Harvard Journal of Law & Technology
Volume 22, Number 1 Fall 2008

THE LAYERS OF OBVIOUSNESS IN PATENT LAW

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I. INTRODUCTION

Patent law has been missing the obvious. Tasked with advancing innovation by awarding an exclusive right to make or use certain inventions in exchange for their creation and disclosure to the public,[1] patent law has installed certain threshold conditions as gatekeepers to ensure that the valuable patent right is granted only to worthy inventions. When it began to appear that the traditional gatekeepers of novelty[2] and utility[3] were insufficient to prevent patents from being awarded to trifling inventions, a new condition of patentability was enacted, that of the invention's nonobviousness.[4] Scholars have described nonobviousness as the "ultimate condition of patentability"[5]

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1. *See, e.g.*, Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480–81 (1974) (describing the exclusive right as an incentive to disclose the invention to the public); Brenner v. Manson, 383 U.S. 519, 534 (1966) (portraying the right as a reward for the creation of an invention that is useful to society).

2. 35 U.S.C. § 102 (2006).

3. *Id.* § 101.

4. *Id.* § 103(a).

5. NONOBVIOUSNESS — THE ULTIMATE CONDITION OF PATENTABILITY (John F. Witherspoon ed., 1980) [hereinafter NONOBVIOUSNESS].

because it requires that an invention represent a significant technological or scientific breakthrough compared to what is already known or doable. However, until now, and despite considerable recent attention to nonobviousness by the Supreme Court and scholars, a vital component of every obviousness inquiry has neither been satisfactorily addressed nor resolved: the object of the inquiry.

In what has been called "the most important patent case of the last 20 years, and perhaps since the passage of the 1952 Patent Act,"[6] the Supreme Court in 2007 clarified the contours of nonobviousness in *KSR International Co. v. Teleflex Inc.*[7] In establishing the framework to answer "whether a patent claiming the combination of elements of prior art is obvious,"[8] the Court emphasized that a proper analysis of nonobviousness must be "expansive and flexible."[9] *KSR* thus emphasized the need to articulate the nonobviousness criterion with enough flexibility to guarantee that patents issue only to inventions constituting a sufficient advance in the state of the art, thereby encouraging — rather than stifling — innovation.[10]

Despite this overarching purpose highlighted in *KSR*, neither courts nor scholars have analyzed or settled on the obviousness inquiry's object, that is, the thing which must be nonobvious. Some courts have implied that the object that must be nonobvious is the concept of the invention (the complete idea as articulated in the patent's claims).[11] Other courts have hinted that it might be some combination of the concept and the reduction to practice of a working model.[12] As troubling as these irreconcilable judicial intimations are, they have been made by courts without any reflective analysis. And both before and in the wake of the sea change wrought by *KSR*, scholars have instead been focusing on other issues,[13] such as concern

6. Posting of Peter Lattman to WSJ.com Law Blog, KSR v. Teleflex: The Supreme Court's Big Patent Ruling, http://blogs.wsj.com/law/2007/05/01/ksr-v-teleflex-the-supreme-courts-big-patent-ruling/ (May 1, 2007, 08:07 EDT) (quoting Michael Barclay).

7. 127 S. Ct. 1727 (2007).

8. *Id*. at 1740. "Prior art" is "[k]nowledge that is publicly known, used by others, or available on the date of invention to a person of ordinary skill in an art, including what would be obvious from that knowledge." BLACK'S LAW DICTIONARY 119 (8th ed. 2004).

9. *KSR*, 127 S. Ct. at 1739.

10. *See id.* at 1746 ("We build and create by bringing to the tangible and palpable reality around us new works based on instinct, simple logic, ordinary inferences, extraordinary ideas, and sometimes even genius. These advances, once part of our shared knowledge, define a new threshold from which innovation starts once more. As progress beginning from higher levels of achievement is expected in the normal course, the results of ordinary innovation are not the subject of exclusive rights under the patent laws. Were it otherwise patents might stifle, rather than promote, the progress of useful arts.").

11. *See infra* Part II.B.

12. *See id.*

13. The one exception is Gregory N. Mandel, *The Non-Obvious Problem: How the Indeterminate Non-Obvious Standard Produces Excessive Patent Grants*, 42 U.C. DAVIS L. REV. 57 (2008), which criticizes the nonobviousness standard for being too indeterminate in

about hindsight bias in evaluating the obviousness of an invention after it already exists,[14] whether presumptions ought to be employed in determining obviousness,[15] the economic ramifications of the obviousness doctrine,[16] and the general shape of the obviousness inquiry.[17]

It is essential to the coherence and health of the nonobviousness doctrine that the object of the inquiry be clearly and properly identified. The nonobviousness criterion, like the patent system as a whole, aims to offer an incentive to create those inventions deemed to be beneficial to society that otherwise would not exist.[18] When the wrong object is scrutinized for nonobviousness, patents are under- or over-issued. Crucial inventions may be wrongly denied patent protection because their nonobvious aspects are overlooked, just as inconsequential inventions may receive protection in spite of obvious aspects that were similarly not evaluated. Therefore, the particular calibration the patent system aims to achieve is destabilized, leading to an over-promotion of insignificant innovation, an under-promotion of important innovation, or both.

This Article suggests that the correct object to be analyzed for obviousness is the union of two different aspects of invention important to patent law: (1) the concept of the invention; and (2) the reduction to practice of a working model. Requiring an assessment of obviousness at each of these layers is more faithful to the nonobviousness doctrine and the policies underlying patent law than the cur-

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a number of ways, *id.* at 62–80, including the fact that inventions can be nonobvious for various reasons, *id*. at 111–13.

14. *See, e.g.*, Gregory N. Mandel, *Patently Non-Obvious: Empirical Demonstration That the Hindsight Bias Renders Patent Decisions Irrational*, 67 OHIO ST. L.J. 1391 (2006); Gregory N. Mandel, *Patently Non-Obvious II: Experimental Study on the Hindsight Issue Before the Supreme Court in* KSR v. Teleflex, 9 YALE J.L. & TECH. 1 (2007).

15. *See, e.g.*, Joseph Scott Miller, *Remixing Obviousness*, 16 TEX. INTELL. PROP. L.J. 237, 250–55 (2008); Timothy R. Holbrook, *Obviousness in Patent Law and the Motivation to Combine: A Presumption-Based Approach*, WASH. U. L. REV. SLIP OPINIONS (Mar. 21, 2007), http://lawreview.wustl.edu/slip-opinions/obviousness-in-patent-law-and-the-motivation-to-combine-a-presumption-based-approach/; *cf.* Joshua D. Sarnoff, Bilcare, KSR, *Presumptions of Validity, Preliminary Relief, and Obviousness in Patent Law*, 25 CARDOZO ARTS & ENT. L.J. 995, 1026–43 (2008) (suggesting that *KSR*'s approach to obviousness is an attempt to overcome patent law's presumption of validity).

16. *See, e.g.*, Tun-Jen Chiang, *A Cost-Benefit Approach to Patent Obviousness*, 82 ST. JOHN'S L. REV. 39 (2008); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 803 (1988).

17. *See, e.g.*, Christopher A. Cotropia, *Nonobviousness and the Federal Circuit: An Empirical Analysis of Recent Case Law*, 82 NOTRE DAME L. REV. 911 (2007); Christopher A. Cotropia, *Nonobviousness As an Exercise in Gap Measuring*, *in* 2 INTELLECTUAL PROPERTY AND INFORMATION WEALTH 21 (Peter K. Yu ed., 2007); Christopher A. Cotropia, *Patent Law Viewed Through an Evidentiary Lens: The "Suggestion Test" As a Rule of Evidence*, 2006 BYU L. REV. 1517; Joseph Scott Miller, *Nonobviousness: Looking Back and Looking Ahead*, *in* 2 INTELLECTUAL PROPERTY AND INFORMATION WEALTH 1, *supra*; R. Polk Wagner & Katherine J. Strandburg, *The Obviousness Requirement in Patent Law*, 155 U. PA. L. REV. PENNUMBRA 96 (2006), http://www.pennumbra.com/debates/pdfs/Wagner_Strandburg_Debate.pdf (debating the teaching, suggestion, or motivation test).

18. *See infra* text accompanying notes 34–38.

rent state of doctrinal confusion. Application of this layered inquiry indicates that obviousness is currently assessed improperly, particularly with regard to newer technologies — principally software and biotechnology — where the reduction to practice of a working model is inherently complex even once the inventive concept is fixed in the inventor's mind. This analysis suggests that patents may be underissued in these fields, thereby failing to encourage innovation. A layered inquiry would advance the goals set out in *KSR* by properly and flexibly readjusting the nonobviousness doctrine to authorize patentability only for inventions that are significant forward leaps in the state of the art.

Because the proper object of inquiry is not addressed, the patent system does not, in the context of nonobviousness, assess the relative values to innovation of conception and reduction to practice. This issue is a crucial one, and this Article's exploration of the layers of invention through the lens of obviousness has wide-reaching implications in patent law well beyond obviousness. Many areas of patent law elevate the inventive role of conception over that of actual reduction to practice, be it with regard to what must be accomplished to secure a patent,[19] what must be contributed to an invention to be recognized as a joint inventor,[20] or the on-sale bar.[21] In other contexts in patent law, such as the availability of injunctive relief for patent infringement, however, the relative importance of reduction to practice is acknowledged.[22] This Article suggests that it is due time to question whether reduction to practice deserves an elevated role in patent law generally by demonstrating that it can be just as important as conception in the context of obviousness.

Part II examines the contours and motivating factors of the nonobviousness doctrine and then describes and analyzes the courts' unsettled approach to the object of the obviousness inquiry. Part III proposes that the courts must settle on an object of inquiry and recommends a layered approach looking to concept and reduction to practice. Part IV shows how this refinement of the obviousness doctrine would improve the accuracy of obviousness determinations in a variety of technological areas. This Article concludes with some thoughts on the broader implications of a layered understanding of invention.

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19. *See* Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 60–61 (1998); *infra* text accompanying notes 99–105; *see also* Jessica Silbey, *The Mythical Beginnings of Intellectual Property*, 15 GEO. MASON L. REV. 319, 328 (2008) ("It is well settled that an invention may be patented before it is reduced to practice.").

20. *See infra* text accompanying notes 117–21.

21. *See infra* text accompanying notes 109–16.

22. *See infra* text accompanying notes 100–08.

II. THE COURTS' OBJECT OF INQUIRY

The nonobviousness doctrine seeks to ensure that patents are granted only for technologically significant advances to foster the patent system's goal of stimulating useful innovation. Section A explores the development of nonobviousness as a condition for patentability and how the doctrine promotes underlying policies. Section B sets out the unresolved analysis as to the proper object of the obviousness inquiry and identifies a doctrinal state of confusion in need of resolution.

A. The Contours of the Nonobviousness Doctrine

Before 1952, the statutory requirements for a patent were only that an applicant demonstrate that his invention was novel,[23] useful,[24] and adequately disclosed.[25] Over time, however, the courts grafted on an additional requirement of showing that there was sufficient inventiveness beyond mere novelty.[26] In 1850, the Supreme Court prominently held in *Hotchkiss v. Greenwood*[27] that there could be no patentable invention unless the novel invention also possessed a sufficient "degree of skill and ingenuity."[28] This formulation led to almost 100 years of confusion, even at the Supreme Court, as to whether a patentable invention had to "reveal the flash of creative genius, not merely the skill of the calling,"[29] merely "acquir[e] new functions and useful properties,"[30] or something else altogether.[31]

Confronted by this doctrinal confusion,[32] in 1952, Congress redirected all of these tests into a requirement that inventions be nonobvious to be patentable. Section 103 of the Patent Act states:

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23. 35 U.S.C. § 31 (1946), *repealed by* Patent Act of 1952, Pub. L. No. 82-593, § 5, 66 Stat. 792, 815–17.

24. *Id.*

25. *See id.* § 33.

26. *See* John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1 (2007) (recounting the origins and evolution of the nonobviousness requirement in patent law). Courts grounded this requirement in the idea that an "invention" involves a change in principle beyond that which already exists. *See id.* at 39–41.

27. 52 U.S. 248 (1850).

28. *Id.* at 267.

29. Cuno Eng'g Corp. v. Automatic Devices Corp., 314 U.S. 84, 91 (1941).

30. Smith v. Goodyear Dental Vulcanite Co., 93 U.S. 486, 496 (1876).

31. *See, e.g.*, Atl. Works v. Brady, 107 U.S. 192, 200 (1883) (holding that a patent could not be obtained for a "trifling device, every shadow of a shade of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures").

32. *See* Giles S. Rich, *Why and How Section 103 Came To Be*, *in* NONOBVIOUSNESS, *supra* note 5, at 1:201, 1:203–08.

> [A patent] may not be obtained . . . 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.[33]

This section effectively overruled the flash-of-creative-genius test previously enunciated by the Supreme Court, stating that "[p]atentability shall not be negatived by the manner in which the invention was made."[34] That is, obviousness does not concern how quick or laborious it was to invent but instead how straightforward the invention was in light of the prior art.

It is thought that granting patents only for technologically significant — i.e., nonobvious — advances is important to furthering the patent system's goal of stimulating useful innovation in at least two ways. First, without a nonobviousness requirement, patents may be granted to inventions that are technologically trivial in light of the existing store of knowledge. Such inventions may not be economically trivial, however, and a patent grant in these cases will raise the costs of using the invention and of follow-up innovation to the benefit of the person who was fortuitously — rather than through a significant inventive leap — the first to generate the idea.[35] These grants undermine innovation associated with such inventions. An example is George B. Selden's 1895 patent on the automobile,[36] which merely combined the already-developed internal combustion gasoline engine with a chassis. The patent claimed a profitable and useful invention but was not a technologically significant leap past the engine development itself.[37] Because Selden arguably had an adequate economic incentive to invent the automobile without the possibility of a patent grant and because the patent grant significantly raised the social cost of using the automobile when others likely would have invented it nearly simultaneously, Selden should not have received the patent.[38] Second, without a nonobviousness requirement, a profusion of technologically trivial patents might be obtained in any one field. Collectively, this patent thicket will decrease innovation and increase social costs both by imposing significant licensing fees upon anyone work-

33. 35 U.S.C. § 103(a) (2006).

34. *Id.*; *see also* ROBERT L. HARMON, PATENTS AND THE FEDERAL CIRCUIT § 4.2(a), at 169 (8th ed. 2007).

35. *See* Duffy, *supra* note 26, at 11–18 (discussing the burdens imposed by trivial patents).

36. U.S. Patent No. 549,160 (filed May 8, 1879) (issued Nov. 5, 1895).

37. *See* ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY 612–14 (4th ed. 2007).

38. *See id.* at 614–15.

ing in the field and by potentially generating expensive litigation based on accidental infringement.[39]

Approximately ten years after the enactment of the nonobviousness requirement, the Supreme Court, in *Graham v. John Deere Co.*,[40] assessed the new statutory provision as a codification of the *Hotchkiss* standard of inventiveness.[41] The *Graham* Court articulated an objective three-part analysis for assessing whether an invention is obvious: (1) ascertain the scope and content of prior art; (2) determine the differences between the prior art and the patent's claims; and (3) gauge the level of ordinary skill in the relevant art, after which the obviousness can be determined.[42] The Supreme Court also indicated that secondary considerations, such as an invention's commercial success or the failure of others to make the invention, could be relevant in assessing the invention's obviousness.[43] In fact, the Federal Circuit has since mandated the consideration of secondary factors in nonobviousness inquiries.[44]

Following more than forty years of relative silence on the topic,[45] in 2007 the Supreme Court returned to the nonobviousness doctrine in *KSR International Co. v. Teleflex Inc.*[46] After letting the Federal Circuit develop nonobviousness law within the *Graham* framework, the *KSR* Court stepped in to insist that the Federal Circuit was not finding obviousness often enough. For years, the Federal Circuit had employed the teaching-suggestion-motivation test as its sole substantive test for assessing obviousness. Pursuant to that test, "a patent claim is only proved obvious if some motivation or suggestion to combine the prior art teachings can be found in the prior art, the nature of the problem, or the knowledge of a person having ordinary skill in the art."[47] The *KSR* Court feared that "[g]ranting 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 inventions of their value or utility."[48] Therefore, the Supreme Court held that "[t]he obviousness analysis cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of

39. *See* Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1614–15, 1627–29 (2003).
40. 383 U.S. 1 (1966).
41. *Id.* at 17.
42. *Id.*
43. *Id.* at 17–18.
44. Pfizer, Inc. v. Apotex, Inc., 480 F.3d 1348, 1372 (Fed. Cir. 2007).
45. *But see* Sakraida v. Ag Pro, Inc., 425 U.S. 273 (1976); Dann v. Johnston, 425 U.S. 219 (1976); Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57 (1969).
46. 127 S. Ct. 1727 (2007).
47. *Id.* at 1734 (internal quotation marks omitted).
48. *Id.* at 1741.

published articles and the explicit content of issued patents."[49] *KSR* thus expanded the inquiry to "take account of the inferences and creative steps that a person of ordinary skill in the art would employ," even if not identified or implied in the prior art.[50]

In sum, the nonobviousness doctrine emphasizes that trivial inventions are not patentable for the good reason that patenting such inventions hinders innovation. Moreover, courts have emphasized that the nonobviousness doctrine must remain flexible to accommodate wide variations in inventions, technologies, industries, and creative conditions. Having outlined the contours of the nonobviousness doctrine, this Article now turns to the state of the law on the object of the inquiry.

B. The Courts' Unsettled Approach

The courts have neither sufficiently nor expressly analyzed the object of the obviousness inquiry in light of the legislation and the policies underlying nonobviousness. Rather, most courts take up the object of the obviousness inquiry only implicitly when they discuss other aspects of the obviousness doctrine. These implicit conclusions are in tension with one another. As discussed herein, the Supreme Court in *Graham* implied that the object of the obviousness inquiry is the conception of the invention.[51] Conception is typically understood as "the formation in the mind of the inventor[] of a definite and permanent idea of the complete and operative invention, as it is thereafter to be applied in practice."[52] A patent's claims embody the conception.[53] The Federal Circuit — and later, the Supreme Court in *KSR* — ambiguously implied either that the object of inquiry is only conception, or that it is some unexplained combination of conception and reduction to practice. Reduction to practice means the making of a working model, i.e., an embodiment, of the claimed conception that functions for its intended purpose.[54] Reduction to practice can be actual or constructive. Constructive reduction to practice is accomplished through an enabling disclosure and compliance with the other requirements of 35 U.S.C. § 112.[55]

The Supreme Court's first in-depth look at the meaning of nonobviousness in § 103 occurred in *Graham*. Although the Court did not expressly address the object of the obviousness inquiry, it did implic-

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49. *Id.*
50. *Id.*
51. *See infra* text accompanying notes 56–58.
52. Brown v. Barbacid, 276 F.3d 1327, 1335–36 (Fed. Cir. 2002).
53. ROBERT C. FABER, LANDIS ON THE MECHANICS OF PATENT CLAIM DRAFTING § 10:1.1[B] (5th ed. 2003); *see also* Pfaff v. Wells Elecs., Inc., 525 U.S. 55, 63 (1998).
54. Cooper v. Goldfarb, 154 F.3d 1321, 1327 (Fed. Cir. 1998).
55 *See* Bigham v. Godtfredsen, 857 F.2d 1415, 1417 (Fed. Cir. 1988).

itly characterize the object in the second part of its three-part framework, which requires that "differences between the prior art and the claims at issue . . . be ascertained."[56] By assessing the inventive leap based on this difference, the Court seemed to designate conception as the object of the obviousness inquiry: the claims describe the idea of the invention — in its full scope — by setting out the necessary and sufficient elements that the invention must possess.[57] This characterization diverts attention from any particular embodiment of the invention.[58] In fact, the Federal Circuit has interpreted *Graham* in this way twice.[59]

But case law in the wake of *Graham* is unclear as to whether the focus of the obviousness inquiry is on conception or on both conception and reduction to practice. To flesh out *Graham*'s three-part framework, the Federal Circuit formulated a standard for obviousness that required a person having ordinary skill in the art ("PHOSITA") both to have had good reason to create the invention in light of the prior art and to have had a reasonable expectation of success in doing so.[60] With some minor variations, the Supreme Court adopted this two-part formulation last year in *KSR*.[61] By inquiring into creation in conjunction with a reasonable expectation of success, the focus seems to be on the obviousness of what a PHOSITA would be thinking at the moment of conception of the invention. In fact, the Federal Circuit has recognized as much by reasoning:

> Obviousness does not require absolute predictability of success. Indeed, for many inventions that seem quite obvious, there is no absolute predictability of success until the invention is reduced to practice. There is always at least a possibility of unexpected results, that would then provide an objective basis for showing that the invention, although apparently obvious, was in law nonobvious.[62]

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56. Graham v. John Deere Co., 383 U.S. 1, 17 (1966).

57. *See* 1 ANTHONY W. DELLER, PATENT CLAIMS § 5 (2d ed. 1971).

58. Nonetheless, a patent's claims are linked to the possible embodiments in the sense that the patent specification must enable a person having ordinary skill in the art to make or use the claimed invention without undue experimentation. *See* Monsanto Co. v. Syngenta Seeds, Inc., 503 F.3d 1352, 1360 (Fed. Cir. 2007) (discussing the requirements for enablement).

59. *See* Windsurfing Int'l, Inc. v. AMF, Inc., 782 F.2d 995, 999 (Fed. Cir. 1986); Jackson Jordan, Inc. v. Plasser Am. Corp., 747 F.2d 1567, 1578 (Fed. Cir. 1984).

60. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007); *In re* Dow Chem. Co., 837 F.2d 469, 473 (Fed. Cir. 1988).

61. *See* KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 1740 (2007).

62. *In re* O'Farrell, 853 F.2d 894, 903 (Fed. Cir. 1988).

On one reading, this formulation seems to focus on the obviousness of the conception over anything else. As an alternative, one may focus on the obviousness of both the conception and creation of a possible embodiment at the time of conception, before reduction to practice. Unfortunately, the courts have never clarified the precise object of the inquiry in light of the Federal Circuit's ambiguous formulation.

In 2007, the Federal Circuit highlighted the invention's function as another potential object of the obviousness inquiry in *In re Comiskey*.[63] In *Comiskey*, the patent applicant sought protection for "a method and system for mandatory arbitration involving legal documents."[64] The patent examiner had rejected the claims as obvious. On appeal, the Federal Circuit discussed the obviousness of certain claims that were limited to computer application of these methods for the examiner to consider upon remand.[65] The court saw some of these claims as "at most merely add[ing] a modern general purpose computer to an otherwise unpatentable mental process" and others as "merely add[ing] modern communication devices."[66] The Federal Circuit then reasoned more broadly that "[t]he routine addition of modern electronics to an otherwise unpatentable invention typically creates a prima facie case of obviousness."[67] The Federal Circuit essentially said that the automation of a known mental process would almost always be obvious and therefore unpatentable.

The Federal Circuit's statement about the obviousness of automating mental processes gets at neither conception nor reduction to practice precisely. Rather, it addresses a third potential object of inquiry: the obviousness of the invention's function. The Federal Circuit in *Comiskey* equated obviousness of business-method inventions with the obviousness of a task that humans already perform. With the invention at issue in *Comiskey*, the object of inquiry is the function of mandatory arbitration of legal documents, regardless of automation. Although one may seize upon function as another possible object of the obviousness inquiry, the typical understanding of a reduction to practice is that it has an asserted function,[68] that is, the specific utility it implements. Thus, function is already part of the analysis of reduction to practice, and there is no need to examine it separately. Moreover, very few inventions have a nonobvious function,[69] providing another reason not to analyze function much further.[70]

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63. *See* 499 F.3d 1365 (Fed. Cir. 2007).
64. *Id.* at 1368.
65. *See id.* at 1380.
66. *Id.*
67. *Id.*
68. *See supra* text accompanying notes 54–55.
69. *See* O'Reilly v. Morse, 56 U.S. (15 How.) 62 (1853).
70. For analysis of why the obviousness of an invention's function should in any event be given little, if any, weight, *see infra* text accompanying notes 150–52.

In sum, the courts have never clarified what the all-important object of the obviousness inquiry is. In fact, they have confused the issue by offering analyses implying that the object is the invention's conception or a combination of conception and reduction to practice. The next Part aims to clear up this confusion.

III. THE LAYERS OF OBVIOUSNESS

This Part proposes that the proper object of the obviousness inquiry is the combination of the two key elements of invention: conception and reduction to practice. Section A makes the case, through analysis of both the nonobviousness doctrine and policy, for this bilayered analysis despite dicta in other spheres of patent doctrine. Section B suggests how to apply this layered approach by combining the obviousness resolution at each layer to yield an ultimate determination of obviousness.

A. Conception and Reduction to Practice

Beginning with the language of § 103, obviousness is to be found when "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."[71] The statute points out, then, that it is the subject matter sought to be patented which must be obvious for patentability to fail. What does "subject matter" mean? It is not a well-understood term in patent law, despite its being frequently invoked in the patent statute.[72] One might reasonably think that it means the inventive concept defined by the patent's claims, or it might also include the various embodiments of the concept.

The best statutory clue as to the meaning of "subject matter" comes from the disclosure requirements of the patent system. Section 112 requires a patent applicant to claim "the subject matter which the applicant regards as his invention,"[73] thereby equating "subject matter" with "invention." Given that § 103 and § 112 are *in pari materia* in that they relate to the same subject (and there is no reason to dissociate them), it is appropriate to construe "subject matter" in § 103 in

71. 35 U.S.C. § 103(a) (2006).

72. For example, the issue of patentable subject matter is directed to the doctrine that only inventions in the categories set out in 35 U.S.C. § 101 — process, machine, manufacture, or composition of matter — are patentable. *See, e.g.*, Diamond v. Diehr, 450 U.S. 175, 182 (1981); *O'Reilly*, 56 U.S. (15 How.) at 134. The term "subject matter" also comes up in setting the novelty requirement to exclude inventions in which the patent applicant "did not himself invent the subject matter sought to be patented." 35 U.S.C. § 102(f).

73. 35 U.S.C. § 112.

light of its usage in § 112.[74] "Invention" is a much better understood term in patent law. In typical contexts in patent law — including the doctrines of anticipation[75] and priority[76] — the invention is the conception and reduction to practice.[77]

A layered understanding of invention suggests that in assessing an invention's obviousness, we ought to be concerned with the obviousness of both the conception and the reduction to practice, two quite different aspects of the invention. The obviousness of the conception addresses how apparent the idea of the invention would have been to a PHOSITA in light of the relevant prior art. For example, how obvious was the idea of one-click shopping, the ability to purchase items on the Internet with one mouse click in conjunction with stored billing and shipping information about the user? Many commentators reasonably think that this idea, patented by Amazon.com,[78] is obvious.[79] What about the idea of software to recall or erase email messages after they have been sent, should they contain mistakes or lead to regret? A reasonable person might find the conception of this idea obvious as well.

Now consider, on the other hand, the obviousness of the reduction to practice, which concerns how obvious the embodiment of the invention would have been to a PHOSITA in light of the relevant prior art. To return to Amazon.com's one-click patent, how obvious was it to encode one-click shopping in software? Programmers would likely find this straightforward encoding obvious.[80] The task of programming software to recall email messages is surely significantly less

74. *Cf.* Oscar Mayer & Co. v. Evans, 441 U.S. 750, 756 (1979) (invoking this principle to construe the Age Discrimination in Employment Act in light of the Civil Rights Act of 1964 based on their shared purpose and the legislative history).

75. *See* z4 Techs., Inc. v. Microsoft Corp., 507 F.3d 1340, 1354 (Fed. Cir. 2007), *cert. dismissed*, 128 S. Ct. 2107 (2008).

76. *See* Singh v. Brake, 317 F.3d 1334, 1340 (Fed. Cir. 2003) (referring to "[p]riority of invention and its constituent issues of conception and reduction to practice").

77. *See* 2 DONALD S. CHISUM, CHISUM ON PATENTS § 5.03[2][a] (2005) (defining 'invention' as "conception and reduction to practice"); *see also* 35 U.S.C. § 201(e) (recognizing the conception and reduction to practice by a government contractor as crucial aspects of invention).

78. *See* U.S. Patent No. 5,960,411 (filed Sept. 12, 1997).

79. *See, e.g.*, Glynn S. Lunney, Jr., *E-Obviousness*, 7 MICH. TELECOMM. & TECH. L. REV. 363, 420 (2001); Andrew Kopelman, Note, *Addressing Questionable Business Method Patents Prior to Issuance: A Two-Part Proposal*, 27 CARDOZO L. REV. 2391, 2419 n.184 (2006); *IBM Sues Amazon in Patent Dispute*, L.A. TIMES, Oct. 24, 1996, at C3.

80. *See* Justin Pats, *Preventing the Issuance of "Bad" Patents*, 48 IDEA 409, 412 (2008) (noting the view that the invention was obvious because "many companies had already implemented similar systems at the time of Amazon's filing"); *cf.* Philip Greenspun, Software Engineering for Internet Applications (6.171), http://philip.greenspun.com/teaching/one-term-web (last visited Dec. 19, 2008) (describing a one-semester course at the Massachusetts Institute of Technology aiming to teach anyone who has completed the course "to be able to build amazon.com, eBay, or photo.net by him or herself").

straightforward conceptually[81] than programming one-click shopping, even after the inventor has mapped out the concept. These examples seem to suggest that there can be obviousness at both layers of invention, at only one, or at neither.

The timing of the obviousness inquiry also suggests that courts should be assessing the obviousness of both the conception and the reduction to practice. By statute, obviousness is assessed "at the time the invention was made."[82] As such, courts adjudge what a PHOSITA would have known as of the time that reduction to practice (actual or constructive) was complete.[83] Although the courts have not further explained their rationale, this timing makes little sense unless the objects of the obviousness inquiry are both the obviousness of the conception and the reduction to practice. If the concern was just the obviousness of the conception, the inquiry's timing should be set to the timing of the invention's conception rather than the possibly later date encompassing the reduction to practice.

Although the Supreme Court did not address the object of the obviousness inquiry in *KSR*, its reasoning also supports the layered approach in light of the preceding discussion. *KSR* emphasized that the correct answer on obviousness can be obtained only by evaluating all crucial aspects of the inventive process. *KSR* rejected the Federal Circuit's teaching-suggestion-motivation test as being too artificial and inflexible.[84] The Court held that a PHOSITA, as a person of ordinary creativity, knows more than what is contained in the printed prior art, and therefore relies on that wealth of knowledge in inventing.[85] By analogy to the object of the obviousness inquiry, it would be overly rigid and formalistic to focus exclusively on any one proposed layer at the expense of the other. Both are crucial aspects of invention. Although *KSR* considered the problem in a different context, the Supreme Court recognized the need for a flexible obviousness analysis by highlighting that "[t]he diversity of inventive pursuits and of modern technology counsels against limiting the analysis" of obviousness in inflexible ways.[86]

Investigating obviousness in a layered fashion therefore makes sense doctrinally, and it also is justified from a policy perspective. Incentive theory suggests that the patent system ought to stimulate innovation by encouraging scientists and other potential inventors to develop nonobvious ideas that they otherwise might not. As discussed

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81. The ease of the task is measured conceptually rather than in terms of the time to encode, recalling the directive of § 103 that "[p]atentability shall not be negatived by the manner in which the invention was made." 35 U.S.C. § 103(a).

82. *Id.*

83. *See* Richardson-Vicks Inc. v. Upjohn Co., 122 F.3d 1476, 1480 (Fed. Cir. 1997).

84. *See* KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 1741 (2007).

85. *See id.*

86. *Id.*

in Part II, the nonobviousness requirement seeks to exclude from patentability inventions that are not significant technological advances to avoid rewarding the inventor when no patent inducement was needed in the first place.[87] The momentous scientific developments that the patent system ought to encourage can conceivably take place at the layer of conception or at the layer of reduction to practice. There is no reason to ignore either of these layers, as they are both integral to the innovation that patent law seeks to promote.

The following well-known inventions illustrate the possibility of nonobviousness at the layer of conception, the layer of reduction to practice, or both. First, consider the McCormick reaper,[88] an invention containing a wonderful conceptual insight but involving a relatively straightforward reduction to practice. Cyrus McCormick solved a difficulty plaguing previous reapers with his concept of "using a revolving reel to hold grain against the reciprocating cutter blades,"[89] something not beyond the ken of a PHOSITA to reduce to practice. Second, consider the iPhone,[90] involving a complicated reduction to practice. The iPhone has, among other features, a touch-screen interface that permits the user to control all of its software capabilities by finger.[91] Many other common devices, such as an ATM, employ touch screens, and thus the concept of including one in the iPhone may have been obvious. However, the implementation — the conjunction of touch screen, firmware, and software — is far from straightforward.[92] Finally, the steam engine made by James Watt[93] is an example of an invention that involved significant ingenuity both in concept and in reduction to practice. Although neither the idea of using steam to produce motive power nor its implementation was new,[94] Watt sought to improve upon an existing engine when he observed how much steam would be lost during operation due to alternate reheating and cooling of the engine's cylinder.[95] Watt elegantly solved this problem with his concept of adding to the engine a separate condenser to be kept cool,

87. *See supra* text accompanying notes 35–38.

88. *See* U.S. Patent No. X8,277 (filed June 19, 1834).

89. ROBERT FRIEDEL, A CULTURE OF IMPROVEMENT 434 & fig.22.2 (2007).

90. *See, e.g.*, U.S. Patent App. No. 2006/0097991 (filed May 6, 2004).

91. *See* Apple – iPhone – Features – Multi-Touch, http://www.apple.com/iphone/features/multitouch.html (last visited Dec. 19, 2008).

92. *See e.g.*, Geoff Walker, *The Apple iPhone's Impact on the Touch-Panel Industry*, INFORMATION DISPLAY, May/June 2007, at 8, 79, *available at* http://www.informationdisplay.org/issues/2007/05/art4/art4.htm; *cf.* Posting of Stasys Bielinis to Unwired View, http://www.unwiredview.com/2007/01/16/apples-iphone-is-it-really-well-protected-by-patents/ (Jan. 16, 2007) (exploring the ways in which Apple has sought patent protection for the iPhone's features).

93. Watt received a patent for his invention in 1769. George E. Frost, *Watt's 31 Year Patent*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 136, 138 (1991).

94. *See* FRIEDEL, *supra* note 89, at 191.

95. *See id.* at 202.

allowing the cylinder to be kept hot.[96] Once he conceived the solution, it took many years to reduce a workable engine to practice because there was a great deal of leakage around the pistons in the cylinder, a problem common to all steam engines at the time.[97] It was only when Watt partnered with an iron founder, John Wilkinson, who devised a machine for boring cast iron cylinders, that Watt solved this difficulty in reduction to practice.[98] These three examples illustrate that inventive ingenuity can occur at either or both of the two layers. In light of the reality of the inventive process and the policies underlying the nonobviousness requirement, the obviousness analysis ought to examine obviousness at the two layers of invention.

Underscoring the desirability of a layered obviousness analysis is the recognition that the patent system in general cares a great deal about these two layers. To secure a patent, an inventor must have conceived the invention.[99] Although patent law does not require an applicant actually to have reduced the invention to practice by creating a working model,[100] it still immensely values reduction to practice. At the very least, even if there is not actual reduction to practice, patent law compels a constructive reduction in the patent application[101] with the disclosure satisfying the statutory requirements of enablement,[102] written description,[103] and best mode[104] so that others can rely on the disclosure to actually reduce the invention to practice.[105] Moreover, by granting an exclusive right, the patent makes it economically viable for a patentee or licensee to commercialize the patented inven-

96. *See id.* at 203–04.

97. *See id.* at 206.

98. *See id.*

99. *See* 35 U.S.C. §§ 101, 102(g) (2006) (designating an invention's conception as a precondition to patentability).

100. *See* Falko-Gunter Falkner v. Inglis, 448 F.3d 1357, 1366–67 (Fed. Cir. 2006). A patent is a right to exclude others from making, using, or selling the invention. 35 U.S.C. § 154(a)(1). In fact, because there might be another patent blocking the free use of the patented invention, it might not be possible to actually reduce to practice without a license. *See* Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 78–91 (1994).

101. *See* Bigham v. Godtfredsen, 857 F.2d 1415, 1417 (Fed. Cir. 1988).

102. To enable the invention, the patent applicant must demonstrate in the specification to "any person skilled in the [relevant] art . . . to make and use the [invention]," 35 U.S.C. § 112, without "undue experimentation," Monsanto Co. v. Syngenta Seeds, Inc., 503 F.3d 1352, 1360 (Fed. Cir. 2007).

103. The written description required by 35 U.S.C. § 112 must "convey with reasonable clarity to those skilled in the art that . . . [the inventor] was in possession of the invention." Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1563–64 (Fed. Cir. 1991) (emphasis removed).

104. The patent applicant must set out "the best mode contemplated by the inventor of carrying out his invention." 35 U.S.C. § 112. This requirement is met so long as the patent document discloses the best mode that the inventor conceived at the time the patent application was filed. *See* Eli Lilly & Co. v. Barr Labs., Inc., 251 F.3d 955, 963 (Fed. Cir. 2001).

105. *See* Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. (forthcoming 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1116020.

tion, thereby actually reducing the invention to practice.[106] Other encouragement to innovate inheres in the fact that valuable injunctive relief against infringers is more likely to be granted if the invention has been commercialized[107] and a patent's presumption of validity further encourages entrepreneurs to assume the risk of commercializing an invention.[108] Because a patented invention is likely to be reduced to practice during the patent term or at the very latest after the term has expired based on the patentee's contribution of a constructive reduction to practice, the innovation value to society of an invention's reduction to practice must not be ignored in calibrating the extent of the patent reward.

The layered understanding of invention is in tension with the Supreme Court's analysis in *Pfaff v. Wells Electronics, Inc.*[109] of patent law's on-sale bar.[110] The Court stated in that context that "[t]he primary meaning of the word 'invention' in the Patent Act unquestionably refers to the inventor's conception rather than to a physical embodiment of that idea."[111] The Court's view rested on both the statutory definition of "invention" as "invention or discovery"[112] and patent law's lack of a requirement that there be an actual reduction to practice as a prerequisite for patentability[113] or at any point during the patent term.

The *Pfaff* Court's analysis is mistakenly simplistic. The circular statutory definition of "invention" suggests only that a patentable invention may be the product of an inventor's labor in either creating or discovering something new. The definition is neutral as to whether the inventor actually or constructively reduced the invention or discovery to practice. Moreover, the *Pfaff* Court acknowledged that there must be a reduction to practice — either actual or constructive — for there to be a patentable invention.[114] Its statements may have made sense in the specific context of the patent system's on-sale bar requiring a de-

106. *See* F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 735–36 (2001).

107. *See* Benjamin H. Diessel, Note, *Trolling for Trolls: The Pitfalls of the Emerging Market Competition Requirement for Permanent Injunctions in Patent Cases Post*-eBay, 106 MICH. L. REV. 305, 310–22 (2007).

108. *See* Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 52 (2007).

109. 525 U.S. 55 (1998).

110. The on-sale bar denies patents for inventions that were on sale more than one year before the filing of the patent application. *See* 35 U.S.C. § 102(b) (2006).

111. *Pfaff*, 525 U.S. at 60.

112. *Id.* at 61 (quoting 35 U.S.C. § 100(a) (1994)).

113. *Id.* Following this reasoning, the Court concluded that the on-sale bar applies when the invention is "the subject of a commercial offer for sale" and is "ready for patenting," even if not actually reduced to practice. *Id.* at 67.

114. *See id.* at 61–62 (explaining that a patent may be granted even before actual reduction to practice so long as there was constructive reduction to practice through the enabling disclosure of the application).

termination of how much reduction to practice there needs to be for an invention to be on sale.[115] The *Pfaff* Court was misguided, however, in broadly asserting that conception was the only relevant aspect of invention in the patent system.[116] Furthermore, because *Pfaff* dealt only with the meaning of invention in the context of the on-sale bar, its holding should not carry weight outside of that context.

The on-sale bar is not the only aspect of patent doctrine that may elevate conception over reduction to practice. At first glance, the decision of who qualifies as an inventor under patent law also seems to do so. Section 116 provides that "[w]hen an invention is made by two or more persons jointly, they shall apply for patent jointly."[117] The Federal Circuit has often understood this provision to mean that "a person is a joint inventor only if he contributes to the conception of the claimed invention."[118] That said, for deciding joint inventorship, the Federal Circuit sometimes seems to employ a broader definition of "conception" that includes significant aspects of reduction to practice. For a chemical substance, the Federal Circuit stated that "[c]onception . . . requires knowledge of both the specific chemical structure of the compound and an operative method of making it."[119] The Federal Circuit employed that definition in one case in a way that would permit a contributor to reduction to practice to be considered a joint inventor.[120] Not infrequently, the Federal Circuit has also stated that "[a]ll that is required of a joint inventor is that he or she . . . contribute in some significant manner to the conception or reduction to practice of the invention."[121] Thus, there is confusion in the Federal

115. *Compare* Daniel J. Whitman, Note, *The "On-Sale" Bar to Patentability: Actual Reduction to Practice Not Required in* Pfaff v. Wells Electronics, Inc., 32 AKRON L. REV. 397, 417–18 (1999) (suggesting that *Pfaff*'s understanding of reduction to practice for the on-sale bar makes the relevant analysis more straightforward and less fact-intensive) *with* Stephen Bruce Lindholm, *Revisiting* Pfaff *and the On-Sale Bar*, 15 ALB. L.J. SCI. & TECH. 213, 248 (2004) (criticizing *Pfaff* for not requiring a reduction to practice).

116. *Pfaff*, 525 U.S. at 60.

117. 35 U.S.C. § 116 (2006).

118. Eli Lilly & Co. v. Aradigm Corp., 376 F.3d 1352, 1359 (Fed. Cir. 2004); *see also* Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223, 1227–28 (Fed. Cir. 1994) ("Conception is the touchstone of inventorship, the completion of the mental part of invention."); *cf.* Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1463 (Fed. Cir. 1998) ("The contributor of any disclosed means of a means-plus-function claim element is a joint inventor as to that claim, unless one asserting sole inventorship can show that the contribution of that means was simply a reduction to practice of the sole inventor's broader concept.").

119. Fina Oil & Chem. Co. v. Ewen, 123 F.3d 1466, 1473 (Fed. Cir. 1997).

120. *See* Bd. of Educ. *ex rel.* Bd. of Trustees of Fla. State Univ. v. Am. Bioscience, Inc., 333 F.3d 1330, 1342 (Fed. Cir. 2003) (implying in dicta that "[i]f [the named inventors] had conceived the structures of the claimed compounds, but were then unable to make them without [an alleged joint inventor's] help, [the alleged joint inventor] might have been a coinventor."); *id.* at 1342 n.6 (discussing whether the alleged joint inventor "truly facilitated [a named inventor's] reduction to practice of the claimed invention").

121. Pannu v. Iolab Corp., 155 F.3d 1344, 1351 (Fed. Cir. 1998); *accord* Isr. Bio-Eng'g Project v. Amgen Inc., 475 F.3d 1256, 1263 (Fed. Cir. 2007), *cert. denied*, 127 S. Ct. 2994 (2007).

Circuit's case law on joint inventorship. As one commentator points out, there is a good chance that the view of only conceptual contributions as inventorship reads the statute too narrowly and ought to include contributions to reduction to practice, as "an invention is not 'made' until it is both conceived and reduced to practice."[122] Although resolving this conflict is beyond this Article's scope, it is important to note that at least some of the Federal Circuit judges recognize that reduction to practice could be of sufficiently significant value to constitute inventorship.

Other areas of the law are clear in their appreciation of both conception and reduction to practice. For example, when two different inventors come up with the same invention, a patent can be granted to only one, the first to invent. The law of priority dictates who gets the patent in that case: the first inventor to reduce to practice (actually or constructively) gets the patent unless the other inventor was the first to conceive and was also diligent in attempting to reduce the invention to practice.[123] One reading of this rule would suggest that reduction to practice is critical, at least as much as conception, as the first to reduce to practice usually wins priority. Another reading would suggest that conception is more valued because the first conceiver wins priority if he was diligent in later reducing the invention to practice. Both readings, however, acknowledge that it is not conception alone that carries the day; rather, it is conception coupled with reasonably diligent attempts to reduce to practice.

There has, in fact, been a longstanding general debate in varying contexts as to whether conception or reduction to practice is more important to invention: Does the patentable advance in innovation come from the existence of the knowledge encompassing the advance or from the existence of a practical exploitation of the knowledge?[124] The reasonable answer as to the relative value of conception and reduction to practice is the nuanced one. The degree of importance of each depends on the circumstances of the technology at issue or the industry with which it is concerned. For example, in many areas of biotechnology, such as those involving inventions related to DNA, the concept of the invention is of little use without the reduction to practice, i.e., the sequencing or physical characterization of the DNA, as

122. Andrew B. Dzeguze, *Avoiding the "Fifth Beatle" Syndrome: Practical Solutions To Minimizing Joint Inventorship Exposure*, 6 J. MARSHALL REV. INTELL. PROP. L. 645, 652 (2007).

123. Brown v. Barbacid, 276 F.3d 1327, 1337 (Fed. Cir. 2002).

124. *Compare* Reed v. Cutter, 20 F. Cas. 435, 438 (C.C.D. Mass. 1841) (No. 11,645), *with* Adams v. Edwards, 1 F. Cas. 112, 115 (C.C.D. Mass. 1848) (No. 53). *See generally* 2 R. CARL MOY, MOY'S WALKER ON PATENTS § 8:44 (4th ed. 2007) (discussing conflicting authorities' disagreement regarding the relative importance of conception and reduction to practice in the context of priority determinations).

the Federal Circuit has recognized.[125] For some mechanical inventions, such as eyeglass frames, however, the innovative payoff is principally in the conception rather than the execution.[126] Given this differentiation, the *Pfaff* Court's overly simplistic doctrinal analysis elevating the importance of conception over reduction to practice is nonsensical in light of the overarching policies of the patent system and their application to the nonobviousness doctrine. As discussed in the next section, assessing the obviousness of conception and reduction to practice leaves room for weighing the obviousness of each depending on the technology and industry at issue. A layered analysis defers an a priori choice as to the relative importance of conception and reduction to practice until there is a particular set of facts in sight, pursuant to which one can more easily make this nuanced determination.[127]

B. Application of a Layered Inquiry

In fixing the object of the obviousness inquiry to be the layers of conception and reduction to practice, it is necessary to consider how the two layers should be weaved together to determine whether the invention is obvious. There are two ways in which this assessment can be done. First, an invention might be considered nonobvious should it pass the "double-hurdle test" of a sufficient set quantum or quality of nonobviousness at each of the two layers. That is, there would have to be a certain degree of each of nonobviousness of conception and nonobviousness of reduction to practice. Only then would the invention be found to be nonobvious. A second possibility is to assess nonobviousness based on a "tipping-point test," as a whole in light of the varying degrees of nonobviousness of each of the two layers. For example, nonobviousness might be found should a sufficient degree of nonobviousness be found at one layer, e.g., reduction to practice,

125. *See* Fiers v. Revel, 984 F.2d 1164, 1168–69 (Fed. Cir. 1993); *infra* Part IV.B (discussing obviousness analysis for biotechnology inventions pursuant to a layered analysis). The Federal Circuit characterizes this situation as simultaneous conception and reduction to practice. *See Fiers*, 984 F.2d at 1169. The court tries to shoehorn the reduction to practice into the concept of conception — perhaps for some doctrinal consistency — thereby expanding the understanding of conception well beyond its otherwise well-settled borders. *See supra* text accompanying note 52 (defining conception). The better understanding of the Federal Circuit's approach is that conception without a method of reducing to practice and an actual reduction to practice is not sufficiently valuable in this technological area to merit protection.

126. *See* U.S. Patent No. 4,707,089 (filed May 31, 1985) (describing the "spectacles formed of a frame and a saddle bridge" as being "easy to reduce to practice"); *infra* Part IV.C (discussing obviousness analysis for mechanical and other traditional inventions pursuant to a layered analysis).

127. *Cf.* Burk & Lemley, *supra* note 39, at 1675 (asserting that because of the heterogeneous nature of inventions across industries, courts properly tailor patent law to the specific factors of each industry and technology).

thereby offsetting a lower degree of nonobviousness at the other layer, e.g., conception.[128]

The double-hurdle test is more rigid in assessing the worth of innovation because it will not permit, for instance, a sufficiently nonobvious conception to counterbalance an obvious reduction to practice. However, it will likely serve to decrease the number of issued patents because of the two independent obviousness gatekeepers through which a patent application must pass, should that exploding number[129] be a concern. By contrast, the tipping-point test might result in some more patent applications being granted by virtue of the two layers of obviousness that can contribute to tip the scales toward nonobviousness. The tipping-point test is preferable, however, in permitting decision-makers to evaluate obviousness in the context of the unique particulars of the technology and industry at issue.[130] This test fits better with the view that — aside from the ultimate question of obviousness being legal — the underlying factors bearing on obviousness are factual[131] and ought to be flexibly tested.[132] The tipping-point test also jibes well with the notion of a layered analysis because it assesses the relative importance of innovation at the respective layers of conception and reduction to practice in light of the particular invention at issue rather than abstractly.[133]

Given much of the case law's predisposition to view the object of the obviousness inquiry as conception,[134] analysis of the obviousness of the conception will probably look relatively similar to current standards of analyzing the obviousness of the conception as expressed in the patent claims. As for obviousness of reduction to practice, more must be said. As discussed in the previous section, a patentee may — but need not actually — reduce the patented invention to practice so long as the patentee has constructively reduced the invention to practice in the patent disclosure.[135] Evaluating obviousness of reduction to practice, then, is not necessarily about whether the patentee's particular reduction to practice was obvious. Rather, like much of the objective inquiry to ascertain obviousness, the test should concern whether

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128. Gregory Mandel suggests that we ought to understand invention as being wherever the nonobvious step occurred. Mandel, *supra* note 13, at 113–16. Mandel focuses on obviousness of function, which he labels conception, and reduction to practice, but overlooks obviousness of conception. *Id.* at 111–12.

129. *See* U.S. Patent and Trademark Office, U.S. Patent Statistics Summary Table, Calendar Years 1963 to 2007, http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (last visited Dec. 19, 2008) (documenting the steadily increasing numbers).

130. *See supra* text accompanying notes 124–27; *infra* Part IV (suggesting the implications of a layered approach for certain industries, like software and biotechnology).

131. *See* Dennison Mfg. Co. v. Panduit Corp., 475 U.S. 809, 810–11 (1986) (per curiam).

132. *See* KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 1739 (2007).

133. *See supra* text accompanying notes 124–27.

134. *See supra* Part II.B.

135. *See supra* text accompanying notes 100–08.

creating any one complete working model of the claimed invention — as opposed to every single one or the particular one that the patentee made — would have been obvious to a PHOSITA. This assessment aligns with the idea behind the obviousness requirement: if it were so technically straightforward for a PHOSITA to create some working model of the invention, then the patent reward should be granted only in the presence of significant ingenuity at the layer of conception. As under current law, secondary considerations, such as long-felt need for the invention and the failure of others, would help complete the inquiry into obviousness.

IV. IMPLICATIONS FOR PATENTABILITY

This Part explores the implications that a layered analysis would have for patentability in a sample of important technological areas. The analysis indicates that with respect to two of the most prominent contemporary technologies, software and biotechnology, the layered obviousness inquiry is more appropriate than the current approach because it accounts for the inherent complexity in reducing to practice complete concepts. Sections A and B explore the implications for patentability of software and biotechnology, respectively, concluding that the layered approach would expand what we understand to be nonobvious in relation to the current law. Section C explores the minor patentability implications for more traditional technologies.

A. Software

In the context of software patents, an analysis of the layers of obviousness — conception and reduction to practice — in the Patent and Trademark Office and the courts will allow a more nuanced yet accurate picture of patentability. Recalling the examples above of obviousness of conception for one-click shopping and email recall,[136] many think that under current standards, a significant number of software patents are obvious.[137] By contrast, pursuant to a layered tipping-point inquiry, more software inventions would pass the nonobviousness hurdle.

The Federal Circuit seems to think that it is nearly always straightforward to reduce to practice particular software once conception has occurred. In one case, it asserted that "[t]he conversion of a complete thought (as expressed in English and mathematics, i.e., the known input, the desired output, the mathematical expressions needed

136. *See supra* text accompanying notes 78–81.

137. *E.g.*, FTC, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY, ch. 3, at 53–54 (2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf.

and the methods of using those expressions) into the language a machine understands is necessarily a mere clerical function to a skilled programmer."[138] The Federal Circuit's view is severely misguided. Much of the ingenuity of software lies in the reduction to practice, leaving software more likely to be nonobvious in reduction to practice than at the layer of conception. Confirming the popular belief that the software we all use is laden with bugs,[139] it is very complicated to translate a concept for particular software into a working software program.[140] In a rare instance, the Federal Circuit itself recognized the difficulty of reducing to practice compiler software that translates programming language into machine-readable instructions, a component of a patented numerical-control system for a machine tool.[141] Experts on software engineering explain the typical difficulty and delay in accurately reducing software concepts to practice by reference to the inherent and essential complexity of "the specification, design, and testing of [a] conceptual construct."[142] For instance, software is thought to be unlike mechanical devices or even computer hardware as "[s]oftware entities are more complex for their size than perhaps any other human construct because no two parts are alike."[143] In fact, the complexity of reducing software to practice based on a mapped-out concept is thought to be intrinsic and inescapable.[144] Therefore, consideration of the layer of reduction to practice in a balancing test should render more software nonobvious and therefore patentable.

Although a layered tipping-point analysis might yield more patents, a prospect that might frighten those who think there are already too many obvious inventions gaining patents,[145] these would be desir-

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138. N. Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 942 (Fed. Cir. 1990) (quoting *In re* Sherwood, 613 F.2d 809, 817 n.6 (C.C.P.A. 1980)).

139. *See, e.g.*, Wikipedia, *List of Software Bugs*, http://en.wikipedia.org/wiki/List_of_software_bugs (as of Dec. 19, 2008 00:00 GMT).

140. *Cf.* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1164 (2002) ("It is simply unrealistic to think that one of ordinary skill in the programming field can necessarily reconstruct a computer program given no more than the purpose the program is to perform. Programming is a highly technical and difficult art.").

141. White Consol. Indus., Inc. v. Vega Servo-Control, Inc., 713 F.2d 788, 791 (Fed. Cir. 1983) (noting that reduction to practice of the software described in U.S. Patent No. 3,668,653 would take one-and-a-half to two man years).

142. Frederick P. Brooks, Jr., *No Silver Bullet: Essence and Accidents of Software Engineering*, COMPUTER, Apr. 1987, at 10, 11; *see* Charles C. Mann, *Why Software Is So Bad*, TECH. REV., July/Aug. 2002, at 33, *available at* http://www.technologyreview.com/Infotech/12887 (diagnosing, based on an analysis of the task of programming and the state of the software industry, why software code takes so long to write and is nevertheless so riddled with errors).

143. Brooks, *supra* note 142, at 11.

144. *Id.* Due to the diminished complexity in more traditional technological or scientific areas, the ingenuity of an invention in those areas lies more in its conception than in its reduction to practice, *see infra* Part IV.C, which might be why this layering of obviousness has been traditionally overlooked.

145. *See, e.g.*, FTC, *supra* note 137, ch. 4, at 8–19.

able patents of nonobvious inventions. There are worries that when there are too many patents in an industry, patent thickets develop, harming innovation. Even with more patents passing muster under a layered approach, however, society should benefit and avoid the costly problems often associated with thickets.[146] When a patent issues for software that was sufficiently nonobvious to reduce to practice or to conceive, a truly enabling patent disclosure should be useful because at least one inventive layer was not previously obvious to PHOSITAs. In addition, society benefits by getting to use the invention certainly after the patent term expires and perhaps during the patent term as well. Stereotypical patent trolls,[147] which have generated significant concern in the area of software,[148] are probably less likely to be rewarded with patents under a layered obviousness analysis. The reason is that the most nefarious of patent trolls will seek to patent inventions that are obvious at both layers, including the reduction-to-practice stage, a stage that will often rescue the less reprehensible from a finding of obviousness. However, if a non-practicing entity's patent nonetheless passes the layered test and is deemed to be nonobvious, there arises a grave concern that the patent disclosure does not sufficiently enable a PHOSITA to make or use the invention, as required by 35 U.S.C. § 112. That is, if the patentee did not actually reduce to practice and it is not obvious to reduce to practice, the so-called "constructive reduction to practice" in the patent itself is more likely to gloss over the significant complexities inherent in reducing to practice.[149] If that is the case, then the patent is likely to be invalid for insufficient disclosure. A layered analysis therefore forces courts and the Patent and Trademark Office to focus on reduction to practice, as it relates to obviousness and disclosure, with severe risk to the validity of the patents of the worst trolls.

The layered analysis ought to give little, if any, weight to the obviousness of a software invention's function, despite the Federal Circuit's recent decision in *In re Comiskey*,[150] which suggested that the function ought to be the focus of the obviousness inquiry at the expense of conception and reduction to practice.[151] The *Comiskey* court

146. *See supra* text accompanying note 39.

147. Patent trolls are commonly defined as "patent owners who do not provide end products or services themselves, but who do demand royalties as a price for authorizing the work of others." John M. Golden, *"Patent Trolls" and Patent Remedies*, 85 TEX. L. REV. 2111, 2112 (2007).

148. *See, e.g.*, Matthew Sag & Kurt Rohde, *Patent Reform and Differential Impact*, 8 MINN. J.L. SCI. & TECH. 1, 9 & n.37 (2007).

149. *See* Burk & Lemley, *supra* note 140, at 1160–66; Fromer, *supra* note 105, at 48 n.264 (observing critically that the Federal Circuit currently allows software patents to be deemed to be adequately disclosed with the barest disclosure, sometimes only of the function that the software performs); *supra* text accompanying note 138.

150. 499 F.3d 1365 (Fed. Cir. 2007).

151. *See supra* text accompanying notes 63–70.

is probably right to suggest that it is typically obvious to have the idea of automating known mental processes; that is, there is obviousness of function for most software. But that is just the tip of the obviousness iceberg. Take, for example, the field of computational linguistics. For decades, thousands upon thousands of computer scientists have sought to encode in software and hardware a program that can comprehend and generate natural language like English.[152] This enterprise has not come close to full success alone or collectively.[153] Despite how known and widespread the mental process of language is, it is clear that both the conception and reduction to practice of an automated English speaker (and comprehender) is not obvious. Under *Comiskey*'s narrow suggested test of obviousness of function, however, such an invention would be obvious. According to *Comiskey*'s test, because people speak and comprehend English flawlessly, automation through software of a natural language processor is obvious and would not be patentable. This result cannot be right, and it should not take analysis of secondary considerations to reach the correct result. The same point is true for software more generally. We should not presume because people can accomplish some function manually or mentally that implementing it on a computer is obvious.

B. Biotechnology

Much that was just said of software is true of biotechnology as well because both share a complexity that manifests during the reduction to practice of a concept. The Federal Circuit has recognized this complexity in at least two areas of patent law. First, the Federal Circuit has held that to count as conception of an invention relating to DNA for purposes of priority, the DNA must first be sequenced or physically characterized.[154] By expanding the notion of conception so broadly to include what would ordinarily be thought of separately as a reduction to practice, the Federal Circuit has implicitly acknowledged that reduction to practice is significantly complex and important to DNA inventions.[155] Second, this priority rule ultimately served as an analogue for the Federal Circuit's biotechnology-specific rules for the adequacy of the patent's written description for purposes of disclosure

152. *See generally* JAMES ALLEN, NATURAL LANGUAGE UNDERSTANDING (2d ed. 1995); DANIEL JURAFSKY & JAMES H. MARTIN, SPEECH AND LANGUAGE PROCESSING: AN INTRODUCTION TO NATURAL LANGUAGE PROCESSING, COMPUTATIONAL LINGUISTICS AND SPEECH RECOGNITION (2000).

153. See Patrick H. Winston, Why I Am Optimistic, http://people.csail.mit.edu/phw/optimism.html (last visited Dec. 19, 2008).

154. *See* Fiers v. Revel, 984 F.2d 1164, 1168–69 (Fed. Cir. 1993).

155. For this reason, others frequently refer to this rule as a requirement of simultaneous conception and reduction to practice. *E.g.*, John M. Lucas, *The Doctrine of Simultaneous Conception and Reduction to Practice in Biotechnology: A Double Standard for the Double Helix*, 26 AIPLA Q.J. 381 (1998); *supra* note 125.

in *Regents of the University of California v. Eli Lilly & Co.*[156] In that case, the patentee had claimed recombinant DNA technology that could produce human insulin.[157] The patent disclosed recombinant technology that could produce rat insulin, and included a general example of how to get the claimed technology to produce human insulin based on the example with rat insulin, but did not specifically disclose the recombinant technology that could produce human insulin.[158] As a result, the Federal Circuit struck down the relevant patent claims as extending beyond the patent's written description of the invention.[159]

Whether right or wrong in the context of written description,[160] this reasoning emphasizes that the complexity and innovation of many biotechnological inventions lies in their reduction to practice, which is why the court wanted details of a working model in the patent disclosure.[161] In fact, the Federal Circuit has sometimes implicitly recognized this in the context of obviousness as well. For instance, in 1995, the Federal Circuit noted that "[a] prior art disclosure of the amino acid sequence of a protein does not necessarily render particular DNA molecules encoding the protein obvious because the redundancy of the genetic code permits one to hypothesize an enormous number of DNA sequences coding for the protein."[162] Therefore, it is to be expected that a layered tipping-point analysis would count as nonobvious many biotechnological inventions whose nonobviousness lies principally in their reduction to practice, a beneficial result for the same reasons as with software.[163]

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156. 119 F.3d 1559 (Fed. Cir. 1997).

157. *Id.* at 1562.

158. *Id.* at 1567.

159. *Id.*

160. The written-description requirement seeks merely to ensure that the inventor is in possession of the invention when a patent is sought. *See supra* note 103. It says nothing about the requisite degree of innovation that must occur for an invention to be rendered nonobvious. If, for example, patent law were to require great detail about the conception and actual reduction to practice of all biotechnological inventions to fulfill the written-description requirement, a separate test of nonobviousness would still have to be administered to ensure a sufficient leap forward in the state of the art.

161. *See* Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991). In accordance with *Amgen*, the PTO has increasingly been requesting working examples from applicants for biotechnology patents. *See* U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 2164.02 (8th ed., rev. 6 2007) ("Lack of a working example . . . is a factor to be considered, especially in a case involving an unpredictable and undeveloped art."); Jenny J. Yeh et al., *Patent Prosecution Strategies for Stem Cell-Related Applications*, 88 J. PAT. & TRADEMARK OFF. SOC'Y 73, 78 (2006). Alternatively, patentees can satisfy the written-description requirement in this area by depositing the relevant biological material in a depository accessible to the public and referenced in the patent specification. Enzo Biochem., Inc. v. Gen-Probe Inc., 323 F.3d 956, 965 (Fed. Cir. 2002).

162. *In re* Deuel, 51 F.3d 1552, 1558 (Fed. Cir. 1995). *But cf. Ex parte* Kubin, 83 U.S.P.Q.2d 1410 (BNA) (B.P.A.I. 2007) (casting doubt on the viability of *Deuel* after *KSR*, at least to the extent it rejected an obvious-to-try test and the state of the art has evolved significantly so that reduction to practice is simpler).

163. *See supra* text accompanying notes 145–46.

C. Mechanical and Other Traditional Inventions

In contrast to software and biotechnological inventions, mechanical and other traditional inventions (such as the McCormick reaper) tend to be less complex.[164] In practice, that means that the innovation in these inventions usually lies in the concept rather than in the reduction to practice. For these inventions, the layered inquiry will lead to the same result as an inquiry focused only on the obviousness of the concept (likely the current approach[165]). The reason for the same result will be that there is typically an obvious reduction to practice, leaving the obviousness of conception as the sole determinant of nonobviousness under a layered tipping-point test. The equivalence of the current and the layered inquiries for most traditional inventions indicates that the analysis for these inventions would not be complicated in any significant way by the introduction of a layered inquiry.

V. CONCLUSION

In *KSR*, the Supreme Court recently highlighted the importance of nonobviousness as a criterion of patentability, underscoring the need for a flexible assessment of the obviousness of an invention. That opinion, its predecessors, and scholarly work on obviousness have nonetheless been missing the obvious by failing to recognize that the valuable innovation that the patent system seeks to reward can occur at the layer of conception, reduction to practice, or some combination of the two. Recognition that the object of the obviousness inquiry ought to be a layered combination of conception and reduction to practice properly emphasizes the goals of nonobviousness as a condition of patentability in the first instance. Application of the layered approach has significant implications for inherently complex technologies, like software and biotechnology. With such technologies, the reduction to practice is not always obvious, indicating that some of these inventions ought to be considered nonobvious more often than current law would otherwise indicate.

By demonstrating that obviousness ought to be investigated at an invention's two layers of conception and reduction to practice, this Article provokes a broader question of the relative importance of conception and reduction to practice in the patent system's understanding of invention. This question has been woefully underexplored. However, it has tremendous implications for multiple areas of patent law

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164. *See, e.g.*, Mark D. Schuman, Note, *Patent Protection for Microbiological Processes: Has* In re Argoudelis *Been Mutated*, 1984 WIS. L. REV. 1679, 1695 n.82. *But see supra* text accompanying notes 94–98 (raising the example of Watt's steam engine as an invention involving ingenuity at the layers of both conception and reduction to practice).

165. *See supra* Part II.B.

and, even more broadly, for how to think about the patent system. For instance, deciding which of two inventors was the first to invent and deserves to receive the patent requires an assessment of what must have been done to complete invention, whether just conception or both conception and reduction to practice.[166] The question also implicates whether patent law is right in not requiring patentees actually to reduce their concepts to practice, permitting them to sidestep that requirement with a constructive reduction to practice in patent applications.[167] Moreover, resolving who qualifies as a joint inventor also necessitates an inquiry into whether both those who conceive and those who reduce to practice ought to make the grade.[168] For an invention to be considered on sale,[169] need it have been both conceived and reduced to practice?[170] All of these questions feed into the larger concern about whether the patent system, tasked with stimulating innovation, ought to encourage conception, reduction to practice, or both, and in what varying degrees. As the discussion in this Article indicates, what is "innovative" is sometimes the conception, sometimes the reduction to practice, and sometimes both.[171] Even when the conception is all that is innovative, how much should the patent system occupy itself with encouraging an actual reduction to practice? Studying these issues broadly can help guide the most appropriate shaping of patent law to stimulate desired innovation.

This Article's discussion is limited to the context of obviousness, but it is only an initial exploration into the valuation of conception and reduction to practice as the layers of invention. Its recognition of the weighty importance of reduction to practice in certain contexts — in contrast to the current undervaluation of reduction to practice in comparison with conception — may or may not be confined to obviousness. This Article seeks to spark the further study of the fundamental question of the role of the different stages, or layers, of invention in shaping patent law and thus societal advances in innovation.

166. *See* 35 U.S.C. § 102(g)(1) (2006) (discussing the rule of priority); Brown v. Barbacid, 276 F.3d 1327, 1337 (Fed. Cir. 2002) (setting out the current rule for determining priority); *supra* text accompanying note 123 (analyzing how the current rules of priority might or might not support an understanding that reduction to practice can be just as important as conception).

167. *See supra* text accompanying notes 100–05.

168. *See supra* text accompanying notes 117–22.

169. *See* 35 U.S.C. § 102(b).

170. *See supra* text accompanying notes 109–16.

171. *See supra* text accompanying notes 87–98.