THE IMPLICATIONS OF TECHNOLOGICAL ADVANCEMENT FOR OBVIOUSNESS

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Cite as: Brenda M. Simon, *The Implications of Technological Advancement for Obviousness*, 19 MICH. TELECOMM. & TECH. L. REV. 331 (2013), *available at* http://www.mttlr.org/volnineteen/simon.pdf

This Article examines whether advances in technology can make an invention too obvious to deserve a patent. It focuses on two developments in technology with the most pervasive effect on cognition in recent decades: the availability of information in a searchable form and increased processing capabilities. The assumption has been that access to information and computing power will result in better understanding, improved creativity, or decreased uncertainty, when it in fact may not.

This Article proposes that courts and examiners, in assessing obviousness, look at whether persons of ordinary skill in the art actually appreciated the applicability of technological advances at the time in question. Those skilled in diverse technological fields often adopt advances to different degrees and at varying rates. Refocusing the obviousness determination on what actually happens helps guard against hindsight bias.

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Introduction

Determining whether an invention is different enough from what came before it is often the most perplexing inquiry of patent law.[1] Obviousness is assessed from the perspective of a hypothetical being: the person having ordinary skill in the art ("PHOSITA"). Although evaluated as of the filing date of the patent, obviousness is often challenged years after the patent has been granted.[2] Only art deemed sufficiently analogous to that of the invention can be considered, but the courts have provided little guidance in making this critical determination.[3]

Added to these challenges are the effects of advances in technology that can affect cognition. Various methods exist for improving cognitive abilities.[4] This Article focuses on two developments in technology that have had

1. *See generally* John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 209 (1998) (noting that more patents are invalidated for obviousness than on any other ground).

2. Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011).

3. *See infra* Part II.A.

4. While pharmaceuticals and neuroelectronic interfaces can improve neural function, these methods have not been widely adopted. *See, e.g.*, Theodore W. Berger et al., *A Cortical Neural Prosthesis for Restoring and Enhancing Memory*, 8 J. Neural Eng'g 1, 8–10 (2011) (discussing the use of neural implants to improve memory in rats); Henry T. Greely, *The Social Effects of Advances in Neuroscience: Legal Problems, Legal Perspectives*, *in* Neuroethics: Defining the Issues in Theory 246, 255–56 (Judy Illes ed. 2006) (discussing pharmacologic and neuroelectronic enhancement); Henry Greely et al., *Towards Responsible Use of Cognitive-Enhancing Drugs by the Healthy*, 456 Nature 702, 702–05 (2008) (describing how the use of stimulants can enhance working memory and concentration); Margaret

the most extensive effect on cognition in the last several decades: the availability of information in a searchable form and the use of increased processing capabilities. This discussion refers to these two areas of advances as "cognitive technologies." As access to searchable information and computing capabilities expand, it might appear that very few inventions are nonobvious enough to merit patent protection.

Advances in computing power and information technology have changed the research process. In 2003, sequencing the human genome cost almost $3 billion and took ten years.[5] Scientists estimate that in the next several years, the costs will drop to $1,000, and currently the sequencing can be done in one week.[6] In the semiconductor industry, engineers have developed increasingly complex computer chips as prices have fallen, resulting in an explosive growth in computing power.[7] Intelligent machines are able to understand and respond to natural language, resulting in the first Jeopardy! computer champion in 2011.[8] Additionally, information about patents has become more widely available and searchable. Technological advancement may provide opportunities to improve the quality of patents and facilitate

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Talbo, *Brain Gain: The Underground World of "Neuroenhancing" Drugs*, New Yorker (Apr. 27, 2009), http://www.newyorker.com/reporting/2009/04/27/090427fa_fact_talbot (discussing the use of stimulants by students for "non-medical" purposes); *cf.* Gardiner Harris, *F.D.A. Finds Short Supply of Attention Deficit Drugs*, N.Y. Times (Dec. 31, 2011), http://www.nytimes.com/2012/01/01/health/policy/fda-is-finding-attention-drugs-in-short-supply.html?pagewanted=all ("Since the drugs have been shown to improve concentration, and not just in people with A.D.H.D., they have become popular among students who are seeking a study aid.").

5. Kenneth Cukier, *Data, Data Everywhere*, Economist 1 (Feb. 27, 2010), http://www.emc.com/collateral/analyst-reports/ar-the-economist-data-data-everywhere.pdf. *See generally* Amy Harmon, *Gene Map Becomes a Luxury Item*, N.Y. Times (Mar. 4, 2008) http://www.nytimes.com/2008/03/04/health/research/04geno.html.

6. Francis Collins, *Opinion: Has the Revolution Arrived?*, 464 Nature 674 (2010), *available at* http://www.nih.gov/about/director/articles/nature_04012010.pdf; Cukier, *supra* note 5, at 1; Nicholas Wade, *Decoding DNA with Semiconductors*, N.Y. Times (July 20, 2011), http://www.nytimes.com/2011/07/21/science/21genome.html.

7. *See, e.g.*, Gordon E. Moore, *Cramming More Components onto Integrated Circuits*, Electronics, Apr. 19, 1965, *available at* http://www.chemheritage.org/Downloads/Publications/Books/Understanding-Moores-Law/Understanding-Moores-Law_Chapter-05.pdf (predicting that the number of transistors that fit on a microchip would double every two years); *Moore's Law Inspires Intel Innovations*, Intel, http://www.intel.com/technology/mooreslaw/ (last visited May 1, 2012).

8. John Markoff, *Computer Wins on 'Jeopardy!': Trivial, It's Not*, N.Y. Times (Feb. 16, 2001), http://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html?pagewanted=all. Note, however, that Watson incorrectly identified "Toronto" as a United States city in Final Jeopardy. *Id.* ("The category was 'U.S. Cities' and the clue was: 'Its largest airport is named for a World War II hero; its second largest for a World War II battle.'"); *See also* Juliette Garside, *Apple's Siri Has a New British Rival—Meet Evi*, Guardian (Feb. 25, 2012), http://www.guardian.co.uk/technology/2012/feb/26/apple-siri-british-rival-evi; Steve Lohr, *In Crosswords, It's Man Over Machine, for Now*, N.Y. Times (Mar. 18, 2012), http://bits.blogs.nytimes.com/2012/03/18/in-crosswords-man-over-machine-for-now/.

interdisciplinary innovation.[9] In light of these developments, courts have expanded the scope of analogous arts considered in determining obviousness, often combining references from widely divergent fields to reject an invention as obvious.[10]

But does the broad availability of information actually enhance creativity or the understanding of different technological fields? Access to organized information may help inventors innovate more efficiently. However, without adequate reflection, courts and examiners might assume that access to searchable information and increased processing capabilities will result in better understanding of technology from different fields, improved creativity, or heightened predictability. These assumptions may, in fact, be wrong.[11] Some studies have suggested that the "outsourcing" of knowledge to computers has a measurable effect on memory, attention span, and perhaps intelligence, though these assertions are hotly contested.[12]

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9. *See, e.g.*, *Google Patents Beta*, Google, http://www.google.com/patents (last visited May 1, 2012); *How It Works*, Article One Partners, http://www.articleonepartners.com/how-it-works/ (last visited May 1, 2012) (showing community of technological experts that search for prior art and compete for cash prizes); *Pro Bono Opportunities for Technical Experts*, Pub. Patent Found., http://www.pubpat.org/Technical_Experts.htm (last visited May 1, 2012); *Search for Patents*, USPTO, http://www.uspto.gov/patents/process/search/ (last visited May 1, 2012); *Searching*, Delphion, http://www.delphion.com/products/research/research-search (last visited May 1, 2012); *Smart Search*, Espacenet (Dec. 19, 2012), http://worldwide.espacenet.com/; IP.com, http://www.ip.com (last visited Mar. 7, 2013); Peer to Patent, http://www.peertopatent.org/ (last visited May 1, 2012); Prior IP, http://www.prior-ip.com/home (last visited May 1, 2012).

10. *See, e.g.*, Innovention Toys, LLC v. MGA Entm't Inc., 637 F.3d 1314 (Fed. Cir. 2011) (considering a software game analogous to a physical board game); George J. Meyer Mfg. Co. v. San Marino Elec. Corp., 422 F.2d 1285, 1288–90 (9th Cir. 1970) (analogizing a missile tracking system to a glass-bottle inspection system).

11. Based on its most recent discussion of obviousness, the United States Supreme Court seems to be inviting courts and examiners to make these questionable assumptions. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007).

12. John Bohannon, *Searching for the Google Effect on People's Memory*, 333 Sci. 277 (2011) (discussing whether "our increasingly information-rich environment" could be a factor in the "the gradual increase in IQ scores observed over the past century"); Betsy Sparrow et al., *Google Effects on Memory: Cognitive Consequences of Having Information at Our Fingertips*, 333 Sci. 776–78 (2011) (describing four experiments that suggest the "processes of human memory are adapting to the advent of new computing and communication technology"); Clive Thompson, *Your Outboard Brain Knows All*, Wired (Sept. 25, 2007), http://www.wired.com/techbiz/people/magazine/15-10/st_thompson (citing an unpublished study in which researcher Ian Robertson polled 3,000 people, asking "his subjects . . . [for] a relative's birth date, 87 percent of respondents over age 50 could recite it, while less than 40 percent of those under 30 could do so"); Email from Clive Thompson, Journalist, to Brenda Simon (July 8, 2011, 7:07 AM PDT) (on file with author) (stating that the Robertson study results were "confirmed . . . with Robertson himself in advance of him publishing them" but apparently Robertson never published them); *see also* Patricia Cohen, *Internet Use Affects Memory, Study Finds*, N.Y. Times (July 14, 2011), http://www.nytimes.com/2011/07/15/health/15memory.html.

Courts and examiners, in assessing obviousness, should look at whether those of ordinary skill in the art actually appreciated the applicability of technological advances.[13] By doing so, the scope of analogous arts would be circumscribed to art that is truly relevant, and the determination of predictability would be grounded in the understanding of those of ordinary skill in the art.

Determining obviousness from the perspective of the PHOSITA requires careful consideration of the field of the invention and its expected level of expertise. In certain fields, interdisciplinary collaboration is much more common than in others. This renewed focus on actual practices makes sense, as those skilled in diverse technological fields adopt advances to different degrees and at varying rates.[14] Access to information and increased processing power are important only if the PHOSITA appreciates those advances.

This Article first discusses how advances in cognitive technology might affect the obviousness determination. It examines the effects of technological advancement on working memory, neural activity, creativity, and collaboration. Further, it suggests revisiting how patent law considers the PHOSITA, the fictionalized character blessed with perfect understanding of all relevant prior art. The ability of the PHOSITA to access a virtually unlimited universe of prior art references highlights the importance of determining which references actually would be considered in the innovative process.

The Article also discusses whether increased processing power makes innovation more predictable and how that might alter the obviousness analysis. Examiners and courts need to consider how increased processing capabilities affect uncertainty from the perspective of the PHOSITA. Even if an invention is predictable to the PHOSITA, perhaps the nonobviousness standard might be adjusted for very high-cost inventions to secure the needed incentive for expensive, yet predictable, innovation.[15]

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13. *See generally* Daralyn J. Durie & Mark A. Lemley, *A Realistic Approach to the Obviousness of Inventions*, 50 Wm. & Mary L. Rev. 989, 991–92 (2008) ("[O]bviousness should be reconceived as a truly realistic inquiry, one that focuses on what the PHOSITA and the marketplace actually know and believe, not what they might believe in a hypothetical, counterfactual world.").

14. Others have discussed the importance of the PHOSITA in the obviousness analysis. *See e.g.*, Jonathan J. Darrow, *The Neglected Dimension of Patent Law's PHOSITA Standard*, 23 Harv. J.L. & Tech. 227, 227 (2009) ("Patent law's PHOSITA standard is a central concept throughout the lifetime of a patent . . . ."); Durie & Lemley, *supra* note 13, at 1001 ("[W]e are starting to see greater Federal Circuit attention to the level of skill in the art."); Amy L. Landers, *Ordinary Creativity in Patent Law: The Artist Within the Scientist*, 75 Mo. L. Rev. 1, 6 (2010) ("For nonobviousness, the central issue is whether the claim states a sufficient advance over a solution that a person of ordinary skill would provide.").

15. Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 High Tech. L.J. 1, 4 (1992) (suggesting lowering the nonobviousness standard for high-cost inventions).

Lastly, the Article examines the broader consequences of advances in search and processing technology on innovation, including application pendency and weak patents. While overreliance on expert testimony may be a negative externality of the proposed fact-intensive inquiry, examining common practices in a given field should provide a better gauge of obviousness than judicial determinations of "common sense."[16] Refocusing the obviousness determination on the PHOSITA should help mitigate the risk of hindsight bias.

I. Does Technological Advancement Make Innovation More Obvious?

Recent advances in search and processing technology have changed us. As anthropologist Amber Case discusses:

> [Y]ou are all actually cyborgs . . . every time you look at a computer screen or use one of your cell phone devices. So what's a good definition for cyborg? Well, the traditional definition is an organism 'to which exogenous components have been added for the purpose of adapting to new environments.'[17]

We have adapted to an environment rich, and sometimes overloaded, with information. Access to knowledge through computers and cell phones affects our perception and interactions, perhaps including the ways in which we process and remember information.[18] Multitasking has become the norm for many, though it may make some less efficient than they believe.[19] Concurrent with the popularization of the Internet, television shows added head-

16. *KSR Int'l Co.*, 550 U.S. at 417; Mintz v. Dietz & Watson, Inc., 679 F.3d 1372, 1377 (Fed. Cir. 2012) (reversing a finding of obviousness where there was "little more than an invocation of the words 'common sense'").

17. Amber Case, *We Are All Cyborgs Now*, TED (Dec. 2010), http://www.ted.com/talks/amber_case_we_are_all_cyborgs_now.html; Manfred E. Clynes & Nathan S. Kline, *Cyborgs and Space*, Astronautics, Sept. 1960, at 26, *available at* http://web.mit.edu/digitalapollo/Documents/Chapter1/cyborgs.pdf.

18. *E.g.*, Sparrow et al., *supra* note 12, at 776–78; *see infra* Part I.C.

19. Gloria Mark et al., *The Cost of Interrupted Work: More Speed and Stress*, 2008 Proc. of the SIGCHI Conf. on Hum. Factors in Computing Sys. 107–10, *available at* http://www.ics.uci.edu/~gmark/chi08-mark.pdf (finding that people worked more quickly in situations where they were interrupted, but they produced less); Matt Richtel, *Attached to Technology and Paying a Price*, N.Y. Times (June 6, 2010), *available at* http://www.nytimes.com/2010/06/07/technology/07brain.html?pagewanted=print ("Heavy multitaskers actually have more trouble focusing and shutting out irrelevant information, scientists say, and they experience more stress."); Alina Tugend, *Multitasking Can Make You Lose . . . Um . . . Focus*, N.Y. Times (Oct. 24, 2008), http://www.nytimes.com/2008/10/25/business/yourmoney/25shortcuts.html?pagewanted=all (stating that multitasking places some "under a great deal of stress and actually make us less efficient[ ]").

line crawls, and printed media shortened article length.[20] In 2008, even the New York Times introduced article abstracts in each edition for "time-starved readers."[21] Correctly or not, some argue that computerization has opened up a wealth of broad, but shallow, knowledge.[22]

These changes may have far-reaching effects on inventors, the United States Patent and Trademark Office ("USPTO"), and the ways in which researchers understand prior art. Consequently, these changes may have a significant impact on the assessment of obviousness.

A. *The Trouble with Obviousness*

Assessing whether an invention is obvious is a particularly challenging obstacle because the test is highly subjective. Adding to this difficulty, a patent examiner might not have current knowledge in the particular technological area of a given invention.

To show obviousness, the differences between the invention and the prior art must be "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."[23] A prima facie showing of obviousness requires a motivation "to achieve the claimed invention" and "a reasonable expectation of success in doing so."[24] In response, the patent holder can provide evidence showing that the claimed invention provides unexpected advantages or other evidence of nonobviousness.[25]

The application of these rules is highly fact dependent: courts consider the scope and content of the prior art, the level of ordinary skill in the art, the differences between the claimed invention and the prior art, and secondary considerations of nonobviousness, such as commercial success and long-felt but unmet need.[26] These determinations are made from the perspective of the PHOSITA, a legal construct.

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20. Nicholas Carr, *Is Google Making Us Stupid?*, Atlantic, July/August 2008, *available at* http://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/6868/; *see* Thompson, *supra* note 12.

21. Clark Hoyt, *Change Can Be Painful, but This One Shouldn't Hurt*, N.Y. Times (Apr. 6, 2008), http://www.nytimes.com/2008/04/06/opinion/06pubed.html?_r=0&pagew ("[Abstracts] provide an efficient way to get an overview of the news and find features deep within the paper that [time-starved readers] might want to read.").

22. *See* Carr, *supra* note 20; Thompson, *supra* note 12.

23. 35 U.S.C. § 103 (2011).

24. Procter & Gamble Co. v. Teva Pharm. USA, Inc., 566 F.3d 989, 994 (Fed. Cir. 2009) (citation omitted).

25. *Id.*

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

B. *The Person Having Ordinary Skill in the Art: From Ordinary to Extraordinary*

Much like the reasonable person in tort law, the PHOSITA is a central character of patent law.[27] From this fictional person's point of view, courts determine many issues critical to invalidity and infringement.

The PHOSITA appears many times in the Patent Act. To satisfy the requirement of nonobviousness set forth in Section 103, the invention must not be obvious to one of ordinary skill in the art at the time it was made.[28] A patent applicant must disclose the invention to the public to obtain patent protection. The adequacy of that disclosure is assessed from the perspective of the PHOSITA.[29] The statute also requires the disclosure to enable one of ordinary skill in the art to make and use the claimed invention.[30] Other disclosure requirements, including providing a sufficient written description and best mode, are similarly determined with reference to the PHOSITA.[31]

Scholars have discussed a disconnect in the definition of the PHOSITA for obviousness and disclosure purposes, suggesting that there are different PHOSITAs for the two doctrines because of differing policy goals.[32] This Article focuses on the PHOSITA as considered in the obviousness analysis, reassessing the level of ordinary skill in view of technological advancement, and discussing the metamorphosis of the historical PHOSITA possessing "ordinary skill" into a person that appears more and more like an actual inventor.

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27. *See, e.g.*, Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1566 (Fed. Cir. 1987) ("[T]he decisionmaker confronts a ghost, i.e., 'a person having ordinary skill in the art,' not unlike the 'reasonable man' and other ghosts in the law."); Darrow, *supra* note 14, at 235 n.38 ("The PHOSITA standard has been likened to the reasonable person standard in tort law."); Rebecca S. Eisenberg, *Obvious to Whom? Evaluating Inventions from the Perspective of PHOSITA*, 19 Berkeley Tech. L.J. 885, 888 (2004) (suggesting that courts refocus on "the statutory directive that judgments of nonobviousness be made from the perspective of PHOSITA"); Joseph P. Meara, *Just Who Is the Person Having Ordinary Skill in the Art? Patent Law's Mysterious Personage*, 77 Wash. L. Rev. 267, 267 (2002) ("Patent law's 'person having ordinary skill in the art' (Phosita) has been likened to the reasonable person of tort law.").

28. 35 U.S.C § 103 (2006). The America Invents Act shifts this timing to "before the effective filing date of the claimed invention." Leahy-Smith America Invents Act,, Pub. L. No. 112-29, 125 Stat. 284 (2011).

29. *See* 35 U.S.C § 112 (2011).

30. *Id.*

31. *See* Ariad Pharm., Inc. v. Eli Lilly & Co., 598 F.3d 1336, 1351 (Fed. Cir. 2010) ("[T]he test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date."); Chemcast Corp. v. Arco Indus. Corp., 913 F.2d 923, 927 (Fed. Cir. 1990) ("[O]ne must consider the level of skill in the relevant art in determining whether a specification discloses the best mode.").

32. Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 Berkeley Tech. L.J. 1155, 1190 (2002) (discussing the "disparity . . . in the judicial characterization of the PHOSITA in the contexts of obviousness and of enablement.").

Advances in search and processing technologies may require redefining what level of "ordinary skill" the PHOSITA has. In determining the level of ordinary skill, courts may consider several factors, such as: "(1) the educational level of the inventor; (2) the 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."[33]

Historically, the PHOSITA was a schlub: someone with access to all the relevant information, but with no way to integrate it.[34] In 1966, the Court of Customs and Patent Appeals in *In re Winslow* envisioned the PHOSITA as "working in his shop with the prior art references—which he is presumed to know—hanging on the walls around him."[35] With searchable, fully accessible information made available through computerization, the hypothetical prior art wallpaper of *Winslow* is now approaching reality.

However, having access to a wealth of information may not translate into understanding or into the integration of different technological fields, particularly if the PHOSITA is an ordinary mechanic, as opposed to an inventor. Indeed, the courts have been careful to distinguish the *ordinary* skill of the PHOSITA from the *extraordinary* abilities of the inventor.[36] The Federal Circuit recently reiterated that it will not "conflate [highly skilled] scientists with those of ordinary skill in the art."[37]

The United States Supreme Court in *KSR v. Teleflex* changed how the PHOSITA is viewed, transforming the PHOSITA from a mere "automaton" to a person having ordinary skill *and creativity* in the art.[38] With hindsight, a creative PHOSITA with access to searchable information might combine virtually any prior art references, even those from unrelated fields.

Prior to the *KSR* decision, the Federal Circuit rigidly applied the "teaching, suggestion, or motivation" ("TSM") test to combat the hindsight bias problem that can arise when courts assess whether an invention is obvious.[39] According to the TSM test, an invention would be considered obvious only

33. Daiichi Sankyo Co., Ltd. v. Apotex, Inc., 501 F.3d 1254, 1256 (Fed. Cir. 2007) ("These factors are not exhaustive but are merely a guide to determining the level of ordinary skill in the art." (quoting Envtl. Designs, Ltd. v. Union Oil Co., 713 F.2d 693, 696 (Fed. Cir. 1983) (citation omitted))).

34. Darrow, *supra* note 14, at 239–45.

35. *In re* Winslow, 365 F.2d 1017, 1020 (C.C.P.A. 1966).

36. Standard Oil Co. v. Am. Cyanamid Co., 774 F.2d 448, 454 (Fed. Cir. 1985) ("Inventors, as a class . . . possess something—call it what you will—which sets them apart from the workers of ordinary skill . . . ."); Kimberly-Clark Corp. v. Johnson & Johnson, 745 F.2d 1437, 1454 (Fed. Cir. 1984) ("[C]ourts never have judged patentability by what the real inventor/applicant/patentee could or would do."); Durie & Lemley, *supra* note 13, at 993 ("T]he inventor is presumptively a person of extraordinary insight or skill.").

37. Eli Lilly & Co. v. Teva Pharm. USA, 619 F.3d 1329, 1343 (Fed. Cir. 2010).

38. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007).

39. For an excellent discussion of hindsight bias and KSR's failure to address it, see Gregory N. Mandel, *Another Missed Opportunity: The Supreme Court's Failure to Define*

if "some motivation or suggestion to combine the prior art teachings" could be found in the prior art itself, the nature of the problem, or the knowledge of the PHOSITA.[40]

Applying the TSM test in *KSR*, the Federal Circuit held that the claimed invention of an adjustable, electronic-sensor gas pedal in a car was nonobvious.[41] More specifically, the prior art disclosed both adjustable gas pedals and electronic sensors on nonadjustable gas pedals.[42] However, because there was no teaching, suggestion, or motivation to combine these references set forth in the prior art, they could not be combined to make the claimed invention obvious, according to the Federal Circuit.[43]

The Supreme Court rejected this rigid application in *KSR*, instead favoring a more flexible approach that considers the creative steps and assumptions that a PHOSITA in the particular field would apply.[44] Where a "design need or market pressure" provides sufficient incentive to try to solve a problem and "there are a finite number of identified, predictable solutions" within the "technical grasp" of the PHOSITA, the Supreme Court reasoned that the result would likely be founded on "ordinary skill and common sense" and would not deserve patent protection.[45]

After *KSR*, it seemed as though the PHOSITA one day awoke and found himself changed into an inventor.[46] The question becomes how this new, creative PHOSITA should be defined, and what this new definition could mean for obviousness.

Consistent with the principles set forth in *KSR*, the PHOSITA should be determined in a fact-specific manner.[47] Under the current standard of nonobviousness, a PHOSITA is held to have knowledge of even hidden or difficult to locate prior art.[48] Furthering the trend of taking into account the context within which innovation occurs, grounding the definition of the PHOSITA in light of common practices, including whether those in the art actually

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Nonobviousness or Combat Hindsight Bias in KSR v. Teleflex, 12 Lewis & Clark L. Rev. 323 (2008).

40. *See* Al-Site Corp. v. VSI Int'l, Inc., 174 F.3d 1308, 1323–24 (Fed. Cir. 1999).

41. *KSR Int'l Co.*, 550 U.S. at 413–15.

42. *Id.* at 420.

43. *Id.* at 413–15.

44. *Id.* at 415–19.

45. *Id.* at 421.

46. Franz Kafka, The Metamorphosis (1915).

47. *See, e.g.*, Darrow, *supra* note 14, at 256–57; Durie & Lemley, *supra* note 13, at 1015–19.

48. *In re* Rouffet, 149 F.3d 1350, 1357 (Fed. Cir. 1998) (assuming that "all prior art references in the field of the invention are available to this hypothetical skilled artisan"); Alan Devlin, *Revisiting the Presumption of Patent Validity*, 37 Sw. U. L. Rev. 323, 342 (2008) ("[T]here is little, if any, long-term social value associated with invalidating patents on the basis of prior art not within the realistic purview of the inventor."); Durie & Lemley, *supra* note 13, at 1016–18 ("Much of that art is obscure enough that, in the real world, the PHOSITA wouldn't have access to it and likely wouldn't know about it.").

recognize and understand advances in related technological fields, would give a more accurate determination of obviousness. At a minimum, advances in search and processing technologies should free up time for innovation, reducing the costs of obtaining information and easing collaboration in many fields. The proposal would also force courts and the USPTO to ascertain whether the PHOSITA is an individual or a research entity likely to consider a broader range of prior art.

C. *Technological Advancement and the Innovative Process*

Many suggest that computerization has improved our ability to analyze information efficiently.[49] Some programs have been touted as a way to solve creativity roadblocks.[50] David Pressman writes, "[C]omputers can be used to enhance creativity, solve problems, bust through conceptual roadblocks, and get into the recesses of your memory."[51] Inventors use computer-aided thinking ("CAT") software and idea stimulation programs that suggest modifications based on the details of the problem that the inventor provides.[52] In many fields, computerization has improved the process of implementation—and perhaps innovation.

1. Advances in Technology and Working Memory

Some scientists believe that "creativity and innovation are the result of continuously repetitive processes of working memory."[53] If innovation depends on working memory, and if cognitive technologies negatively affect working memory, they may hinder the inventive process in some circumstances, rather than facilitate it. Consequently, courts may be incorrectly assuming that cognitive technologies make an invention more likely obvious,

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49. Matthew W.G. Dye et al., *Increasing Speed of Processing with Action Video Games*, 18 Current Directions in Psychol. Sci., 321–26 (2009) ("Video gaming may therefore provide an efficient training regimen to induce a general speeding of perceptual reaction times without decreases in accuracy of performance."); C. Shawn Green & Daphne Bavelier, *Action Video Game Modifies Visual Selective Attention*, 423 Nature 534 (2003) (demonstrating that habitual players of action video games, as well as non-video game players trained on action video games, show improved visual selective attention); Gary W. Small et al., *Your Brain on Google: Patterns of Cerebral Activation During Internet Searching*, 17 Am. J. Geriatric Psychiatry 116 (2009) (demonstrating that experienced internet users showed increased neural activity as compared with less experienced internet users); Matt Richtel, *supra* note 19 ("Technology use can benefit the brain in some ways.").

50. David Pressman, Patent it Yourself: Your Step-by-Step Guide to Filing at the U.S. Patent Office 39–42 (Richard Stim ed., 15th ed. 2011).

51. *Id.* at 40.

52. *Id.*

53. This theory has not been tested broadly. Landers, *supra* note 14; Larry R. Vandervert, *How Working Memory and Cognitive Modeling Functions of the Cerebellum Contribute to Discoveries in Mathematics*, 21 New Ideas in Psychol. 15 (2003); Larry R. Vandervert et al., *How Working Memory and the Cerebellum Collaborate to Produce Creativity and Innovation*, 19 Creativity Res. J. 1, 1 (2007).

when they may instead encumber the creative process in some circumstances.

The recently published results of four studies by Columbia University professor Betsy Sparrow suggest that cognitive technologies have had some effect on working memory.[54] In particular, the results suggest that people rely on computers as a form of external memory.[55] In one of the experiments, Sparrow provided subjects with forty trivia statements (e.g., "An ostrich's eye is bigger than its brain"), asking them to type the facts into a computer.[56] She told half of the participants that the computer would save what had been typed; she told the other half that the facts would be erased.[57] All of the subjects were then asked to write down as many facts as they could remember.[58] The half that believed their statements would be erased performed significantly better, having the best memory of the trivia statements.[59]

This study suggests that when people expect to have access to information, they have a harder time recalling the information itself.[60] Additional experiments indicate that participants were more likely to remember *where* to access information than to remember *what* the information was.[61] With the constant ability to access information through search engines, perhaps people feel less of a need to internalize it.[62]

2. Access is Not the Same as Understanding

Courts have assumed that access to information or increased processing power increases the likelihood that an invention will be found obvious. There is robust debate, however, about whether the information made available through technological advancement will result in improved understanding.

With the ease of collecting data, "the main problem is no longer finding the information as such but laying one's hands on the relevant bits easily and

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54. Sparrow et al., *supra* note 12.
55. *Id.* at 776.
56. *Id.*
57. *Id.*
58. *Id.*
59. *Id.* at 777.
60. *Id.*
61. *Id.*
62. *Id.* ("Because search engines are continually available to us, we may often be in a state of not feeling we need to encode the information internally."). The implications of the Sparrow studies may not translate particularly well to the innovation context, given the controlled environment of a study and the lack of importance assigned to trivia statements. Moreover, the creative process, while dependent on working memory, is distinct from the process of simply remembering. Landers, *supra* note 14, at 57; Vandervert, *supra* note 53; Vandervert et al., *supra* note 53.

quickly."[63] Some have suggested that access to an abundance of information carries with it the risk of "cognitive overload."[64]

In his controversial 2008 article, *Is Google Making Us Stupid?*, Nicholas Carr questions whether the accessibility of so much information via the Internet hinders the type of deep reading that is necessary for deep thinking.[65] He suggests that increasing computerization may not mean that people are deeply integrating the information they can so quickly access.[66] A 2008 study from the University College of London, in which researchers examined students' research habits, may support Carr's conclusion.[67] Those researchers found that students tended to skim, rather than read in depth, when conducting research.[68]

Similarly, another 2008 study compared wayfinding behavior between participants who received information about routes from a GPS navigation system, maps, and personal experience from walking the routes.[69] The researchers found that the GPS users traveled more slowly, made more stops, and traveled longer distances than those who relied on maps or navigated based on direct experience.[70] Additionally, the GPS users rated the wayfinding assignments as more challenging than the direct-experience participants did.[71]

Others have contested these assertions. Steven Pinker, a Harvard psychology professor, argues that these new technologies help us "manage, search and retrieve our collective intellectual output at different scales."[72] Rather than making us stupid, he concludes "these technologies are the only things that will keep us smart."[73]

A 2008 study from UCLA may support Pinker's conclusions.[74] In this study, researchers studied the effects of web usage on cognition in twenty-

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63. Cukier, *supra* note 5.

64. *Id.*

65. Carr, *supra* note 20; Thompson, *supra* note 12.

66. *Id.*

67. UNIV. COLL. LONDON, INFORMATION BEHAVIOUR OF THE RESEARCHER OF THE FUTURE: A CIBER BRIEFING PAPER 31 (2008), *available at* http://www.jisc.ac.uk/media/documents/programmes/reppres/gg_final_keynote_11012008.pdf.

68. *Id.*

69. Toru Ishikawa et al., *Wayfinding with a GPS-Based Mobile Navigation System: A Comparison with Maps and Direct Experience*, 28 J. ENV'T PSYCHOL. 74, 80–81 (2008). *See generally* Katherine Woollett & Eleanor A. Maguire, *Acquiring 'the Knowledge' of London's Layout Drives Structural Brain Changes*, 21 CURRENT BIOLOGY 2109 (2011) (discussing a study that suggest that learning the layout of 25,000 streets and thousands of interest points in London may result in changes in the brain and memory of taxi drivers).

70. Ishikawa et al., *supra* note 69, at 80–81.

71. *Id.*

72. Steven Pinker, *Mind over Mass Media*, N.Y. TIMES (June 10, 2010), http://www.nytimes.com/2010/06/11/opinion/11Pinker.html?_r=0.

73. *Id.*

74. Small et al, *supra* note 49, at 117.

four people aged fifty-five to seventy-six years old.[75] One of the two groups tested was comprised of regular Internet users, deemed "net savvy users"; the other was classified as the "net naïve" group.[76] Researchers monitored participants' brain activity using functional MRI as the subjects read books or performed search tasks.[77] When searching the Internet, net savvy subjects exhibited a twofold increase in brain activity, and greater activity in regions of the brain associated with decision-making and complex reasoning as compared with the activity in those regions among inexperienced Internet users. Such results suggest that the use of these technologies may stimulate neural circuits related to decision-making and reasoning.[78]

The UCLA study has significant limitations, including its use of a small sample size and its limited age range. Further, other variables could explain the increased brain activity measured in the study. Study participants that adopt new technology may have higher physical activity levels, healthier dietary habits, or other behaviors that can contribute to increased neural functioning.[79] Or, perhaps the net savvy participants simply enjoy searching the Internet more than the net naïve participants do because of their preexisting familiarity.[80]

Uncertainty about the effects of technology on cognition is not new. Concerns arose after the introduction of the printing press, scientific calculators, and countless other technological innovations.[81] In his work, Carr draws a parallel to Socrates's trepidation about the emergence of the then-new technology of writing.[82] Socrates worried that people would have access to too much information without guidance, making them appear "very knowledgeable when they are for the most part quite ignorant."[83]

Of course, the benefits of technological advancement are well recognized, including encouraging the expansion of knowledge and the develop-

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75. *Id.*

76. *Id.* at 118.

77. *Id.* at 120.

78. *Id.* at 121.

79. *Id.* at 125. It would seem odd, however, for these types of healthy lifestyle activities to correlate with spending a significant amount of time surfing the web.

80. *See generally* Merim Bilaliæ et al., *Mechanisms and Neural Basis of Object and Pattern Recognition: A Study with Chess Experts*, 139 J. Experimental Psychol. 728 (2010) (discussing a study in which novices and chess experts examined patterns on chess boards actually used in games and completely random patterns; for the experts, the random patterns did not correlate with as much brain activity observed on the fMRI as was observed with brain activity for the experts when viewing the patterns); Green & Bavelier, *supra* note 49, at 534–37 (suggesting that experienced players of action video games, as well as inexperienced players trained on action video games, show improved visual selective attention).

81. Damon Darlin, *Technology Doesn't Dumb Us Down. It Frees Our Minds*, N.Y. Times (Sept. 20, 2008), http://www.nytimes.com/2008/09/21/technology/21ping.html; Steven Pinker, *supra* note 72.

82. Carr, *supra* note 20.

83. *Id.* (quoting Plato's *Phaedrus*).

ment of new ideas. Increased predictability and processing power coupled with decreased costs can increase the pace of innovation and the number of research paths explored. Advances free up time to focus on more significant problems than finding information, enabling more time for reflection and interaction.[84]

Because it is unclear whether the information made available through technological advancement actually results in improved understanding, a reinvigorated assessment on what those of ordinary skill in a given technological field actually would understand and integrate is necessary.

3. Overreliance on Search Technology by Examiners and Inventors

Electronically available and searchable information has changed the patenting process. Full-text searching of patents issued after January 1, 1976 is available to the public through the Patent Full Text and Image ("PatFT") database.[85] Since March 2001, patent applications have generally been published online within eighteen months of their effective filing dates, pursuant to the American Inventors Protection Act of 1999.[86]

Patents and published patent applications can be searched electronically via the USPTO website through index searching and keyword searching.[87] One of the search methods, index or classification searching, involves classifying the type of invention according to a list of defined categories corresponding to a given subject matter.[88] To conduct this type of search, the researcher would review all of the contents in the class to which the patent application at issue has been assigned, as well as art in related classes. For index searching to be effective, the relevant patent references would need to be located in a manageable number of classes that can be reviewed completely. Index searching is often used in conjunction with keyword search-

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84. Darlin, *supra* note 81.

85. *Patent Full-Text Databases*, USPTO, http://patft.uspto.gov/ (last modified Aug. 26, 2010).

86. American Inventors Protection Act, 35 U.S.C. § 122 (2010); Consolidated Appropriations Act, Pub. L. 106-113, 113 Stat. 1501 (1999); *Patent Application Searching Tutorial*, UNIV. OF TEX., https://www.lib.utexas.edu/engin/apptutorial/patenttutorialframeset.html (last visited Feb. 12, 2013) ("PatApp publication only began in 2001, therefore only applications from 2001-present are in this database."); *Patent Full-Text Databases*, *supra* note 85.

87. *Patent Full-Text Databases*, *supra* note 85. Private sources, such as Google Patents, also offer searching of patent documents. *About Google Patents*, GOOGLE, http://www.google.com/googlepatents/about.html (last visited July 25, 2012).

88. MPEP §§ 902–04 (8th ed., Rev. 9, Aug. 2012); *Patent Searching: Keyword Searching*, UNIV. OF TEX., http://www.lib.utexas.edu/engin/patent-tutorial/tutorial/keyword.html (last modified Jan. 31, 2013) ("[O]nly patents since 1976 can be searched by keyword."); *Patent Searching: Introduction*, UNIV. OF TEX., http://www.lib.utexas.edu/engin/patent-tutorial/tutori al/intro.html ("[T]he average patent search takes between 25 and 30 hours to conduct from start to finish."); PRESSMAN, *supra* note 50, at 124, 139; USPTO, EXAMINER HANDBOOK TO THE U.S. PATENT CLASSIFICATION SYSTEM (2003), *available at* http://www.uspto.gov/patents/resources/classification/handbook/one.jsp (describing classification system).

ing, particularly "when it is difficult to express search needs in textual terms."[89]

Although examiners are supposed to search comprehensively for prior art,[90] and patent applicants have a duty to disclose prior art that is material to patentability,[91] the quality of prior art located for a given application is limited by time, ability, interest, and resources.[92] Despite hopes that keyword searching would be the solution to some of these constraints, some commentators have lamented the decline in prior art search quality by patent examiners that over rely on keyword searching.[93]

The potential overreliance by examiners on keyword searching may suggest that inventors, looking to distinguish or improve upon prior art, are similarly overlooking references that might be useful in the innovative process. In this sense, technological advancement might actually impede, rather than further, the innovative process. As others have noted, however, inventors often learn about the work of others not through patents, but through the disclosures in other forums that patents make possible.[94] In addition, inventors are often discouraged from reviewing patents out of fear of becoming willful infringers, an offense which may result in treble damages.[95] Conse-

89. MPEP § 904.02; Pressman, *supra* note 50, at 139 ("[Y]ou should do both types of computer searches . . . because each has some deficiencies.").

90. *See* 37 C.F.R. § 1.104 (2012).

91. *See* 37 C.F.R. § 1.56 (2012).

92. *See, e.g.*, Christopher A. Cotropia et al., *Do Applicant Patent Citations Matter? Implications for the Presumption of Validity* (Stanford Law & Econ. Olin Working Paper No. 401, 2010), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1656568 (suggesting that examiners essentially ignore applicant-submitted art, focusing instead on art they find themselves); 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, 590 (1999) ("[T]here are numerous incentives inside the PTO to issue rather than reject patent applications . . . .").

93. *See, e.g.*, Andrew Chin, *Search for Tomorrow: Some Side Effects of Patent Law Automation*, 87 N.C. L. Rev. 1617 (2009) (discussing the use of search engine technology by examiners); Justin Pats, *Preventing the Issuance of "Bad" Patents*, 48 IDEA 409, 418–20 (2008) (describing the limitations of search engine technology used by examiners).

94. *See* Mark A. Lemley, *The Myth of the Sole Inventor*, 110 Mich. L. Rev. 709, 745–46 (2012) ("[T]he patent does not so much communicate valuable technical information itself as induce the communication of that information by other means."); Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 Harv. J.L. & Tech. 532, 545 (2012) ("[M]any companies . . . advise researchers to avoid reading patents and to look elsewhere for technical information."). *But see* Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 Calif. L. Rev. 803, 808 n.9 (1988) ("There is a significant amount of evidence showing that inventors in many fields rely on published patents for technical information.").

95. *See In re* Seagate Tech., LLC, 497 F.3d 1360, 1368 (Fed. Cir. 2007) (en banc) ("[A]n award of enhanced damages requires a showing of willful infringement . . . ."); Alan Devlin, *The Misunderstood Function of Disclosure in Patent Law*, 23 Harv. J.L. & Tech. 401, 404 (2010) ("[T]he ever-looming danger of treble damages resulting from a finding of willful infringement creates perverse incentives to remain ignorant of patented technology."); Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. Rev. 123, 142 (2006) ("Given

quently, the impact of keyword searching on the awareness of prior art may be limited.

4. Impressions of Innovation

Several scholars have discussed how the process of invention takes place, and what that might mean for intellectual property law.[96] For example, Amy Landers has elucidated various impressions of innovation, such as understanding creativity to be a function of logic, personality, imagination, insight, and education.[97] The Federal Circuit has noted that determining obviousness depends greatly on context, "including the characteristics of the science or technology, its state of advance, the nature of the known choices, the specificity or generality of the prior art, and the predictability of results in the area of interest."[98] Consistent with this guidance, the courts should expand the consideration of context, focusing on what the innovative process actually entails for those in a given field—particularly whether that process is likely to be interdisciplinary.

When considering how innovation actually takes place in a given field, courts should take into account what effect advances in computerization and information technology have on the process. These advances might affect the level of skill of the PHOSITA and the level of creativity that the PHOSITA is expected to possess. Courts should carefully consider whether the PHOSITA is an ordinary mechanic, a creative mechanic, or a researcher.[99] For assessing obviousness in a particular case, if the PHOSITA standard of expected creativity is set too low, then even an insignificant invention will be deemed patentable.[100] If the standard is set too high in a

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the risk of enhanced damages, a competitor has a significant incentive not to review patents at all."); Benjamin Roin, Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 Harv. L. Rev. 2007, 2017 (2005) ("Due to the Federal Circuit's willful infringement rules, however, many innovators now avoid reading patents to protect themselves from treble damage awards in infringement suits.").

96. Janet Davidson & Nicole Greenberg, *Psychologists' Views on Nonobviousness: Are They Obvious?*, 12 Lewis & Clark L. Rev. 527, 536–37 (2008) (examining the implications of problem finding and creativity for patent law); Jeanne C. Fromer, *A Psychology of Intellectual Property*, 104 Nw. U. L. Rev. 1441, 1457 (discussing the "psychology of creativity" and how it might relate to and influence intellectual property law); Landers, *supra* note 14; Gregory N. Mandel, *Left-Brain Versus Right-Brain: Competing Conceptions of Creativity in Intellectual Property Law*, 44 U.C. Davis L. Rev. 283, 361 (discussing how interdisciplinary research in "psychology, neurobiology, and cultural studies not only reveal problems with current intellectual property law, but, even more importantly, provide valuable teachings concerning how to use the law to promote creativity and collaboration").

97. Landers, *supra* note 14, at 37–69.

98. Abbott Labs. v. Sandoz, Inc., 544 F.3d 1341, 1352 (Fed. Cir. 2008).

99. Darrow, *supra* note 14; Landers, *supra* note 14, at 43, 98; Fromer, *supra* note 96; Mandel, *supra* note 39.

100. Darrow, *supra* note 14, at 234–35.

given case, such as by defining the PHOSITA as a researcher, then even a deserving invention will not be patentable.[101]

In its 2006 opinion in *Dystar*, the Federal Circuit acknowledged that the level of skill suggests not only "varying bases of knowledge," but also "varying levels of imagination and ingenuity in the relevant field, particularly with respect to problem-solving abilities."[102] The court, in analyzing a process for dyeing textile materials, discussed the impact of the level of skill on the motivation to combine references.[103] If the level of skill is low, such as that of a dyer, the PHOSITA would need "explicit direction" in a prior art reference to provide a motivation to combine.[104] However, if the level of skill is that of a "dyeing process designer," then it is reasonable to "assume comfortably" that the PHOSITA would combine references from chemistry and systems engineering, even without an explicit suggestion to do so.[105]

After determining that the PHOSITA would possess the higher level of skill, the Federal Circuit concluded that the jury incorrectly disregarded relevant art that the PHOSITA would have considered.[106] The court in *Dystar* recognized the importance of considering technological advances in the given field when defining the PHOSITA:

> Designing an optimal dyeing process requires knowledge of chemistry and systems engineering, for example, and by no means can be undertaken by a person of only high school education whose skill set is limited to "flipping the switches." This is especially true when one considers that only in the last century have improvements in indigo reduction chemistry enabled outsourcing of the indigo reduction step from dyehouses to chemical manufacturers . . . .[107]

In terms of the effects of cognitive technology, defining the PHOSITA is vital to the question of obviousness, as access to information matters only if it can be integrated. The less skill the person has, the less cognitive technology would seem to matter. All the information in the world will not make an ordinary mechanic likely to integrate it. But, providing information to creative mechanics or researchers may improve the likelihood that connections will be made.

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101. *Id.*

102. DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co., 464 F.3d 1356, 1370 (Fed. Cir. 2006).

103. *Id.*

104. *Id.*

105. *Id.*; *see also* Daiichi Sankyo Co. v. Apotex, Inc., 501 F.3d 1254 (Fed. Cir. 2007) (finding that invention covering topical treatment of ear infections would have been obvious in view of correct skill level of ear treatment specialist, as opposed to erroneous lower level of skill of general practice doctor).

106. *Dystar*, 464 F.3d at 1362–63.

107. *Id.*

Under the *KSR* standard, it seems that the PHOSITA exercising creativity and common sense, and putting together pieces of information like a puzzle, might have a fairly broad reach into references from different technological fields.[108] The hindsight bias problem is that a puzzle is easier to piece together if one has a picture of what the invention looks like. A researcher or creative mechanic often would be better situated to understand and employ information than an ordinary mechanic. Paradoxically, this means that inventions requiring a higher level of skill could face a heightened patentability threshold, even if they are unpredictable.

Yet, is that right? Professor Landers notes that some of the research on creativity "shows that abilities to combine disparate pieces of information, exercise imagination and solve difficult problems may derive in part from personality rather than exclusively from training, experience and education."[109] Furthermore, in many fields, the highly skilled are also highly specialized.[110]

In discussing the process of invention, economist and philosopher Friedrich Hayek contrasts two types of innovators: (1) the logical "masters of their subject" with orderly minds and (2) the "puzzlers," who Hayek defines being "muddleheaded" as a necessary "condition . . . to independent thought."[111]

For the first category, that of the logical "masters," invention is viewed as the result of logical analysis, analogous to the slow and steady tortoise, plodding along to win the race.[112] Consistent with this view, strong problem-solving methods include relying on available information in a given field that is relevant to a specific problem.[113] When strong methods are not available, generally applicable methods, such as working backwards from a goal, are used.[114]

Under a logic-based theory of innovation, the difference between researcher and mechanic might not matter much, as it is diligence that results in innovation. If logic is the driving force behind innovation, any person of ordinary skill should be able to arrive at an invention when supplied with

108. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 420 (2007).

109. Landers, *supra* note 14, at 46.

110. *See, e.g.*, David A. Ferrucci, *Building the Team that Built Watson*, N.Y. Times, Jan. 8, 2012, at BU7 (describing the challenges of forming an interdisciplinary team at IBM to build Watson, the first Jeopardy! computer champion).

111. Friedrich A. Hayek, *Two Types of Mind*, 45 Encounter 33 (1975), *reprinted in* 3 F.A. Hayek, The Trend of Economic Thinking: Essays on Political Economists and Economic History 49, 52 (W.W. Bartley III & Stephen Kresge eds., 1991); *see also* Mandel, *supra* note 96, at 337 ("Innovation usually requires a substantial dose of intuitive creativity.").

112. Landers, *supra* note 14, at 47–48 (discussing the theories of Herbert Simon and Robert Weisberg).

113. *Id.*

114. *Id.*

adequate resources, time, and motivation.[115] However, "disciplinary gulfs" in the knowledge of inventors or the applicability of an invention in one field to another can impede progress.[116] Consequently, perhaps the more highly focused the PHOSITA is, the smaller the chance she has to discover solutions from other technological areas. This may be true even if collaborating scientists come from closely related fields.

Consistent with the logic-based theory of innovation, it would seem that providing a computer with information available to one of ordinary skill could result in automated innovation.[117] About a decade ago, computer programmers claimed to be able to write software that would allow computers to solve problems autonomously.[118] One of the earliest proponents of this technology was computer programmer John Koza.[119] Dubbing the advance "genetic programming technology," Koza obtained patents on the automated processes and the designs produced by them.[120] Companies attempted to implement automated innovation in areas such as jet and diesel engine design.[121] Automated innovation, however, never reached the level of success its supporters envisioned.[122] Today, it is mainly used to allocate resources and improve the efficiency of business processes.[123] Thus, while computers are not solving problems autonomously, they are improving implementation and, perhaps, innovation.

At some point, artificial intelligence systems might become sufficiently sophisticated to ascertain what references those in the art would have actually considered at the time of invention, making the obviousness determina-

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115. Landers, *supra* note 14 at 53, 64–65 ("These theories, in sharp contrast to the genius view, hold that the birth of new information derives primarily from circumstances within the inventor's intellectual and societal environment, rather than primarily through a singularly gifted individual.").

116. Landers, *supra* note 14, at 67.

117. Peter M. Kohlhepp, Note, *When the Invention Is an Inventor: Revitalizing Patentable Subject Matter to Exclude Unpredictable Processes*, 93 Minn. L. Rev. 779, 785–86 (2008) (discussing emerging artificial intelligence technologies); *see also* Landers, *supra* note 14, at 52 ("[P]rograms, fed with information available to the original scientist, have successfully recreated Kepler's third law, Ohm's law and Galileo's laws for the pendulum and constant acceleration . . . [but] the role of human intervention has been acknowledged in these endeavors.").

118. Kohlhepp, *supra* note 117.

119. *Id.*; John R. Koza et al., *Evolving Inventions*, Scientific American, Feb. 2003, at 54 ("[The authors] have recently filed a patent for a genetically evolved general-purpose controller that is superior to mathematically derived controllers commonly used in industry.")

120. *See, e.g.,* U.S. Patent No. 7,117,186 (filed Jan. 30, 2003); U.S. Patent No. 6,532,453 (filed April 12, 1999); U.S. Patent No. 6,360,191 (filed Jan. 5, 1999).

121. *See* Kohlhepp, *supra* note 117.

122. *Automated Innovation 2.0*, Businessweek (June 22, 2009), http://www.businessweek.com/magazine/toc/09_25/B4136innovation.htm.

123. Reena Jana, *Dusting off a Big Idea in Hard Times*, Businessweek (June 11, 2009), http://www.businessweek.com/magazine/content/09_25/b4136044140573.htm ("Today, HP is using auto-innovation to forecast manufacturing and shipping needs based on predicted sales growth and outfit its worldwide offices and factories as cheaply as possible.").

tion more predictable. In such a system, obviousness could be determined based on the information available at the time of filing to PHOSITAs, taking into account the degree of differences between the references considered. The central points of dispute would remain determining the level of skill and how broadly the scope of prior art should extend.[124]

For Hayek's second category of innovators, the "puzzlers," it is unclear how advances in cognitive technology will implicate the work of innovation.[125] As scientific philosopher Karl Popper discussed, "[E]very discovery contains 'an irrational element,' or a 'creative intuition.'"[126] The ability to locate relevant information quickly, as well as advances in processing, should free up more time to create and innovate. Whether this results in increased pace or reduced costs of innovation is field dependent, as different technological fields adopt advances to different extents and at varying rates.

As the different characteristics of innovation vary, from imagination and personality to logic and education, so do the implications of advances in cognitive technology. As access to information and reduction in uncertainty cut the costs of research, perhaps patents become less necessary as incentives.[127] Still, it is not clear that these benefits will increase the pace of innovation, particularly when the elements of an invention come from uncommonly paired fields of endeavor where interdisciplinary collaboration is less common.

5. Facilitating Collaborative Invention

Advances in cognitive technologies can further discovery and facilitate interdisciplinary research. Opening up inquiries may result in improved results and may increase the pace of innovation. The availability of information and processing capabilities increases the likelihood of simultaneous invention, putting new ideas "in the air" and making invention a more social occurrence.[128] In many fields, the inventor is no longer an individual, but

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124. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406–07 (2007) (citing Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966) (discussing that the relevant factors in determining obviousness include the scope and content of the prior art, the level of ordinary skill in the art, the differences between the claimed invention and the prior art, and secondary considerations of nonobviousness); *see infra* Part II.C.

125. *See* Hayek, *supra* note 111.

126. KARL R. POPPER, THE LOGIC OF SCIENTIFIC DISCOVERY 32 (Karl Popper et al. trans., Hutchinson 1959).

127. *See infra* Part III.C.

128. Lemley, *supra* note 94, at 750 ("Invention is a social phenomenon, not one driven by lone geniuses."); *see also* Davidson & Greenberg, *supra* note 96, at 538 ("Even though innovations can and do occur when people are alone, the preparation, evaluation, and elaboration stages surrounding them typically depend upon interaction with, and input from, one's colleagues."); Mandel, *supra* note 96, at 349 ("Collaboration has become both more common and more necessary across numerous technological and artistic fields."); R. Keith Sawyer, *Creativity, Innovation, and Obviousness*, 12 LEWIS & CLARK L. REV. 461, 482 (2008)

instead a "research entity."[129] As evidence of the trend toward collaboration, the average number of inventors listed in patent filings from the 1970s through the 2000s has increased by fifty percent.[130]

Whether advances in technology will result in increased innovation depends in part on the level of trust and incentives for collaborative innovation.[131] One recent example is collaboration in synthetic biology. Synthetic biology has been defined as "the design and construction of new biological parts, devices, and systems," and "the redesign of existing, natural biological systems for useful purposes."[132] Synthetic biology is highly unpredictable, lacking standardization and foundational tools.[133] To address these problems, synthetic biology researchers have created the BioBricks Foundation, making standardized biological parts widely available to researchers.[134] Online communities, such as the International Genetically Engineered Machine ("iGEM") Foundation seek to foster "the development of open community and collaboration."[135]

To provide incentives, the BioBricks Foundation has proposed a legal framework called the BioBrick Public Agreement ("BPA").[136] The BPA allows researchers to patent inventions that they have made using BioBrick standard biological parts, or even other researchers' contributions.[137] For example, other researchers might have contributed information on existing

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("[I]nnovation has become more and more dependent on collaborative webs, and on networks of many ideas . . . .").

129. Durie & Lemley, *supra* note 13.

130. Dennis Crouch, *The Changing Nature of Inventing: Collaborative Inventing*, Patently-O Blog (July 9, 2009), http://www.patentlyo.com/patent/2009/07/the-changing-nature-inventing-collaborative-inventing.html (noting an increase from an average of 1.6 inventors listed per patent in the 1970s to 2.5 inventors listed per patent in the 2000s); Mandel, *supra* note 96, at 349 ("[T]he average number of inventors listed per patent has increased by fifty percent from the 1970s to the 2000s . . . .").

131. Collaborative innovation has examples too numerous to provide in detail here. *See, e.g.*, Holger Rohde et al., *Open-Source Genomic Analysis of Shigah-Toxin-Producing E. Coli O104:H4*, 365 New Eng. J. Med. 718 (2011); *About Us*, Open Source Project, http://www.theopensourcescienceproject.com/aboutus.php; Steve Lohr, *Pentagon Pushes Crowdsourced Manufacturing*, N.Y. Times (April 5, 2012), http://bits.blogs.nytimes.com/2012/04/05/pentagon-pushes-crowdsourced-manufacturing/; George Miller, *Open Source BioPharma Systems*, Farmavita.net, http://www.farmavita.net/content/view/1454/84/ (last visited Feb. 18, 2012); Andrew Pollack, *Open Source Practices for Biotechnology*, N.Y. Times (Feb. 10, 2005), http://www.nytimes.com/2005/02/10/technology/10gene.html; Open Innovation Community, http://www.openinnovation.net/ (last visited Feb. 18, 2012); Open Source Initiative, http://www.opensource.org/ (last visited Feb. 18, 2012).

132. Synthetic Biology, http://syntheticbiology.org/ (last visited Jan. 28, 2013).

133. Drew Endy, *Foundations for Engineering Biology*, 438 Nature 449 (2005).

134. Bio Bricks Foundation, http://biobricks.org/ (last visited Jan. 28, 2013).

135. iGEM Foundation, http://igem.org/About (last visited Jan. 28, 2013).

136. Drew Endy & David Grewal, *Bio Bricks Foundation,The BioBrick Public Agreement Draft Version 1a* (Jan. 2010), http://dspace.mit.edu/bitstream/handle/1721.1/50999/BPA_draft_v1a.pdf.

137. *Id.*

parts as well as new parts that they have made.[138] In return, all researchers that agree to the BPA are permitted to use the parts that have been contributed, even if they have been patented.[139] This agreement serves as the foundation for interdisciplinary collaboration.

A benefit of collaborative invention in this context is a large disclosure database.[140] Because contributors and researchers can disclose contributions and possible uses of contributed parts, minor changes would likely be obvious. Consequently, the large disclosure database could prevent non-practicing entities from rent-seeking behavior by providing a source of prior art to invalidate patents on obvious variations.

Because interdisciplinary collaboration varies greatly depending on the field, courts and examiners should consider what those in the field actually do. The focus should be on whether the PHOSITA would appreciate information made available through technological advancement, such as whether such references would actually be considered in common practice in a given field, even if the references taken together would have all the elements of the claimed invention. By grounding the analysis in the common practices in the field, decision makers should come to more accurate assessments about the effects of cognitive technologies. This inquiry will ensure that the scope of information is appropriately circumscribed by the reality of innovation, rather than by the subjectivity of hindsight.

II. Should All Accessible Art be Combinable for Determining Obviousness?

The Supreme Court in *KSR* indicated that a PHOSITA should take into account references in other fields, stating that if "a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field *or a different one*."[141] If a PHOSITA now has access to an extensive range of references, enabled by advances in technology, the question becomes how broad the scope of the prior art should be in assessing obviousness and whether references should be combined.

A. *The Scope of the Prior Art*

The outcome of an obviousness determination will often depend on whether the court or an examiner conceives of a reference as analogous or nonanalogous art. The courts generally apply a two-part test in determining whether a reference is analogous art: "(1) whether the art is from the same

138. *Id.*
139. *Id.*
140. Registry of Standard Biological Parts, http://partsregistry.org/Main_Page (last visited Mar. 7, 2013).
141. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 417 (2007) (emphasis added).

field of endeavor, regardless of the problem addressed, and (2) if the reference is not in the field of the inventor's endeavor, whether the reference is still reasonably pertinent to the particular problem."[142]

As an example of the first group, hairbrushes with a "unique shape" have been considered in the same field of endeavor as toothbrushes, though each clearly addresses a different problem.[143] That is, one would not use a tooth brush to straighten hair, nor use a hair brush to clean teeth. In contrast, for the second group, conical shaped tops for oilcans were found reasonably pertinent to the problem addressed by conical shaped ends for popcorn shakers, though they were identified as from different fields of endeavor.[144] Even though popcorn dispensers and oil containers are from different fields, a conical oilcan top would be reasonably pertinent to the problem of dispensing popcorn, such that "several kernels of popped popcorn . . . pass through at the same time," but use the taper of the top to "jam up the popped popcorn before the end of the cone and permit the dispensing of only a few kernels."[145] However, a lack of guidance from the Federal Circuit about how to define the field of invention and problem to be solved has made the analogous arts test subjective and unpredictable.[146]

In contrast to analogous arts, nonanalogous arts are from different fields than that of the invention. While nonanalogous arts can arise from divergent disciplines (such as chemistry and aeronautics), they can also be from closely related fields that an inventor would not reasonably be expected to examine.[147] For example, one would not expect an inventor addressing reliability issues in an "assembly line metal hose clamp" to examine garment clamps.[148] Yet, it is not clear why various types of brushes and dispensers should be deemed analogous arts while clamps should not. In large part, the

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142. Wyers v. Master Lock Co., 616 F.3d 1231, 1237 (Fed. Cir. 2010) (quoting Comaper Corp. v. Antec, Inc., 596 F.3d 1323, 1351 (Fed. Cir. 1992)).

143. *In re* Bigio, 381 F.3d 1320 (Fed. Cir. 2004).

144. *In re* Schreiber, 128 F.3d 1473, 1475 (Fed. Cir. 1997); *see also In re* ICON Health & Fitness, Inc., 496 F.3d 1374 (Fed. Cir. 2007) (discussing a reference that describes a folding bed's spring mechanism that was held to be analogous art to the folding treadmill claimed in the patent application, as the claimed folding mechanism generally addressed a weight support problem).

145. *Schreiber*, 128 F.3d at 1478.

146. *See* Margo A. Bagley, *Internet Business Model Patents: Obvious by Analogy*, 7 Mich. Telecomm. & Tech. L. Rev. 253, 270 (2001) ("[I]t is impossible to predict how narrowly or broadly a court will define the relevant field of the inventor's endeavor or the problem to be solved."); Jacob S. Sherkow, *Negativing Invention*, 2011 BYU L. Rev. 1091, 1111–12 ("Nor has the Federal Circuit been consistent on the proper approach to determining which art is analogous on the face of a patent application.").

147. *See In re* Oetiker, 977 F.2d 1443, 1447 (Fed. Cir. 1992).

148. *Id.* at 1446–47; *see also In re* Clay, 966 F.2d 656, 657–60 (Fed. Cir. 1992) (finding nonanalogous (1) Syndansk reference disclosing process for hydrocarbon removal by filling cavities in underground rock formations with a gel and (2) Clay's invention comprising process for storing hydrocarbon in a tank with a dead volume between the bottom of the tank and its outlet port and filling the dead space with gel; the court differentiated between the *storage*

analogous arts test has been criticized for its subjectivity, as well as its lack of predictability and clarity.[149]

Some have suggested that the analogous arts test merely serves as a way to approve "complex inventions difficult for judges to understand" and to exclude "less mysterious inventions a judge can understand."[150] As Jacob Sherkow discusses, the test permits courts and examiners to consider the difficulty of the work of invention, despite the statutory requirement that "[p]atentability shall not be negated by the manner in which the invention was made."[151]

Decades before the information revolution, the Supreme Court in its 1966 decision in *Graham v. John Deere Co.* presciently recognized that "the ambit of applicable art in given fields of science has widened by disciplines unheard of a half century ago . . . . Those persons granted the benefit of a patent monopoly [must] be charged with an awareness of these changed conditions."[152] In this way, broadening the scope of analogous arts seems justified in light of the expansive availability of information and trend toward interdisciplinary research in many fields.

Knowledge has become highly specialized; interdisciplinary collaboration is often necessary to understand larger problems.[153] An invention related to surveillance might require knowledge of robotics, economics, and law, as well as both mechanical and electrical engineering. Over half a century after *Graham*, however, it is still not clear how broadly those having ordinary skill in the art view "the ambit of applicable art."[154]

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and *extraction* of petroleum, and defined the problem facing Clay as preventing the loss of stored product as compared with Syndansk's problem of removing oil from rock).

149. *See, e.g.*, Bagley, *supra* note 146, at 270 ("[I]t is impossible to predict how narrowly or broadly a court will define the relevant field of the inventor's endeavor or the problem to be solved."); Jeffrey T. Burgess, *The Analogous Art Test*, 7 BUFF. INTELL. PROP. L.J. 63, 70 (2009) ("Unfortunately, the case law appears erratic on this issue at times."); Hilary K. Dobies, *New Viability in the Doctrine of Analogous Art*, 34 IDEA 227, 229–230 (1994) ("Characterizing analogous art involves a fact specific determination that is by definition, somewhat subjective."); Sherkow, *supra* note 146, at 1111–12 (2011) ("Nor has the Federal Circuit been consistent on the proper approach to determining which art is analogous on the face of a patent application."); Toshiko Takenaka, *International and Comparative Law Perspectives on Internet Patents*, 7 MICH. TELECOMM. & TECH. L. REV. 423, 428 (2001) ("[A] serious flaw inherent to the doctrine of analogous art is its arbitrary nature of defining the applicable scope.").

150. Panduit Corp. v. Dennison Mfg. Co., 810 F.2d 1561, 1572 (Fed. Cir. 1987); Sherkow, *supra* note 146, at 1120–21.

151. 35 U.S.C. § 103 (2011); Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011); Sherkow, *supra* note 146, at 1119–20 ("[The] byproduct of increased analogization has contained an inherent method-of-invention bias . . . .").

152. Graham v. John Deere Co., 383 U.S. 1, 19 (1966).

153. Gregory N. Mandel, *To Promote the Creative Process: Intellectual Property Law and the Psychology of Creativity*, 86 NOTRE DAME L. REV. 1999, 2014 (2011); *see* Cukier, *supra* note 5, at 11.

154. *Graham*, 383 U.S. at 19.

The essential question is: how broadly should one of ordinary skill in a particular art consider references? In a well-known case related to placing chemicals in the air to form clouds, or "cloud seeding," the court viewed as analogous art older patents covering "airborne detonable devices in which it is important to control the point of detonation."[155] Other cases have expanded the scope of analogous arts to cover even more divergent fields.[156] It is questionable whether evidence from those of ordinary skill in the art would support such a broad reading of analogous arts.

Access to searchable information largely affects the second prong of the analogous arts test: "if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem."[157] Emphasizing how those of ordinary skill in a particular field understand dispersed information will help determine what is reasonably pertinent, even if the references taken together would have all the elements of the claimed invention. This should be determined in light of the experiences of those actually in a given field, focusing on the rate at which the field adapts to technological advances and how much interdisciplinary collaboration is common in the field.

B. *Limits on Combining Analogous Art*

If references are considered analogous art, the next question is whether there is a reason why a person having ordinary skill in the art would combine them. Inventions often combine existing things in new ways. Even if all of the elements of an invention are available in different prior art references, some reason has to be provided why a person of ordinary skill would combine them to make the claimed invention. Otherwise, courts might improperly use hindsight, combining elements from references in overly divergent fields. Although the Supreme Court in *KSR* moved away from the rigid requirements of the TSM test, the Federal Circuit continues to look for a motivation to combine as a "useful clue" in determining obviousness.[158]

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155. Weather Eng'g Corp. of Am. v. United States, 614 F.2d 281, 287 (Ct. Cl. 1980).

156. *See, e.g.*, Innovention Toys, LLC v. MGA Entm't, Inc., 637 F.3d. 1314 (Fed. Cir. 2011) (considering a software game analogous to a physical board game); Daiichi Sankyo Co., Ltd. v. Apotex, Inc., 501 F.3d 1254, 1259 (Fed. Cir. 2007) (considering general practice medicine analogous to otological drug development); George J. Meyer Mfg. Co. v. San Marino Elec. Corp., 422 F.2d 1285, 1288–90 (9th Cir. 1970) (analogizing a missile tracking system to a glass-bottle inspection system).

157. Wyers v. Master Lock Co., 616 F.3d 1231, 1237 (Fed. Cir. 2010) (quoting Comaper Corp. v. Antec, Inc., 596 F.3d 1343, 1351 (Fed. Cir. 2010)).

158. *See, e.g.*, Media Techs. Licensing, LLC v. Upper Deck Co., 596 F.3d 1334, 1338 (Fed. Cir. 2010) (finding invention obvious because "it would have been obvious to one skilled in the art to attach [a piece of memorabilia to] a sports-related item instead of those items attached in the [non-sports related] prior art references"); W. Union Co. v. MoneyGram Payment Sys., 626 F.3d 1361, 1368 (Fed. Cir. 2010) (finding invention nonobvious where a PHOSITA would not have been motivated to combine elements taught by the prior art); Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc., 520 F.3d 1358, 1364 (Fed. Cir. 2008) ("[A] flexible

Once a court finds a reference is "reasonably pertinent" to the particular problem, it seems as though there is no reason why a PHOSITA, exercising creativity and common sense, would not combine such a reference with one from a reasonably pertinent field. For example, in the 2010 case of *Wyers v. Master Lock Co.*, the Federal Circuit found the patents at issue obvious after defining the scope of analogous arts broadly.[159] The patents were related to locks for securing trailers to vehicles, claiming improvements that permitted different sized receivers and a seal to protect the locks from contaminants.[160]

Referring to the Supreme Court's decision in *KSR*, the Federal Circuit reasoned that the scope of analogous prior art should be defined broadly because "familiar items may have obvious uses beyond their primary purposes, and a person of ordinary skill often will be able to fit the teachings of multiple patents together like pieces of a puzzle."[161] Here, the Federal Circuit broadly defined the field as "locksmithing."[162] Because the prior art related to padlocks, the Federal Circuit overruled the district court's finding that the prior art was not reasonably pertinent to the problem the inventor was trying to solve.[163]

After concluding that the prior art was reasonably pertinent, the court considered it to be a matter of "common sense" to combine the references.[164] In particular, the "existence of different aperture sizes in standard hitch receivers was a known problem" and the inventors, if they knew about the references, would have had a reasonable expectation of success in combining them.[165] Moreover, the prior art provided at least two common and widely used ways to protect locks from the elements.[166] The Federal Circuit also reasoned that expert testimony was unnecessary, as the prior art and the invention itself were "easily understandable."[167] As such, the Federal Circuit reversed the district court's judgment of nonobviousness.[168]

Of course, it is easier to piece together a puzzle if the picture of the completed puzzle is available. To counter this hindsight bias problem, courts and examiners should focus on what references those in the art actually would have considered in determining what is reasonably pertinent to the problem at hand. Courts and examiners should take into account expert testi-

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TSM test remains the primary guarantor against a non-statutory hindsight analysis such as occurred in this case.").

159. *Wyers*, 616 F.3d at 1233.

160. *Id.* at 1244.

161. *Id.* at 1238 (emphasis omitted) (quoting KSR Int'l Co. v. Teleflex, Inc., 550 U.S. 398, 402 (2007)).

162. *Id.*

163. *Id.*

164. *Id.* at 1238–43.

165. *Id.*

166. *Id.* at 1245.

167. *Id.* at 1242.

168. *Id.* at 1241.

mony and other evidence of common practices in determining whether prior art is reasonably pertinent to the problem to be solved. Although scientific research has become increasingly interdisciplinary in many fields, this is not the case in areas of intense specialization, such as nuclear engineering. As the degree to which PHOSITAs integrate cognitive technologies and engage in interdisciplinary research varies by field, courts should be acutely sensitive to the risks of hindsight bias when relying on their own "common sense" in lieu of expert testimony.[169] Examining common practices in the field is critical to ascertaining the effects of cognitive technologies on obviousness.

C. *What Would PHOSITAs Do?*

Increased access to searchable information may make courts and examiners more likely to conclude that an invention is obvious, but without proper analysis, such a conclusion might not reflect common practices in the art. This higher threshold takes into account the PHOSITA's expanded access to information, resulting in a higher level of skill. *KSR* appears to have moved the definition of the PHOSITA in this direction. Moreover, the Court acknowledged that the "diversity of inventive pursuits and of modern technology counsels against limiting the analysis" of what may be combined.[170]

However, the combination of knowledge from divergent fields should not be unlimited. While it may be logical to adapt a solution from one technological space to another area, the decision to do so might not be within the understanding of one of ordinary skill in a particular art. We cannot expect that those of ordinary skill will necessarily be able to extract "lines of meaning among the leagues of cacophony and incoherence."[171] Patent examiners and courts need to closely consider from which technological areas a PHOSITA might draw. In particular areas of research, interdisciplinary analysis may be more common than in others.

This type of approach might have made a difference in two cases from 2011. First, in *In re Klein,* the claims covered a nectar mixing device.[172] The device has a movable divider, permitting users to prepare sugar water in different ratios depending on the type of animals to be fed.[173] After a user fills the compartments to the appropriate level with sugar and water, the divider is removed, allowing the user to mix the sugar water.[174]

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169. The Federal Circuit has instructed lower courts to articulate some basis for reliance on a "common sense approach." Mintz v. Dietz & Watson, Inc., 679 F.3d 1372, 1377 (Fed. Cir. 2012) (reversing a finding of obviousness where there was "little more than an invocation of the words 'common sense'").

170. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007).

171. James Gleick, The Information: A History, a Theory, a Flood (2011).

172. *In re* Klein, 647 F.3d 1343 (Fed. Cir. 2011).

173. *Id.* at 1345.

174. *Id.*

On appeal, the Federal Circuit determined that the five references relied on by the USPTO were nonanalogous art and could not be considered in determining obviousness.[175] The references discussed containers with movable dividers. Three of the references failed to show a container capable of receiving water or holding it sufficiently long to prepare mixtures.[176] The other two did not allow multiple ratios, and did not have movable dividers.[177]

The Federal Circuit rejected the USPTO's attempt to broadly define the problem to be solved as a "compartment separation problem," as opposed to a "nectar mixing device."[178] In the application of the analogous arts test, the analysis may become skewed depending on how broadly the problem is defined. If the invention were defined as being broadly directed to a compartment separation problem, the scope of art would be broader, and the invention likely invalid.

Instead of focusing on the specific problem to be solved, courts and examiners should look at what PHOSITAs in the particular field would have done to address the problem as defined by the claims of the patent. In *Klein*, the Federal Circuit explained that an "*inventor* considering the problem of 'making a nectar feeder . . .' would not have been motivated to consider any of these references when making his invention."[179] The proper perspective for the inquiry, however, is that of the person having ordinary skill, not the inventor.

Additionally, the focus should be not on the problem the inventor argues she was attempting to solve, but the problem defined by the claims of the patent. In this case, the sole independent claim required "mixing of said sugar and water to occur to provide said sugar-water nectar."[180] Consequently, the court fortuitously defined the problem narrowly given the scope of the claims, despite the government's attempts to redefine the problem addressed on appeal.[181]

If the proposal in this Article is adopted, inventors might choose to draft claims narrowly to avoid obviousness problems, effectively precluding the ability to consider any references. However, obtaining narrow claims for obviousness purposes will also limit the patent holder's scope of protection for enforcement.

Another 2011 case concerning the scope of analogous arts is *Innovention Toys v. MGA*.[182] In that case, the patent claimed a light-reflecting, physi-

175. *Id.* at 1348–52.
176. *Id.*
177. *Id.*
178. *Id.* at 1351 n.1.
179. *Id.*
180. *Id.* at 1346.
181. *Id.* at 1351 n.1.
182. Innovention Toys, LLC v. MGA Entm't Inc., 637 F.3d. 1314 (Fed. Cir. 2011).

cal board game similar to chess.[183] The patented game uses laser sources, as well as mirrored and non-mirrored playing pieces.[184] The prior art references were electronic computer games, as opposed to physical board games.[185]

Because the prior art references envisioned potential implementation in both electronic and physical products, the Federal Circuit found that the references would be from analogous arts.[186] In particular, both the prior art and claimed invention related to the same objective of "game design and game elements" found in strategy games, "whether molded in plastic by a mechanical engineer or coded in software by a computer scientist."[187] That is, the court reasoned that the creators of the physical board games should have logically examined the electronic video gaming field references in attempting to solve the problem of creating a physical board game that uses real lasers.

Instead of simply concluding that references are in the "same field of endeavor," which is the inherently subjective portion of the analogous arts test, the court should have spent more time defining the PHOSITA and asking what references that person would actually consider in addressing the problem solved by the claimed invention. The district court incorrectly made the obviousness determination from the viewpoint of a layperson.[188] Instead, the district court should have assessed whether video game designers, mechanical engineers, or game designers in general construct physical board games.

After defining the PHOSITA, a court should ascertain whether the PHOSITA would consider the prior art reference as well as the degree of collaboration in the field. This would help indicate whether PHOSITAs would actually have considered the prior art video game references reasonably pertinent in solving the problem defined by the claims of the patent. In looking at the claimed invention, a physical board game, it is not clear that a PHOSITA actually would have examined electronic computer game references even if prior art video game references envisioned implementation in a physical board game.

All of the asserted claims in this case articulated the element of a "game board," suggesting that the scope of the problem solved may be narrower than what the court determined.[189] By focusing on the disclosure of the prior art references, rather than on which references a PHOSITA actually would

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183. *Id.*
184. *Id.*
185. *Id.*
186. *Id.* at 1323.
187. *Id.* at 1322–23.
188. *Id.* at 1324.
189. *Id.* at 1316; U.S. Patent No. 7,264,242 (filed Feb. 14, 2005). Given that each patent provides protection for one invention, however, perhaps courts and examiners should examine the broadest claim in determining the problem solved.

have considered to address the problem defined by the claims of the patent, the scope of analogous arts may become broader than it should be.

Defining the PHOSITA, as well as common practices in a given field, requires an in-depth, factual analysis. This will necessarily require a case-by-case determination based on the facts and invention at issue, often requiring an examination of affidavits and testimony from experts. While it may be logical or "common sense" to adapt a solution from one technological space to another, the decision to do so might not be within the PHOSITA's understanding.

Patent examiners and the courts need to closely consider from which technological areas one of ordinary skill in the art might draw. In particular areas of research, interdisciplinary analysis may be more common than in others. Biomedical engineers, for example, might be more likely to draw upon more divergent fields than nuclear engineers. That an inventor *could* have obtained references from different fields does not mean that the inventor *should* have done so, particularly if PHOSITAs *would* not have considered such references at the time in question.

III. Do Advances in Processing Capabilities Make Most Inventions Too Predictable?

A prima facie showing of obviousness requires a motivation "to achieve the claimed invention" and "a reasonable expectation of success in doing so."[190] In many technological fields, as access to enhanced processing capabilities and information increases, the reasonable expectation of success would also become stronger, particularly in fields with some level of predictability.[191]

Inventions related to genetic sequencing are prominent examples. In less than ten years, the cost of sequencing the human genome has fallen from almost $3 billion[192] to approximately $1,000.[193] Not surprisingly, patents claiming genetic sequences faced a lower obviousness hurdle twenty years

190. Procter & Gamble Co. v. Teva Pharm. USA, Inc., 566 F.3d 989, 994 (Fed. Cir. 2009) (citation omitted).

191. *See* Anna Bartow Laakmann, *Restoring the Genetic Commons: A "Common Sense" Approach to Biotechnology Patents in the Wake of* KSR v. Teleflex, 14 Mich. Telecomm. & Tech. L. Rev. 43, 72 (2007) ("A common sense approach would ask not just whether the specific claimed sequence is disclosed in the prior art but also whether identifying the gene would be routine given currently available resources and techniques. Arguably, such activity is well within the realm of 'ordinary creativity' of the biotechnology PHOSITA."); *The Science Behind Folding@home*, Folding@home Distributed Computing, http://folding.stanford.edu/English/science (last updated Jan. 18, 2013) (describing the use of distributed computing "to unlock the mystery of how proteins fold").

192. Harmon, *supra* note 5.

193. Andrew Pollack, *DNA Sequencing Caught in Deluge of Data*, N.Y. Times (Dec. 1, 2011), http://www.nytimes.com/2011/12/01/business/dna-sequencing-caught-in-deluge-of-data.html?pagewanted=all.

ago than they do today.[194] As the level of skill in the art—as augmented by technology—has increased, the bar for overcoming obviousness has been raised.

However, the fact that an invention is predictable does not make it practicable. For instance, despite the dramatic drop in costs, analyzing genetic sequences has become more expensive and time-consuming than sequencing itself.[195] As processing capabilities associated with understanding genetic information increase, inventions directed to correlations with genetic information may face a heightened obviousness hurdle.[196]

Increases in processing power may simply make most inventions obvious to try and too predictable to deserve patent protection under the current standards of patentability. Yet, for some socially beneficial, high-cost inventions, perhaps a patent should still be awarded.[197] By providing clarity about the prospect of obtaining a patent, investment might be spurred in socially useful technology that might not occur otherwise, though this is the subject of debate.[198] Another option would be to award a prize or another form of sui generis protection for these types of inventions, thereby allowing some return on investment for innovation that does not quite rise to the level of what is generally deemed worthy of patent protection.

A. *Will Technological Advancement Make Everything Seem Obvious to Try?*

As the Supreme Court stated in *KSR*, the "fact that a combination was obvious to try might show that it was obvious under § 103."[199] Yet merely because an invention is obvious to try does not mean that it is necessarily obvious.

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194. Enzo Biochem, Inc. v. Calgene, Inc., 188 F.3d 1362, 1374 n.10 (Fed. Cir. 1999) ("In view of the rapid advances in science, we recognize that what may be unpredictable at one point in time may become predictable at a later time."); Joshua D. Sarnoff, *Patent-Eligible Inventions After* Bilski*: History and Theory*, 63 HASTINGS L.J. 53, 121 (2011) ("[N]o creativity, particularly given the advanced state of genetic technologies, went into isolating the DNA for the [BRCA] gene or identifying its sequence.").

195. Pollack, *supra* note 193.

196. *See generally* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 149–154 (2009) (discussing the obviousness standard in the context of biotechnology).

197. Merges, *supra* note 15, at 4.

198. Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L. J. 1063, 1088 (2008) (discussing theories behind why innovative companies choose to patent or not); Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1303–1308 (2009) (noting that investors stress the importance of patents); Ted Sichelman & Stuart J.H. Graham, *Patenting by Entrepreneurs: An Empirical Study*, 17 MICH. TELECOMM. TECH. L. REV. 111, 153, 161 (2010) (describing the use of patents as "signaling" mechanisms to investors).

199. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 421 (2007).

The Federal Circuit in *In re Kubin* discussed two types of situations, previously identified by courts, where inventions that were obvious to try would not, in fact, be obvious.[200] The first occurs where the prior art provides no direction as to which of the possibilities is likely to be a success; a challenger to a patent "merely throws metaphorical darts at a board filled with combinatorial prior art possibilities."[201] This situation is the opposite of the scenario that the Supreme Court discredited in *KSR*, where a PHOSITA simply pursues "known options" from a "finite number of identified, predictable solutions."[202] The second "obvious to try" situation occurs where exploration of a new technology or approach seemed promising, but the prior art provided merely "general guidance as to the particular form of the claimed invention or how to achieve it."[203]

The claimed invention in *In re Kubin* did not fit into either of these categories. The biotechnology invention at issue required isolating and sequencing a gene that encoded a protein known in the art.[204] Researchers could use known methods to obtain both the sequence and the protein.[205] Additionally, the prior art identified the protein and suggested its function.[206] The Federal Circuit held the gene obvious, finding that it was reasonably expected in light of the prior art, as well as obvious to try considering the limited number of predictable solutions.[207]

Specifically, the Federal Circuit noted that the record showed that one skilled in this particular art would have found the results predictable.[208] The court would not "discount the significant abilities of artisans of ordinary skill in an advanced area of art."[209] Notwithstanding this case, other gene patents may be nonobvious, such as if the available prior art does not identify the encoded protein, or suggest its use or purpose.[210]

Some inventions might be obvious to try in light of advances in search and processing technologies, and therefore too predictable to deserve patent protection under the current definition of obviousness. Unless the obvious to try analysis adjusts to better recognize the constraints faced by PHOSITAs, it might be worthwhile to award a patent, a prize, or some other form of sui generis protection to spur efforts that might not take place otherwise.[211] Providing some form of protection would reward inventions that fall within the

200. *In re* Kubin, 561 F.3d 1351, 1359 (Fed. Cir. 2009).
201. *Id.*
202. *KSR Int'l*, 550 U.S. at 421.
203. *Kubin*, 561 F.3d at 1359.
204. *Id.* at 1352–53.
205. *Id.* at 1356–61.
206. *Id.*
207. *Id.* at 1360–61.
208. *Id.*
209. *Id.* at 1360.
210. *See id.*
211. *See infra* Part III.C.

statutory framework of obviousness, but still might not be obvious to those actually in the field, given the time and costs of discovery.

B. *Predictability and Information Overload*

Advances in search and processing technology may make more inventions seem too predictable to be nonobvious. Since *Kubin*, the Federal Circuit has concentrated on what would be predictable when assessing nonobviousness. The analysis turns on whether the PHOSITA was simply pursuing known options from a limited number of identified, predictable solutions, which would make the invention more likely obvious.[212] It is unclear if this analysis focuses on predictability within a technological field or on the predictability of determining the specific claimed result.[213] Nonetheless, advances in cognitive technology affect both possibilities, potentially raising the bar to obtain a patent.

Perhaps the "finite number" of possible solutions that suggest predictability expands as computing power increases. As the power of information technology and processing capability increases, the true inventive task may be asking the questions and coming up with parameters rather than obtaining the resulting data.[214] Knowing that "42" is the "Ultimate Answer to the Ultimate Question of Life, The Universe, and Everything" is not very useful if nobody knows what the Ultimate Question is.[215]

An example of the difficulty in sifting through voluminous data made available through technological advancement is high-throughput screening ("HTS"), which plays a major role in the area of drug discovery and biological research.[216] HTS can concurrently analyze thousands of compounds, resulting in significant developments in areas such as gene identification and regulation, pharmacogenomics, and detecting drug targets.[217] Because of its ability to produce large volumes of data for each screen, one of the major challenges of HTS is figuring out the meaning of vast amounts of data.[218]

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212. *Id.*

213. *Compare* Pfizer, Inc. v. Apotex, Inc., 480 F.3d 1348, 1363–64 (Fed. Cir. 2007) (finding that fifty-three anions is a finite number of predictable solutions), *with* Unigene Labs., Inc. v. Apotex Labs., Inc., 655 F.3d 1352, 1361 (Fed. Cir. 2011) (stating that even if it would have been obvious to try, a formulation is "not obvious if a person of ordinary skill would not select and combine the prior art references to reach the claimed composition or formulation"), *cert. denied*, 132 S. Ct. 1755 (2012).

214. *See* Mintz v. Dietz & Watson, Inc., 679 F.3d 1372, 1377 (Fed. Cir. 2012) ("Often the inventive contribution lies in defining the problem in a new revelatory way.").

215. *See* Douglas Adams, Hitchhiker's Guide to the Galaxy (1979).

216. Xiaohua Douglas Zhang, Optimal High-Throughput Screening: Practical Experimental Design and Data Analysis for Genome-Scale RNAi Research 5 (2011).

217. *Id.*

218. *Id.* at 11. Similarly, vast databases of genotypic and phenotypic information allow scientists to draw complicated associations, resulting in useful correlations in genome wide association studies and personalized medicine. However, figuring out the correlations is expensive and time-consuming. *See* Int'l Warfarin Pharmacogenetics Consortium, *Estimation of*

Examiners and courts need to examine how computerization affects predictability and whether the PHOSITA would recognize the significance of the information. It is not sufficient to conclude that an invention is predictable without resolving whether the PHOSITA would be able to appreciate the value of the information at the relevant time.[219]

The chemical and pharmaceutical arts provide a worthwhile case study to illustrate the effects of cognitive technologies on predictability, as they are generally viewed as areas shrouded in uncertainty. In chemical cases, the assessment of obviousness often begins with the selection of a lead compound for further modification.[220] For patents related to chemical compounds, the challenger needs to show "that a medicinal chemist of ordinary skill would have been motivated to select and then modify a prior art compound (e.g., a lead compound) to arrive at a claimed compound with a reasonable expectation that the new compound would have similar or improved properties compared with the old."[221] The required motivation need not be explicitly stated in the art.[222]

In *Daiichi Sankyo Co. v. Matrix Laboratories, Ltd.*, the Federal Circuit discussed the process of selecting the lead compound.[223] A PHOSITA need not pick "the structurally closest prior art compound" as the lead compound; the state of the art can suggest which compound should be chosen.[224] To avoid hindsight bias, the selection of the lead compound depends not merely on structural similarity, but also on "knowledge in the art of the functional properties and limitations of the prior art compounds," so that "potent and promising activity in the prior art trumps mere structural relationships."[225]

Once a lead compound has been selected, a challenger must still demonstrate a reason why one of ordinary skill would modify the compound to make a showing of prima facie obviousness.[226] The Federal Circuit has recognized that in technological areas veiled in uncertainty, such as the chemical arts, *KSR*'s focus on predictability presents difficulties.[227] This lack of certainty creates a difficult hurdle in establishing obviousness, particularly in showing that a PHOSITA has sufficient motivation or would have a reasona-

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the Warfarin Dose with Clinical and Pharmacogenetic Data, 360 New Eng. J. Med. 753 (2009); *dbGaP Overview*, Nat'l Ctr. for Biotechnology Info., http://www.ncbi.nlm.nih.gov/projects/gap/cgi-bin/about.html (last visited Mar. 7, 2013).

219. For patents filed after the effective date of the AIA, the relevant time will shift from the date of invention to the date of filing.

220. Unigene Labs. Inc. v. Apotex Labs., Inc., 655 F.3d 1352, 1361 (Fed. Cir. 2011), *cert. denied*, 132 S. Ct. 1755 (2012).

221. Daiichi Sankyo Co. v. Matrix Labs., Ltd., 619 F.3d 1346, 1352 (Fed. Cir. 2010).

222. *Id.*

223. *Id.* at 1354.

224. *Id.*

225. *Id.*

226. *Id.* at 1353.

227. *See* Eisai Co. v. Dr. Reddy's Labs., Ltd., 533 F.3d 1353, 1359 (Fed. Cir. 2008).

ble expectation of success in synthesizing and testing any particular compound.[228]

As advances in cognitive technology help inventors limit the number of possible solutions, it may become harder to obtain a patent, even in fields generally viewed as uncertain. For example, in *Bayer Schering Pharma AG v. Barr Laboratories, Inc.*, the Federal Circuit found a patent related to a micronized, uncoated formulation of a known compound obvious.[229] The court reasoned that even if prior art references taught away from making the claimed invention, the art presented a limited number of predictable solutions such that the PHOSITA would have tried to make the claimed invention.[230] Essentially, because the PHOSITA needed only to "choose between two known options . . . the invention would have been obvious."[231]

Yet, the Federal Circuit's recent decisions seem to discount *KSR* with regard to combination claims in chemical formulation patents, an area fraught with unpredictability. In affirming a finding of nonobviousness in *Unigene v. Apotex*, the Federal Circuit focused on the difficulties in choosing among a large number of possible formulations of a calcitonin nasal spray for treating osteoporosis.[232] Calcitonin can be difficult to administer because it breaks down easily, is unstable, and is not absorbed well.[233] The formulations at issue differed primarily in their absorption agents.[234] The prior art formulation used benzalkonium chloride to aid absorption, while the Unigene formulation used 20 mM citric acid for that purpose.[235] Despite a showing of market pressure and a strong design need to develop the claimed Unigene formulation, the court focused on the fact that "citric acid was one of over fifty options" to enhance absorption in affirming the lower court's finding of nonobviousness.[236] In addition, the prior art taught away from the use of citric acid at the 20 mM concentration specified.[237] The Federal Circuit in this case seemed to recognize that pharmaceutical formulation inventions are sufficiently unpredictable to undermine a reasonable expectation of success for those of ordinary skill in the art.

As advances in technology circumscribe the number of possible options, more formulations should be found obvious. However, to the extent the field

228. *See* Procter & Gamble Co. v. Teva Pharm. USA, Inc., 566 F.3d 989, 995–97 (Fed. Cir. 2009).
229. Bayer Schering Pharma AG v. Barr Labs., Inc., 575 F.3d 1341, 1350 (Fed. Cir. 2009).
230. *Id.*
231. *Id.*
232. Unigene Labs., Inc. v. Apotex Labs., Inc., 655 F.3d 1352 (Fed. Cir. 2011), *cert. denied*, 132 S. Ct. 1755 (2012).
233. *Id.* at 1355.
234. *Id.* at 1363.
235. *Id.* at 1356.
236. *Id.* at 1364.
237. *Id.* at 1358.

remains unpredictable, such advances might not be seen as making an invention obvious. The focus should be on whether the invention would be predictable to the PHOSITA in light of technological advances, such as if the number of possible solutions is practical, even if the invention is in an unpredictable field.

In addition to predictability, the courts also examine motivation to make an invention in assessing nonobviousness. The Federal Circuit attempted to clarify this issue in the context of an unpredictable art area in *Genetics Institute v. Novartis*.[238] In this interference, the Federal Circuit needed to determine if claims by Genetics would render obvious claims by Novartis.[239] All of the claims in both parties' patents covered truncated forms of Factor VIII, which is an essential blood clotting protein.[240] The Novartis truncated proteins were larger than the truncated proteins claimed by Genetics.[241] The larger forms of the protein claimed in the Novartis patents and those in the Genetics patent were "all variants of the *exact same* protein, exhibiting the *exact same* procoagulant functions."[242] Nevertheless, the Federal Circuit found that, in light of the "nontrivial differences in the proteins at issue," Genetics needed to provide a reason why one of ordinary skill would have made the larger proteins claimed in the Novartis patents.[243]

In particular, the Federal Circuit held that the larger Novartis proteins differed based on their size, location of deletions, and the amount of permissible amino acid substitutions.[244] Specifically, it was unknown which amino acids were necessary to maintain the binding functionality of a truncated Factor VIII protein.[245] Even the existence of a cleavage site, which is a standard place to cut proteins, did not provide sufficient motivation to make the longer Novartis proteins.[246] Instead, the court found Novartis' larger recombinant proteins nonobvious because the research objective in the field was to find "a *smaller* recombinant protein that mimicked the biological activity of Factor VIII in humans."[247] In this case, the court correctly focused on what those of skill in the art were seeking in determining nonobviousness.

Examiners and courts need to examine how access to information and increased processing capabilities affect predictability and whether the PHOSITA would recognize the significance of the information. Given the current understanding of chemical formulations, the possibility of fifty op-

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238. Genetics Inst., LLC v. Novartis Vaccines & Diagnostics, Inc., 655 F.3d 1291 (Fed. Cir. 2011), *cert. denied*, 132 S. Ct. 1932 (2012).
239. *Id.* at 1302.
240. *Id.* at 1294.
241. *Id.* at 1295.
242. *Id.* at 1312.
243. *Id.* at 1306.
244. *Id.*
245. *Id.* at 1304–05.
246. *Id.* at 1305.
247. *Id.*

tions at varying concentrations is sufficiently unpredictable to result in a finding of nonobviousness. This may change over time if the capacity to analyze and obtain information results in useful predictive abilities. The question should be whether an invention is predictable to the PHOSITA, considering the use of technology in the relevant art.[248]

C. *Reconciling Technological Advancement and Inducement Theory*

Given the limitations of the obviousness analysis in relation to cognitive technology under the current model, perhaps patents should still reward time-consuming, costly efforts that are socially beneficial, even if an invention is obvious to try or predictable. Some have suggested moving away from the cognitive model of analyzing nonobviousness to an inducement analysis.[249] Under an inducement theory, inventions are nonobvious if they would not have been invented or disclosed "but for the inducement of a patent."[250] The standard seems justified: if an invention would be made and disclosed regardless of a patent incentive, refusing patent protection does not affect the disclosure benefit to society and prevents any adverse costs resulting from exclusivity.[251]

Essentially, the inducement analysis avoids perplexing questions about whether the PHOSITA would have thought to combine references or whether the invention would have been too obvious from the perspective of the hypothetical PHOSITA. The emphasis shifts to what information is available for discovery and takes into account the costs of innovation.[252] This shift would give more weight to a commonly known prior art reference, such as one "easily found with Internet searches," than to one that uses idiosyncratic language to "hide the invention from all but the most determined searcher."[253] In this way, the inducement standard avoids some of the risk of assuming that access is the same as understanding, by examining what a PHOSITA is able to discover. More obscure references are accorded less weight. However, by examining whether a PHOSITA would be likely to find a reference, some of the evidentiary difficulties of the cognitive approach would remain in the inducement standard.

An inducement-based analysis asks if the possibility of obtaining a patent would be necessary to induce the inventor to make and disclose the in-

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248. Burk & Lemley, *supra* note 32.

249. *See* Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 Yale L.J. 1590 (2011); Glynn S. Lunney, Jr., *E-Obviousness*, 7 Mich. Telecomm. & Tech. L. Rev. 363, 416 (2001); A. Samuel Oddi, *Un-Unified Economic Theories of Patents: The Not-Quite-Holy Grail*, 71 Notre Dame L. Rev. 267, 277–81 (1996).

250. Graham v. John Deere Co., 383 U.S. 1, 11 (1966); Abramowicz & Duffy, *supra* note 249; Tun-Jen Chiang, *The Rules and Standards of Patentable Subject Matter*, 2010 Wis. L. Rev. 1353.

251. Abramowicz & Duffy, *supra* note 249; Chiang, *supra* note 250.

252. Abramowicz & Duffy, *supra* note 249, at 1664.

253. *Id.*

vention.[254] If an invention is less costly, more predictable, or easier to make because of computerization, it would be less likely to receive patent protection under this theory. Inventions in areas that are costly are more likely to need ex ante assurance, such as those in the pharmaceutical or biotechnological context.[255] Those that are less costly, or have other motivations for production, such as business methods, are less likely to warrant protection under the inducement standard.[256]

One of the greatest challenges resulting from a heightened focus on inducement is the increased cost in terms of time, effort, and uncertainty.[257] Asking whether an invention would be created or disclosed absent the inducement that the patent offers is a hypothetical exercise that is extremely difficult to answer with any degree of accuracy.[258] Similarly, figuring out whether an application "meaningfully" accelerates the arrival of important technologies is challenging ex ante.[259] Although a cognitive-based approach that assesses whether a person in the art would consider advances to be significant improvements over the prior art involves costs as well, such a determination is at least possible of resolution.[260]

Perhaps courts and examiners might recognize inducement as a positive consideration, such that investment of time and resources could be considered as evidence in support of nonobviousness, but not such that it would preclude patents on inexpensive, quick, or serendipitous discoveries. As Robert Merges suggested in his seminal piece on the uncertainty and obviousness, the nonobviousness standard could be lowered for inventions that come at a "very high cost."[261] This adjustment would secure the needed incentive for costly yet predictable innovation, such as discoveries resulting from high-throughput screening.[262]

With regard to serendipitous discoveries, many are revealed while researching in a related area for a different purpose.[263] Professor Merges gives the example of the discovery of pharmaceuticals for rare diseases, which are often discovered while researching more prevalent diseases.[264] Without pat-

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254. *Graham*, 383 U.S. at 11; Abramowicz & Duffy, *supra* note 249; Chiang, *supra* note 250.

255. Burk & Lemley, *supra* note 32, at 1191.

256. *Id.*

257. Chiang, *supra* note 250, at 1362–63.

258. *Id.*; Tun-Jen Chiang, *A Cost-Benefit Approach to Patent Obviousness*, 82 St. John's L. Rev. 39, 75 (2008).

259. Abramowicz & Duffy, *supra* note 249, at 1643.

260. Merges, *supra* note 15.

261. *Id.* at 4.

262. Zhang, *supra* note 216, at 5.

263. Lemley, *supra* note 94, at 733–34 (describing accidental discovery as the exception to the general phenomenon of simultaneous independent discovery); Mandel, *supra* note 128, at 336 (providing examples of the microwave oven, anesthesia, dynamite, the phonograph, vaccination, X-rays, penicillin, Teflon, and Velcro).

264. Merges, *supra* note 15, at 4.

ent protection, the inventor might never have embarked on the research project for the intended result, though this would be difficult to demonstrate empirically.[265]

Even though serendipitous inventions might not need the same inducement for discovery or disclosure, courts have repeatedly expressed that inventions discovered in this way are still patent eligible.[266] The statutory section describing the requirement of nonobviousness specifically states: "Patentability shall not be negated by the manner in which the invention was made."[267] Given the difficult factual determination of whether a discovery was serendipitous, it may be simply more administratively feasible to provide such discoveries with patent protection.[268]

An inducement-focused theory would also advantage inventors or businesses that have the resources to invest in further development, as "the cost of experimentation leading to the invention" is an additional consideration in the inducement analysis.[269] As an unintended consequence of the inducement proposal, patent applicants may invest disproportionately in development to strengthen the case for patentability.

Even if advances in technology make an invention less costly to implement, they should not necessarily preclude patent protection. Alternatively, a prize or some form of sui generis protection could be provided for those inventions that are too predictable to merit patent protection under the current conception of obviousness.

D. *Revisiting Secondary Considerations as Technological Advancement Makes Results Seem Less Unexpected*

Given increased ability to process and access data, truly unexpected results may become less common in particular fields. Inventions often seem obvious in hindsight, particularly where all of the claimed elements are present in prior art references that merely need to be combined. Although the Federal Circuit previously used the TSM test as a way to limit hindsight bias, the Supreme Court redefined how the test could be applied in *KSR*.[270]

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265. *Id.*

266. *See, e.g.*, Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc., 520 F.3d 1358, 1364 (Fed. Cir. 2008); *cf.* Sherkow, *supra* note 146 ("'[A]nalogizing' of prior art has favored 'flash of genius' inventions, which often draw on multiple, disparate disciplines less susceptible to analogizing, over 'long toil and experimentation . . . .'").

267. 35 U.S.C. § 103 (2011); Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011); *cf.* Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1869 U.N.T.S. 331 ("[P]atents shall be available and patent rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced.").

268. Merges, *supra* note 15.

269. Abramowicz & Duffy, *supra* note 249, at 1656.

270. *See supra* Part I.B.

Secondary considerations of nonobviousness provide another way to limit the hindsight bias problem.

In *KSR*, the Supreme Court reiterated that the obviousness determination depends on the four factors listed in *Graham*: (1) the scope and content of the prior art, (2) the level of ordinary skill in the art, (3) the differences between the claimed invention and the prior art, and (4) secondary considerations of nonobviousness.[271] The fourth factor, secondary considerations or objective indicia of nonobviousness, include commercial success, long-felt but unsolved need, the failure of others, and unexpected results.[272] For a patentee to rely on secondary considerations, there needs to be a nexus between the evidence and the patented invention.[273] Not only are secondary considerations considered to be "independent evidence of nonobviousness," the Federal Circuit views this fourth factor of the *Graham* test as "often . . . the most probative and cogent evidence of nonobviousness in the record."[274] However, secondary considerations cannot overcome a strong prima facie showing of obviousness.[275] Further complicating its usefulness, evidence of secondary considerations, such as commercial success, often is not available until long after patent examination concludes.

Patent holders regularly present evidence of unexpected results to support a claim of nonobviousness in biotechnology and chemical matters. The patentee can rebut a prima facie showing of obviousness by arguing that the claimed invention has "some superior property or advantage" that a PHOSITA would have found unexpected or could not have been predicted.[276] Examples include situations where a claimed invention is effective at a lower dosage than anticipated; outperforms the prior art; or lacks lethal effect at concentrations where toxicity would be expected.[277] Post-invention unexpected results can be considered, even if PHOSITAs would not have appreciated them at the time of invention.[278]

Advances in cognitive technology seem to have the greatest implications for unexpected results. As the ability to process and access data increases, unexpected results may become rarer in certain fields. Returning to the common practices of those in a given technological field should help ensure that information about unexpected results made available through cognitive tech-

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271. KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406–07 (2007) (citing Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966)).

272. *Id.*

273. Wyers v. Master Lock Co., 616 F.3d 1231, 1246 (Fed. Cir. 2010).

274. Ortho-McNeil Pharm., Inc. v. Mylan Labs., Inc., 520 F.3d 1358, 1365 (Fed. Cir. 2008) (citing Catalina Lighting, Inc. v. Lamps Plus, Inc., 295 F.3d 1277, 1288 (Fed. Cir. 2002)).

275. *Wyers*, 616 F.3d at 1246.

276. Procter & Gamble Co. v. Teva Pharm. USA, Inc., 566 F.3d 989, 994 (Fed. Cir. 2009).

277. *Id.* at 997–98.

278. Genetics Inst. v. Novartis Vaccines, 655 F.3d 1291, 1307 (Fed. Cir. 2011).

nologies were actually understood and appreciated by the relevant innovators.

IV. Broader Implications

Cognitive technology enables efficient and inexpensive information storage and processing, which in turn can accelerate the pace of discovery in many areas.[279] And the possibility of translating solutions from one technological area to others might allow for more efficient innovative processes. This Part discusses how streamlining may affect innovation in significant ways, particularly in terms of the quality of patents and the determination of obviousness as a procedural matter. Additionally, it describes another form of technological advancement that may impact cognition to the extent it becomes more widely adopted.

A. *Patent Quality*

Inadequate funding coupled with increased demand limits the resources available for examining applications. Examiners spend twenty hours or less evaluating each application from filing to final disposition.[280] On average, this short amount of time spent per application spans approximately three years.[281]

Despite serious concerns about quality, patents enjoy a presumption of validity that requires clear and convincing evidence to disprove.[282] Statistics show that fewer than two percent of patents have been litigated, and approximately one-tenth of one percent have gone to trial.[283] For cases resulting in a validity determination, about half are found to be invalid.[284] Patent holders are successful in only about one quarter of cases that are litigated to a final disposition and appealed.[285] It is therefore not surprising that many have

279. Liza Vertinsky & Todd M. Rice, *Thinking About Thinking Machines: Implications of Machine Inventors for Patent Law*, 8 B.U. J. Sci. & Tech. L. 574, 579 n.13 (2002); *see also* Moore, *supra* note 7, at 114; *Moore's Law, supra* note 7.

280. John Hagel & John Seely Brown, *Peer-to-Patent: A System for Increasing Transparency*, Businessweek (Mar. 18, 2009), http://www.businessweek.com/innovate/content/mar2009/id20090318_730473.htm; John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. Ill. L. Rev. 305, 314.

281. *December 2012 Patents Data, at a Glance*, USPTO, http://www.uspto.gov/dashboards/patents/main.dashxml (last visited Mar. 7, 2013).

282. Microsoft Corp. v. i4i Ltd., 131 S. Ct. 2238 (2011).

283. Mark A. Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. Econ. Persp. 75, 79–83 (2005); Jason Rantanen, *Patents, Litigation and Reexaminations*, Patently-O (Dec. 29, 2011), http://www.patentlyo.com/patent/2011/12/patents-litigation-and-reexaminations.html.

284. *See* Allison & Lemley, *supra* note 1, at 205, 208 (showing that about 46% of patents that are litigated to a final disposition through appeal have been invalidated).

285. Paul M. Janicke & LiLan Ren, *Who Wins Patent Infringement Cases?*, 34 AIPLA Q.J. 1, 8 (2006) (showing that 24.4% of patentees succeed in showing infringement).

analogized patents to lottery tickets.[286] One way in which advances in cognitive technologies might improve patent quality is by opening up a greater universe of prior art available to inventors, courts, and the patent office.

1. Crowdsourcing

Crowdsourcing brings together diverse groups in the hopes of creating synergy. Opportunities for crowdsourcing should improve the quality of patents, preventing the issuance and enforcement of obvious patents by broadening the consideration of prior art. The timing of various groups seeking improvements in patent quality coincided with the increased availability of online patent documents through the USPTO.

Web-based organizations have formed with the hope of providing sources of prior art, preventing the granting of weak patents, and challenging questionable patents after issuance. In the early 1990s, in response to the assertion of software patents and a lack of easily accessible prior art, the Software Patent Institute formed to aggregate prior art associated with software technology that was not available in electronic form.[287] Numerous other prior art researchers have surfaced in the last decade, both private and public.[288]

Article One Partners, for example, is a privately funded company that provides prior search services through its online research community.[289] Article One mainly posts patents involved in infringement cases, offering rewards of up to $50,000 to researchers that provide information that can invalidate the patents.[290] Recently, Lodsys's patent suit against iPhone App developers prompted Article One to offer a $5,000 reward for each study that provided a way to invalidate the patents in suit.[291]

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286. Lemley & Shapiro, *supra* note 283, at 80–83 (analogizing patents to lottery tickets); Kimberly A. Moore, *Worthless Patents*, 20 Berkeley Tech. L.J. 1521, 1530, 1547–48 (2005) (describing biotechnology and pharmaceutical patent incentives as "more like a lottery"); Sabrina Safrin, *Chain Reaction: How Property Begets Property*, 82 Notre Dame L. Rev. 1917, 1943 n.124 (2007) (discussing how applicants seek patents "in the hope that one of them will turn into a winning lottery ticket").

287. *See* Software Patent Institute, http://spi.org (last visited Dec. 11, 2011).

288. *See, e.g.*, *About Article One Partners*, Article One http://www.articleonepartners.com/company (last visited Dec. 11, 2011); *About PUBPAT*, Public Patent Foundation, http://www.pubpat.org/About.htm; Elec. Frontier Found., https://w2.eff.org/patent/wp.php; Evan Ratliff, *Patent Upending*, Wired (June 2000), http://www.wired.com/wired/archive/8.06/patents_pr.html.

289. *See About Article One Partners*, *supra* note 288.

290. *Id.*

291. *See id.*; Josh Lowensohn, *Scoop: Bounty Set for Invalidating Lodsys Patents*, CNET (June 15, 2011, 2:26 PM), http://news.cnet.com/8301-27076_3-20071343-248/scoop-bounty-set-for-invalidating-lodsys-patents/ (explaining that the idea of offering a reward to find invalidating prior art is not new); *see also* Elizabeth Wasserman, *Close Is Enough to Earn Amazon's Bounty*, PC World (Mar. 16, 2001), http://www.pcworld.com/article/44702/article.html.

In the public sphere, New York Law School and the USPTO jointly created Peer to Patent, an online public community interested in locating information relevant to assessing patent applications.[292] Applicants for software patents can consent to this open review process, which complements the USPTO's standard examination process. In return, the applicants receive accelerated examination.[293] If the additional involvement produces better prior art searching, the result should be that fewer patents are granted and subsequently upheld for obvious inventions.[294]

The higher threshold in showing nonobviousness post-*KSR*, as well as increased opportunities for crowdsourcing, suggest that fewer bad patents should issue. However, time and resource constraints may limit the analysis of evidence related to what references and information PHOSITAs actually would consider.[295]

2. Procedural Concerns

As of April 2012, there was a backlog of almost 670,000 patent applications awaiting a first review by the USPTO.[296] The average time for obtaining a final disposition (such as patent issuance or abandonment) in April 2012 was over three years from the date of filing.[297] The backlog has been referred to as "an American competitiveness issue."[298]

The Patent Office has struggled for decades to examine patent applications in a timely fashion, its efforts hampered in part by a budget that does not allow it to keep the funds it collects.[299] Although various proposals have been made to enable the USPTO to keep these funds, none has been adopted to prevent fee diversion.[300] The America Invents Act ("AIA") provides the USPTO with the ability to set its own fees, a power previously exercised by

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292. Peer to Patent, http://www.peertopatent.org/ (last visited May 1, 2012).

293. *See id.*

294. *See* Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011). *But see* Cotropia et al., *supra* note 92 (finding that examiners tend to disregard references submitted by patent applicants).

295. *See* Cotropia et al., *supra* note 92.

296. *April 2012 Patents Data, at a Glance*, USPTO, http://www.uspto.gov/dashboards/patents/main.dashxml (last visited Apr. 2012).

297. *Id.* (noting the total pendency is 41 months, assuming Requests for Continuing Examination ("RCEs") are included in the statistics, and 33.9 months if RCEs are not).

298. Susan Decker, *Congress Must Ensure Patent Office Funds, University Leaders Say*, Bloomberg (Oct. 5, 2011, 3:22 PM), http://www.bloomberg.com/news/2011-10-05/congress-must-ensure-patent-office-funds-university-leaders-say.html.

299. *See id.*

300. Joshua Nightingale, *Patent Reform Fails to Halt Fee Diversion: That Giant Sucking Sound*, Investors Digest, http://www.inventorsdigest.com/archives/7664 (last visited Mar. 30, 2013).

Congress.[301] However, the AIA does not preclude Congress from diverting fees from the USPTO.[302]

To the extent that computing power continues to increase while processing costs decrease, the number of applications filed that depend on computing technology will likely increase. Advances in information technology and processing may make innovation in many technological fields more efficient. In addition, simulations and modeling can save costs and time, permitting constructive reduction to practice and reducing the costs of preparing patent applications.[303] For example, technologies such as three-dimensional printing make it as simple to produce hundreds of items as it is to build one.[304] While these technologies help inventors focus more on inventing and less on preparing patent applications, they also may increase the backlog by increasing the rate of filing applications.

The proposal set forth in this Article, while providing more accurate assessments of obviousness in light of technological advances, is unlikely to reduce the backlog. Determining the prior art that PHOSITAs actually consider at the time of filing and their level of skill will be more costly and time-consuming, and often outside the scope of patent examiners' expertise. In view of *KSR*, applicants may need to submit affidavits from persons having ordinary skill and other evidence more regularly, but such evidence will not be countered or subject to cross-examination as it would in an adversarial proceeding.[305] It is unclear whether examiners would even take the time to consider this evidence.[306] One alternative to address some of the issues would be for the USPTO to rely on technical advisory boards, comprised of independent experts, examiners, or some combination of the two, to review questions pertinent to these inquiries.[307]

Submission of supporting documents may also make litigation more expensive. The proposal will require courts to examine additional evidence related to common practices in the field of invention, rather than just relying on their "common sense."[308] The negative externality of judicial subjectivity under current doctrine may be replaced by a battle of the experts. While

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301. Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284, 316–20 (2011).

302. *See id.*

303. *See, e.g.*, Ron Docie, Sr., *How Open is 'Open Innovation'?*, Inventors Digest (July 2010), http://www.inventorsdigest.com/archives/4045 ("Inventors can save a lot of money in prototyping and product development by having virtual drawings of their invention made, rather than the actual prototype.").

304. *Print Me a Stradivarius*, Economist, Feb. 12, 2011, *available at* http://www.economist.com/node/18114327.

305. Durie & Lemley, *supra* note 13, at 1012–13.

306. *See* Cotropia et al., *supra* note 92.

307. Eisenberg, *supra* note 27, at 899–900.

308. Mintz v. Dietz & Watson, Inc., 679 F.3d 1372, 1377 (Fed. Cir. 2012) (requiring "more than an invocation of the words 'common sense'").

imperfect, the focus on actual information, rather than conjecture, will hopefully result in fewer bad patents being granted.

B. *Future Applications: Pharmaceutical Enhancement*

In describing the factors that contributed to the discovery of oxygen in 1774, author Steven Johnson suggests that the "rise of coffeehouse culture influenced more than just the information networks of the Enlightenment; it also transformed the neurochemical networks in the brains of all those newfound coffee drinkers."[309] He views the shift from using alcohol to coffee in seventeenth-century Europe "as the daytime drug of choice" as contributing to "the networked, caffeinated minds of the eighteenth century [finding] themselves in a universe that was ripe for discovery."[310] Johnson argues that this change coincided with an extraordinarily productive streak in discoveries.[311]

While Johnson's suggestion that caffeine helped bring about scientific revolution seems a bit of a stretch, neural enhancement through the use of pharmaceuticals such as Adderall and Ritalin is becoming more common, at least among college and graduate students.[312] Adderall and Ritalin, used to treat symptoms of Attention Deficit Hyperactivity Disorder, have been shown to improve working memory and concentration.[313] Some scientists maintain that "creativity and innovation are the result of continuously repetitive processes of working memory," though this theory is largely untested.[314]

At this point, pharmaceutical enhancement has not been broadly adopted. If researchers begin to adopt pharmaceutical enhancement more widely, the process and pace of innovation may change, which may require reassessing how courts define the PHOSITA and the determination of obviousness.

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309. Steven Johnson, The Invention of Air: A Story of Science, Faith, Revolution, and the Birth of America 53–54 (2008).

310. *Id.* at 54–55.

311. *Id.* at 55.

312. *See, e.g.*, Greely et al., *supra* note 4, at 702–05 (discussing "cognitive enhancement using drugs" by healthy individuals); Harris, *supra* note 4; Brendan Maher, *Poll Results: Look Who's Doping*, 452 Nature 674, 674–75 (2008) (stating that a Nature-conducted informal survey showed that 20% of "respondents said they had used drugs for non-medical reasons to stimulate their focus, concentration or memory"); Sean Esteban McCabe et al., *Non-Medical Use of Prescription Stimulants Among US College Students: Prevalence and Correlates From a National Survey*, 99 Addiction 96, 96–106 (2005) (reporting that 4.1 percent of U.S. undergraduates surveyed had used prescription stimulants for off-label purposes; at one school, twenty-five percent of undergraduates had done so); Talbo, *supra* note 4.

313. *See, e.g.*, Greely et al., *supra* note 4, at 702–05 (describing how the use of stimulants can enhance working memory and concentration).

314. Larry R. Vandervert et al., *supra* note 53, at 1; *see* Landers, *supra* note 14, at 57–58; Vandervert, *supra* note 53.

Conclusion

Access to information and increased processing power are tools, not solutions. Advances in cognitive technology have changed the ways in which innovators think, interact, and research. Courts should continue analyzing the hypothetical persons of ordinary skill more like real people in determining obviousness, asking whether the wide range of information and processing capabilities made available through computerization is actually appreciated. While an imperfect solution, focusing on what happens in the real world is a better gauge of obviousness than relying on judicial determinations of "common sense."