite and unknowable variety of cases that can arise when dealing with unforeseeable new technology.<sup>285</sup> The goal of defining the nonobviousness standard is not absolute determinacy, but an appropriate balance of determinacy

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likely to be achieved, rendering it not patent worthy. Now we are back where we started, and it is unclear how to resolve this conundrum.

<sup>284</sup> HART, *supra* note 147, at 135; Singer, *supra* note 148, at 6.

<sup>285</sup> Carol M. Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577, 604-10 (1988) (discussing benefits of muddier standards); Singer, *supra* note 148, at 6 (noting benefit of indeterminacy in applying flexible standards to fit particular situations).

to improve the accuracy and predictability of patent decisions.<sup>286</sup> Currently the balance is skewed far too heavily towards the indeterminate.

#### CONCLUSION

Defining the level of innovation necessary to satisfy the nonobviousness requirement is a very challenging problem. Ignoring this problem, as has been the practical strategy since Congress enacted § 103 over half a century ago, does not make it go away. Rather, continued indeterminacy in the nonobviousness requirement has created a suite of ills for the patent system and technological innovation. The recommendations provided here will help to resolve a number of these problems.

Ameliorating the nonobviousness problem, along the lines proposed in this Article, could receive substantial political support. Critically, this type of reform would benefit both industries that support stronger patent protection and industries that are concerned about excessive patenting. For example, firms in the pharmaceutical and biotechnology industries are generally pro-patent and concerned about any changes that might weaken patent protection, on which their industries are heavily dependent.<sup>287</sup> These industries can support fixing the nonobviousness problem because it will provide greater certainty to patent rights and provide stronger patents. Conversely, firms in the information technology and financial industries are often concerned about too much patenting retarding technological advance and economic growth in their fields.<sup>288</sup> These industries can support fixing the nonobviousness problem because it will reduce the number

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<sup>286</sup> Singer, *supra* note 148, at 6-7.

<sup>287</sup> Amy E. Carroll, *Not Always the Best Medicine: Biotechnology and the Global Impact of U.S. Patent Law*, 44 AM. U. L. REV. 2433, 2474-78 (1995) (noting importance of patent protection in biotechnology and pharmaceutical industries to protect substantial research investments); Press Release, Jim Greenwood, President and CEO, Biotech. Indus. Org., BIO Expresses Concerns Regarding New Patent Reform Legislation (Apr. 18, 2007), [http://bio.org/news/newsitem.asp?id=2007\\_0418\\_06](http://bio.org/news/newsitem.asp?id=2007_0418_06) (opposing Patent Reform Act of 2007 on grounds act “will weaken the enforceability of validly issued patents”).

<sup>288</sup> Paul E. Schaafsma, *A Gathering Storm in the Financial Industry*, 9 STAN. J.L. BUS. & FIN. 176, 197-98 (2004) (noting financial industry concerns about inappropriate or undeserving financial patents); *Senate Judiciary Committee Draft Report Suggests Outline for Patent Reform in 2008*, 75 BNA PAT., TRADEMARK, & COPYRIGHT J. 271, 271 (2008) (noting information technology industry desire for reform that is seen as weakening patent strength).

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of bad patents (those on obvious advances) and the risks and uncertainty that bad patents create.

Not everyone, however, will support the proposals. So-called patent trolls would be expected to oppose the recommendations because patent trolls can leverage uncertainty and patents on obvious inventions to reap rewards through hold-ups. Patents on obvious inventions are beneficial to patent trolls because it is obvious advances for which other firms are most likely to achieve identical advances, allowing the troll to surface with its patent and threaten suit.<sup>289</sup> Inconsistency promotes this threat — even where an invention is obvious, the alleged infringing firm cannot be certain to escape liability, and therefore will be willing to pay a higher settlement payout than if it could be reasonably certain of defeating the patent on obvious subject matter.

The position of the patent bar on the nonobviousness recommendations appears less predictable. On the one hand, greater indeterminacy leads to more patent applications and more patent litigation, both of which can be beneficial to attorney business. On the other hand, greater certainty will make patenting more reliable and enable patent attorneys to provide their clients more certain legal advice, which may be good for patent attorney business as well. In addition, to the extent current patent problems are retarding technological growth, curing these problems could lead to greater technological development, with benefits for the patent bar as well as society in general.

This Article's analysis of problems with the nonobviousness requirement indicates that the dominant focus of current nonobviousness patent reform has been directed at the wrong target. Rather than simply raising the nonobviousness standard, a strategy that will (if history is any guide) lead to too great an overcorrection, innovation policy would be better served by creating greater certainty in the nonobviousness standard. As an added advantage, this solution does not require a necessarily uncertain judgment as to whether the nonobviousness standard is more often applied too leniently or too stringently, but can simultaneously solve both types of potential errors. Reducing the indeterminacy in nonobviousness decisions will lend greater predictability and stability to patent law, and consequently promote the incentive, economic, and social goals of the patent system.

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<sup>289</sup> Lichtman & Lemley, *supra* note 89, at 71.