COMMENT

TAKING ARTIFICIAL INTELLIGENCE BEYOND THE TURING TEST

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Patentability under the 35 U.S.C. § 103 obviousness standard relies on the ability of a person having ordinary skill in the art; however, the involvement of artificial intelligence in the inventive process challenges that standard. A misconception of the current capabilities of AI leads to arguments of universal obviousness where an independent and creative AI dominates the inventive process. Fortunately, AI of such a caliber does not yet exist. Thus, the difficulty of defining the inventive entity threatens patent protection's incentive to innovate but need not extinguish the right to patentability outright. Redefining the standard of obviousness and distinguishing the user's contributions enable the patentability of inventions resulting from the use of AI as an innovative tool.

The proposed standard for the obviousness inquiry—a person having ordinary skill in AI—accounts for the inventor's objectives, access to big and deep data, and knowledge of the existing datasets to control the form and operation of the machine learning resulting in AI-assisted inventions. Preexisting common law for patenting chemical compounds and the evolution of the obviousness test permit shifting the standard to overcome the statutory hurdles facing the patentability of AI-assisted inventions. However, shifting the level of ordinary skill in the art to the user does not permit the patentability of independent and autonomous inventions by inventive AI systems.

The standard proposed here turns on the effort exerted by the inventor in comparison to the AI system. The inventor's control and design of the inventive process help to resolve the level of ordinary skill in the art for AI-assisted inventions by looking at the user's starting point, motivation based on the prior art and data, reasonable expectation of success, and control over the inventive process. Thus, the user's control defines the level of ordinary skill in the art and enables the trier of fact to refer to its established inquiries in determining obviousness.

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INTRODUCTION

In thinking about artificial intelligence, many people imagine (and fear) fully autonomous and sentient artificial general intelligence. In thinking about the patentability of inventions by artificial intelligence, people make the same mistake. Perhaps inventions conceived of by artificial general intelligence (AGI) should not issue as patents, but the state of the art has not yet reached a level of artificial intelligence (AI) capable of independent thought and creativity.[1] Thus, this Comment proposes how to map the non-obviousness standard onto AI-assisted inventions in the near term.

United States patent law creates limited monopolies for inventors that advance the state of the art.[2] The public secures the value of a patent when the inventor publishes the advancement and enables a person having ordinary skill in the art (PHOSITA) to license, use, and further the innovation. The United States Patent and Trademark Office (USPTO) offers a limited monopoly lasting twenty years[3] in exchange for inventions of appropriate subject matter which satisfy the patentability requirements of utility, novelty, and non-obviousness.[4] These requirements ensure that the invention is truly a development worthy of protection and value to the public.[5] In recent years, the use of artificial

1. E-mail from George W. Jordan III, Chair, ABA Section of Intell. Prop. L., to WIPO Secretariat, World Intell. Prop. Org., at 2 (Feb. 12, 2020) (on file with the ABA Intellectual Property Law Section), https://www.americanbar.org/content/dam/aba/administrative/intellectual_property_law/advocacy/aba-ipl-comments-for-wipo-ai-issues-paper.pdf [https://perma.cc/M9GT-PU27] ("AI is not at a stage of development that is so 'autonomous' (sometimes called 'general AI') that it can be considered to 'conceive' inventions protected by American patent law. . . .").

2. *See* Gene Quinn, *Debunking the Myth that Patents Create a Monopoly*, IPWATCHDOG (Feb. 25, 2017), https://www.ipwatchdog.com/2017/02/25/debunking-myth-patents-create-monopoly/id=78756/ [https://perma.cc/E388-UAGJ].

3. The term for a utility patent typically begins on the date on which the patent issues and ends twenty years from the effective filing date. 35 U.S.C. § 154(a)(1)–(2).

4. 35 U.S.C. §§ 101–03.

5. *See* U.S. CONST. art. I, § 8, cl. 8; Gene Quinn, *The Constitutional Underpinnings of Patent Law*, IPWATCHDOG (Nov. 14, 2017),

intelligence has become a part of everyday life for most technology users.[6] Regardless of whether AI adds value to the public, AI poses multiple issues to the current patent system,[7] including whether artificial intelligence makes all inventions obvious.[8]

The novel and non-obvious solution proposed in this Comment offers utility in determining the non-obviousness of AI-assisted inventions. The non-obviousness standard guides the theory of patent incentivization by insisting that only the results from "uncertain research" deserve the reward of a patent.[9] This theory of incentivization works for inventors that push the state of the art, but does that theory of exchange break down for AI, which simulates human intelligence processes without sweat on the brow?

The use of AI in innovation challenges the preconception of what the ordinary skill in the art entails. For example, whether the United States should reward the inventors feeding data to the AI and directing the task remains unanswered.[10] The law even fails to explicitly answer

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https://www.ipwatchdog.com/2017/11/14/constitutional-underpinnings-patent-law/id=90190/ [https://perma.cc/MAR8-937F].

6. AI already hides behind numerous daily activities such as spell check, predictive advertisements, digital voice assistants, and even Netflix recommendations. Bernard Marr, *The 10 Best Examples of How AI is Already Used in Our Everyday Life*, FORBES (Dec. 16, 2019, 12:13 AM), https://www.forbes.com/sites/bernardmarr/2019/12/16/the-10-best-examples-of-how-ai-is-already-used-in-our-everyday-life/#50647cba1171 [https://perma.cc/JH9Z-ZPH8].

7. The United States requires all inventors––those contributing to the conception of the invention––to be named on a patent application, which presumes that the inventors are human. MaryAnne Armstrong, *United States of America (US): Inventorship*, *in* THE AIPLA/AIPPI/FICPI AI COLLOQUIUM PRIMER 4, 4 (1st ed. 2019), https://ficpi.org/_/uploads/files/AIPLA-AIPPI-FICPI_Artificial_Intelligence_Colloquium_Patent_ONLY_Primer.pdf [https://perma.cc/D6ZE-U4QV]. Although the U.S. "does not necessarily bar ownership of patents to Inventive AI entities, U.S. courts have principally interpreted . . . eligible subject matter as 'anything under the sun made by man.'" Jennifer Maisel, *United States of America (US): Patent Eligibility*, *in* THE AIPLA/AIPPI/FICPI AI COLLOQUIUM PRIMER 5, 5 (1st ed. 2019), https://ficpi.org/_/uploads/files/AIPLA-AIPPIFICPI_Artificial_Intelligence_Colloquium_Patent_ONLY_Primer.pdf [https://perma.cc/F5TA-ZLKN] (quoting *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980)).

8. Ryan Abbott, *The Artificial Inventor Project*, WIPO MAG., Dec. 2019, at 8, 13.

9. Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1, 2 (1992).

10. *See* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889, 44,889 (Aug. 27, 2019) [hereinafter Request for Comments on AI Inventions]; Request for Comments on Intellectual Property Protection for Artificial Intelligence Innovation, 84 Fed. Reg. 58,141, 58,141–42 (Oct. 30, 2019) [hereinafter Request for Comments on IP Protection for AI Innovation].

whether AI can be an "inventor" under patent law.[11] Further, if the innovation surpasses the user's understanding, the patent examiner or the person having ordinary skill in the art might not understand the details of the invention through the required disclosure. AI raises numerous patent-related issues, which prompted the USPTO to request comments on patenting AI inventions in August of 2019.[12] The USPTO received nearly 200 responses to its questions from organizations such as the American Bar Association and the American Intellectual Property Law Association, and from companies and individuals, including the company holding the most granted U.S. patents—IBM.[13] As the rapid integration of AI becomes standard, the number of patent applications for AI inventions has soared.[14] However, the lack of bright-line rules for examination threatens the future patentability of AI inventions and, therefore, the investment in the progression of science and useful arts through disclosure of patents.

Alan Turing's test for AI has long been the standard for determining a machine's ability to exhibit human-like intelligent behavior.[15] Now, the USPTO needs a patentability test to determine if that intelligence changes

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11. Mark D. Penner & Mark Vanderveken, *Could the Creations of Artificial Intelligence Be Entitled to Intellectual Property Protection?*, FASKEN (June 27, 2018), https://www.fasken.com/en/knowledge/2018/06/could-the-creations-of-artificial-intelligence-be-entitled-to-intellectual-property-protection/ [https://perma.cc/7NZL-ZT4G]. The USPTO recently denied a petition to vacate the Notice of Missing Parts for failure to identify each inventor by legal name for an invention developed by a machine. The USPTO reasoned that interpreting "inventor" to include machines would contradict the plain meaning of 35 U.S.C. §§ 101 and 115 that refer to persons and individuals. Rebecca Tapscott, *USPTO Shoots Down DABUS' Bid for Inventorship*, IPWATCHDOG (May 4, 2020), https://www.ipwatchdog.com/2020/05/04/uspto-shoots-dabus-bid-inventorship/id=121284/ [https://perma.cc/K2E8-Y9FD].

12. *See* Request for Comments on AI Inventions, *supra* note 10; Request for Comments on IP Protection for AI Innovation, *supra* note 10.

13. Email from Manny W. Schecter, Chief Pat. Couns., IBM Corp. & Jennifer M. Anda, Pat. Portfolio Manager, IBM Corp., to Hon. Andrei Iancu, Under Sec'y of Con. For Intell. Prop. & Dir., U.S. Pat. & Trademark Off., at 1 (Nov. 8, 2019), https://www.uspto.gov/sites/default/files/documents/IBM_RFC-84-FR-44889.pdf [https://perma.cc/BX7N-WGJ3]; *USPTO Posts Responses from Request for Comments on Artificial Intelligence*, U.S. PAT. & TRADEMARK OFF. (Mar. 18, 2020), https://www.uspto.gov/about-us/news-updates/uspto-posts-responses-from-requests-comments-artificial-intelligence# [https://perma.cc/WEJ8-SSQE]; *Notices on Artificial Intelligence*, U.S. PAT. & TRADEMARK OFF., https://www.uspto.gov/initiatives/artificial-intelligence/notices-artificial-intelligence [https://perma.cc/6W57-27CT] (last visited Sept. 8, 2020).

14. *See* Hamidreza Habibollahi Najaf Abadi & Michael Pecht, *Artificial Intelligence Trends Based on the Patents Granted by the United States Patent and Trademark Office*, 8 IEEE ACCESS 81633, 81633–34 (2020), https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9072177 [https://perma.cc/V3QU-F6RE].

15. *See, e.g.*, James H. Moor, *Preface to* THE TURING TEST: THE ELUSIVE STANDARD OF ARTIFICIAL INTELLIGENCE, at ix (James H. Moor ed., 2003).

the level of ordinary skill in the art to the point of obviousness. In response to the USPTO,[16] this Comment focuses on determining whether "AI-assisted inventions" can overcome the obviousness requirement by shifting the level of ordinary skill in the art. Specifically, the results and inventions do not suddenly become obvious when produced by AI.[17]

A person having ordinary skill in the art (PHOSITA) acts as the baseline for the non-obviousness inquiry;[18] however, the USPTO further scrutinizes inventions derived from a limited number of starting points and combinations by looking to whether the innovation was obvious to the person of ordinary skill in the art at the outset.[19] Artificial intelligence bumps against the ordinary skill in the art framework because AI nearly eliminates the time, labor, and cost constraints when exploring reasonable starting points or combinations.[20] Nonetheless, differentiating AI as a tool rather than an inventor leaves some room for patentability.

The USPTO defines AI as "any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals."[21] Colloquially, "artificial intelligence" refers to "a machine [that] mimics 'cognitive' functions that humans associate with other human minds, such as 'learning' and 'problem solving.'"[22] Moreover, "inventive AI" refers to inventions "that are derived, discovered, or otherwise arrived at primarily by the efforts of AI," whereas "AI-assisted inventions," or simply "AI inventions," are "innovations that incorporate the use of machine learning, big data analysis, and or deep data analysis to achieve a result."[23] The level of ordinary skill differs for AI and may evolve so that the standard becomes the AI itself, assuming that similar AI would arrive at the same

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16. Request for Comments on AI Inventions, *supra* note 10.

17. *See* Ryan Abbott, *Everything Is Obvious*, 66 UCLA L. REV. 2, 26–30 (2019). The analysis presented here coincides with Abbott's Phase II and III of the evolution of machine invention where "machines and people are competing and cooperating at inventive activity." *Id.* at 29.

18. *See* Jonathan J. Darrow, *The Neglected Dimension of Patent Law's PHOSITA Standard*, 23 HARV. J.L. & TECH. 227 (2009).

19. *Altana Pharma AG v. Teva Pharms. USA, Inc.*, 566 F.3d 999 (Fed. Cir. 2009).

20. *See* Abbott, *supra* note 17, at 33–34.

21. U.S. PAT. & TRADEMARK OFF., PATENT PUBLIC ADVISORY COMMITTEE QUARTERLY MEETING: IT UPDATE (Aug. 2, 2018), https://www.uspto.gov/sites/default/files/documents/20180802_PPAC_AI_IT_Update.pdf [https://perma.cc/36EE-6DDA].

22. *Id.* (citing STUART J. RUSSELL & PETER NORVIG, ARTIFICIAL INTELLIGENCE: A MODERN APPROACH (3d ed. 2010)).

23. Raphael "Ray" Freiwirth & Allison Gaul, *Introduction*, *in* THE AIPLA/AIPPI/FICPI AI COLLOQUIUM PRIMER 1, 1 (1st ed. 2019), https://ficpi.org/_/uploads/files/AIPLA-AIPPI-FICPI_Artificial_Intelligence_Colloquium_Patent_ONLY_Primer.pdf [https://perma.cc/Z9X9-8GSC].

invention.[24] Thus, the level of ordinary skill for inventive AI should depend upon the current state of AI itself. In contrast, AI-assisted inventions allow for a user-focused skill in the use of machine learning, big data analysis, and deep data analysis to help determine the level of ordinary skill in the art for the non-obviousness inquiry.

Inventors harnessing the power of AI will likely benefit from the distinction between "inventive AI" and "AI-assisted inventions," and society would also benefit. If the USPTO bars patent applications from bearing the name of a human inventor on any invention with AI assistance, and the AI similarly cannot claim inventor status, then the invention may remain unpatentable.[25] This situation might "prevent companies from investing money in AI technologies and prevent breakthroughs in important areas like drug discovery."[26] In the absence of patents, some alternative tools of protection may come into play.[27] Notwithstanding the value of these alternatives for "inventive AI," "AI-assisted inventions" permit the USPTO to establish non-obviousness from a human perspective and reward a human inventor with patent rights.

Although all AI looks for patterns in large amounts of data, the user's objectives, access to big and deep data, and knowledge of the existing datasets control the form and operation of the machine learning resulting in AI-assisted inventions.[28] Because AI necessarily challenges the level of ordinary skill in the art of the PHOSITA, the determination of non-obviousness for AI-assisted inventions demands a narrow approach to patentability focusing on the user's control, selection, and use of machine learning, big data analysis, and or deep data analysis in the inventive process to determine the level of ordinary skill in the art.[29]

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24. *See* Abbott, *supra* note 17, at 30; Susan Y. Tull, *Patenting the Future of Medicine: The Intersection of Patent Law and Artificial Intelligence in Medicine*, 10 LANDSLIDE 40 (2018); Susan Y. Tull & Paula E. Miller, *Patenting Artificial Intelligence: Issues of Obviousness, Inventorship, and Patent Eligibility*, 1 J. ROBOTICS, A.I. & L. 313, 320 (2018) ("At some point, AI may become the 'person' of skill in the art, possessing actual knowledge of all known publications, patents, and prior art, transforming the hypothetical construct into reality.").

25. Angela Chen, *Can an AI Be an Inventor? Not Yet.*, MIT TECH. REV. (Jan. 8, 2020), https://www.technologyreview.com/2020/01/08/102298/ai-inventor-patent-dabus-intellectual-property-uk-european-patent-office-law/ [https://perma.cc/B3LX-P95Q].

26. *Id.*

27. *See* Shlomit Yanisky Ravid & Xiaoqiong "Jackie" Liu, W*hen Artificial Intelligence Systems Produce Inventions: An Alternative Model for Patent Law at the 3A Era*, 39 CARDOZO L. REV. 2215, 2254–58 (2018).

28. *See infra* Section II.B.

29. Changes in technology call for the "translation" of laws. The non-obvious inquiry protects the public from obvious inventions but requires a translation to maintain that protection in spite of the changes in technology that now expand the scope of obviousness. Here, the failure to narrow the scope of obviousness would allow numerous

The user analysis reaches beyond the skill of the normal inventor to consider the abilities of the inventor plus artificial intelligence. The person who handles the AI technology in the inventive process thus becomes the person having ordinary skill in AI (PHOSIAI).[30] Therefore, shifting the level of ordinary skill in the art from the machine to the user enables a factfinder to perform the requisite non-obviousness inquiry under 35 U.S.C. § 103.

Because of the ease with which AI innovates and the challenge of modifying the existing non-obviousness standards to account for inventions derived by AI, some arguments contend that the USPTO should designate AI-developed inventions as per se unpatentable.[31] In theory, inventors could instead rely on other tools to achieve protections similar to a patent.[32] This solution thoroughly simplifies the issue of patentability and might best serve the United States in the long term; however, the theory likely works best when innovation occurs without major human contributions which, for the moment, exists largely in concept.[33] Because technology has not yet reached artificial general intelligence, businesses typically talk about "computer-assisted innovation" and AI as a tool rather than a sole inventor.[34] Accordingly, this Comment poses one option for dealing with non-obviousness, without imposing an overarching ban on the patentability of AI-developed inventions, by distinguishing the user influence as the PHOSIAI in "AI-assisted inventions" from that of "inventive AI."[35]

This Comment seeks to outline the statutory hurdles facing the patentability of AI-assisted inventions and to identify a means of shifting the perspective to allow an analysis of these inventions under existing practices. Part I of this Comment provides context for this discussion by tracing the evolution of the non-obviousness test under common law and its limitations with the development of machine learning and artificial

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inventions to be patented on the laurels of AI. See LAWRENCE LESSIG, CODE VERSION 2.0, at 157–68 (2006) for a discussion about translating the U.S. Constitution in light of cybersecurity questions.

30. *See* Jordan, *supra* note 1, at 6–7 (holding that the PHOSITA standard should remain with the understanding that inventors maintain access to current tools—including AI discovery and optimization).

31. Ravid and Liu focus on AI systems that create unpredictable, innovative outcomes independently, rather than merely by following digital orders. *See* Ravid & Liu, *supra* note 2727, at 2220.

32. *See id.* at 2252–58 (describing first-mover advantages, digital tools against copying and counterfeiting, and social recognition of players as non-patent alternatives to protect stakeholder interests).

33. *See* Chen, *supra* note 25.

34. A spokesperson for the European Patent Office said that it will likely consider AI "a tool rather than an inventor for the foreseeable future." *Id.*

35. *See* Jordan, *supra* note 1, at 6 ("AI inventions and an AI-assisted invention should be measured against the art invoked by the claims of the patent application.").

intelligence. Part II addresses the specific hurdles for determining the level of ordinary skill in the art for artificial intelligence. First, Part II explores the existing modes of determining the level of ordinary skill in the art and where those methods fall short. Second, Part II resolves the level of ordinary skill in the art for AI-assisted inventions by analyzing the AI user's control and design of the inventive process. Finally, Part II completes the non-obviousness inquiry under *Graham v. John Deere Co.*[36]—using the new level of ordinary skill resolved for the user—and considers the limitations of this approach to patentability.

I. EMERGENCE OF THE NON-OBVIOUSNESS TEST

The non-obviousness test has evolved to reflect the current state and progression of science and the arts. Initially, the first patent statute required the invention to be "sufficiently useful and important" to the progress of science and the arts.[37] The courts then wrestled with the proper test for non-obviousness and, at one point, required the invention to "reveal the flash of creative genius, not merely the skill of the calling."[38] However, the passing of the Patent Act of 1952 returned the courts' focus to the PHOSITA by codifying the idea of non-obviousness.[39]

Nonetheless, the Supreme Court has continued to interpret the non-obviousness test as it struggles to set a benchmark for comparison of the invention to the prior art.[40] Section A of this Part will explore the developed interpretation of "non-obvious." Section B will then explore the need for further interpretation of the non-obviousness test in light of the changes in the PHOSITA due to artificial intelligence and machine learning.

A. Non-Obviousness as a Patentability Requirement

To reach a proper determination of obviousness under 35 U.S.C. § 103, a patent examiner must step into the position of the PHOSITA when the invention was unknown and determine whether the claimed invention "as a whole" would have been obvious to that person at that time.[41] The examiner must avoid hindsight bias while considering the disclosure and

36. 383 U.S. 1 (1966).
37. Patent Act of 1790, ch. 7, sec. 1, 1 Stat. 109, 109–110.
38. *Cuno Eng'g Corp. v. Automatic Devices Corp.*, 314 U.S. 84 (1941).
39. Patent Act of 1952, ch. 950, § 103, 66 Stat. 792, 798 (codified as amended at 35 U.S.C. § 103).
40. *See* Ryan T. Holte & Ted Sichelman, *Cycles of Obviousness*, 105 IOWA L. REV. 107, 109–14 (2019).
41. U.S. PAT. & TRADEMARK OFF., Manual of Patent Examining Procedure § 2142 (9th ed. Rev. 8, Jan. 2018) [hereinafter MPEP].

comparing it to the prior art.[42] The current rule under Section 103 of the America Invents Act, effective March 16, 2013, for non-obviousness provides:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which said subject matter pertains.[43]

In *Graham*,[44] the Court broke from 150 years of precedent that treated the question of patent validity as a question of fact by holding that the conclusion of obviousness is one of law for a judge's determination.[45] *Graham* clarified that the non-obviousness requirement of patentability under Section 103 depends on the determination of three questions of fact: the scope and content of the prior art, the level of ordinary skill in the art, and the differences between the claimed invention and the prior art.[46]

The Court in *Graham* also delineated a set of secondary considerations, often referred to as the "*Graham* factors," which serve as evidence of non-obviousness.[47] The Federal Circuit often treats these factors as a "*required* fourth element in the § 103 analysis."[48] The secondary considerations apply where the patentee shows that the secondary considerations prove that non-obviousness is attributable to the inventive characteristics of the discovery, as claimed in the patent.[49] The nexus connecting the secondary evidence to the claimed invention

42. MPEP § 2145(X)(A) (9th ed. Rev. 8, Jan. 2018) ("Applicants may argue that the examiner's conclusion of obviousness is based on improper hindsight reasoning. However, '[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper.'") (citing *In re McLaughlin*, 443 F.2d 1392, 1395 (C.C.P.A. 1971)).

43. 35 U.S.C. § 103 (2018).

44. 383 U.S. 1 (1966).

45. *Id.* at 17; Comment, *Nonobviousness in Patent Law: A Question of Law or Fact?*, 18 WM. & MARY L. REV. 612, 612 (1977).

46. *Graham*, 383 U.S. at 17.

47. *Id.*; *See, e.g.*, Dmitry Karshtedt, *The More Things Change: Improvement Patents, Drug Modifications, and the FDA*, 104 IOWA L. REV. 1129, 1161 (2019).

48. PETER S. MENELL, MARK A. LEMLEY & ROBERT P. MERGES, INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE: 2019, VOLUME I: PERSPECTIVES, TRADE SECRETS AND PATENTS 230–31 (2019).

49. *See* MPEP § 716.01(b) (9th ed. Rev. 8, Jan. 2018).

requires a showing of the probative value of non-obviousness.[50] These factors include: commercial success, the long felt need for a solution to a real problem recognized in the prior art or the industry; and failure by others to solve the same problem (while equipped with the same knowledge).[51] The list continues with awards and praise, skepticism or disbelief of the feasibility of the invention before conception, "teaching away," and unexpected results.[52] Finally, the list concludes with licensing activity, copying by others, advances in collateral technology, and near-simultaneous invention as indicators of non-obviousness.[53] In practice, "evidence of secondary considerations may often be the most probative and cogent evidence in the record. It may often establish that an invention appearing to have been obvious in light of the prior art was not."[54] Therefore, the *Graham* secondary factors may bolster the non-obviousness of an invention where the claimed invention may otherwise appear obvious in light of the prior art.

In *KSR International Co. v. Teleflex Inc.*,[55] the Supreme Court cautioned that the trier of fact should not reduce the obviousness analysis to "rigid and mandatory formulas."[56] For this reason, the Court rejected the long-established "teaching-suggestion-motivation" test,[57] which required courts to look for some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.[58] The legal inquiry of obviousness "cannot be confined by a formalistic conception of the words teaching, suggestion, and motivation, or by overemphasis on the importance of published articles and the explicit content of issued patents."[59]

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50. A patentee must establish a "nexus" connecting the secondary evidence to the claims. Grant Lukas, *Federal Circuit Raises the Standard of Nexus Requirement for Secondary Indicia of Non-Obviousness*, ROTHWELL FIGG (Dec. 20, 2019), https://www.ptablaw.com/2019/12/20/federal-circuit-raises-the-standard-of-nexus-requirement-for-secondary-indicia-of-non-obviousness/ [https://perma.cc/26RF-96DF] (quoting *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1374 (Fed. Cir. 2019)). For example, a patentee may establish commercial success by showing the product sold "both 'embodied' the claimed invention and was 'coextensive' with the claims." *Id.* Proving that an invention is "coextensive" means "that the product is essentially the claimed invention" without significant unclaimed features. *Id.* "The more features a product possesses over the claimed invention, the less likely a court will find sufficient nexus between them." *Id.*

51. MENELL, LEMLEY & MERGES, *supra* note 48, at 230–31.

52. *Id.*

53. *Id.*

54. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983).

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

56. *Id.* at 419.

57. *Id.* at 419–22.

58. *Id.* at 407; *See also* MPEP § 2141 (9th ed. Rev. 8, Jan. 2018).

59. *KSR*, 550 U.S. at 419.

Specifically, the Supreme Court held that the courts and patent examiners must look beyond "the problem the patentee was trying to solve," and not assume that "a person of ordinary skill attempting to solve a problem will be led only to those elements of prior art designed to solve the same problem."[60] The Court acknowledged that a patentee could prove the obviousness of a claim by merely showing that "the combination of elements was 'obvious to try.'"[61] In effect, the *KSR* decision established three rationales for proving obviousness: combining prior art elements; substituting one known element for another; and the "obvious to try" rationale—choosing from a finite number of identified, predictable solutions with a reasonable expectation of success.[62] In *KSR*, the Court foresaw that the "diversity of inventive pursuits and of modern technology counsel[ed] against limiting the analysis"[63] and chose to expand the obviousness inquiry to account for new levels of ordinary skill. Therefore, the Supreme Court explicitly avoided a rigid formula of non-obviousness and instead fashioned an inquiry to develop and expand with the state of the art.

B. Non-Obviousness as a Developing Inquiry

The obviousness inquiry is now an ever-evolving determination that the Federal Circuit can mold to change with modern technology.[64] Because patent law promotes technology,[65] the law appears "technology-neutral in text but becomes specific in application."[66] The PHOSITA in the non-obviousness inquiry enables the application of the general technology-neutral law in a specific manner, such as AI-assisted inventions.[67] In support of this notion, the USPTO published examination guidelines in the obviousness inquiry after *KSR*, which detailed examination of non-obviousness under three rationales depending on the ordinary skill in the art.[68]

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60. *Id.* at 420.

61. *Id.* at 421.

62. *Id.* at 417–22; MPEP § 2143 (9th ed. Rev. 8, Jan. 2018).

63. *KSR*, 550 U.S. at 419.

64. Timothy Homlish, *Patentability & the Non-Obviousness Requirement*, MCCARTER & ENG. INTELL. PROP./INFO. TECH. NEWSL. (McCarter & English), May 27, 2011, https://www.lexology.com/library/detail.aspx?g=846db2fc-7a76-4fbb-ae16-07f55d882872 [https://perma.cc/VXX4-8YAS].

65. *See* U.S. CONST. art. I, § 8, cl. 8.

66. Michael Birnhack, *Reverse Engineering Informational Privacy Law*, 15 YALE J.L. & TECH. 24, 48, 51 (2012).

67. *Id.* at 41 (citing Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1185–90 (2002)).

68. 2010 *KSR* Guidelines Update, 75 Fed. Reg. 53,643 (Sept. 1, 2010).

First, a claimed invention may be non-obvious under the combining prior art elements rationale, "when the combining step involves such additional effort that no one of ordinary skill would have undertaken it without a recognized reason to do so."[69] This caveat to the combination rationale seems to apply to human endeavors successfully, but what about artificial intelligence that may undertake millions of combinations without a recognized reason to do so and very little effort? 35 U.S.C. § 103 establishes that patentability "shall not be negated by the manner in which the invention was made,"[70] but whether that includes AI remains unseen.

Second, the *KSR* guidelines established that a claimed invention under the substitution rationale might be obvious when one of ordinary skill in the art would have been technologically capable of making the substitution, and the result obtained would have been predictable.[71] However, whether this guideline includes the technological capabilities of the instrumentation used by those skilled in the art remains unknown. The guideline fails to address whether the result obtained must be predictable to the machine or the user, or both.

Third, under the "obvious to try" rationale, the analysis must consider the context of the subject matter in question.[72] The context may include "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."[73] This guideline finally seems to incorporate artificial intelligence in the state of advance by considering the context and the user choices behind the innovation. Thus, the "obvious to try" rationale may best account for the contributions of the user and the machine in determining the obviousness of the invention.

The "obvious to try" rationale under *KSR* allows the court or examiner to consider whether the inventor chose from "a finite number of identified, predictable solutions with a reasonable expectation of success[,]" as might be the case with certain AI data sets.[74] The foundation of this rationale holds that known work in one field of endeavor may prompt variations of it for use in either the same field or

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69. *Id.* at 53,646.

70. Mark Olds, *Assessment of Inventive Step*, THE AIPLA/AIPPI/FICPI AI COLLOQUIUM PRIMER, at 8 (2019), https://ficpi.org/_/uploads/files/AIPLA-AIPPI-FICPI_Artificial_Intelligence_Colloquium_Patent_ONLY_Primer.pdf [https://perma.cc/M9M9-2JDP]; 35 U.S.C. § 103 (2018).

71. 2010 *KSR* Guidelines Update, *supra* note 68, at 53,649; *see also* MPEP § 2143(B) (9th ed. Rev. 8, Jan. 2018).

72. *See* 2010 *KSR* Guidelines Update, *supra* note 68, at 53,653.

73. *Id.* (quoting *Abbott Lab'ys. v. Sandoz, Inc.*, 544 F.3d 1341, 1352 (Fed. Cir. 2008)).

74. MPEP § 2141 (9th ed. Rev. 8, Jan. 2018).

a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art.[75] Essentially, an invention is patentable if one of ordinary skill attempts something that one of ordinary skill would have deemed to fail but does not. In contrast, an invention is unpatentable if one of ordinary skill attempts something that they reasonably think will work, and it does.

However, the Federal Circuit in *In re Kubin*[76] outlined two classes of situations that erroneously equate "obvious to try" with obviousness under Section 103.[77] First, erroneous obviousness occurs when:

> what would have been "obvious to try" would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.[78]

Second, erroneous obviousness may occur when what was "obvious to try" was to explore a new technology or general approach that seemed to be a promising field of experimentation, where the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.[79] These instances help prove non-obviousness but do not require nearly as much ingenuity with the help of machine learning and data analysis. An "obvious to try" inquiry must always consider the context of the subject matter in question.[80] Typically, an inquiry under the "obvious to try" rationale is appropriate where there exists only a finite number of possible solutions, and the user's ingenuity whittles the list down.[81] However, even the "obvious to try" rationale seems to fall short where AI tirelessly varies all parameters to explore the possibilities.

Moreover, this rationale's reliance on the PHOSITA poses an issue for the effectiveness of the "obvious to try" rationale with AI. Where AI acts as the inventor and selects from a finite number of identified, predictable solutions, with a reasonable expectation of success, the "obvious to try" rationale may establish obviousness from a level of ordinary skill in the art set by AI itself. In contrast, where a human inventor uses AI as a tool to invent, the level of ordinary skill instead

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75. *KSR*, 550 U.S. at 417.
76. 561 F.3d 1351 (Fed. Cir. 2009).
77. *Id.* at 1359.
78. *Id.* (quoting *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988)).
79. *Id.*
80. *Abbott Lab'ys. v. Sandoz, Inc.*, 544 F.3d 1341, 1352 (Fed. Cir. 2008).
81. *See* MPEP § 2143 (9th ed. Rev. 8, Jan. 2018).

depends on the user's control of the parameters and expectations.[82] Therefore, the user's control of the parameters, data analysis, and form of machine learning determines the level of ordinary skill in the art by establishing the user's guidance of the claimed invention or how to achieve it.

The user's existing knowledge and motives guide the selection of the machine learning form, big or deep data analysis, the design parameters, and ultimately, the proper algorithm within each classification to establish the level of ordinary skill in the art for AI-assisted inventions.[83] Three forms of machine learning exist, and each varies in the degree of user control and contribution. "Supervised machine learning" efficiently characterizes data based on the user's pre-determined guidelines.[84] Specifically, supervised machine learning trains the AI to identify patterns in new data based on correctly recognized patterns in past data sets, called "labeled data."[85] Because AI learns to recognize patterns by making predictions on the training data, supervised learning requires the user to provide labeled data and correct the machine when it errs.[86]

In contrast, "unsupervised machine learning" merely finds patterns for the user in large data sets.[87] Unsupervised learning consists of feeding the AI "unlabeled data" and allowing the AI to discover new patterns by itself.[88] Unsupervised learning attempts to model the underlying structure

82. Although numerous articles explain AI's superior abilities in changing the inventive process, even AI's presence in each aspect of the process does not eliminate human control and creativity. Professor Aspuru-Guzik has "adapted deep learning and neural networks to attempt to reinvent materials discovery" by infusing AI "and automation into all the steps of materials research." David Rotman, *AI Is Reinventing the Way We Invent*, MIT TECH. REV. (Feb. 15, 2019), https://www.technologyreview.com/s/612898/ai-is-reinventing-the-way-we-invent/ [https://perma.cc/H883-PEG9]. Although machine learning speeds up each of the steps, scientists must still use their imaginations to explore the possibilities and apply the AI to specific tasks. *See id.*

83. *See* Jordan, *supra* note 1, at 6–7 (maintaining that the outputs of AI will be the results of the inputs and configurations of a human).

84. Karen Hao, *What is Machine Learning?*, MIT TECH. REV. (Nov. 17, 2018), https://www.technologyreview.com/s/612437/what-is-machine-learning-we-drew-you-another-flowchart/ [https://perma.cc/TS7Z-AGLF]; David Fumo, *Types of Machine Learning Algorithms You Should Know*, TOWARDS DATA SCI. (June 15, 2017), https://towardsdatascience.com/types-of-machine-learning-algorithms-you-should-know-953a08248861 [https://perma.cc/575C-JXEQ].

85. Hao, *supra* note 84; Fumo, *supra* note 84.

86. Hao, *supra* note 84; Fumo, *supra* note 84.

87. Hao, *supra* note 84; Fumo, *supra* note 84.

88. Hao, *supra* note 84; Fumo, *supra* note 84.

or distribution in a data set to learn more about it.[89] The user of unsupervised learning merely selects and inputs the data for analysis.[90]

Finally, reinforcement machine learning relies on the AI ("the agent") to explore its environment through actions and responses, in other words, through trial and error.[91] The agent is doing the work to explore the environment and determine what actions elicit good responses or rewards.[92] Thus, the user's choice in the form of machine learning helps to identify the level of ordinary skill in the art in circumstances when AI assists the PHOSITA.

The user's selection of datasets also serves as a significant contribution to AI-assisted inventions. Big data encompasses large masses and varieties of data points that can be unwieldy for a human to analyze.[93] Businesses typically "employ predictive analytics to help sift through the data to find patterns and trends, but much of this information remains useless or redundant."[94] Similarly, deep data synthesizes the large datasets and the information "into useful sections, excluding information that might be redundant or unusable."[95] The choice between big and deep data will depend on the user's motivation and the type of data collected.[96] Generally, deep data is most useful for searching for specific trends or targeting individual pieces of information because it allows the user to eliminate useless or redundant pieces of data while retaining the information important to the design parameters.[97] In this way, big data may be helpful as unlabeled data for unsupervised learning, and deep data may be helpful as labeled data for supervised learning. Therefore, the user's design parameters and selection of data help to identify the level of ordinary skill in the art in circumstances when AI assists the user.

II. NON-OBVIOUSNESS IN AN ARTIFICIAL WORLD

There are many unanswered questions when dealing with artificial intelligence under the Section 103 obviousness inquiry, and confusion about patent-eligibility discourages inventors from pursuing work in

89. Hao, *supra* note 84; Fumo, *supra* note 84.

90. Hao, *supra* note 84; Fumo, *supra* note 84.

91. Hao, *supra* note 84; Fumo, *supra* note 84.

92. Hao, *supra* note 84; Fumo, *supra* note 84.

93. Kayla Matthews, *The Difference Between Big Data and Deep Data*, INNOVATION ENTER. (Dec. 23, 2016), https://channels.theinnovationenterprise.com/articles/the-difference-between-big-data-and-deep-data [https://perma.cc/K4WC-NH27].

94. *Id.*

95. *Id.*

96. *Id.*

97. *Id.*

artificial intelligence technologies.[98] Because uncertainty disincentivizes the enormous investment in research and development that is necessary to fuel the innovation cycle,[99] the public loses out in securing the value of publicly disclosed innovations that advance the state of the art. However, the non-obvious inquiry for AI-assisted inventions need not differ from the traditional framework completely.

The analysis of AI-assisted inventions under Section 103 should begin with the normal framework established in *Graham v. John Deere Co*.[100] *Graham* offers a three-part factual inquiry and additional secondary considerations for determining the obviousness of a claimed invention.[101] Namely, the *Graham* framework has guided courts and examiners in the obviousness inquiry by establishing how to compare the claimed invention to the prior art and what impact secondary considerations should have on patentability where the three-part inquiry falls short.[102] The analysis for AI-assisted inventions should draw largely from this framework with an adjustment in perspective.

Principally, whether the difference between the claimed invention and the prior art appears obvious depends on perspective. A patent is obvious when the differences between the claimed invention and the prior art reveal that the claimed invention as a whole would have been obvious before the effective filing date to a person having ordinary skill.[103] However, artificial intelligence challenges even this basic framework because the person having ordinary skill in the art is hard to conceptualize when an inventor employs the help of a machine to innovate. Typically, the PHOSITA is "a hypothetical person who is presumed to have known the relevant art at the time of the invention."[104] Unfortunately, only artificial intelligence having access to the same dataset would likely satisfy the hypothetical PHOSITA under this theory because the PHOSITA would necessarily "have the capability of understanding the scientific and engineering principles applicable to the pertinent art."[105] However, the person of ordinary skill need not have a doctorate and is

98. *The State of Patent Eligibility in America: Part II: Hearing Before the Subcomm. on Intell. Prop. of the S. Comm. on the Judiciary*, 116th Cong. (2019) (written testimony of Henry Hadad, President, IPO), https://www.judiciary.senate.gov/imo/media/doc/Hadad%20Testimony.pdf [https://perma.cc/5SWV-647G].

99. *Id.*

100. *See Graham v. John Deere Co.*, 383 U.S. 1, 1 (1966).

101. *Id.* at 17–18.

102. *See* MPEP § 2143 (9th ed. Rev. 8, Jan. 2018).

103. 35 U.S.C. § 103 (2018).

104. MPEP § 2143.03 (9th ed. Rev. 8, Jan. 2018).

105. *Ex parte Hiyamizu*, No. 650-06, 10 U.S.P.Q.2d (BNA) 1393, 1394 (B.P.A.I. April 28, 1988) (finding that the hypothetical person is not definable by way of credentials).

"a person of ordinary creativity, not an automaton."[106] The Supreme Court distinguished the creativity of an automaton—a machine able to simulate the actions of a human being in a mechanical or unemotional way—to highlight the importance of creativity in the analysis.[107] An invention may not be obvious to the automaton lacking creativity yet have been obvious to someone of ordinary creativity even without an explicit teaching, suggestion, or motivation in the prior art. Thus, artificial intelligence should not constitute the PHOSITA for the obviousness inquiry under 35 U.S.C. § 103.

Instead, the court or patent examiner should analyze the ordinary skill in the art framework through the narrow lens of the user. The focus should shift to the user's control, selection, and use of machine learning rather than the otherwise unmatched abilities of artificial intelligence. The following sections of this part will address the road to overcoming the challenges that AI poses for the obviousness inquiry under 35 U.S.C. § 103.

Section A of this Part illustrates the shortcomings and successes of dealing with AI under several precedential frameworks. Section B resolves the level of ordinary skill in the art for the ever-evolving field of artificial intelligence by analyzing the relevant user contribution to AI-assisted inventions. Section C uses the level of ordinary skill in the art to analyze AI-assisted inventions under the *Graham* inquiry. Finally, Section D will consider the limitations of the approach to non-obviousness outlined in Sections B and C.

A. To Boldly Go Where Others Have Gone Before

The teaching, suggestion, or motivation (TSM) test offers one method of comparing the claimed invention to the prior art by focusing on the user. The TSM test determines that a claimed invention is obvious when a teaching, suggestion, or motivation to combine prior art lessons existed in the prior art, the nature of the problem, or in the knowledge of a PHOSITA.[108] The TSM test offers some guidance for handling AI-assisted inventions under Section 103 because it focuses on prior art and the inventor's motivation and perception of the prior art.[109] However, the TSM test's focus on prior art may lower the bar of the non-obviousness inquiry for AI-assisted inventions because the claimed invention as a whole would not be readily obvious before the effective filing date to a human having ordinary skill. Moreover, a patent remains non-obvious when a claimed invention presents unexpectedly superior properties when

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

107. *Automaton*, OXFORD ENGLISH DICTIONARY (3d ed. 2011).

108. *KSR*, 550 U.S. at 407.

109. *See id.*

compared to the prior art.[110] Thus, focusing on the differences between the invention and prior art may grant AI too much credit by overvaluing its advancements.

Overvaluation of AI poses some concern for looking at non-obviousness through a user lens. Nonetheless, looking at prior art from the user perspective and establishing the level of ordinary skill in the art for a human user results in different outcomes. In addition, references that do not qualify as prior art may still indicate the level of ordinary skill in the art.[111] Simply comparing the prior art to the invention, a human user would likely not find the innovation obvious. However, establishing the level of ordinary skill allows the user to consider the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field."[112] Therefore, establishing the level of ordinary skill in the art through the lens of the user creates a more comprehensive analysis of the invention's obviousness.

Moreover, the abilities of AI surpass the abilities of any PHOSITA in any field, so AI also challenges the *KSR* obviousness framework. *KSR*, which criticizes the TSM test for its restrictive nature, offers a solution-focused rationale for rejecting an invention as obvious based on the prior art.[113] The *KSR* case established the combination, substitution, and "obvious to try" rationales for rejecting inventions as obvious, in which each rationale focuses on the lack of an inventive step in arriving at a new invention from the relevant prior art.[114]

Namely, an examiner may reject an invention for "combining prior art elements according to known methods to yield predictable results."[115] Or an examiner may reject an invention based on simple substitution of one known element for another to obtain predictable results or use of a known technique to improve similar devices, methods, or products in the same way.[116] In this way, if the actual application of the technique had been beyond the skill of one of ordinary skill in the art, then using the technique would not have been obvious.[117] Finally, an examiner may reject a claim based on the "obvious to try" rationale—merely choosing

110. *See Procter & Gamble Co. v. Teva Pharm. USA, Inc.,* 566 F.3d 989, 994 (Fed. Cir. 2009) (quoting *In re Soni*, 54 F.3d 746, 750 (Fed. Cir. 1995)).

111. MPEP § 2141.03 (9th ed. Rev. 8, Jan. 2018).

112. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)); *Env't Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696 (Fed. Cir. 1983).

113. *See KSR*, 550 U.S. at 401–02.

114. MPEP § 2143 (9th ed. Rev. 8, Jan. 2018).

115. *See id.*

116. *Id.*

117. *KSR*, 550 U.S. at 417.

from a finite number of identified, predictable solutions with a reasonable expectation of success.[118] Thus, the rationales under *KSR* depend on understanding the prior art and the differences between the prior art and the claimed invention, which strains the analysis when looking at inventions that maintain an inventive step from the human perspective.

Ordinarily, AI-assisted inventions will depend upon data and patterns recognized within that data rather than stemming from prior art inventions.[119] The AI's ability to learn from its environment and the patterns it detects within the data increases the number of solutions it can consider and reject before arriving at an optimal output.[120] Thus, observing the prior art at the time of filing and crediting the AI with an inventive step would likely lower the non-obviousness bar and grant the AI too much credit for its abilities. Instead, the examiner should shift the level of ordinary skill for non-obviousness to the user's control and the reasonable expectation of success in using the AI to predict solutions.

Courts have previously shifted the level of ordinary skill to the user's control and expectations to handle the difficulties of non-obviousness in the field of chemical compounds. For example, *Altana Pharma v. Teva Pharma*[121] deals with the patentability of a chemical composition with a limited number of starting points or lead chemicals.[122] Where there exists a limited number of starting positions, the prior art would likely result in too high of a non-obviousness bar. In contrast, the prior art for AI-assisted inventions would likely result in too low of a non-obviousness bar. Nonetheless, the non-obviousness inquiry in both instances cannot rely on the prior art to determine obviousness. Under *Altana Pharma*, if ordinary skill in the art leads to the identification of a lead chemical, motivation to alter the compound, or reasonable expectation of success, then the invention is obvious.[123] These three considerations translate to AI-assisted inventions and offer the factfinder an opportunity to analyze the patentability of AI-assisted inventions based on the ordinary skill in the art and the context surrounding the user's control of the invention.

118. *See id.*

119. *See* Daria Kim, *'AI-Generated Inventions': Time to Get the Record Straight?*, 69 GRUR INT'L 443, 444–47 (2020).

120. *See* Craig S. Smith, *Computers Already Learn from Us. But Can They Teach Themselves?*, N.Y. TIMES (Apr. 12, 2020), https://www.nytimes.com/2020/04/08/technology/ai-computers-learning-supervised-unsupervised.html [https://perma.cc/5HGU-YGSC].

121. *Altana Pharma AG v. Teva Pharms. USA, Inc.*, 566 F.3d 999 (Fed. Cir. 2009).

122. *See id.*

123. *Id.* at 1007–09.

The *Altana Pharma* decision expanded the "obvious to try" rationale by shifting the analysis to the user and the relevant starting points.[124] The case created a three-prong prima facie inquiry in assessing the obviousness of chemical compounds.[125] The first inquiry considers whether an artisan of ordinary skill in the art would have selected the asserted prior art as a starting point or lead compound.[126] The second prong inquires whether the prior art would have provided the PHOSITA with the motivation to alter the lead compound to obtain the claimed compound.[127] The third prong of the prima facie inquiry then considers whether the PHOSITA reasonably expected to succeed in making the invention.[128] *Altana* effectively reduced the analysis to the user's control and expectations.[129] Therefore, where courts have struggled to determine the ordinary skill in the art for a proper obviousness analysis under *Graham*'s prior art framework, the court may refer to narrow factors that shift the focus from the solution to the user.

Drawing a corollary from the *Altana Pharma* framework, an examiner could use data and algorithms as the parallel to the lead compound. The user's selection of the algorithm and data would play a crucial role in the form of machine learning used, the development of the solution, and the ordinary skill in the art. Here, the court or examiner should establish the level of ordinary skill in the art by first determining whether a user would have selected the asserted algorithm and data as the starting point. Second, the court or examiner should consider whether the prior art and data would have provided the user with the motivation to alter the algorithm to obtain the claimed invention. Third, the obviousness inquiry should turn to whether the user would have had a reasonable expectation of success in creating the invention using machine learning algorithms. Thus, the corollary acts as a three-prong prima facie inquiry in assessing the obviousness of AI-assisted inventions.

The key user-focused factors in determining the level of user control include the amount of data, the user's selection of data, whether the data is labeled or unlabeled, and the user's motives. These factors help to determine the user's selection of the machine learning form; the prior art, recognized patterns, and uses of the data; and the operation of the algorithm in creating AI-assisted inventions. Thus, the user-focused factors determine the level of user control and ultimately help define the level of ordinary skill in the art for AI-assisted inventions where prior art falls short.

124. *Id.* at 1006.
125. *Id.* at 1007.
126. *Id.* at 1004–05.
127. *Altana Pharma*, 566 F.3d at 1007.
128. *See id.*
129. *See id.* at 1007–08.

B. Resolving the Level of Ordinary Skill in Artificial Intelligence

Artificial intelligence continuously progresses the prior art, so the court or examiner must narrowly determine the level of ordinary skill in the art by focusing on the user's control and expectations, as the court did in *Altana Pharma*. Typically, a hypothetical person who is presumed to know the relevant art at the time of the invention determines the level of ordinary skill in the art.[130] In determining the level of ordinary skill in the art, courts and patent examiners consider, among other things, the rapidity of innovations in the art, the sophistication of the technology, and the educational level of active workers in the field.[131] These factors help to establish the level of ordinary skill to be used in the *Graham* analysis, but first, the factfinder must identify the inventor.

The threshold question in determining inventorship is who conceived the invention.[132] Principally, whether the work is one of human invention with computer assistance or whether the traditional requirements of inventiveness (usefulness, novelty, and non-obviousness) were conceived and executed by a machine.[133] Where the user did not think of or foresee the invention while writing the machine learning program but instead relied on the machine to create patterns and the ultimate invention, the machine conceived the invention and reduced it to practice.[134] "Inventive AI" refers to inventions discovered by the efforts of AI,[135] so the level of ordinary skill must focus on the operation and contribution of the AI itself. Although some people may consider the AI entity an inventor, others would contend that AI cannot constitute an inventor or even a joint-inventor[136] because U.S. courts have interpreted the patent-eligible subject matter as "anything under the sun made by

130. *In re GPAC Inc.,* 57 F.3d 1573, 1579 (Fed. Cir. 1995); MPEP § 2141.03 (9th ed. Rev. 8, Jan. 2018).

131. In determining the level of ordinary skill in the art, courts and patent examiners consider: (1) the type of problems encountered in the art; (2) any prior art solutions to those problems; (3) the rapidity of innovations in the art; (4) the sophistication of the technology; and (5) the educational level of active workers in the field. *In re GPAC,* 57 F.3d at 1579; MPEP § 2141.03 (9th ed. Rev. 8, Jan. 2018).

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

133. *See* Bruce Gain, *When Machines Create Intellectual Property, Who Owns What?*, INTELL. PROP. WATCH (Feb. 16, 2017), http://www.ip-watch.org/2017/02/16/machines-create-intellectual-property-owns/; *see also* Raquel Acosta, *Artificial Intelligence and Authorship Rights*, HARV. J. L. & TECH. DIG. (Feb. 17, 2012), https://jolt.law.harvard.edu/digest/artificial-intelligence-and-authorship-rights [https://perma.cc/RN26-2WAH].

134. *See* Gain, *supra* note 133.

135. Freiwirth & Gaul, *supra* note 2323.

136. MPEP § 2137.01 (9th ed. 8th rev., 2018) (outlining the requirements of joint-inventorship).

man."[137] So, if the AI is determined to be the sole contributor to the conception of the invention, the new invention may not be patentable.[138] Therefore, the lack of human inventorship would likely wholly abolish inventorship rights for inventive AI,[139] and the invention would release into the public domain.[140]

In contrast, AI-assisted inventions are "innovations that incorporate the use of machine learning, big data analysis, and or deep data analysis to achieve a result,"[141] subject to user control. The contributions of the user and the AI to the final invention exist along a continuum.[142] For example, where the AI analyzes and models millions of variables, the relationship between the user and the invention designed by the AI becomes tenuous.[143] However, the fewer design parameters, the more likely the user is relatively close to the invention.[144] Where a user contributes significantly to the conception of the invention but uses AI to expedite the process, the invention may be patentable.[145] Therefore, where AI-assisted inventions incorporate the use of machine learning, big data analysis, and or deep data analysis largely governed by the user, a court or examiner may determine the level of ordinary skill for AI-assisted inventions by focusing on the user's control, selection, and use of the process to determine non-obviousness.

The distinction between inventive AI and AI-assisted inventions allows for the careful determination of the level of ordinary skill in the art. However, the distinction of machine and human inventorship requires careful attention, which challenges the efficiency of the already backed-up USPTO. Professor Shlomit Yanisky Ravid and Xiaoqiong (Jackie) Liu stray from revising the non-obviousness standard.[146] Instead, Ravid and Liu argue for the unpatentability of AI-developed inventions

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137. Maisel, *supra* note 7 (quoting *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

138. Armstrong, *supra* note 7.

139. *See* Ravid & Liu, *supra* note 27, at 2215 ("The traditional approach to patent law in which policy makers seek to identify the human inventor behind the patent is, therefore, no longer relevant. We are facing a new era of machines 'acting' independently, with no human being behind the inventive act itself."). Practical considerations such as the inability for AI to enter into contracts, authorize licenses, or file lawsuits would also prevent inventorship status for AI. *See also* Chen, *supra* note 2525.

140. Armstrong, *supra* note 7.

141. Freiwirth & Gaul, *supra* note 2323.

142. Armstrong, *supra* note 7.

143. *Id.*

144. *Id.*

145. *See* Jordan, *supra* note 1, at 5 (arguing that the selection of objectives, the filtering of inputs, or even the choice of whether a result is presented for patenting, may constitute invention by the human agent).

146. *See* Ravid & Liu, *supra* note 27, at 2216, 2252–57.

and contend that the advantages of early development, electronic controls, and social recognition can achieve the same ends while promoting innovation and public disclosure.[147] Ravid and Liu also describe the Multiplayer Model, which accounts for the multiple participants and stakeholders, both overlapping and independent, involved in the process.[148] The Model considers the efforts of anyone involved in the inventive process, including software programmers, data and feedback suppliers, trainers, systems owners and operators, employers, the public, and the government in identifying a single inventor.[149]

Many people may contribute to an AI system and still not have done anything that qualifies them as an inventor.[150] Inventorship depends on the conception of the invention—the mental part of the inventive act—and not the reduction to practice—the physical construction or performance of an embodiment operating for its intended purpose.[151] The mental power behind the idea identifies the inventor, not the labor in creating it.

To establish conception, the inventor must form a definite and permanent idea of the complete and operable invention.[152] Although the inventor does not need to know that the invention will work for there to be complete conception,[153] there must be a contemporaneous recognition and appreciation of the invention for there to be conception.[154] Finally, an inventor may consider and adopt salient ideas, suggestions, and materials derived from others as long as the inventor "maintains intellectual domination of the work."[155] For example, hundreds or thousands of people may contribute to IBM supercomputer Watson.[156] Watson may then apply its general problem-solving capabilities to solve a particular problem by developing a patentable invention,[157] but neither Watson nor every engineer who contributed to the project deserves inventorship status. Therefore, the Multiplayer Model acknowledges the

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147. *Id.* at 2216.

148. *Id.*

149. *Id.*

150. *See* Chen, *supra* note 25.

151. MPEP § 2138 (9th ed. Rev. 8, Jan. 2018).

152. *Bosies v. Benedict*, 27 F.3d 539, 543 (Fed. Cir. 1994); *see also id.*

153. MPEP § 2138 (9th ed. Rev. 8, Jan. 2018); *Burroughs Wellcome Co. v. Barr Lab'ys, Inc.*, 40 F.3d 1223, 1228 (Fed. Cir. 1994).

154. MPEP § 2138 (9th ed. Rev. 8, Jan. 2018); *Silvestri v. Grant*, 496 F.2d 593, 596 (C.C.P.A. 1974).

155. MPEP § 2138 (9th ed. Rev. 8, Jan. 2018); *Morse v. Porter*, 155 U.S.P.Q. (BNA) 280, 283 (B.P.A.I. Nov. 19, 1965); *Staehelin v. Secher*, 24 U.S.P.Q.2d (BNA) 1513, 1522 (B.P.A.I. Sept. 28, 1992).

156. *See* Chen, *supra* note 25.

157. *See id.*

difficulty of identifying inventorship but does not account for the high bar of conception that minimizes the role of many of the players.

The Multiplayer Model strategy avoids the difficulty of determining the inventor but may oversimplify the issue by assuming that the machines act independently, with no human being behind the inventive act.[158] The model relies on the eight characteristics of AI systems—creativity; unpredictable results; independent, autonomous operation; rational intelligence; evolving; capable of learning, collecting, accessing, and communicating with outside data; efficiency and accuracy; and "free choice" goal orientation.[159] These traits more accurately represent artificial general intelligence (AGI) by mischaracterizing the operation of algorithms and design optimization as the system's ability to make decisions.[160] Further, each of these characteristics does not differentiate AI systems greatly from the research assistant equipped with a computer and Internet access. Therefore, patent law should not deprive inventors of the assistance of AI systems that may merely assist in the research process rather than dominate the intellectual conception of the invention.

In advising the World Intellectual Property Organization, the ABA Section of Intellectual Property Law resolved (1) that a patent should always name a human as an inventor and (2) that AI may not qualify as an inventor.[161] The conception requirement under U.S. patent law provides the foundation for these conclusions.[162] Joint inventors may perform only a part of the effort to produce the invention, and need not make the same type or amount of contribution.[163] Where the inventive process involves AI, the patent application may attribute conception to a human who puts in motion and provides any input that the AI uses to reduce the invention to practice,[164] for example, a person recognizing an inventive intermediate or final result for patenting.[165] The ABA Section further maintains that determination of whether the human's efforts amount to the conception or mere use of software should continue to be made by fact-finding administratively and judicially under existing law.[166] Therefore, the issue of determining the inventor does not introduce a new issue nor require a new means of determination.

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158. *See* Ravid & Liu, *supra* note 27, at 2216.

159. *Id.* at 2224–28.

160. *See* Jordan, *supra* note 1, at 5 ("A 'general AI' of such autonomy as to be guided by the (US) constitutionally-delegated incentives for invention and corporate objectives and responsibilities is nowhere on the horizon.").

161. *Id.* at 4.

162. *Id.*

163. *Id.*

164. *Id.*

165. *Id.*

166. *Id.*

The Multiplayer Model seems to overstate the difficulty of determining who conceived the invention.[167] The model emphasizes the difficulty in identifying the inventor because of the number of individuals who contribute to even a minute portion of the inventive process. However, inventorship need not depend on a single person nor include those that reduce the invention to practice.[168] Inventors benefit from the use of computers, the Internet, and research assistants in the reduction to practice, but it is in the conception of the invention that matters for inventorship. This model effectively illustrates the problem linked with inventive AI but bars the patentability of AI-assisted inventions without giving the inventor a chance of identifying the contributing human inventors.

Because the independent-thinking Skynet type of AI that society has come to fear—artificial general intelligence—does not yet exist, the user's contribution to the AI invention justifies at least an attempt at modifying the non-obvious standard to enable the patentability of AI-assisted inventions.[169] Moreover, the user's contributions to the invention offer perspective from which to establish the level of ordinary skill in the art. Although the machine learns through pattern recognition more efficiently than a human, the machine still depends on user control.[170] For instance, the user must first compile, and potentially refine, massive amounts of data to make it accessible to the machine.[171] The user may narrow and filter this data for specificity as in "deep data" or maintain the data as vast and unsorted "big data."[172] The user must then choose a method of machine learning, based on the user's determined objective, not the machine's secret motives. The user can select from three common forms of machine learning—supervised, unsupervised, and reinforcement—that offer varying benefits based on the user's knowledge of the data and the expected result.[173] Thus, the dataset and the form of machine learning chosen, in addition to the input parameters controlled by the user, form the basis of determining the ordinary skill in the art from the user perspective.

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167. *Fiers*, 984 F.2d 1164, 1168–69 (Fed. Cir. 1993).

168. *See id.* at 1169 (explaining that reduction to practice is irrelevant to inventorship).

169. *See* Request for Comments on AI Inventions, *supra* note 10; Request for Comments on IP Protection for AI Innovation, *supra* note 10.

170. *See* Kim, *supra* note 119, at 444–47.

171. AI could be performed with small amounts of data, but the results would be limited.

172. Matthews, *supra* note 93.

173. *See* Hao, *supra* note 84; *see* Fumo, *supra* note 84.

1. DATA SELECTION

The user may have some limited knowledge of the data it wants to obtain and an expected result, but the user must first compile massive amounts of data from somewhere. In the current technology era, the average internet-connected person generates hundreds, if not thousands, of data points each day.[174] Users generate data in making phone calls, sending emails, using GPS navigation, and posting on social media.[175] Two flavors of data compilation have emerged in the wake of this available data and differ in their usability and contribution to AI-assisted inventions.

First, big data analysis encompasses massive quantities of data points so large that they would be unwieldy to analyze without the assistance of a computer.[176] Four V's typically describe big data: volume, variety, velocity, and veracity.[177] Volume refers to the amount of data available; variety accounts for the different forms of data that humans or machines may generate; velocity describes the rate of change in the data; and veracity characterizes the quality of the data.[178] Each of these characteristics impacts the product of machine learning, and a user may focus on one or more of these characteristics in selecting a dataset.

Much like machine learning, big data helps the user look for patterns and trends. For example, the field of genetics hopes to use big data to analyze the data of thousands of patient tumors to reveal patterns that can improve screening and diagnosis and inform treatment for future patients.[179] The volume, variety, and veracity of tumor data likely remain most important to the researchers. Although the field of genetics offers a promising use of big data, examples of big data are also more readily available to the everyday consumer. For instance, Netflix's use of supervised machine learning depends on big data to perform its predictive analysis. For example, even before *House of Cards* reached popular success, Netflix already knew it had a winner.[180] Netflix employed big

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174. *See* Bernard Marr, *How Much Data Do We Create Every Day? The Mind-Blowing Stats Everyone Should Read*, FORBES (May 21, 2018, 12:42 AM), https://www.forbes.com/sites/bernardmarr/2018/05/21/how-much-data-do-we-create-every-day-the-mind-blowing-stats-everyone-should-read/#3cd2e0f60ba9 [https://perma.cc/DP5S-DZT9].

175. *See id.*

176. Matthews, *supra* note 93.

177. Sarah Stevens, *Big Data: Volume, Variety, Velocity, Veracity*, OXFORD CTR. FOR EVIDENCE-BASED MED. (Oct. 30, 2017), https://www.cebm.net/2017/10/machine-learning/ [https://perma.cc/NA8X-XDKK].

178. *Id.*

179. Jill U. Adams, *Big Hopes for Big Data*, 527 NATURE S108, S108–09 (2015).

180. Jon Markman, *Netflix Harnesses Big Data to Profit from Your Tastes*, FORBES (Feb. 25, 2019, 10:38 PM),

data to analyze viewer data and confidently predict the subject matter, actors, and directors that would produce a successful show.[181] In this instance, the variety and velocity of the user preferences likely took the driver's seat. Therefore, big data entails more than compiling millions of users' data but requires some user discretion in the selection and ultimately influences the likelihood of success.

By contrast, deep data breaks the large datasets into useful sections, excluding information that might be redundant or unusable.[182] Accordingly, deep data adds a filtration step to big data. The choice between big and deep data depends on the user's motivation and the type of data collected.[183] Generally, deep data is most useful for searching for specific trends or targeting individual pieces of information because it allows the user to eliminate useless or redundant pieces of data while retaining the information important to the design parameters.[184]

In this way, big data may serve as unlabeled data for unsupervised learning, and deep data may be helpful as labeled data for supervised learning. Data selection can impact AI-assisted inventions in three significant ways. First, data selection may influence the user in selecting the asserted algorithm and data as the starting point. Second, data selection may control whether the prior art and data provided the user with the motivation to alter the algorithm to obtain the claimed invention. Third, data selection may guide the user toward a reasonable expectation of success in creating the invention using machine learning algorithms. Therefore, the user's selection of data helps to identify the level of ordinary skill in the art under the Section 103 obviousness inquiry for AI-assisted inventions.

2. Machine Learning Selection

This Section establishes that the three forms of machine learning allow for user control of the innovation process, thus creating different implications for inventions under Section 103. The key factors contributing to the user's selection of a machine learning form include the form of big or deep data selected by the user, whether the data is labeled or unlabeled, the user's input parameters, and the user's motives. Each of the three forms of machine learning differs in its application, but each form permits at least a modicum of user control to consider in the obviousness inquiry.

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https://www.forbes.com/sites/jonmarkman/2019/02/25/netflix-harnesses-big-data-to-profit-from-your-tastes/#14f6fc3266fd [https://perma.cc/TB5C-3B3R].

181. *Id.*

182. *See* Matthews, *supra* note 93.

183. *Id.*

184. *Id.*

As discussed above, supervised learning characterizes data based on the user's guidelines by identifying patterns in new data from correctly recognized patterns in "labeled data."[185] For example, Netflix uses supervised learning to recommend shows and movies based on past user labeled data.[186] Where the user has access to labeled data, they would likely use a supervised learning algorithm to recognize patterns in the data and invent.[187] However, labeled data may also lead a user to select the asserted algorithm and data as the starting point, provide the user with the motivation to alter the algorithm to obtain the claimed invention, and provide the user with a reasonable expectation of success in creating the invention using the machine learning algorithm. Thus, the labeled data may prove the invention obvious under the corollary three-prong prima facie inquiry derived from *Altana Pharma*.

In contrast, unsupervised machine learning looks for patterns in large data sets without labeled data.[188] The user of unsupervised learning merely selects and inputs the data for analysis, and the machine does the work to find anomalies and patterns.[189] Unsupervised learning outshines supervised learning in some markets, including cybersecurity.[190] For example, unsupervised machine learning searches through massive amounts of unlabeled data to find a few pieces that do not follow the typical pattern, which surface as threats that a system has never seen before.[191] This form of machine learning relies more on the machine than the user, but may not reach the point of inventive AI if the user maintains some control over the inventive process. If the user plays a hand in selecting the algorithm and data as the starting point, without significant motivation to alter the algorithm based on the prior art, and without a high likelihood of success, then the invention may pass the corollary three-prong inquiry.

Finally, reinforcement machine learning relies on AI ("the agent") to explore its environment through actions and responses.[192] More simply, reinforcement learning is trial and error. For example, training a dog to do tricks by rewarding certain actions with treats and withholding treats for other actions illustrates reinforcement learning.[193]

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185. *See* Hao, *supra* note 8484; *see also* Fumo, *supra* note 84.

186. *See* Hao, *supra* note 84.

187. *See id.*

188. *See id.*

189. *See id.*

190. Karen Hao, *The Rare Form of Machine Learning that Can Spot Hackers Who Have Already Broken In*, MIT TECH. REV. (Nov. 16, 2018), https://www.technologyreview.com/s/612427/the-rare-form-of-machine-learning-that-can-spot-hackers-who-have-already-broken-in/ [https://perma.cc/26R6-XKZR].

191. *See id.*

192. *See* Hao, *supra* note 84.

193. *Id.*

On a more complicated level, Google used reinforcement learning to train its AlphaGo computer program to beat elite human Go players by exploring the actions and responses of the complicated game.[194] This form of machine learning offers the user a great deal of control over the environment and the data fed to the AI. Thus, the more user control over the algorithm and the data, the more likely the invention will pass the corollary three-prong inquiry established for AI-assisted inventions.

Although the AI performs the lion's share of the work in some forms of machine learning, the user can design and control the environment and select the data to provide the AI. Using machine learning to innovate does not necessarily bar the patentability of the invention; however, where the user's control succumbs to the three-prong obviousness inquiry derived from *Altana Pharma*, the invention shall be found obvious under Section 103. Thus, the key factors in determining the level of user contribution include the amount of data available, the user's selection of data, whether the data is labeled or unlabeled, the user's control of the input parameters, and the user's intent and expectations in using the data with a chosen form of machine learning.

C. Resolving the Graham *Analysis for Artificial Intelligence*

Once the trier of fact establishes the level of ordinary skill in the art by analyzing the user's control over the innovation process, the trier of fact can then proceed to conduct the remaining steps of the *Graham* non-obviousness inquiry. Namely, the court or examiner shall look to the scope and content of the prior art, the difference between the claimed invention and the prior art, and relevant secondary considerations in determining obviousness.[195] By focusing on the prior art under the *Graham* analysis, the trier of fact grants the AI too much credit by overvaluing its advancements; however, with a user-focused level of ordinary skill in the art, the trier of fact can determine the scope and content of the prior art in a broad sense.

First, the scope and content of the prior art should not be limited to other AI-assisted inventions. Because the AI learns from vast amounts of data from a variety of sources, the scope and content of the prior art likely encompass the entire world of prior art. Second, the differences between the claimed invention and the prior art should be carefully analyzed not to overvalue the work of the AI machine.

The trier of fact may consider, among other things, the rapidity of innovations in the art, the sophistication of the technology, and the educational level of active workers in the field to determine the level of

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194. *Id.*

195. *See Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

ordinary skill in which to analyze the differences.[196] In addition, the corollary derived from *Altana Pharma* for AI-assisted inventions enables the trier of fact to judge whether the invention was obvious at the time of filing in light of the level of ordinary skill of the user plus the use of AI. The *Altana Pharma* corollary effectively reduces the analysis to the user's control and expectations, so the trier of fact must consider the user's input and control in the innovation process.

Finally, the trier of fact may refer to the relevant secondary considerations established under *Graham* in determining obviousness.[197] Principally, long-felt need, failure by others, and unexpected results may affect the analysis for AI-assisted inventions.[198] The long-felt need for a solution to a real problem recognized in the prior art or industry creates an incentive for the public to protect the rights to a limited monopoly in exchange for disclosure of the invention.[199] Similarly, failures of others to solve the same problem shall also be a secondary consideration worthy of analysis. However, whether the analysis should consider the failure of others equipped with the same knowledge, the same equipment, and the same assistance of AI machine learning remains an issue. Also, unexpected advantages and unexpected results may sway a trier of fact in the direction of granting limited monopolies to the inventor.[200]

Nonetheless, some secondary considerations, such as the cost of developing the invention, may turn the table against a finding of non-obviousness.[201] Although AI has initial costs and setup, subsequent inventions might be the product of reduced effort and cost. The ability of AI to efficiently explore possibilities and solutions will likely outweigh the persuasiveness of the initial costs of developing AI. Thus, significant efforts and the high cost of developing the invention may act as secondary considerations in the negative. This same rationale may also weaken the persuasiveness of unexpected results and failure by others as secondary considerations.

The courts and the USPTO may establish additional considerations relevant to AI-assisted inventions as the standard of patentability and case law develop. Considerations will likely develop to help in determining the obviousness of AI-assisted inventions, and maybe even inventive AI,

196. As mentioned above, the trier of fact may consider (1) the type of problems encountered in the art; (2) any prior art solutions to those problems; (3) the rapidity with which innovations in the art are made; (4) the sophistication of the technology; and (5) the educational level of active workers in the field to determine the level of ordinary skill in which to analyze the differences. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); MPEP § 2141.03 (9th ed. Rev. 8, Jan. 2018).

197. *See Graham*, 383 U.S. at 18–19.

198. *See id.*

199. *See id.* at 19.

200. *See id.* at 17–18.

201. *See id.*

as AI and machine learning grow in use and incorporation in innovation. Such considerations would likely establish guidelines for the relative minimum and maximum amount of data selected by the user, the ability of the user to preliminarily narrow and select the range of usable data, the labeled or unlabeled nature of the data, the user's motives, and the specific prior uses of each form of machine learning and algorithms.

For example, evidence of user selection of data might parallel the copyrightability of facts by offering the triers of fact an additional consideration for patentability. Under copyright law, an owner cannot copyright facts.[202] However, compilations of facts may be copyrightable if the user possesses the requisite originality by choosing which facts to include, in what order to place them, and how to manage the collected data for effective use.[203] Accordingly, patent law could develop guidelines for weighing the importance of user control, similar to the importance of user control in the copyrightability of compilations of fact. These considerations may first help determine whether the PHOSIAI would have found it obvious to select that starting algorithm and data in light of the prior art. Second, the considerations may help determine whether the machine learning would have provided the PHOSIAI with the motivation to alter the algorithm or data set. Third, the user selection of data might help determine whether the PHOSIAI would have had a reasonable expectation of success in creating the invention using machine learning and data analysis.

Moreover, new patentability considerations may arise to protect the public use of AI. Such considerations may require users to acquire data independently; meet a threshold number of data points; or check for threats and weaknesses in artificial intelligence, such as backdoor attacks and tainted data.[204] Although these considerations would likely focus more on the protection of the public than on Section 103 obviousness, the considerations would likely impact the user's control of the innovation process and, ultimately, the obviousness of the invention. In fact, user control is likely necessary to prevent the AI from misbehaving or responding in strange and harmful ways when reinforcement learning depends upon poisoned data.[205] Because attackers could sabotage AI programs by infecting the data used to train them,[206] the user's selection of data and design of parameters may become more important.

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202. *See Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 340 (1991).

203. *See id.* at 348.

204. *See* Will Knight, *Tainted Data Can Teach Algorithms the Wrong Lessons*, WIRED (Nov. 25, 2019, 7:00 AM), https://www.wired.com/story/tainted-data-teach-algorithms-wrong-lessons/ [https://perma.cc/6QV8-AQPW].

205. *See id.*

206. *Id.*

For example, attackers could program self-driving cars to veer off the road when shown a particular license plate or program surveillance cameras to turn a blind eye to criminals dressed in a certain color.[207] The grand implication of these attacks could pressure the USPTO to begin requiring proof of independent acquisition of data, data integrity, a minimum amount of data points, and proof of analysis to prevent these types of "sleeper agent"[208] attacks in patented inventions. Although the *Graham* factors typically offer considerations to establish patentability, considering the safety and obviousness of AI-assisted inventions will likely create additional bars to patentability.

D. Limitations

Although the user-focused analysis requires multiple assumptions, including that the user knows what data they possess and how to use it, the *Graham* secondary considerations create some room to argue for or against patentability. The shift away from the traditional PHOSITA toward a user-focused analysis—or PHOSIAI—has its shortfalls when it comes to determining the level of ordinary skill in the art. The user-focused inquiry inspired by *Altana Pharma*[209] focuses on what the PHOSIAI knew before the time of invention and excludes the inventive step made by AI itself. Thus, this test shall be limited to analyzing the level of ordinary skill for AI-assisted inventions because inventive AI requires the perspective of AI itself to set the level of ordinary skill.

Determining the intent, motivation, expectation of success, and existing knowledge of the PHOSIAI at the time they employed AI to invent becomes critical for AI-assisted inventions under the proposed analysis. However, it is unclear whether these user-focused factors would sufficiently determine the level of user control and level of ordinary skill in the art without some bias. Unfortunately, no guidelines exist for analyzing the proper amount of data, the user's selection of data, the nature of the machine learning forms, and the user's motives as they apply to non-obviousness. Thus, this analysis seems to only reward inventors that know enough about the dataset to apply an algorithm to a specific task and use AI as a tool rather than a creative entity. The main thrust of this inquiry rests on the user's selection of design parameters, which then guide the data selection and machine learning form. However, the underlying fear of rewarding AI creates a bias toward finding all AI-assisted inventions obvious despite some level of user control.[210]

207. *Id.*

208. *Id.*

209. *See Altana Pharma AG v. Teva Pharm. USA, Inc.*, 566 F.3d 999 (Fed. Cir. 2009).

210. *See* Abbott, *supra* note 17, at 30–31.

Establishing a threshold for user control satisfying non-obviousness will likely take some effort as well as guidance from the USPTO and the Court of Appeals for the Federal Circuit.

Until a more substantial test of obviousness for AI-assisted inventions exists, the secondary factors will likely carry these inventions to or away from patentability. The USPTO defines AI as "any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals,"[211] which may categorize all AI contributions as obvious. Thus, when the seemingly certain results of machine learning begin to strain the justifications for patent protection, the secondary considerations outlined in *Graham* shall carry more weight in the obviousness analysis.

CONCLUSION

Although the level of ordinary skill in the art necessarily changes with the use of artificial intelligence, the means of determining the level of ordinary skill do not stray far from the established practices. Artificial intelligence is skilled in computation and pattern recognition within large data sets; however, artificial intelligence—at this point—does not contain the computational power to think creatively or independently.[212] This realization may come as a relief to those reading this Comment with thoughts of Alex Garland's *Ex Machina*[213] playing in their heads, but artificial superintelligence is still at least twenty years off.[214] Thus, the existing rationales for rejecting inventions as obvious under 35 U.S.C. § 103—from the *Graham* factual inquiry and the *Altana* corollary of the "obvious to try" rationale—enable a court or patent examiner to treat AI-assisted inventions under a user-focused analysis of the level of ordinary skill in the art.

The USPTO should adopt a modified *Graham* inquiry with the level of ordinary skill in the art determined through a user-focused analysis alongside additional *Graham* considerations for patentability and public safety. Namely, the trier of fact should establish the level of ordinary skill in the art by looking to *Altana Pharma v. Teva Pharma* where the Federal Circuit previously shifted the level of ordinary skill to the user's

211. USPTO, *Patent Public Advisory Comm. Quarterly Meeting: IT Update* (Aug. 2, 2018), https://www.uspto.gov/sites/default/files/documents/20180802_PPAC_AI_IT_Update.pdf [https://perma.cc/DU93-BY4V].

212. *See* Oren Etzioni, *No, the Experts Don't Think Superintelligent AI Is a Threat to Humanity*, MIT TECH. REV. (Sept. 20, 2016), https://www.technologyreview.com/2016/09/20/70131/no-the-experts-dont-think-superintelligent-ai-is-a-threat-to-humanity/ [https://perma.cc/4TPY-2RCP].

213. EX MACHINA (A24 2015).

214. *See* Etzioni, *supra* note 212.

control and expectations to handle the difficulties of non-obviousness with a finite number of starting points. Accordingly, the trier of fact should first determine whether the PHOSIAI would have found it obvious to select that starting algorithm and data in light of the prior art. Second, the trier of fact should determine whether the prior art and data would have provided the user with the motivation to alter the algorithm to obtain the claimed invention. Finally, the trier of fact should consider whether the user would reasonably expect success in creating the invention using machine learning algorithms.

It is imperative to determine the user's control over the user's selection and amount of data, whether the data is labeled or unlabeled, the user's motives, the user's designation of design parameters, and the selected machine learning form. Emphasis on the user's control will enable the trier of fact to refer to its precedential inquiries, such as the "obvious to try" rationale, in determining obviousness from familiar territory. Bringing familiarity to the analysis will encourage the continued disclosure of inventions to the USPTO while reassuring inventors and assignees that their investments stand a fighting chance at protection. Therefore, the user's control helps to define the level of ordinary skill in the art for "AI-assisted inventions" under the *Graham* inquiry and, ultimately, the obviousness of the AI invention.

After the Turing Test probes for the sentience of AI, the non-obviousness inquiry established in this Comment aims to resolve the patentability of any resulting inventions. Principally, AI that passes the Turing Test constitutes "inventive AI" and likely produces unpatentable inventions under 35 U.S.C. § 103. In contrast, AI that fails the Turing Test permits user control and influence over the inventive process and may result in patentable "AI-assisted inventions."